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MOUNT RENNIE

NORTHERN TERRITORY

SHEET SF/52—15 INTERNATIONAL INDEX

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Compiled by L. C. Ranford

Issued under the authority of the Hon. David Fairbairn, Minister for National Development.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
CANBERRA 1968

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT
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Explanatory Notes on the Mount Rennie Geological Sheet

The Mount Rennie Sheet area is in the south-western part of the Northern Territory between latitudes 23° and 24° south and longitudes 129° and 130° 30′ east. The southern half of the Sheet area includes folded Proterozoic and Palaeozoic sediments of the Amadeus Basin, and the northern half contains outcrops of Precambrian igneous and metamorphic rocks.

There are no permanent settlements. Access is either by an unsealed graded road from Papunya Mission (in the Northern Territory) to Giles Weather Station (in Western Australia) via the Ehrenberg Range, Mount Leisler, and the Davenport Hills, or by an ungraded track from Haast Bluff Cattle Project to near the Davenport Hills via Mount Rennie and Ligertwood Cliffs.

The Mount Rennie Sheet area is part of an Aboriginal Reserve and permission to enter the Reserve must be obtained from the Native Welfare Department at Alice Springs.

The average rainfall is 8 to 10 inches, but both the distribution and amount of rain in any one year are extremely uncertain. Maximum temperatures frequently exceed 100° F in the summer, but the nights are generally cool. Occasional frosts occur during the period from June to August.

Vegetation is very sparse, apart from spinifex. Mulga grows in all the floodout areas adjacent to the ranges and in some interdune swales, and desert oaks are scattered throughout the sand-dune country.

The following maps and photographs are available for the Mount Rennie Sheet area: planimetric maps at 4 miles to 1 inch and 1 : 250,000 scale, photomosaics at 4 miles to 1 inch scale, and photo-scale compilations controlled by slotted-templet assembly. All of these were prepared by and are available from the Division of National Mapping, Department of National Development. Air-photographs, taken by Adastra Airways Pty Ltd in 1957 at a scale of 1 : 50,000, are also available.

Geological Investigations

Before 1958, the area had received only cursory examination by a few explorers and geologists. In 1891, Tietkins (1891) took a prospecting party across the area, and in 1906, George (George & Murray, 1907) led a government prospecting expedition into the south-west part of the area.

Other workers such as Chewings, Mawson & Madigan, Terry, Tindale, and Quinlan & Prichard explored and mapped areas to the east, but as far as is known none of them ventured on to the Mount Rennie Sheet area. (Chewings, 1891, 1914, 1928, 1931, 1935; Mawson & Madigan, 1930; Terry, 1931, Madigan, 1932a, Tindale, 1933; Prichard & Quinlan, 1962).

In 1958, Gillespie of Frome-Broken Hill Company Pty Ltd visited the Winnecke Hills, Kintore Range, Ehrenberg Range, Davenport Hills, Mount Rennie, Johnson Hill, and other features; he measured sections wherever practicable.

The Institut Français du Pétrole made a geological photointerpretation of the Amadeus Basin in 1960 (Scanvic, 1961) for the Bureau of Mineral Resources. Geologists of the Bureau of Mineral Resources mapped the Mount Rennie Sheet area in 1961 (Wells, Forman, & Ranford, 1965). Since 1961, geologists employed by United Canso Oil and Gas Pty Ltd have made reconnaissance visits to parts of the area. Haites (1963) measured some sections in the Larapinta Group.

Geophysical Investigations

A regional gravity survey of the Mount Rennie Sheet area was made by the Geophysical Branch of the Bureau of Mineral Resources in 1962 (Lonsdale & Flavelle, 1963), and preliminary Bouguer anomalies are shown in an unpublished map (G69-124-2) by the Geophysical Branch of the Bureau of Mineral Resources. Since this time, aeromagnetic surveys have been completed for Roset Pty Ltd (1963) and Reef Exploration Pty Ltd (Boyd & Morris, 1965). A regional aeromagnetic and radiometric survey by the Geophysical Branch of the Bureau of Mineral Resources was completed in 1965 (Young & Shelley, 1966).

PHYSIOGRAPHY

There are no rivers, creeks, or surface water on the area, but a few short drainage channels radiate from the Kintore and Ehrenberg Ranges. Most of the area is sand plain which, except for an east-west-trending belt in the centre, carries numerous longitudinal sand dunes. The dunes trend west-south-west to west-north-west and are up to 40 feet high; some are simple longitudinal dunes and some mesh or braided.

Mount Leisler in the Kintore Range (2955 feet) is the highest peak, and rises about 1300 feet above the general level of the sand plain. Most of the other hills and ranges are less than 500 feet high.

Lake Macdonald, a dry salt pan or salt lake, extends into the western part of the area. In July 1960, the water level was about 4 inches below the surface of the lake (Wells, Forman, & Ranford, 1964).

STRATIGRAPHY

The stratigraphy is summarized in Tables 1 and 2.

Precambrian Metamorphic and Igneous Rocks

Igneous and metamorphic rocks crop out in the north. They have not been mapped in detail and have not been dated by isotopic means. These rocks unconformably underlie sediments considered to be of Proterozoic age.

TABLE 1. PRECAMBRIAN STRATIGRAPHY

Age	*Rock unit and map symbol*	*Lithology*	*Thickness (feet)*	*Stratigraphic relationships*	*Topography*	*Fossils*
Lower Palaeozoic to Proterozoic	Maurice Formation (Pza)	Red cross-bedded sandstone, siltstone.	—	Conformable on Ellis Sandstone. Top not exposed.	Sandstone forms prominent ridges.	
	Ellis Sandstone (Pze)	Kaolinitic quartz sandstone, minor calcareous sandstone, siltstone.	—	Conformable between Carnegie Formation and Maurice Formation.	Well exposed in strike ridge.	
Proterozoic	Carnegie Formation (Puc)	Sandstone, siltstone, pebbly sandstone, conglomerate.	?	Discomformable on Bitter Springs Formation.	Strike valley with a few low strike ridges.	
	Bitter Springs Formation (Pub)	Crystalline dolomite, dolomitic limestone, limestone, siltstone, evaporites.	?	Appears to be conformable on Heavitree Quartzite. Evaporites have intruded younger formations at Johnstone Hill and possibly in cores of some anticlines.	Low hills.	Algal stromatolites.
	Heavitree Quartzite (Puh)	Sandstone, conglomeratic sandstone, siltstone; cross-bedded; some pyrite moulds.	850—	Unconformable on Precambrian igneous and metamorphic rocks.	Very prominent strike ridges.	
Undifferentiated	(pCl)	Basalt, fine-grained, amygdaloidal and vesicular.			Rounded hills.	
	(pCs)	Quartz-sericite schist, quartz amphibolite.			Low hills and ridges.	
	(pCg)	Gneissic granite with angular xenoliths of medium-grained intermediate gneiss.			Ranges, hills and low rises.	
	(pCq)	Quartzite, fine to coarse-grained, recrystallized.			Strike ridges.	
	(pC)	Undifferentiated metamorphic and igneous rocks.			Low hills	

The *Heavitree Quartzite* (Joklik, 1955), which has its type area at Heavitree Gap on the Alice Springs Sheet area, is the basal unit in the Amadeus Basin succession. The formation crops out as a prominent ridge at scattered localities along the northern margin of the Amadeus Basin, unconformably overlying the Precambrian igneous and metamorphic rocks. The Heavitree Quartzite is correlated with the Dean Quartzite on the southern margin of the basin.

The *Bitter Springs Formation* (Joklik, 1955; Wells, Ranford, Stewart, Cook, & Shaw, 1967) has its type area at Bitter Springs Gorge on the Alice Springs Sheet area. In the Mount Rennie Sheet area it is conformable on the Heavitree Quartzite along the northern margin of the basin and is also exposed in the cores of some deeply eroded anticlines. Evaporites in the Bitter Springs Formation have intruded younger sediments in some areas (e.g. Johnstone Hill) and have been squeezed into the cores of anticlines, as in the anticline in the south-east corner of the Sheet. The Formation contains a number of types of algal stromatolites and is correlated with the Pinyinna Beds in the south-western part of the Amadeus Basin.

The *Carnegie Formation* (Wells, Forman, & Ranford, 1964) has its type area in a large unnamed range north of the Wallace Hills in Western Australia (Rawlinson Sheet area). The formation is disconformable on the underlying Bitter Springs Formation and is overlain by the Cleland Sandstone. The contact with the Cleland Sandstone is not exposed, and Wells, Forman, & Ranford (1964) suggest that the units are conformable. However, later work in the central part of the Amadeus Basin (Ranford, Cook, & Wells, 1965) has indicated the presence of an unconformity beneath the Cambrian sediments, and the contact is probably unconformable in the Mount Rennie Sheet area. The Carnegie Formation is considered to be laterally equivalent to part of the Boord Formation (Macdonald Sheet area, Western Australia), and possibly parts of the Pertatataka Formation (Mount Liebig Sheet area) and the Winnall Beds (Bloods Range Sheet area), and is tentatively regarded as Proterozoic.

The *Ellis Sandstone* (Wells et al., 1964) crops out in a prominent ridge in the western side of the Sheet area south of the Bonython Range, overlies the Carnegie Formation conformably.

The thick sequence of red strongly cross-bedded sandstone and some siltstone that follows conformably on the Ellis Sandstone at one locality in the west has been tentatively identified with the *Maurice Formation* (Wells et al., 1964). The formation is faulted against the Bitter Springs Formation and its top is not visible.

Both the Ellis Sandstone and the Maurice Formation were thought originally to be late Proterozoic or early Cambrian (Wells et al., 1964), but it is now almost certain that they are Proterozoic (Wells et al., in prep.) and are correlated with the Winnall Beds of the southern part of the Amadeus Basin and the Pertatataka Formation of the northern part.

TABLE 2. PHANEROZOIC STRATIGRAPHY

Age	Group	Rock unit and map symbol	Lithology	Thickness (feet)	Stratigraphic relationships	Topography	Fossils
QUATERNARY		(Qa)	Alluvium, soil.			Alluvial flats and scree slopes.	
		(Qs)	Aeolian sand.			Dunes and sand plain.	
		(Qt)	Evaporites.			Floor of salt lake.	
		(Ql)	Travertine.			Low mounds.	
TERTIARY		(Tc)	Conglomerate.			Slopes bordering hills and ranges.	
PERMIAN		(P)	Silty sandstone, micaeous siltstone; cross-bedded, ripple-marked, scattered pebbles and clay pellets. Some slump folds.	60—	Correlated with Buck Formation on Macdonald Sheet area; unconformable on Pertnjara Group.	Low mesas.	
DEVONIAN TO PERMIAN		Ligertwood Beds (Pzl)	Breccia, sandstone, conglomerate, conglomeratic sandstone, moderately to poorly sorted.	60—	Unconformable on Pertnjara Group? May be related to fault movements late in Palaeozoic.	Low mesas.	
DEVONIAN TO CARBONIFEROUS	PERTNJARA GROUP	(Pzp)	Calcareous siltstone, siltstone, sandstone.	2000—	Synorogenic, unconformable on older units; contacts apparently conformable in synclinal troughs.	Strike ridges and low rounded hills.	
	PERTNJARA GROUP	Brewer Conglomerate (Pzb)	Pebble and cobble conglomerate.	? 1000–2000	Overlies Pertnjara Group.	Rounded hills.	
SILURIAN? TO DEVONIAN		Mereenie Sandstone (Pzm)	White sandstone, large-scale cross-bedding. Ripple marks, suncracks. Characteristic joint pattern on air-photos.	2000—	Apparently conformable on underlying Larapinta Group. Known to be unconformable.	Strike ridges and low hills.	Bedding plane markings probable organic origin.
CAMBRIAN TO ORDOVICIAN	LARAPINTA GROUP C–01	Carmichael Sandstone (Oc)	Red-brown silty sandstone, minor interbeds of siltstone.	100—	Conformable on Stokes Siltstone.	Low hills.	
	LARAPINTA GROUP C–01	Stokes Siltstone (Ot)	Siltstone, shale, limestone.	Subsurface only	Conformable between Carmichael Sandstone and Stairway Sandstone.	Beneath alluvium in strike valleys?	
	LARAPINTA GROUP C–01	Stairway Sandstone (Os)	Sandstone, siltstone, limestone.	115—	Conformable between Stokes Siltstone and Horn Valley Siltstone.	Low strike ridges.	Trilobites, gastropods, brachiopods, pelecypods. *Diplocraterion*, *Cruziana*.
	LARAPINTA GROUP C–01	Horn Valley Siltstone (Oh)	Siltstone, shale, limestone.	0–235	Conformable between Stairway Sandstone and Pacoota Sandstone.	Strike ridges.	Pipe-rock, trilobites, gastropods, pelecypods.
	LARAPINTA GROUP C–01	Pacoota Sandstone (C–Op)	Sandstone, friable, medium to coarse, cross-bedded.	0–280	Conformable beneath Horn Valley Siltstone and conformable or disconformable on Cleland Sandstone.	Strike ridges.	Pipe-rock, trilobites, gastropods, pelecypods.
CAMBRIAN		Cleland Sandstone (Cc)	Sandstone, pebbly sandstone; cross-bedded, slump-folded, feldspathic, micaceous.	1765—	Contact with older units not exposed, may be unconformable.	Low strike hills and rounded hills.	

PALAEOZOIC

Cambrian

The *Cleland Sandstone* (Wells et al., 1965) was defined in the Cleland Hills on the Mount Liebig Sheet area. It is overlain conformably by the Pacoota Sandstone and, as discussed above, may unconformably overlie the Carnegie Formation. No fossils have been found in the Cleland Sandstone, but it is considered to be laterally equivalent to the Goyder Formation, Petermann Sandstone, Deception Formation, Illara Sandstone, and part of the High River Shale of the Pertaoorrta Group on the neighbouring Mount Liebig Sheet area, and is therefore regarded as Middle to Upper Cambrian.*

Cambrian-Ordovician

The *Pacoota Sandstone* (Prichard & Quinlan, 1962; Mawson & Madigan, 1930) is the basal unit of the *Larapinta Group* (Prichard & Quinlan, 1962). Its type locality is at Ellery Creek on the Hermannsburg Sheet area. On the Mount Rennie Sheet area, the Pacoota Sandstone conformably overlies the Cleland Sandstone, but on the eastern side of the Mount Liebig Sheet area and at the type locality, it conformably overlies the Goyder Formation. The Pacoota Sandstone is 2700 feet thick at Ellery Creek, but has thinned to about 280 feet in the south-east corner of the Sheet area; it is not exposed west of longitude 129° 30′ E. 'Pipe-rock', tracks, trails, and fossil moulds were observed, but were too friable to collect. Lower Ordovician fossils were collected on the Mount Liebig Sheet area, and both Upper Cambrian and Lower Ordovician fossils on the Hermannsburg Sheet area.

Conformably above the Pacoota Sandstone is the *Horn Valley Siltstone* (Mawson & Madigan, 1930; Madigan, 1932; Prichard & Quinlan, 1962); the type locality is at Ellery Creek on the Hermannsburg Sheet area. The maximum thickness in the Mount Rennie Sheet area is about 235 feet, in the south-east corner, and it is not exposed west of longitude 130° E. It has a maximum known thickness of about 1400 feet at the eastern end of the Idirriki Range on the Mount Liebig Sheet area. Fossils of Lower Ordovician age were collected.

The *Stairway Sandstone* (Chewings, 1935; Prichard & Quinlan, 1962; Wells et al., 1965) conformably overlies the Horn Valley Siltstone; its type locality is also in Ellery Creek on the Hermannsburg Sheet area. On the Mount Rennie Sheet area, the thickness of the Stairway Sandstone cannot be determined from outcrop, but is almost certainly less than 500 feet. It is about 1840 feet in the Idirriki Range on the Mount Liebig Sheet area. Fossils indicate a Lower Ordovician age; but fossils of both Lower and Middle Ordovician age have been collected from the thicker and better exposed sections in the Mount Liebig Sheet area. The Stairway Sandstone was probably more widely deposited than the preceding formations of the Larapinta Group; the margin of the basin during deposition of the Stairway Sandstone was probably very close to longitude 129° E. A thin bed of pelletal phosphorite within the Stairway Sandstone crops out at one locality 12 miles east-south-east of Worman Rocks.

* The Cleland Sandstone is now included in the Pertaoorrta Group (Wells et al., 1967).

In the well exposed sections of Larapinta Group on the eastern side of the Mount Liebig Sheet area, the Stairway Sandstone is conformably overlain by the *Stokes Siltstone* (Prichard & Quinlan, 1962; Wells et al., 1967). On the Mount Rennie Sheet area, Quaternary sediment separates exposures of Stairway Sandstone and Mereenie Sandstone. Limestone of the Stokes Siltstone crops out in the Macdonald Sheet area to the west and the Bloods Range Sheet area to the south, and presumably is present beneath the Quaternary cover above the Stairway Sandstone in this area. The Stokes Siltstone is probably less than 500 feet thick in the Mount Rennie Sheet area. The fossiliferous limestone which occurs towards the base of the Siltstone on the neighbouring Sheet areas is of Upper Ordovician age.

The *Carmichael Sandstone* (Wells et al., 1967) is the youngest formation of the Larapinta Group. The only outcrops unequivocally identified with it are on the eastern edge of the Sheet area. The Carmichael Sandstone conformably overlies the Stokes Siltstone and is overlain apparently conformably by the Mereenie Sandstone. *Cruzianas* similar to those collected from rocks of known Ordovician age have been collected from the formation in the central part of the Amadeus Basin.

Silurian-Devonian

The Larapinta Group is overlain, apparently conformably, by the *Mereenie Sandstone* (Madigan, 1932; Prichard & Quinlan, 1962), but a regional unconformity separates these units on the eastern side of the Amadeus Basin. The contact is not exposed on the Mount Rennie Sheet area and disconformity is possible. The only fossils yet found in the area are bedding-plane markings interpreted as a type of feeding trail.

Devonian-Carboniferous

The *Pertnjara Group* (Chewings, 1931; Prichard & Quinlan, 1962; and Wells in Wells et al., in prep.) overlies the Mereenie Sandstone with a regional unconformity in the western MacDonnell Ranges. The Pertnjara Group is preserved in broad synclinal troughs. It includes fine to coarse clastics and is considered to be a continental synorogenic facies.

The Pertnjara Group has been divided into three formations; the Parke Siltstone at the base, the Hermannsburg Sandstone, and the Brewer Conglomerate at the top. The only formation differentiated in the Mount Rennie Sheet area is conglomerate which crops out about 14 miles east of Ligertwood Cliffs and which has been tentatively identified as the Brewer Conglomerate. It is the only known outcrop of conglomerate belonging to the Pertnjara Group in the Sheet area. Because of poor exposure the remainder of the Pertnjara Group has not been differentiated, but for the most part the outcrops appear to be made up of the Hermannsburg Sandstone. Fossils have not been found in this formation on the Mount Rennie Sheet area. However, plates of dermal armour of the placoderm *Bothriolepis* have been identified by J. Gilbert-Tomlinson (1968) in collections from a sandstone lens in the Parke Siltstone on the Mount Liebig Sheet area, and Hodgson

(1968) has described a spore assemblage from approximately the same horizon in the same area. These fossils indicate a late middle or early Upper Devonian age for the basal part of the Pertnjara Group.

Devonian-Permian

The *Ligertwood Beds* (Wells, Forman, & Ranford, 1965) have their type area at Ligertwood Cliffs in the Mount Rennie Sheet area. They crop out within a zone up to 8 miles wide which extends 70 miles from a point 10 miles west-north-west of Mount Rennie to a point just north of the Mu Hills on the Macdonald Sheet area. Two units, separated by a disconformity, are recognized within the Ligertwood Beds. Steep-sided channels were cut in the lower unit before the upper unit was laid down; away from these channel margins, both units are flat-lying. The Ligertwood Beds are thought to have been deposited adjacent to faults which formed after the Pertnjara Group was folded. The sediments are regarded as being within the age range Devonian to Permian.

Permian

A few small outcrops of flat-lying sandstone, siltstone, and claystone unconformably overlie the Pertnjara Group. The sediments are poorly sorted, conglomeratic, and slump-folded, and include some siltstone beds with varve-like laminations. The sequence is similar to the Buck Formation (Wells et al., 1964) on the neighbouring Macdonald Sheet area and is tentatively considered to be of Permian age.

CAINOZOIC

Tertiary

Piedmont conglomerates are found close to the ranges and hills. They have been dissected by recent streams and have been tentatively mapped as Tertiary because of their similarity to deposits in the central part of the Amadeus Basin (Ranford, Cook & Wells, 1965).

Quaternary

An unknown thickness of aeolian sand, alluvium, and evaporites covers most of the Sheet area. Evaporites occur in the bed of Lake Macdonald and as travertine mounds over the calcareous sediments.

DIAPIRIC STRUCTURES

At Johnstone Hill, in the south-eastern quadrant, a mass of gypsum has penetrated the Cleland Sandstone, Pacoota Sandstone, Stairway Sandstone, Mereenie Sandstone, and basal beds of the Pertnjara Group. The intruded sediments have since been tilted to a near-vertical position so that the outcrop at the surface approximates to a vertical cross-section through the diapir. The intrusive gypsum is about 1 mile in diameter at the surface and rises to about 100 feet above the sand plain at its highest point. The gypsum mass has an amorphous, friable, weathered crust with some secondary crystalline selenite. The primary laminated and contorted gypsum is exposed in deeply incised gullies. Several isolated large angular blocks of weathered crystalline dolomite, crystalline dolomitic limestone, and brecciated crystalline dolomite lie on the surface of the gypsum. The primary gypsum exposed in the gullies contains angular blocks of relatively fresh gypsiferous silty calcareous laminated dolomite, some of which contains dark irregular laminae which may be carbonaceous. Several large masses of dolomite crop out at the northern side of Johnstone Hill, but do not exhibit any consistent structural trend. The largest mass of dolomite rises about 150 feet above the highest point of the gypsum mass. Much of the dolomite is contorted and brecciated and contains possible stromatolites and beds of gypsiferous dolomite similar to the isolated fragments found within the laminated gypsum. Most of this crystalline dolomite is lithologically identical with the Bitter Springs Formation and is referred to it. (A. A. Öpik has reported palimpsests of shelly fossils within a specimen of the gypsiferous dolomite. These fossils could be derived from possible Cambrian sediments at depth, fragments of which may have been brought to the surface by the gypsum intrusion. Alternatively, it is possible that the structures are inorganic in origin and are due to progressive brecciation and recrystallization of the rock.)

Gypsum is also exposed in the core of an anticline in the south-east. Cleland Sandstone crops out on the flanks of the fold about 2 miles from the gypsum core. No large masses of carbonate rocks are present and there are only a few scattered, randomly oriented blocks of dolomite, limestone, and calcareous siltstone resting on top of, and embedded in, the gypsum. Most of the dolomite is brecciated, particularly in outcrops near the centre of the gypsum mass. The fragments in the breccia are irregular and very angular, mostly no larger than an inch across, and are cemented by fine dark grey and green-grey limestone or dolomite. Some of the carbonate rock in these weathered fragments is silicified, and nearly every specimen has a vuggy texture due to the weathering of the more soluble material. Some laminae of dark grey and white chert occur in the dolomite.

The largest exposed mass of gypsum and carbonate rocks in the core of the anticline is about 2 miles long and about ½ mile wide. Most of the outcrop is secondary amorphous friable white gypsum with some secondary crystalline selenite. However, laminated and severely brecciated primary gypsum is exposed in several places in small gullies. The brecciated material is made up of angular fragments of grey and white laminated gypsum up to 6 inches across, cemented in a matrix of amorphous white gypsum. There is no evidence from these outcrops that the gypsum has pierced the overlying sediments or is in intrusive contact with any sediments, but the brecciation of the carbonates and the shearing of the gypsum demonstrates that the mass has been mobile.

GEOLOGICAL HISTORY

The sediments of the Amadeus Basin consist of a very thick sequence of shallow marine, deltaic, and continental deposits of Upper Proterozoic and

Palaeozoic age which have been preserved in a large downwarp in the Precambrian basement. The basement is composed of granite, schist, gneiss, amphibolite, and quartzite whose history has not been deciphered.

The geological history of the Amadeus Basin began with the deposition of sandstone, siltstone, and conglomerate of the Heavitree Quartzite, laid down as a blanket sand and continuous over a very great distance along the northern margin of the Basin. The Heavitree Quartzite grades upwards into the Bitter Springs Formation, which was laid down in shallow water in which colonial algae flourished. Deposits of gypsum and possibly other evaporites were precipitated from the shallow seas in some areas.

In the western part of the Sheet area, the Bitter Springs Formation was overlain by sediments of the Carnegie Formation, which contain a conglomerate bed composed of boulders and pebbles of Bitter Springs Formation, indicating a disconformity between these two formations. In this area the Ellis Sandstone was laid down conformably on the Carnegie Formation and was followed in turn by the Maurice Formation. The Ellis Sandstone and Maurice Formation were probably not deposited over the major part of the Mount Rennie Sheet area; they were laid down in transitional and continental environments and are probably fluvial and littoral deposits.

The Petermann Ranges Orogeny (Forman, 1966), which was centred in the south-western part of the Amadeus Basin, took place in late Upper Proterozoic or early Lower Cambrian times. After this orogeny and a period of erosion, the Cleland Sandstone was deposited on the Carnegie Formation.

The Larapinta Group sediments follow conformably on the Cleland Sandstone and mark the return to a shallow-water marine stable shelf environment. Widespread sedimentation, commencing with a sand sheet (Pacoota Sandstone), consisted of an alternation of sandstone, shale, and limestone. All the Larapinta Group formations thin to the west, and only the Stokes Siltstone is known to extend into Western Australia. This type of marine sedimentation began in the late Upper Cambrian and lasted at least until the Upper Ordovician, when epeirogenic movements caused the sea to regress and terminated the deposition of the Carmichael Sandstone. The deposition of the Mereenie Sandstone followed in a transitional and continental environment. Major orogenic movements uplifted large areas of sediments, particularly along the present northern margin of the basin, before and during deposition of the Pertnjara Group, which consists largely of pebbles and boulders derived from the older sediments.

Most of the folding, faulting, and later erosion of the Amadeus Basin sediments took place before the Permian Period and after the deposition of the Pertnjara Group. Considerable vertical movement took place along major faults south of Lake Macdonald, where the Pertnjara Group and Mereenie Sandstone have been faulted against the Bitter Springs Formation.

A thin veneer of possible Permian glacial sediments was deposited in some areas. Piedmont gravels and valley conglomerates were deposited during a pluvial period in the Cainozoic, and sand dunes were formed during a later arid phase. The present cycle of erosion is not vigorous and its main result has been the production of thin pediments and alluvial deposits.

ECONOMIC GEOLOGY

There are no known economic mineral deposits within the area.

Petroleum Prospects

The northern half of the Sheet area has no petroleum prospects, but the southern half has some possibilities. The sediments include Proterozoic and Ordovician marine sediments; although the more obvious structures have been eroded to Upper Proterozoic levels, the outcrop is sparse in places and possibly some concealed structures are closed in Palaeozoic sediments. The section includes possible source rocks of Proterozoic and Ordovician age and reservoir rocks of Cambrian and Ordovician age. Lutites within Proterozoic and Palaeozoic formations as well as evaporites in the Proterozoic sequence could provide suitable caps for any hydrocarbon accumulation.

Large quantities of wet gas have been found in the Larapinta Group sediments in the Mereenie Anticline in the neighbouring Mount Liebig Sheet area, and although the section is much thinner in the Mount Rennie Sheet area further prospecting is warranted.

Underground Water

There are no waterbores in the area and therefore no information on the depth of the piezometric surface. A reasonable supply of water would be expected from the alluvium in the floodout areas adjacent to the ranges.

Phosphate

Pelletal phosphorite has been found in the rubble derived from the Stairway Sandstone 12 miles east-south-east of Worman Rocks. Phosphorites have been found elsewhere in the Amadeus Basin (Cook, 1963 and 1966; Barrie, 1964; Ranford, Cook, & Wells, 1965; Wells, Ranford, Stewart, Cook, & Shaw, 1967), but deposits of economic value have not been located as yet. Phosphate minerals are commonly associated with radioactive deposits, and therefore radiometric survey can be used to delineate areas worthy of prospecting for phosphate.

Evaporites

Halite occurs as a thin surface crust on Lake Macdonald and gypsum occurs as a crystal mush beneath the surface.

Large deposits of gypsum also occur at Johnstone Hill and in the south-eastern corner, and other evaporites may occur with the gypsum beneath the surface.

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