

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

MINERAL RESOURCES DIVISION

CONSTRUCTION MATERIAL - PORT MacDONNELL BREAKWATER

Client: MINISTER OF MARINE

by

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<u>No.</u>	<u>Plan Accompanying the Report</u>	<u>Scale</u>
71-816	Pt. MacDonnell Breakwater - Sources of Construction Material.	1:500,000

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INTRODUCTION

The construction of a stone-mound breakwater at Port MacDonnell will require about 100,000 to 170,000 tons of suitable stone. Individual blocks should be about 5 tons in weight, and an amount as yet unspecified should contain individual blocks which range in weight from 5 to 10 tons.

Potential sources of breakwater construction material in the immediate area surrounding Port MacDonnell have been investigated by Pain (1970). His report shows that there are two deposits containing some suitable material: These are the basalt at Mt. Schank about 8 miles from Port MacDonnell and the dolomite at Up and Down Rocks about 35 miles from Port MacDonnell. Engineers concerned with the project have cast serious doubts on the availability of suitable rock of the right size from Mt. Schank, and much of the material from Up and Down Rocks may be below size due to thin bedding and irregular dolomitisation.

Because no suitable deposits are definitely known within 30 miles of Port MacDonnell, it is appropriate at this stage to set down brief comments on the nature and locality of all the known construction materials within a reasonable distance of the port. The selection of one or more deposits for further testing will then depend upon engineering feasibility studies of the more interesting deposits. The deposits are shown on the accompanying locality map.

GEOLOGICAL SETTING

Port MacDonnell and other localities mentioned in this report are situated near or within the Gambier Embayment of the Otway Basin. The embayment is bounded to the north by the Padthaway Ridge, the Murray Basin and the western extension of the Great Dividing Range. The embayment is an elongated downwarp of the crust which extends in a south-east direction along the coast of South Australia towards the Otway Ranges in Victoria. The north-west boundary is a composite arcuate structure in part a fault and in part a hinge zone (see insert on the locality map)

Tertiary sediments in the Gambier Embayment are at least 4,000 feet thick, and overlies about 10,000 feet of Mesozoic rocks which rest upon a basement of Lower Palaeozoic meta-sedimentary rocks intruded by granite and porphyry. The Palaeozoic rocks crop out on the embayment margins. Older basin sediments up to and including those of Lower Tertiary age are mainly buried below younger deposits. The Middle Eocene Tartwaup Formation which crops out at Knights Quarry is an exception. Successively younger Tertiary deposits include the Compton Conglomerate, the Gambier Limestone and the overlying

Naracoorte Limestone. Of these, the Gambier Limestone is the formation most commonly found at or near ground surface within the embayment area.

Volcanic rocks belonging to the "Older Volcanics" of Lower Tertiary age and the "Younger Volcanics" of late Tertiary to Recent age crop out in Victoria. Apart from recent falls of volcanic ash, two phases within the "Younger Volcanics" are known - pre and post Bridgewater Formation. The "Younger Volcanics" extend into South Australia as a roughly east-west volcanic belt as far west as Mt. Muirhead. Isolated centres of late Tertiary to Recent volcanics occur over a distance of nearly 40 miles between Mt. Schank and Mt. Graham.

The Tertiary and older rocks are veneered by Pleistocene sands of the Coomandook and Bridgewater Formations, calcrete, various deposits laid down during Recent high-sea levels, modern beach gravels of flint released from the Mt. Gambier Limestone, dolomites and other deposits of the shallow coastal lakes, swamp deposits, and aeolian sands of the Recent coastal and inland dunes.

SOURCES OF CONSTRUCTION MATERIAL

Granitic Rocks

Kingston: Granodiorite crops out near the coast and adjacent to the Princes Highway about 12 miles north of Kingston and 100 miles north-west of Port MacDonnell. A report by Miles and Eley (1950) gave an estimate of visible reserves within the main body of the deposit, after allowing 10% for soil and voids, of 108,700 tons.

Potential reserves to a depth of 5 feet below ground level were said to be 93,300 tons, with an additional 12,550 tons per vertical foot below this depth to practical limits at about 50 feet.

Quarrying has removed most of the visible reserves at the main deposit. Other small outcrops occur in the immediate vicinity and also further to the north near the common boundary of Hundreds Neville, Wells and Duffield (M.N. Hiern pers. comm.)

Dergholm: Granite (Dergholm Granite) is reported from the Dergholm area, about 75 miles from Port MacDonnell. (Tarvydas, 1967 and Hiern - pers. comm). However, the value of this material as breakwater construction material is not known. At this stage of the investigation, the distance between Port MacDonnell and Dergholm - greater than that between Port MacDonnell and Portland - makes the deposit less interesting than others recorded herein.

Volcanics

Mount Schank: A hard, dense olivine basalt at Mount Schank quarry eight and a half miles from Port Macdonnell is the nearest source of basalt. Pain (1970) reports that the basalt flow is approximately 15 feet thick and rests upon Gambier Limestone. He states: "There are three layers of rock exposed in the quarry wall. The top layer is 1-2 feet thick and consists of very light, scoriaceous material overlain by a thin soil cover. Underlying this is a somewhat vesicular band varying from 5 feet to 8 feet in thickness, which lies on top of a layer of massive, dense olivine basalt between 5 feet and 10 feet thick.

"The dense olivine basalt is very strongly jointed and would not yield blocks of the size required, but the vesicular layer could produce blocks from 3 to 5 tons in weight, with occasional blocks up to 7 or 8 tons."

Samples from the vesicular layer showed no loss in the Sodium Sulphate Soundness Test, and loss in the Los Angeles Abrasion Test was only 19%. Very serious doubt based on practical quarrying experience has been cast on the availability of suitable sized rock by the Engineer for Planning and Development, Department of Marine and Harbours.

Mount MacIntyre: The material from Mount MacIntyre is a hard, dense olivine basalt much of which is too closely jointed to provide blocks of suitable size. Although it has been used for bitumen screenings, degradation due to break-down of secondary minerals has been reported.

Jones Ridge: The Director of the Geological Survey in the Mines Department of Victoria reports (pers. comm.) that "the nearest known sound basalt is approximately 34 miles from Port Macdonnell, at Jones Ridge. The stone is exposed in a small quarry near the Fire Tower at co-ordinates approximately 280,093 on 'Nelson' 1:63,360 sheet. Access is through private land leaving the road at coordinates 270,078. It is not known if basalt in the vicinity of Jones Ridge would yield blocks of the required size, or could usefully augment supplies of selected material from more remote sources. Jones Ridge is close to two acres of National Park (see plan, JBF) and some objections may be raised against quarrying in this vicinity."

Cape Sir William Grant: The basalt used for breakwater construction at Portland was quarried at Cape Sir William Grant, 3 miles south of Portland harbour. This quarry is about 65 miles by road from Port MacDonnell, but is the nearest proven source of suitable material. The quarry is controlled by the Portland Harbour Trust Commissioners, P.O. Box 155, Portland, 3305. The director of the

Geological Survey in Victoria who supplied the information above, expressed an opinion that - depending on the quantity of stone required - it may prove best to obtain the material from the Cape Sir William Grant quarry as this is a proven source of large blocks.

Other Basalt Deposits: Basalt is exposed on the south-east side of the Bluff (Section 455, Hundred of Hindmarsh), but this would be too scoriaceous for use in a breakwater. Basalt deposits have also been described from 3 miles east-south-east and 7 miles north of Dergholm in Victoria by Tarvydas (1967) and Mason and Tarvydas (1967), but the deposits are strongly weathered and jointed and are unlikely to yield large blocks.

Gambier limestone and Equivalents

Gambier Limestone and its equivalents in the Glenelg Group in Victoria crop out over a very wide area in South Australia and Victoria. In some places, later dolomitisation has hardened the original rock.

Up and Down Rocks: The deposit at Up and Down Rocks 35 miles from Port MacDonnell has been reported on by various authors. (See Johns, 1965 and Firman, 1971). Dolomitisation of the thinly bedded fossiliferous and sandy limestone is irregular and unpredictable. (Pain 1970) reports: "It is thought that blocks of suitable size could be won from the eastern face of the quarry, but much of the material may be below required size due to the thinly bedded nature of the rock and to irregular dolomitisation."

Other Limestone and Dolomite Deposits: Limestones along the lower Glenelg River (and including limestone of the Quaternary Bridge-water Formation) are sufficiently well cemented to yield large blocks or slabs, but the Director of the Geological Survey of Victoria (pers. comm) considers it unlikely that such material would be sufficiently durable for breakwater construction.

Other dolomite occurrences have been examined by Pain (1970) in South Australia and Victoria. In South Australia the occurrences examined were on Sections 732, 737, 738 Hundred of MacDonnell, one and a half miles west of Mt. Salt; Section 827, Hundred of MacDonnell, two miles south west of Mount Schank; and Sections 333 and 334, Hundred of Caroline, five to six miles west of Nelson in Victoria. In all cases, the material was of considerably poorer quality than at Up and Down Rocks.

Gravel and Sand

Port MacDonnell to Cape Banks: Gravel (flint pebbles) occur along the southern coast from Port MacDonnell north-west to Cape Banks. Principal localities are Stony Point, Douglas Point, Middle Point, Blackfellows Caves and Cape Banks. The coastal deposits are characterised by their black colour, hardness and freedom from calcareous inclusions. The typical coastal deposit is a bank of pebbles six to eight feet thick fringing high water mark (Willington, 1956).

Knights Quarry The only known deposit of construction sand occurs at Knights Quarry in Section 715, Hundred of Blanche.

The gravel near Port MacDonnell, the sand at Knights Quarry and crushed material from other quarries (notably that at Mount Schank) might conceivably be used for the construction of large cement blocks.

Miscellaneous Factors Influencing Site Selection

The high cost of stone from Mt. Schank Quarries Pty.Ltd., as pointed out by Mr. Zuvich, Inspector of Mines and Quarries, in an appendix to the report by Pain (1970) should be taken into account when mining engineering feasibility studies are carried out.

Jones Ridge in Victoria is close to two areas of National Park and some objection may be raised against quarrying in this vicinity.

A Search Permit under the Extractive Industries Act of 1966 should be obtained in respect to any land on which exploration work in Victoria is intended.

An Extractive Industry Licence in the case of private land, or Extractive Industry Lease, if on Crown land, would be needed to cover the exploitation in Victoria of any deposit of stone for use in South Australia.

The transport of stone by barge from near Kingston or near Portland could be considered.

An existing rail link between Portland and Mt. Gambier may facilitate transport of stone from Portland to Port MacDonnell.

CONCLUSIONS

The only source of large blocks of suitable construction material less than 30 miles from Port MacDonnell is at Mt. Schank. Very serious doubts have been cast on the availability of suitable sized rock by engineers connected with this project.

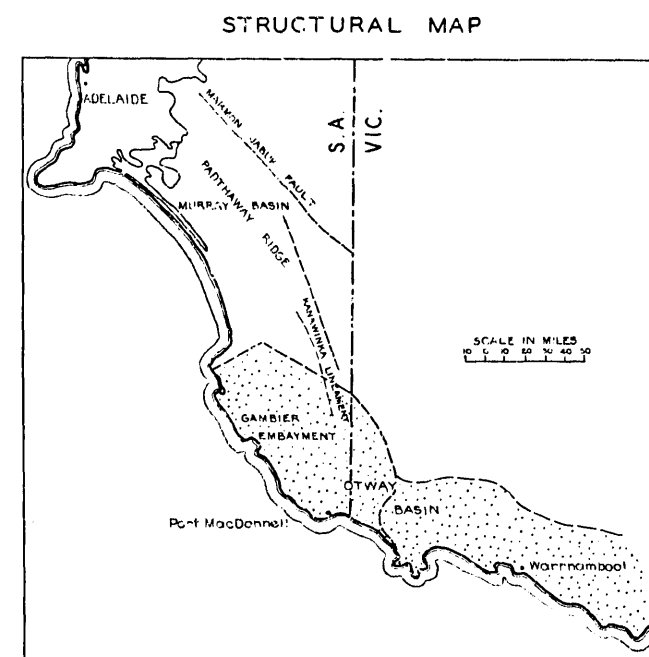
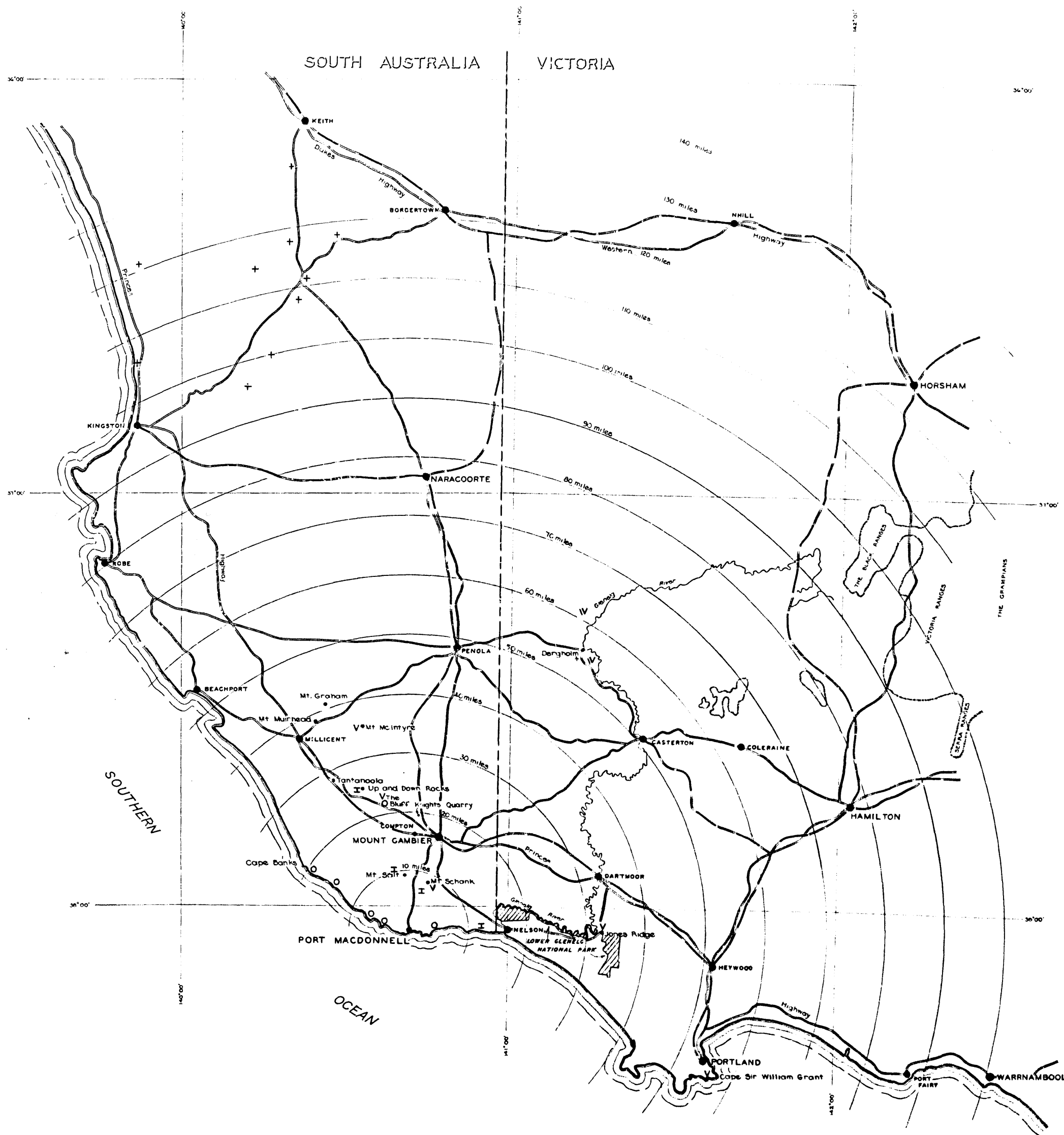
Sound basalt occurs approximately 34 miles from Port MacDonnell at Jones Ridge in Victoria, but it is not known if the deposit would yield blocks of the right size.

A proven source of basalt blocks suitable for breakwater construction occurs at Cape Sir William Grant 3 miles south of Portland, Victoria.


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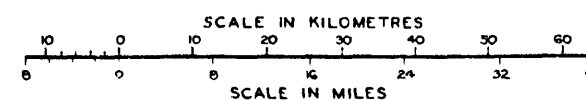
REFERENCES

- Firman, J.B., 1971. Regional Stratigraphy of Surficial Deposits in the Murray Basin and Gambier Embayment. S. Aust. Dept. Min. Rept. 71/1 (unpub.)
- Johns, R.K., 1965. Tantanoola Dolomite Deposit - up and Down Rocks. S. Aust. Dept. Min. Min. Rev. Adelaide. 118: pp.5-15.
- Mason, M.G. and Tarvydas, R.K., 1967. Report on Basalt Deposit - Salt Creek (Victoria). S.A. Dept. Min. Rept. 64/61 (unpub.)
- Miles K.R. and Eley, J.R., 1950. Taratap Granodiorite Deposit, Kingston S.E., S.Aust. Dept. Min. Rept. 27/43 (unpub.).
- Pain, A.M., 1970. Preliminary Report. Breakwater Construction Materials - Port MacDonnell. S. Aust. Dept. Min. Rept. 69/117 (unpub.).
- Tarvydas, R.K., 1967. Basalt Deposit, Sections 4 and 3, Parish Roseneath, County Follett, Victoria. S. Aust. Dept. Min. Rept. 65/82 (unpub.)
- Willington, C.M., 1956. Flint Deposits - County Grey, S. Aust. Dept. Min. Min. Rev. Adelaide 100: 100-101.



LEGEND CONSTRUCTION MATERIALS

- SEDIMENTARY ROCKS**
- O** Flint gravels
 - V** Newer Volcanics: Olivine basalt, tuff, ash, both older and younger than Pleistocene Bridgewater Formation
 - I** Gambier Limestone and equivalents
- IGNEOUS ROCKS**
- V** Older Volcanics: Olivine basalt
 - +** Granitic rocks: Granodiorite (Kingston area) and Denham Granite



DEPARTMENT OF MINES - SOUTH AUSTRALIA			
PORT MACDONNELL BREAKWATER SOURCES OF CONSTRUCTION MATERIALS			
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