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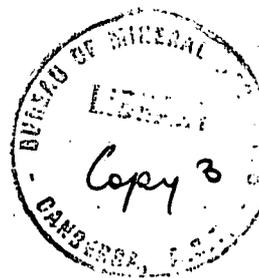
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REPORT ON A GEOLOGICAL SURVEY OF COMMONWEALTH
TERRITORY, JERVIS BAY

by

W.J. Perry & J.M. Dickins

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SUMMARY

Outcrops in the Commonwealth Territory at Jervis Bay consist almost entirely of sandstone of Permian age. The name Jervis Bay Sandstone is proposed for these rocks, which have been found to underlie the Wandrawandian Siltstone, and are tentatively correlated with the Conjola beds - all units of the Shoalhaven Group, which includes part of the former Upper Marine Series. Marine fossils having affinity with those found in the former Upper Marine Series have been found in the Jervis Bay rocks. The sandstones have been invaded in a few places by basic intrusive rocks, probably during the Tertiary Period.

The only materials of economic significance found in the Territory are firebrick clay, and ferruginous gravel useful for surfacing roads. Additional supplies of the ferruginous gravel may occur in the areas delineated on the map as suitable for further prospecting.

INTRODUCTION

This report is based on field work at Jervis Bay and in the surrounding area during the period 4th to 30th June, 1952. The purpose of the investigation was primarily economic, though no further attention was given to the deposit of firebrick clay previously described (Smith, W.C., Belford, D.J., Hawthorne, W.L., and Robertson, A.V., 1948).

Locality

The Jervis Bay Territory is approximately 125 miles south of Sydney and has an area of little more than 24½ square miles, including Bowen Island. The northern boundary runs from the north point of Bowen Island through Captains' Point to the coast, thence through a point 200 feet north of Huskisson trig to the west coast. Elsewhere the Territory is bounded by the water of St. George's Basin, Sussex Inlet and the South Pacific Ocean. (See Plan No. A.C.T. 18-4).

Access

The settlement is in the vicinity of Captains' Point the site of the former Naval College, and is readily accessible by land, sea and air; a bitumen road connects the settlement with the Prince's Highway, there is a naval jetty at Captains' Point and a naval aerodrome about 1 mile to the south-south-west.

Water Supply

Water for the settlement comes from Lake Windermere, a lake formed by the impounding of a number of small streams by sand dunes. The water is pumped to a high level reservoir half a mile east of the lake. A separate reservoir and pumping station supply the aerodrome.

CLIMATE AND VEGETATION

The area has warm summers and mild winters and an average annual rainfall of nearly 45 inches evenly distributed throughout the year.

Approximately half of the Territory is covered by old fixed dunes with a dense growth of large eucalypts including bloodwood and blackbutt; the undergrowth is commonly bracken and coarse grass. Low dense scrub grows on the rocky headlands, and scattered stunted scrub and grass-trees on the open undulating sandstone areas. A forest classification map of the area, showing height and density of vegetation in detail, was compiled by the Commonwealth Forestry and Timber Bureau in June, 1950.

Survey Method

Vertical aerial photographs of the whole area at a scale of 1 to 30,000 (roughly 2 inches to the mile) were available. Observation points were noted on the appropriate photo, pricked through and numbered on the back. Altitudes were measured by surveying aneroids, correctness for diurnal variation being applied by reference to an altimeter read half-hourly at base, St. George's Basin. Check readings were taken at sea level and at trig points when possible.

Prior to the detailed mapping of the Territory, a reconnaissance was made of the surrounding region west to the Prince's Highway and north to the Shoalhaven River, to determine the stratigraphic position of the Jervis Bay rocks within the Permian succession of the South Coast.

PHYSIOGRAPHY

The greater part of the Territory consists of gently undulating sandstone country with considerable sand cover, drained by small short inherited consequent streams. Those streams flowing west have been impounded by sand-dunes with the formation of Lake Windermere and Lake McKenzie. These sand dunes form a broad tree-covered spit which extends from the lakes to Sussex Inlet.

The east and south-east coast consists for the most part of precipitous cliffs ranging up to about 450 feet in altitude at the headland east of Steamer's Beach. The highest point in the area is Bherwerre trig., 551 feet, situated on a fixed sand-dune about $\frac{3}{4}$ mile north of Steamer's Beach.

On the south-west coast, wave-cut rock platforms front the headlands, which are separated one from the other by bay-head beaches.

It is probable that Jervis Bay and St. George's Basin are structural basins originating from gentle dome and basin folding within the Permian strata. The soft Wandrawandian Siltstone was removed more easily from unwarped areas than the harder underlying Jervis Bay Sandstone, leaving the present surface which largely reflects the gentle folds. Prior to the formation of St. George's Basin and the Bay the entrance to the latter was probably the old valley of Currumbene Creek and its former tributary Moona Moona Creek. At the end of the Pleistocene Epoch the whole area was partly submerged and the streams be-trunked by the general rise in sea-level.

GEOLOGY

Previous Work

Several workers have described the geology of the area about Jervis Bay in a general way, but, except for igneous rocks, no specific mention is made of the Territory.

Jáquet, Harper and Card (1905, p.78) recorded the occurrence of three dykes on the south-west coast of the Territory and referred to them as olivine-basalt. Card and Harper (1915, p.357) quoting the 1905 paper, discussed the same dykes again and provisionally named them olivine-dolerite. Harper (1915) mapped the Jervis Bay area as undifferentiated Upper Marine "Series", and Brown (1933) in her geological map of the South Coast of N.S.W. represented Jervis Bay as Permo-Carboniferous "sandstone, etc." David (1950, p.347) also referred the Jervis Bay sediments to the Upper Marine "Series".

1. Sedimentary rocks

A brief reconnaissance of the region from the Shoalhaven River to St. George's Basin has led to the conclusion that the sediments of the Jervis Bay Territory underlie the Wandrawandian pebbly silt-

stone of David and Stonier (1890). The Jervis Bay rocks are therefore tentatively correlated with the Conjola Beds of Permian age.

The sedimentary rocks exposed in the Territory are dominantly sandstone, as shown in the stratigraphic sections below; the name proposed for these rocks is Jervis Bay Sandstone, as the sandstone is exposed along a considerable proportion of the shoreline of the Bay and is the rock on which the settlement of Jervis Bay is built.

The Jervis Bay Sandstone consists of medium to coarse-grained light-grey sandstone, in places silty, usually well jointed and massively bedded. In many places it is poorly sorted, with many rounded pebbles and few cobbles and boulders of milky quartz, quartzite, chert, slate, jasper, and in places igneous rocks, distributed haphazardly throughout. Some of the quartz pebbles show cracks and are in poor condition, possibly indicating that they have passed through more than one cycle of erosion. One phyllite boulder was seen with the subjacent silty sandstone beds bent round it, indicating that it had been dumped not rolled on to the sediments. None of the pebbles examined showed striations, but striated pebbles have been found in other formations of the Shealhaven Group (Thiele, 1903, p.59). The poor sorting shown by the Jervis Bay Sandstone, and the dumping referred to, are considered to be the result of the dropping of pebbles on to the finer sediments of the sea floor from melting ice rafts in the Permian seas. In terms of the nomenclature of fragmental silicate rocks proposed by Condon (1952) the dominant rock types in the area fall within the sandstone group; unlike the normal quartz sandstone, the quartz grains are usually angular. Silty sandstones are common, quartz greywackes less common, and rocks belonging to the greywacke group proper are found in places.

The distribution of the Jervis Bay Sandstone in the Territory is shown on the map accompanying this report. Neither the bottom nor the top of the formation is exposed in the Territory, though slightly less than $\frac{1}{2}$ mile west of Lamb's Point the Jervis Bay Sandstone dips beneath the overlying Wandrawandian Siltstone. Consequently there is no outcrop in the Territory suitable for a type section; however, the following section was measured on the east coast near Stony Creek at Latitude $35^{\circ} 10\frac{1}{2}'$ South, Longitude $150^{\circ} 45'$ East. It consists from the top downwards of

73 feet medium to coarse-grained light grey sandstone with a few glauconite grains; some cross-bedding at bottom; sample J.B. 50 at top

63 feet not exposed; obscured by sand cover and vegetation

15 feet coarse-grained light grey sandstone with many quartz granules and numerous rounded quartz pebbles and cobbles throughout; bedding flaggy to massive; some fossil wood impressions; sample J.B. 49 at top

38 feet medium to coarse-grained silty grey sandstone bedding flaggy to massive

8 feet interbedded silty relatively softer grey sandstone with worm burrows and Brachiopod impressions, and harder medium to coarse-grained light grey sandstone

29 feet massively-bedded coarse grained light grey sandstone with numerous rounded pebbles and cobbles and occasional small boulders of quartz, quartzite, slate, and igneous rocks; sandstone grades laterally in places into silty micaceous sandstone; sample J.B. 48 at top
Sea level.

Total thickness 226 feet.

A thicker section probably stratigraphically below the Stony Creek section, was found on the headland to the east of

Steamer's Beach at Latitude $35^{\circ}10\frac{1}{2}'$ South, Longitude $150^{\circ}44'$ East. Here the section in descending order, is as follows:-

357 feet intermittent outcrops of massively bedded medium to coarse-grained light-grey sandstone

10 feet massive coarse-grained light-grey sandstone

96 feet interbedded medium to coarse-grained light-grey sandstone and very sandy dark grey siltstone with quartz granules; sample J.B. 36 at top,

grading in the lowest 30 feet into interbedded coarse-grained light grey sandstone to fine conglomerate, and dark grey silty sandstone with Pelecypods and Gastropods; sample J.B. 35 at bottom.

Sea level.

Total thickness 463 feet.

A number of marine fossil horizons were seen in the Jervis Bay Sandstone and the most favourable fossil localities examined have been sampled. (Fossil samples J.B. 32, 35, 44A, 47 and 65 were collected, the positions of which are shown on the plan.) J.B. 35 comes from the base of the section at the east end of Steamer's Beach and represents the lowest fossil horizon; it comprises abundant pelecypods with some brachiopods and gastropods. The Jervis Bay breakwater is built of sandstone taken from two quarries to the south of the settlement. J.B. 65, from the breakwater, probably represents the fossil horizon at the base of the larger quarry, 1 mile south of Captain's Point; it contains abundant pelecypods and brachiopods, while J.B. 32 from Flat Rock Creek about 1 mile south-west of Captain's Point, contains only pelecypods. J.B. 47 from the headland $\frac{3}{4}$ mile south-west of Cape St. George consists of a single Aviculopectenid.

J.B. 44A and possibly J.B. 32 and J.B. 47 are stratigraphically slightly above J.B. 65.

Correlation of the fauna is difficult because of the inadequate stratigraphical palaeontology which has been done on the Eastern Australian Permian, but it can be stated that the fauna from the Jervis Bay Sandstone shows closer affinity with that recorded elsewhere from the Shoalhaven Group than with the fauna of the Lower Marine of the Hunter Valley. Determinations of the fossils are included in appendix 1. Five samples of the Jervis Bay Sandstone were examined by I. Crespin for microfossils but none was found.

Overlying the Jervis Bay Sandstone in places is a ferruginous gravel. A section measured on the road to Christian Minde about $\frac{1}{2}$ mile south-west of Huskisson trig, showed the following profile, from the top downward,

1 feet grey sandy soil
1 foot nodules of sandstone with limonite skin or pellicle (J.B. 31), and rounded quartz pebbles in brown sand matrix,
1 foot quartz pebbles in yellow sandy matrix, weathered sandstone.

The limonite-covered nodules are mostly of pebble size with a few small cobbles, and are suitable for use as a dressing in road making. Probably the nodules may be classified with the cemented aggregates of Bryan (1952, p.49). They are found in areas of near flat or gently sloping topography on both the Jervis Bay and the Nowra Sandstone; it is not clear whether they have been formed by pedogenic processes in place, or whether they are the redistributed ferruginous nodules of a pre-existing profile.

2. Igneous rocks

The igneous rocks of the Territory have been described previously by Jaquet, Harper, and Card (1905). They mapped three dykes on the south-west coast, the positions of which are shown on Plan No. 1. The most southerly of these, $1\frac{1}{2}$ miles north of St. George's Head, has been examined and because of its outcrop pattern is thought to be an intrusive plug rather than a dyke. The overlying sandstones in a small area have been slightly bowed upward by the intrusion, which in another place shows a steeply dipping contact with the sandstone, and a chilled margin of 6 to 9 inches. The weathered rock has a pitted surface, and shows abundant greyish plagioclase phenocrysts and a few black augite phenocrysts in a greenish-grey ground mass. A sample of the rock has been analysed (Jaquet et al., 1905, p.91) and the chemical composition is that of a dolerite.

On a small bay-head beach near the outcrop a sample of black mineral sand (J.B. 53) was collected, the composition of which is shown in appendix 2.

Another outcrop of igneous rock, probably a dyke, was seen 3 miles north-north-east of St. George's Head; unfortunately it was inaccessible and a sample could not be obtained.

The age of the igneous rocks is believed to be Tertiary (Brown, 1933, p.45).

STRUCTURE

Insufficient regional work has been done to permit of more than a brief account of the structure of the Territory. The information obtained from this limited area indicates that Jervis Bay is a synclinal basin, and that the Territory itself is formed of an anticlinal ridge the axis of which swings round to the south of the Bay, and which is bounded on the east and south-east by possible fault lines.

Minor normal faults with fault surfaces dipping north-east at 30 degrees are present at Governor Head, and there is a steepening of the westerly dip of the beds in a small area as one proceeds east.

There is evidence of slight reverse faulting on the headland $\frac{1}{2}$ mile south-west from Cape St. George, indicating that compressional movements have been active in the area. The fault surfaces dip south-west at 35 to 40 degrees and the movement along the surfaces is of the order of 2 feet. Though the dips in the Territory are in most places less than 10 degrees, at St. George's Head the westerly dip increases from 9 to 22 degrees as one moves east through 650 feet; this steepening may be due to drag along a west-dipping normal fault farther to the east, though this idea involves the erosion and disappearance of the upthrown block.

The Jervis Bay Sandstone is well jointed, and the several caves along the coastline near sea level probably owe their formation to the ease of weathering of the sandstone along intersecting joints.

DEPOSITS OF ECONOMIC SIGNIFICANCE

1. Firebrick clay

A report on the firebrick clay deposit south-west of the aerodrome has been issued previously (Smith et. al., 1948), and no additional work was done during the present investigation. The boundary of the clay deposit shown in the 1948 report has been transferred to plan ACT 18-4. It is probable that there are other small clay occurrences in the Territory; one small claypit was seen near Telegraph Creek where it is crossed by the track to Governor Head.

2. Road-building material

A useful material for road construction is the ferruginous gravel which is found overlying the Jervis Bay Sandstone about one mile north of the Territory, and also to a limited extent within the Territory itself. As previously indicated, it usually occurs beneath a cover of sandy soil in relatively flat or gently sloping areas. To obtain the material, the sand cover is stripped off and the gravel moved by bulldozer into a large heap at a loading ramp; as required, the gravel is then pushed off the ramp into a truck below. Examination of the air photographs has revealed areas in the Territory where additional gravel deposits are likely to be found, and these areas are outlined on the accompanying plan.

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APPENDIX I

DETERMINATIONS OF FOSSILS FROM JERVIS BAY
A.C.T.

by

J.M. Dickins

Sample J.B. 35

Pelecypods

Astartila cf compressa Fletcher	common
Morismopteria sp.	Very common
Chaenomya? sp.	Uncommon
Stutchburia cf compressa (Morris)	common
Astartella sp.	common
Avidulopecten sp. ind.	Uncommon
Nuculana nov. sp.	common
Schizodus sp.	Uncommon

Gastropods

Platyschisma? sp.	} Uncommon
Ptychomphalina sp.	
Plourotomaridae gen.ind.	

Brachiopods

Dielasma sp.	Uncommon
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Sample J.B. 65

In the two quarries from which the rock for the breakwater was taken the fossils are badly preserved.

Pelecypods

Astartila cf compressa Fletcher	common
Stutchburia cf compressa Morris	Very common
Aviculopecten cf fittoni Morris	Uncommon

Gastropods

Gen.ind.	Uncommon
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Brachiopods (Determined by G.A. Thomas)

Martiniopsis? cf subradiata (Sowerby)	common
Spirifex cf stutchburii Etheridge	common
Dielasma sp.	common

Plantae

Remains of stems, some apparently lignified	Uncommon
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Sample J.B. 32

Pelecypods

Chaenomya? sp. (of Pachydomus cuneatus (Sowerby))	Common
Astartila cf compressa Fletcher	common
Schizodus sp. ind.	Uncommon
Notomya? sp.ind.	Uncommon
Myonia sp. ind.	Uncommon

Sample J.B. 44A

Astartila sp.	common
Dielasma sp.	common

Sample J.B. 47

Aviculopecten cf tenuisculus Dana	Single specimen
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APPENDIX 2

SAMPLE OF BEACH SAND FROM JERVIS BAY A.C.T.

by

J. Ward

Locality	wt. % of conc.	Percentage Composition of Conc.				
		Zircon	Rutile	Ilmenite	Magnetite	O.Minerals
Jervis Bay A.C.T.	15.1%	23.8	8.1	53.9	1.6	12.6

(1) "O. Minerals" is made up of the following:-

Garnet = 0.6%
Epidote = 2.9%
Monazite = 0.4%
Tourmalino = 3.3%
Leucoxeno = 5.0%
Spinel &
Sapphire &
Corundum = 0.4%

(2) Mineral grains in the sand are particularly fine.

(3) The rutile is of a very dark variety.

GEOLOGICAL MAP COMMONWEALTH TERRITORY JERVIS BAY

SCALE OF MILES



Geology by W.J. Perry & J.M. Dickins
Topographic Base from Slotted Template Assembly
by National Mapping Section

REFERENCE

CAINOZOIC QUATERNARY

- Q_o Alluvium
- Q_s Sand areas with vegetation
Sand drifts and beaches

TERTIARY

- T_o Dolerite

PALAEZOIC PERMIAN

- P_w Wandrawandian Siltstone
- P_j Jervis Bay Sandstone

- Established geological boundary position definite
- Established geological boundary position approximate
- Buildings
- Cliff
- Areas probably underlain by ferruginous gravel
- Swampy areas
- Sand dune
- Sealed Road
- Track
- Prevalent dip
- Dip and strike

