COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1961/87

EXPLANATORY NOTES ON THE CORNISH 4-MILE GEOLOGICAL SHEET, F/52-1

Compiled by

A.T. Wells

RECORDS 1961/87

EXPLANATORY NOTES ON THE CORNISH 4-MILE GEOLOGICAL SHEET, F/52-1

Compiled by

A.T. Wells

EXPLANATORY NOTES ON THE CORNISH 4-MILE GEOLOGICAL SHEET, F/52-1

Compiled by

A.T. Wells

RECORDS 1961/87

INTRODUCTION

The Cornish Sheet, in the north-eastern part of the Canning Basin, lies between latitudes 20° and 21° South, and longitudes 126° and 127°30' East. There is no permanent settlement within the Sheet area, although Balgo Mission is only about 18 miles east of the north-eastern corner and Billiluna Station is 56 miles by road from Delivery Camp. The Canning Stock Route crosses the Cornish Sheet and is used by Billiluna Station for droving stock to Carnegie Station, about 500 miles to the south. Access to the area is by way of a vehicle track which follows the Canning Stock Route as far south as Well 48, near Godfreys Tank. Godfreys Tank is 107 miles from Billiluna Homestead via this track. There is a subsidiary track from Billiluna Homestead to Werriada Yard at the southern extremity of Gregory Salt Lake.

Annual rainfall in the area is usually less than ten inches, but ample supplies of potable water can be obtained from wells along the Canning Stock Route.

The conditions encountered while carrying out a geological reconnaissance of the north-east Canning Basin are described by Casey & Wells (1956).

Previous Investigations

The earliest explorer in the area was A.C. Gregory (1857), who in 1856 followed Sturt Creek southwards and discovered Gregory Salt Lake.

In 1873 Col. P.E. Warburton (1875) crossed the 'Great Sandy Desert' from Alice Springs to the Oakover River. His exploration route passed about 20 miles south of Gregory Salt Lake at Lady Edith Lagoon.

D.W. Carnegie's exploration route (1898) from the West Australian Goldfields to Halls Creek passed across the western part of the Cornish Sheet and he named many prominent features.

A practicable stock route between Wiluna and Halls Creek was surveyed by Canning in 1906 and 1907. In 1908 H.W.B. Talbot accompanied Canning when the stock route was opened and published (1910) an account of the geology and water supplies. E. Kidson (1921) recorded magnetic observations along the Stock Route. L.J. Jones (1922) travelled along the Canning Stock Route and made a geological investigation of Block 21H (20 - 22°S, 123°30' - 129° E) for the Locke Oil Development Syndicate and Kimberley Petroleum. He describes a dome $1\frac{3}{4}$ miles east of No. 48 Well and a terrace or monoclinal fold, 2 miles west of No. 50 Well, Canning Stock Route.

In 1925, Terry (1927) travelled from Halls Creek to Godfreys Tank as part of an exploring and prospecting expedition in north-eastern Australia.

W.G. Woolnough (1933) described a flight from Louisa Downs to Gregory Salt Lake, in a report on aerial survey operations in Australia.

D.F. Mackay (1934) covered a great deal of the Canning Basin during an aerial survey, but very little of the Cornish Sheet was included.

A preliminary aerial reconnaissance of the desert area was carried out by C.St.J. Bremner (1940) for Caltex (Aust.) Oil Development Pty Ltd, mainly to assess transportation difficulties and the distribution of outcrops.

W.H. Maddox (1941) made a geological reconnaissance in the north-eastern part of the Fitzroy Basin, including a traverse to Godfreys Tank. An account of the geology south and south-west of Balgo Mission by H.J. Evans (1948) in an unpublished report to Frome Broken Hill Pty Ltd includes a small area of the Cornish Sheet.

F. Reeves (1949) carried out extensive aerial and ground geological reconnaissance in the Canning Basin for Vacuum Oil Co. Much of his report covering the north-eastern area is based on work by W.H. Maddox and H.J. Evans.

The Sheet was photographed by the R.A.A.F. in 1953 at a scale of 1 : 50,000, and a 4-mile photomosaic was compiled by the National Mapping Division. In 1954, the Bureau of Mineral Resources, Geophysical Section, carried out an aeromagnetic reconnaissance of the Canning Basin; portions of three flight lines from Halls Creek cross the Sheet.

A geological reconnaissance of the area was made by the Bureau of Mineral Resources in 1955, and gravity readings were taken by a geologist of West Australian Petroleum Pty Ltd, who accompanied the party. Astrofixes were taken by the Western Australian Lands and Survey Department the same year. In 1956 surveyors from the Department of the Interior observed astrofixes and instrument-levelled heights along the Canning Stock Route as far south as Well 48. In 1957, as part of the Bureau of Mineral Resources helicopter survey of the Canning Basin, gravity observations were made in the south-western sector of the Cornish Sheet.

Terry (1957) summarizes some of the exploratory work in the Canning Basin.

The results of astrofixes on this Sheet are tabulated below. Those with prefix N were observed by the W.A. State Lands & Surveys Department, and those with prefix K.B.S. by the Department of the Interior.

Astro-Station	Latitude	Longitude	Easting	Northing
N.10	20°21' 14.58"	126°46' 35.7"	488680	2453395
N.11	20°44' 35.2"	126°39' 45.0"	475461	2406346
N.12 (Approx.)	20°58' 10.0"	127°27' 46.0"	566377	2378337
N.13	20°35' 05.3"	127°19' 11.8"	550509	2425057
K.B.S. 1	20°16' 13.2"	126°33' 04.3"	462975	2463634
K.B.S.2	20°13' 0.6"	126°56' 37.3"	507859	2469909
K.B.S.3	20°00' 46.2"	127°18' 42.9"	550144	2494325

PHYSIOGRAPHY

The main land-forms in the area are dissected hills, sand plains, and alkali or clay flats. The largest areas of dissected hills are the Minnie Range, Bishop Range, Southesk Tableland, and the hills near Godfreys Tank. The higher peaks are mostly about 350 feet above the level of the surrounding sand plain, and 1300 feet or less above sea level. Mesas and buttes are common in the dissected hills, especially where the sediments are flat-lying. In places where the sediments are folded, mesas and buttes are formed only where a well developed duricrust or laterite cap has formed and has been subsequently deeply dissected.

The sand plain of the desert ranges from about 800 to 950 feet above sea level. The sand plain on the western margin of the Sheet and the depression in which Gregory Salt Lake is situated are topographically the lowest. Gregory Salt Lake and adjacent smaller lakes are alkali flats formed by internal drainage; the surface of the lakes consists of alluvium with some gypsum and salt deposits.

The largest drainage channel on the sheet is Sturt Creek, which flows into Gregory Salt Lake. A smaller stream, Djaluwon Creek, flows into the southern end of the lake. Any streams draining the dissected hills are very short, and on reaching the sand plains mostly terminate in claypans with associated alluvial deposits. Examples of this type of stream are those north of the Roberts Range and a short creek emptying on the flat on which Well 50 is situated.

The area was probably uplifted ~~unfiromly~~ uniformly, and the initial surface (Cotton, 1945) was probably a plain modified only by the more prominent structural elements. After a period of lateritization, which apparently affected only some parts of the area, the land surface was subjected to desert weathering, and the present landform is the result of an arid erosion cycle. Stream erosion was probably the most potent factor in reducing the upland areas. Redistribution of pediments gave a plain of arid erosion. Gregory Salt Lake is a local base level for stream alluvium brought into the lake by Sturt Creek.

STRATIGRAPHY*

No Palaeozoic rocks older than Permian are exposed on the Sheet and no basement rocks crop out. Outcrops are generally poor except in areas of mesa and butte topography or in folded sediments adjacent to prominent fault-lines. The rocks are generally deeply weathered and a laterite cap is still preserved on much of the quartz greywacke and the finer-grained clayey sediments.

Permian

Permian rocks cover the largest surface area, and are represented by both marine and estuarine or freshwater sediments.

---

* Specimen Numbers (e.g. C.23) refer to samples collected during 1955 and housed in the Bureau of Mineral Resources Museum.

Permian rocks are well exposed in the dissected sediments in the Southesk Tableland and Bishop Range where the sediments are folded. No Permian formations older than the Noonkanbah Formation have been recognised: they may be concealed by the younger formations or may be part of the undifferentiated Permian sections not visited, though, as neither the Poole Sandstone nor the Grant Formation could be recognised by photo-pattern, most of the sediments probably belong to the Noonkanbah or Liveringa Formation.

The Noonkanbah Formation has very poor outcrops and for the most part is obscured by deposits of alluvium and sand. The formation was mapped by its lithology, photo-pattern, and type of outcrop, especially where the fine sandstone and shale crop~~s~~ out sporadically on clay flats and ~~is~~ are overlain by the fossiliferous Balgo Member. The Noonkanbah Formation is made up chiefly of calcilutite and fine quartz greywacke, with some concretionary sandstone and shale.

Outcrops of the Balgo Member of the Liveringa Formation are usually well exposed, but in some places it is hard to distinguish the Balgo Member from the Noonkanbah Formation in photo-pattern, especially where relief is not great. As a consequence many of the Permian sediments in the Southesk Tableland and Bishop Range cannot be identified and are mapped as undifferentiated Noonkanbah Formation or Balgo Member. Fossiliferous Balgo Member crops out at C47, but no other localities with well preserved fossils were found. At C47 the sediments are fine silicified sandstone and fine micaceous ripple-marked sandstone overlying concretionary micaceous quartz-greywacke; the greywacke contains the numerous marine fossils.

In contrast to the Balgo Member and the Noonkanbah Formation the Condren Sandstone Member of the Liveringa Formation usually crops out as mesas and buttes, breakaways, and dissected rounded hills, which produce a distinctive photo-pattern. The outcrops are mostly light-coloured and form prominent topographic features with good exposures. The member has a well developed joint-pattern and erosion along the joints often produces an en echelon arrangement of conical hills, notably in some parts of the Southesk Tableland and in the Roberts Range. A contact of the Condren Sandstone Member with a conglomerate possibly of the overlying Cretaceous Godfrey Beds was observed at C59, 13 miles north-north-west of Godfreys Tank. The contact surface dips at 10° - 20° east. The underlying sandstone is a micaceous shaly medium-grained current-bedded and ripple-marked sandstone with some interbedded shale. The lithology is similar to that of other outcrops of Condren Sandstone in the north-east part of the Canning Basin. The sandstone was laid down in an estuarine or possibly near-shore shallow-water marine environment. The contact with the Balgo Member is probably conformable.

Triassic-Jurassic

Several small outcrops of micaceous shale and fine sandstone contain abundant Isaura sp., Lingula sp., and a lamellibranch form aff. Pseudomonotis (R.O. Brunnschweiler, pers. comm.). In the Bishop Range (C13, C14) this shale overlies Noonkanbah and other Permian sediments without apparent unconformity; but at M29 and C31 in the Minnie Range a similar Isaura-bearing shale overlies a plant-bearing sandstone and siltstone of Upper Triassic or Lower Jurassic age which has been named the Culvida Sandstone and may be the equivalent of the Erskine Sandstone of the Fitzroy Basin (Brunnschweiler 1954). The shale in the Bishop Range has been identified with the Blina Shale (Reeves, 1951) of the Fitzroy Basin, and that which overlies the Culvida Sandstone has been mapped as undifferentiated Mesozoic; but the two are indistinguishable.

The Blina Shale has no characteristic topographic expression and may either cap isolated peaks or form low dissected hills of moderately dipping strata.

The Culvida Sandstone (Casey & Wells, 1961) is only exposed in the Minnie Range near Well 50 on the Canning Stock Route. The best exposures are on the banks of a small watercourse that drains eastward on to the claypan on which Well 50 is situated. White (1957) has described the plants collected from C8 and C62. The minimum thickness of the formation, estimated from several sections in isolated breakaways, is probably less than 200 feet. The lithology of this formation is much more variable than that of the Blina Shale: sandstone with abundant clay pellets probably derived from the interbedded siltstone. The Culvida Sandstone mostly forms low hills, and some isolated peaks such as those at Chilpada Chara. The slopes of the peaks give a characteristic smooth pattern on the air photographs.

Cretaceous

The Godfrey Beds (Elliott, Casey, & Wells, in McWhae et al. 1958) crop out near Godfreys Tank, predominantly as massive quartz sandstone, with a minimum thickness of 300 feet. The type area is C3a, 3.2 miles north-north-east of Well 48 on the Canning Basin Stock Route, where the Beds crop out as prominent breakaways and many promontories and prominent peaks. They also crop out at Mount Cornish and Mount Elgin. Steep-sided narrow valleys have been eroded in the sediments near Godfreys Tank, and some of them terminate in large pot-holes that have been excavated by small waterfalls: two such holes are Godfreys Tank and Breadens Pool. The breakaways are capped by a very massive sandstone up to 20 feet thick which is underlain by a well bedded comparatively softer sandstone. In several places the worm trail *Rhizocorallium* and *?Etea* sp. indicate a probable Lower Cretaceous age for the Godfrey Beds. At the type section, which is 179 feet thick, *Rhizocorallium* was found in a quartz sandstone about 45 feet from the base of the breakaway.

At C59 the Condren Sandstone Member is overlain by a coarse conglomerate with boulders of sedimentary rocks up to two feet across which is probably the basal conglomerate of the Godfrey Beds. In the Minnie Range two photo-interpreted outcrops of the Godfrey Beds overlie the Culvida Sandstone and at C23 an outlier of sandstone with Rhizocorallium overlies undifferentiated Noonkanbah Formation or Balgo Member. In both areas the nature of the contact is not known. The Godfrey Beds are nowhere in contact with younger formations.

The closest outcrops of Cretaceous rocks to these on the Cornish Sheet are at Brookman Waters on the Stansmore Sheet (F/52-6), where siltstone and claystone with indeterminate radiolaria (cf. Cenosphaera, identified by ~~Miss~~ Dr I. Crespin) crop out.

Quaternary

Salt deposits are not widespread; they are found as a thin crust on the surface of Gregory Salt Lake and on some of the smaller claypans and saltpans on the Sheet. Thin deposits of evaporite have been reported in several of the smaller streams that drain into the Salt Lake. Caliche and travertine are common near the groups of claypans and salt lakes at the north-eastern corner of the Sheet. A very large area of travertine stretches southwards from Well 50 on the Canning Stock Route as far as Lady Edith Lagoon and thence north-westwards to Well 49 on the Canning Stock Route. Large masses of travertine occur in the sand plain area south of Fishes Bluff and between Wells 45 and 46 on the Canning Stock Route. These large deposits probably lie on low ground, where ground water evaporates very close to the surface. A coquinite with numerous small turretted gastropods occur in the travertine at C11.

Alluvium occurs either as small fans and outwash plains where small streams draining the dissected hills empty their load onto the sand plain, or comparatively larger areas in the north-east corner of the Sheet area, derived from the transported load in Sturt Creek. The surface of Gregory Salt Lake is predominantly alluvium with some salt and caliche. A notable feature of the alluvium is that it is light grey or almost white.

Aeolian sand covers extensive plains and is heaped into numerous seif chains trending east-west. A thin coating of hematite on the sand-grain surfaces gives the sand its red or orange colour. The sand is generally medium to fine-grained and subangular to subrounded.

STRUCTURE

The Cornish Sheet area forms part of the very large intracratonic Canning Basin. No basement rocks are exposed and the thickness of sediments can only be estimated approximately from the scant geophysical data.

The sediments of the Canning Basin are cut by numerous faults trending north-north-west. They are nearly parallel to the trend of the Fenton and Pinnacle Faults to the north-west, but do not appear clearly to define shelf and trough areas. The available reconnaissance gravity data indicate a trough whose deepest part passes south-south-east from Godfreys Tank and then south-east through into the Southesk Tablelands. To the north-east and south-west of this trough gravity values are relatively high, and the sediments therefore probably much thinner. Another gravity high trends east-north-east in the north-west corner of the Sheet: it may indicate a basement ridge at the south-eastern end of the Fitzroy Basin. The faults on this Sheet therefore may not be continuations of the Pinnacle and Fenton systems, although they may have a similar origin. Variation in the thickness of the Upper Proterozoic rocks may greatly influence the gravity values on the Sheet. Faults are generally parallel to the trend of the steep gradient, but not close to it.

Faulted monoclinal folds, asymmetrical folds and dome-and-basin structures are present in the Minnie and Bishop Ranges and the Southesk Tableland. These structures are common in hinge-line areas affected by mass slumping and differential compaction in the thicker section of sediments in the adjacent troughs.

The structure of the Godfrey Beds at Godfreys Tank is not clear. The numerous dips measured in the area suggest several small folds with gently dipping limbs. The most prominent appears to be a south-pitching syncline with its axis roughly coinciding with the trend of Breaden Valley.

Two unusual structures occur on the Sheet. One is an almost circular dome about two miles in diameter near C23 in the Southesk Tableland. The second is a basin about 2½ miles in diameter, 4 miles south-east of C41. The beds in the basin dip east-north-east in its south-western quadrant. No dips were measured in the dome. These structures are unusual in being almost perfectly symmetrical, but they may be, like the other structures referred to above, the concomitants of slump movement in an unstable area. The size and symmetry of the dome are not inconsistent with the dimensions of domes produced by salt intrusions. (A large salt mass was recently discovered south of the Fenton Fault in the WAPET Frome Rocks No. 1 Bore.) There is no evidence of the presence of salt or associated rocks at this dome, but a large mass of salt may nevertheless be present at depth.

Gregory Salt Lake lies in a topographic depression but there is no evidence from the surrounding sediments of the structural origin of the lake. Any uplifting of the sediments along the prominent fault lines to the south may have been instrumental in damming back the lake.

ECONOMIC GEOLOGY

Petroleum Potentialities

The area must be considered to have some possibility of petroleum accumulations. Permian and Mesozoic rocks crop out and Palaeozoic sedimentary rocks older than Permian may be present in the basin sediments. An appreciable thickness of sediments is indicated by the large relatively low gravity anomalies, but whether this reflects a thickness of Phanerozoic rocks or reflects a change in basement density is not known.

The Mesozoic rocks have little potential for petroleum: they are relatively thin and in most places deeply dissected.

Source beds for petroleum may be present in Palaeozoic rocks in the trough area. If so, then drainage from these beds may give petroleum accumulation in reservoir rocks, which could well develop near hinge-line areas of sedimentation. The shale, siltstone, and calcareous beds in the Noonkanbah Formation would be suitable as cap and source rock. The Permian formations could possibly act as reservoir beds in the northern half of the Sheet, where they are overlain by Mesozoic rocks.

Apart from the small dome near C23, there are no well defined closed anticlines in the Permian rocks, and most folding is monoclinal, near faults.

Water Resources

Surface water is limited to rock-holes, water-holes, and water that may accumulate in any of the salt lakes and claypans. Sturt Creek has many water holes and several are present in the short streams interconnecting the numerous lakes and claypans in the north-eastern part of the Sheet. Most of them are used for watering cattle. Two of the largest rock-holes in the area are Godfreys Tank and Breadens Pool. Godfreys Tank holds about 40,000 gallons, but is inaccessible to stock. Breadens Pool could be used for watering a few head of stock at a time, and when full holds about 20,000 gallons.

Wells on the Canning Stock Route are on the average 15 miles apart; the northernmost is Well 51 near Delivery Camp Plain. The wells have struck good supplies of water, generally at depths from 20 to 70 feet, mostly in Permian sediments. The supply from these wells as shown on the Canning Stock Route map is given in the Table below.

Well No.	Depth in feet	Storage	Supply	Quality of water.
45	28	2,250 gals.	1,000 gals/hr.	Excellent
46	27	1,300 "	2,000 "	"
47	25	1,500 "	1,260 "	"
48	66	7,650 "	130 "	(Now caved in)
49	50	4,800 "	500 "	Excellent
50	62	3,300 "	500 "	"
51 (Werriado)	22	900 "	1,750 "	Poor quality

The spoil from Well 51 is hard sandy clay with large amounts of gypsum. These materials may be connected with the evaporite deposits in Gregory Salt Lake.

BIBLIOGRAPHY

BREMNER, C.St.J., 1940 - Aerial geological reconnaissance of the Fitzroy Desert Basin, Western Australia. Unpubl. Rep. to Caltex (Aust.) Oil Development Pty Ltd.

BRUNNSCHWEILER, R.O., 1954 - Mesozoic stratigraphy and history of the Fitzroy and Canning District. J. geol. Soc. Aust., 1, 35.

CARNEGIE, D.W., 1898 - SPINIFEX AND SAND. London, Pearson.

CASEY, J.N., and WELLS, A.T., 1956 - Operational problems and conditions in the North-East Canning Basin, W.A. Bur. Min. Resour. Aust. Rec. 1956/93 (unpubl.).

CASEY, J.N. and WELLS, A.T., 1961 - Regional geology of the North-East Canning Basin. Bur. Min. Resour. Aust. Rep. 49 (in press).

DICKINS, J.M., 1958 - Permian fossils from the Canning Basin, Western Australia. Bur. Min. Resour. Aust. Rec. 1958/7 (unpubl.)

EVANS, H.J., 1948 - Memorandum on geological reconnaissance south and south-west of Pallotine Mission. Unpub. Rep. for Frome-Broken Hill Pty Ltd, 2000-G-2.

GARRETT, M.J., 1956 - Gravity traverses by Geological Party G.C. in the eastern portion of the Fitzroy-Canning Basin. Unpub. Rep. for West Aust. Petroleum Co. Pty Ltd.

GREGORY, A.C., 1857 - Papers relating to an expedition recently undertaken for the purpose of exploring the northern portion of Australia. Parl. Pap., London, 1857.

GREGORY, A.C., 1878 - Appendix M in Report by the Surveyor General for the year 1897, in W. Aust. parl. Pap., Vol. II, 1898.

GUPPY, D.J., LINDNER, A.W., RATTIGAN, J.H., and CASEY, J.N., 1958 - The geology of the Fitzroy Basin, Western Australia. Bur. Min. Resour. Aust. Bull. 36.

JONES, L.J., 1922 - A geological reconnaissance of Locke Oil Co. Lease 21H, Canning Basin, W.A. Geol. Surv. W. Aust. File No. 121/22 (Unpubl.).

KIDSON, E., 1921 - General magnetic Survey of Australia and on an expedition over the Canning Stock Route, W.A., 1914. Carneg. Inst. Washington, Dep. Terr. Magnetism, 4, 1921, p.164.

MACKAY, D.F., 1934 - The Mackay Aerial Survey Expedition, Central Australia, May-June 1930. Geogr. J., 84 (6), Dec. 1934.

MADDOX, W.H., 1941 - A geological reconnaissance of the north-eastern part of the Fitzroy Basin, Western Australia. Unpubl. Rep. to Caltex (Aust.) Oil Development Pty. Ltd.

McWHAE, J.R.H., PLAYFORD, P.E., LINDNER, A.W., GLENISTER, B.F., and BALME, B.E., 1958 - The stratigraphy of Western Australia. J. geol. Soc. Aust., 4, (2).

REEVES, F., 1949 - Geology and oil prospects of the Desert Basin, Western Australia. Unpubl. Rep. for Vacuum Oil. Co. Pty Ltd.

REEVES, F., 1951 - Australian oil possibilities. Bull. Amer. Ass. Petrol. Geol., 35(12), 2479-2525.

TALBOT, H.W.B., 1910 - Geological observations between Wiluna and Halls Creek. Bull. geol. Surv. W. Aust. 39.

TERRY, M., 1927 - THROUGH A LAND OF PROMISE, London, Jenkins.

TERRY, M., 1957 - The Canning Basin of Western Australia. Geogr. J., 123 (2), 157-166. June 1957.

TRAVES, D.M., CASEY, J.N., and WELLS, A.T., 1956 - The geology of the south-western Canning Basin, Western Australia. Bur. Min. Resour. Aust. Rep. 29.

VEEVERS, J.J., 1957 - Operations of the 1957 Canning Basin Party. Bur. Min. Resour. Aust. Rec. 1957/90 (unpubl.).

* WARBURTON, P.E., 1875 - A journey through the western interior of Australia. S. Aust. Parl. Pap. 28.

WHITE, Mary E., 1957 - Report on plant fossils from the North-East Canning Basin, Western Australia. Bur. Min. Resour. Aust. Rec. 1957/74 (unpubl.).

WOOLNOUGH, W.G., 1933 - Report on aerial survey operations in Australia during 1932. By Authority, Canberra .

* VEEVERS, J.J., and WELLS, A.T., 1961 - The geology of the Canning Basin, Western Australia. Bur.Min.Resour.Aust.Bull. 60

TABLE I - STRATIGRAPHY AND CORRELATIONS ON THE CORNISH SHEET, F/52-1

AGE	MAP SYMBOL	FORMATION	MINIMUM THICKNESS IN FEET	LITHOLOGY	FOSSILS	CORRELATION
QUATERNARY	Qa		20	Alluvial silt, & sand		
	Qs		0-120	Aeolian sand		
	Ql		10	Travertine		
	Qc		5	Caliche		
	Qt		1	Evaporites - gypsum and halite.		
CRETACEOUS	Kg	Godfrey Beds	300	Coarse and fine quartz sandstone thin bedded, some siltstone.	Rhizocorallium and Ætea sp.	Anketell Sandstone of south-west Canning Basin. (Traves, Casey & Wells, 1956).
TRIASSIC OR JURASSIC	M		30	Well bedded sandstone and shale.	Isaura sp.	
	Mc	Culvida Sandstone	100	Coarse current-bedded sandstone and inter-bedded fine white shale	Numerous plants.	Erskine Sandstone of Fitzroy Basin. (Brunnschweiler, 1954)
TRIASSIC	Rb	Blina Shale	100	Medium micaceous shale and sandstone, well bedded.	Isaura sp., Lingula sp. Pseudomonotis sp.	Blina Shale of Fitzroy Basin, (Reeves, 1951).
		DISCONFORMITY				
PERMIAN	Pr	Liveringa Formation: (Condren Sandstone (Member	250	Massive jointed sand-stone and interbedded laminated sandstone.	Plants	Middle plant bearing beds of Liveringa Formation.
	Po	Liveringa Formation: Balgo Member or Lightjack Member	200	Quartz greywacke, medium sandstone, some shale.	Stutchburia cf. muderongensis, Atomodesma sp.ind.	Lightjack Member of Liveringa Formation. (Guppy et al. 1958).
	Pn	Noonkanbah Formation	50+	Calcilutite and fine quartz greywacke with concretionary sandstone and shale.	Marine macrofossils.	

MESOZOIC

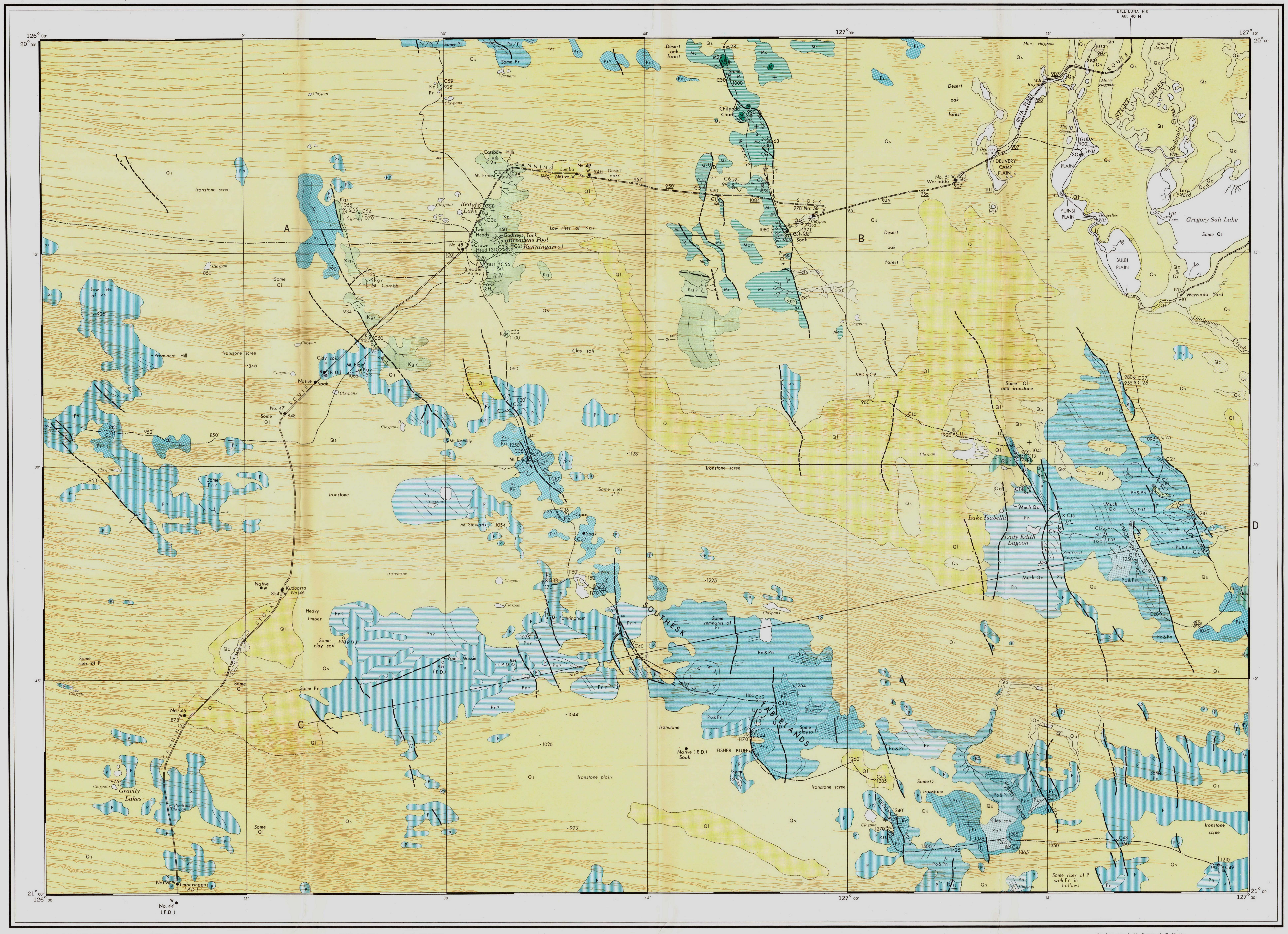
FIRST EDITION 1960

CORNISH

WESTERN AUSTRALIA

AUSTRALIA 1:253,440

4 MILE GEOLOGICAL SERIES SHEET F 52-1



Reference

CAINOZOIC	QUATERNARY			Qa	*Alluvium*
				Qs	*Sand*
				Ql	*Hard travertine, tufa*
				Qc	*Caliche*
				Qt	*Evaporites*
MESOZOIC	CRETACEOUS		Godfrey Beds	Kg	*Coarse and fine, thin-bedded quartz sandstone, some siltstone*
	TRIASSIC — JURASSIC			M	*Thin-bedded sandstone and shale*
			Culvida Formation	Mc	*Coarse, current-bedded sandstone and interbedded fine white shale*
	TRIASSIC		Blina Shale	Rb	*Micaceous shale and medium-grained, thin-bedded sandstone*
			Disconformity		
PALAEOZOIC	PERMIAN	Liveringa Formation	Condren Sandstone Member	Pr	*Massive jointed sandstone and interbedded laminated sandstone*
			Balgo Member	Po	*Quartz greywacke, medium-grained sandstone and some shale*
			Lightjack Member or Noonkanbah Formation	Pn/Pj	*Undifferentiated*
			Balgo Member & Noonkanbah Formation	Po&Pn	*Undifferentiated*
			Noonkanbah Formation	Pn	*Calcilutite and fine quartz greywacke with minor sandstone and shale*
			Undifferentiated	P	*Sandstone and shale*
			Unconformity		
PRECAMBRIAN	UNDIFFERENTIATED			p€	*Metamorphic rocks with granite intrusions and sediments (in section only)*

- *Established geological boundary, position approximate*
- *Established fault, position approximate, relative movement and dip indicated where known*
- *Established fault, concealed*
- *Inferred fault*
- *Inferred fault, concealed*
- *Strike and dip of strata*
- *Horizontal strata*
- *Dip < 15°* (air-photo interpretation)
- *Dip 15°-45°* (air-photo interpretation)
- *Trend of bedding* (air-photo interpretation)
- *Joint pattern* (air-photo interpretation)
- *Marine macrofossil locality*
- *Plant fossil locality*
- × C 12 *Text reference to specimen locality*
- *Route of geological party's traverse*
- *Geological party's traverse along vehicle track*
- *Sand dunes*
- W.H. *Waterhole*
- R.H. *Rockhole*
- W *Well*
- *Stock route*
- · 1265' *Height in feet, instrument levelled* (datum: mean sea level, Derby)
- · 1190' *Height in feet, barometric* (datum: mean sea level, Derby)
- N20 *Astro station*
- (P.D.) *Position doubtful*

Compiled and published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development.
Transverse Mercator Projection.

INDEX TO ADJOINING SHEETS

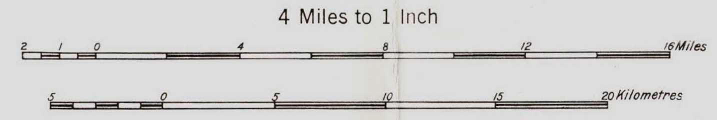
Showing Magnetic Declination

CROSSLAND	MT BANNERMAN	BILLILUNA
DUMMER	CORNISH	LUCAS
PERCIVAL	HELENA	STANSMORE

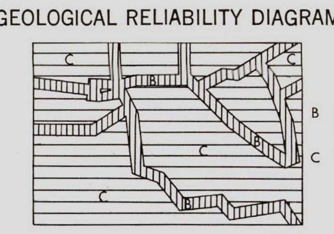
ANNUAL CHANGE 30" E

Scale

4 Miles to 1 Inch

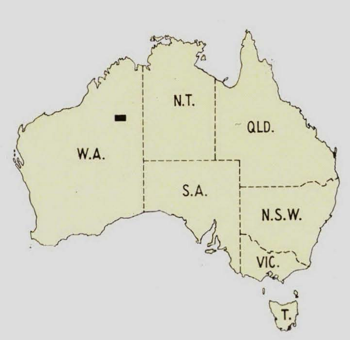


GEOLOGICAL RELIABILITY DIAGRAM



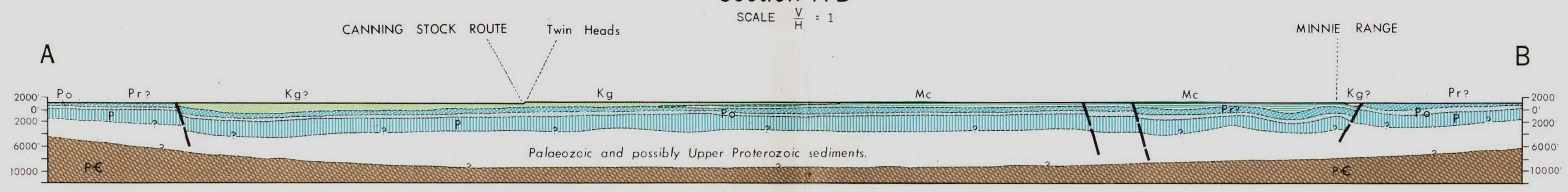
B *Reconnaissance—regional traverses and air-photo interpretation*
C *Sketchy—air-photo interpretation*

Geology by: J. N. Casey, A. T. Wells.
Compiled 1959 by: J. N. Casey, A. T. Wells.
Drawn by: Adastra Airways Pty. Ltd.



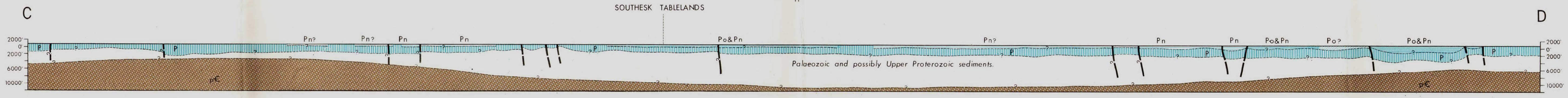
Section A-B

SCALE $\frac{V}{H} = 1$



Section C-D

SCALE $\frac{V}{H} = 1$



AIR-PHOTOGRAPH FLIGHT DIAGRAM

Air-photography by the Royal Australian Air Force; complete vertical coverage at 1 : 50000 scale; Mission Numbers: 1474 1478 1487 1488 1489 1491 1492 1493 1510 1567 1569 1572 1573 May - August 1953

CORNISH

SHEET F 52-1

Printed by Mercury Press, Hobart.

Complimentary

Copies of this map may be obtained from the Bureau of Mineral Resources, Geology and Geophysics, Canberra, A.C.T., or the Geological Survey of Western Australia, Perth, W.A.