DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

MINERAL RESOURCES DIVISION

PRELIMINARY REPORT

BREAKWATER CONSTRUCTION MATERIALS

PORT MacDONNELL

- Department of Marine and Harbours -

by

A.M. PAIN
GEOLOGIST
NON-METALLIC SECTION

Rept.Bk.No. 69/117

8th January, 1970

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PLANS

Plan No.	Title	Scale
69-965	Penola 4-Mile Geological Series	4 miles = 1 inch

Rept.Bk.No. 69/117
G.S. No. 437
D.M. 1062/69

8th January, 1970

DEPARTMENT OF MINES
SOUTH AUSTRALIA

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PRELIMINARY REPORT

BREAKWATER CONSTRUCTION MATERIALS

PORT MacDONNELL

- Department of Marine and Harbours -

ABSTRACT

Potential sources of breakwater construction material in the area surrounding Port MacDonnell have been investigated. Deposits of dolomite, basalt and flint pebbles in the area were inspected, and the presence of granite near Dergholm in Victoria has been noted. Samples of olivine basalt from the quarry at Mount Schank were submitted to the Highways and Local Government Testing Laboratories, and to the Australian Mineral Development Laboartories. Testing of these samples has yielded encouraging results. At this stage in the investigation the quarry at Mt. Schank appears to be the most promising source of material, but more detailed specifications are needed before a final conclusion can be reached. Further exploration required to define each site is nominated.

INTRODUCTION

On 22nd August, 1969, a request was received from the Department of Marine and Harbours to locate supplies of construction rock in the vicinity of Port MacDonnell. This information is required to provide a factual basis for preparing estimates for the construction of a breakwater.

Although no specifications have yet been received from the Department of Marine and Harbours, it is understood that approximately 50,000 to 100,000 tons of rock will be required, of which a considerable proportion should be in large blocks ranging from 5 to 10 tons.

The area was visited between 4th and 7th November, 1969. The author was accompanied by J. Zuvich of the Mining Branch who inspected quarries in the area and made the preliminary tonnage estimates quoted in this report.

GEOLOGY

Precambrian basement rocks lie at considerable depth in the Lower South-East of South Australia.

The oldest rocks exposed in the area are the Lower Tertiary Knight Group of sands and clays which outcrop near the Tartwaup Fault, 6 miles north-west of Mount Gambier. They are conformably overlain by the almost flat-lying Gambier Limestone which consists mainly of fossiliferous limestone with some flint horizons. With the exception of the Flint, these are soft sediments unsuitable for construction purposes.

During the Quaternary period there was some volcanic activity, and deposits of basalt flows, ash, lapilla and bombs accumulated around centres such as Mount Gambier and Mount Schank, and also further north at the Bluff and Mount MacIntyre. In western Victoria, there were extensive flows of basalt.

Dolomite has formed in the Gambier Limestone in areas affected by faulting. It is thought that the dolomite was formed by metasomatic replacement of the original fossiliferous limestone. Although the rock is generally hard, porous and friable zones are quite common.

Fluctuations in sea level during the Quaternary Period have resulted in an extensive cover of the Lower Tertiary sediments by Pleistocene aeoleanite, beach sands, and Recent sands and swamp deposits.

Extensive flint pebble deposits have accumulated along the coast near Port MacDonnell as a result of erosion and re-working of the Gambier Limestone.

POSSIBLE SOURCES OF MATERIAL

Within the Lower South-East of South Australia, and Western Victoria, only four types of material are available. The locations of these are shown on the accompanying plan.

Dolomite

The deposit at Up and Down Rocks near Tantanoola (Sections 195, 200, Hundred of Hindmarsh) is at present being quarried by S.A. Silicates Co.Pty.Ltd. for use in glass manufacture. Road mileage from the quarry to Port MacDonnell is approximately 35 miles. Dolomitisation of the thinly bedded sequence of fossiliferous and sandy limestones is very irregular and unpredictable. The dolomite is pale-brown to pink, and varies from very hard rock to loose sand. It is thought that blocks of suitable size could be won from the eastern face of the quarry, which is unsuitable for glass manufacture. Much of the material mined may be below the required size due to the thinly bedded nature of the rocks and the irregularity of dolomitisation.

Another dolomite deposit was examined near Compton adjacent to the Tartwaup Fault. (Section 715, Hd. Blanche). Although some blocks would be of suitable size, most would be too small or too friable.

Other reported occurrences were examined at the following localities:

Sections 732, 737, 738, Hundred of MacDonnell; 1½ miles west of Mount Salt.

Section 827, Hundred of MacDonnell; 2 miles southwest of Mount Schank.

Sections 333, 334, Hundred of Caroline, 5-6 miles west of Nelson, Victoria.

In all cases, the material observed was of considerably poorer quality than at Up and Down Rocks, and it is unlikely that suitable material could be obtained from these deposits.

Basalt

Basalt deposits occur in the Lower South-East of South Australia, and are very extensive in Western Victoria. This material has been used for breakwater construction at Portland, and more detailed information on its engineering properties could be obtained from the appropriate Victorian Government Departments. The Victorian Department of Mines may be able to suggest localities where this material could be obtained in Western Victoria.

Basalt deposits were examined at Mount MacIntyre, The Bluff and Mount Schank.

The material from Mount MacIntyre is a hard, dense olivine basalt, much of which is too closely jointed to provide blocks of suitable size. A large amount of this material has been used for bitumen screenings, but degradation is reported from secondary minerals. Its suitability for breakwater construction is therefore questionable.

Much of the basalt exposed on the southeastern side of the Bluff (Section 455, Hundred of Hindmarsh) would be too scoriaceous for use as blocks in a breakwater. Better rock may exist on the southwestern side but more work will be necessary to establish this.

The Mount Schank quarry is the nearest source of basalt, being only 8½ miles by road from Port MacDonnell. Much of the rock in the vicinity of Mount Schank is soft ash and tuff, but a thin flow on the westernside of the cone is being mined by Mount Schank Quarries Pty.Ltd. The basalt flow is approximately 15 feet thick, and the quarry floor is on Gambier Limestone. There are three layers of rock exposed in the quarry wall. The top layer is 1 - 2 fee thick and consists of very light, scoriaceous material overlain by a thin soil cover. Underlying this is a somewhat vesicular band varying from 5 ft. to 8 ft. in thickness, which lies on top of a layer of massive, dense olivine basalt between 5 ft. and 10 ft. 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 of up to 7 or 8 tons.

Encouraging results were obtained from Los Angeles Abrasion and Sulphate Soundness tests which were conducted on samples submitted to the Highways and Local Government Testing Laboratories. The Los Angeles Abrasion Loss was 19% in the case of the vesicular olivine basalt and 14% for the dense olivine basalt. Neither rock type showed any loss in the Sodium Sulphare Soundness Tests.

Samples were also submitted to the Australian Mineral Development Laboratories. The rocks were found to consist predominatly of plagioclase, pyroxene, opaque minerals, and olivine, with no deleterious accessory of secondary minerals which could break down rapidly in adverse chemical conditions.

In order to establish reserves of this material, it would be necessary to conduct a stadia survey of the quarry area, followed by a drilling programme. There appears to be a reasonable chance that sufficient stone would be available at Mount Schank.

Flint Pebbles

Two deposits of flint pebbles occur quite close to Port MacDonnell. Within 5 miles east of the twon there are long mounds along the seafront, composed of flint pebbles up to 6 inches diameter, with an average diameter of 4 inches. The mounds are up to 5 feet high and 15 feet wide. Preliminary estimates indicate that this, and several smaller deposits nearby would yield a total of around 20,000 tons. Mining lease No. 2638 held by P.J. Pascoe of Port MacDonnell covers the greater part of these deposits, but some materials occurs outside the lease.

Access to this deposit is by unsurfaced road, and upgrading of the road would be necessary, particulary for the last half a mile.

Both flint deposits occur on Crown Land which is exempt from the operation of the Mining Act from the shore to half a mile inland. To establish the tonnage and quality of the deposits, pitting or trenching would be required.

Granite

Coarse-grained pink granite deposits northwest of Dergholm in Victoria could produce rock of high quality, but because they are approximately 75 miles by road from Port MacDonnell, they were not inspected by the author.

CONCLUSIONS AND RECOMMENDATIONS

This report summarises the availability of construction material in the area.

At this stage, further specifications are needed from the Marine and Harbours Department to compare with the results of laboratory tests and observations made during the reconnaissance. On receipt of this data, more specific selection can be made.

Further geological investigation, as outlined earlier will be required to provide accurate estimates of tonnages available.

AMP:JB:JKD
8.1.1970

A.M. PAIN
GEOLOGIST
NON-METALLIC SECTION

REFERENCES

JOHNS, R.K., 1962. Dolomite Deposits - Lower South-East, Min. Rev., Adelaide, No. 117, pp.102-105.

JOHNS, R.K., 1963. Tantanoola Dolomite Deposit - Up and Down Rocks, Min. Rev. Adelaide, No. 118, pp.5-15.

SPRIGG, R.C., COCHRANE, G.W., and SOLOMON, M., 1951. Geological Atlas of South Australia - Penola 4-Mile Sheet.

WILLINGTON, C.M., 1954. Flint Deposits - County Grey. Min. Rev., Adelaide, No. 100, pp.100-102.

APPENDIX I

ESTIMATED COST OF STONE FOR PROPOSED BREAKWATER

(a) Mt. Schank Quarries Pty.Ltd.,

At present the quarry operator at Mt. Schank Quarry favours mining the more fractured material, and selectively mines to a certain extent to produce as fine a material as possible to feed the crusher. The drilling pattern is designed to produce as much small material as possible with the primary blast. Even so, due mainly to the small primary crusher, it is necessary to do a lot of secondary blasting. It is estimated that about one pop is required for every ton of output.

A combination of these factors together with such factors as the harder nature of the stone and generally higher country operating costs makes the product more expensive than metropolitan stone.

As a comparison, screenings at Mt. Schank are selling for $3.50 per ton whilst in Adelaide, the price is $1.60 to $2.20 per ton. Spalls in Adelaide sell for about $1.00 per ton up to sizes that can be loaded with the quarry equipment. With larger blocks, which necessitate the hiring of a crane, the price may go as high as $1.30 per ton depending on crane hire charges. There is no market for run-of-quarry products in Adelaide so that a price for this product could not be obtained, but discussions with local quarries indicate that it would sell at about $1.00 per ton.

The manager at Mt. Schank has indicated that the price of run-of-quarry material would be about $2.00 per ton but no firm quote was given. In my opinion this price is too high. A price in the order of $1.00 per ton would be more appropriate and still leave a good margin of profit for the quarry operator. In negotiating a price with the quarry it should be pointed out that the type of stone required for the breakwater could be mined cheaper than at present because a wider drilling pattern could be used and secondary blasting for crusher stone would be eliminated as the larger blocks could be used for the breakwater. It would be advantageous from both sides if advance notice was given to the quarry that their product is to be used, so that the larger rocks obtained in their normal operation could be stockpiled.

The quarry manager also indicated that he would be interested in the cartage contract. Negotiations on this aspect would favourably assist negotiations on the mining side.

Finally, if stone from Mt. Schank proves to be suitable the anticipated cost of this material landed at Port MacDonnell would be about $2.50 per ton.

(b) Flint Pebbles

Assuming that this material is suitable and that arrangements can be made to mine it both on the existing Mineral Lease and on Crown Lands a substantial saving in final costs would result when compared with the cost of Mt. Schank rock. This material can be mined with a front-end loader but will probably require screening on the spot to eliminate the fine material (minus 2 inch) which constitutes 10-20% of the deposit.

It is estimated that this material could be landed at the breakwater for approximately $1.50 per ton allowing for loading, screening and cartage costs with a royalty of 10 cents per ton for the leaseholder. This estimate could vary widely depending on throughput of the operation and the amount of royalty by the leaseholder.

J.J. Zuvich

J.J. ZUVICH
INSPECTOR OF MINES & QUARRIES

APPENDIX II

AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES REPORT M.P. 1875-70

PETROGRAPHIC REPORT ON TWO ROCKS FROM MT.SCHANK QUARRY

by

R. COOPER
UNDER THE DIRECTION
OF DR. A. H. SPRY

Sample: P369/69: TS 24014

Location:
Mt. Schank Quarry, four feet below top of quarry face.

Rock Name:
Vesicular olivine basalt.

Hand Specimen:
Vesicular olivine basalt. A fine grained grey rock containing numerous unlined vesicles which are as much as ¼ of an inch in diameter.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Olivine	10
Pyroxene	20
Plagioclase	45
Interstitial feldspar	4
Opaque grains	20
Apatite	1
Vesicles (% age of whole slide)	10-15

The rock consists of subhedral, often lozenge shaped phenocrysts of olivine seated in an intergranular groundmass of plagioclase, pyroxene, and opaque minerals.

The olivine is colourless, up to 1.5 mm long, has a negative biaxial figure with a very large 2V and is undoubtedly a forsteritic variety.

The pyroxene in the groundmass occurs in small grains and occasional prisms as much as 0.25 mm long. It is brown, optically positive, and is probably a slightly titaniferous augite.

The plagioclase which occurs in laths typically 0.20 mm long is presumed to have composition approximating to labradorite. The other felspar present has an interstitial habit, low relief, and is rarely simply twinned. It could be either an albitic plagioclase or a potash felspar.

Sample: P370/69: TS 24015

Location:
Mt. Schank Quarry. Twelve feet below top of quarry face.

Rock Name:
Olivine basalt.

Hand Specimen:
A fine grained grey rock containing numerous very small (0.3 mm diameter) holes.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Olivine	12
Pyroxene	20
Plagioclase	40
Interstitial felspar	6
Opaque grains	20
Apatite	2

The rock contains euhedral, subhedral and rarely, slightly skeletal olivine phenocrysts seated in a fine-grained groundmass the texture of which is intergranular.

The olivine phenocrysts are colourless with a prismatic habit and range in size up to 1.00 mm. They have very straight optic axis figures which suggests a forsteritic (magnesian) composition.

The pyroxene has a brown colour, occurs in small grains (0.03 mm diameter) and elongated prisms up to 0.25 mm long, is optically positive, and is probably a slightly titaniferous variety of augite.

There are two felspars present, one of which occurs in small laths typically between 0.15 and 0.20 mm long. It is simply and polysynthetically twinned and presumed to be labradorite. The other felspar is interstitial in habit, is mostly untwinned and has a relief less than balsam, and could be either a sodic plagiocalse of alkali felspar. It is also riddled by fine needle of apatite.

The opaque mineral occurs in small grains, average diameter 0.03 mm, and is thought to be a variety of titanomagnetite.

Conclusions:
Suitability of the samples for a breakwater.

The rocks would be eminently suitable providing they are representative of the worst material in the quarry rather than the best. The samples are of a fresh olivine basalt which contains no deleterious accessory or secondary minerals such as zeolites and chlorites which could break down rapidly in adverse chemical conditions. This rock, providing its strength is not impaired greatly by the quantity of vesicles should also be fairly resistant to abrasions.

APPENDIX III

Results of Los Angeles Abrasion and Sulphate Soundness Tests on two samples from Mount Schank Quarry

(Excerpt from a letter by C.R. Sandman, Senior Testing Officer, Highways and Local Government Dept. Materials and Research Laboratories)

The results of Los Angeles Abrasion and sodium sulphate soundness tests conducted on two (2) samples of basalt from Mt. Schank Quarry were as follows.

	Sample 1 Vesicular Basalt	Sample 2 Dense Basalt
Los Angeles Abrasion %	19	14
Sodium Sulphate Soundness % Loss	Nil	Nil

The above tests were conducted on material reduced to -3" + 1½" to conform with aggregate sizes specified for the standard Los Angeles Abrasion test.

Test results indicate both basalt types to be sound and suitable for use in breakwater construction. However it is recommended that a detailed petrological examination be made of each material with special reference to the presence of secondary minerals, which if present in amounts greater than about 25 per cent, contribute to rapid breakdown of such material due to weathering.

Mr. A.M. Pain of your department was advised that this laboratory is not currently set up to conduct weathering tests, the results of which could be applied to such large material. The currently used test method requires material finer than 3/4" and test results from this size of material would be difficult to interpret for breakwater construction.

~~An account for $20.00 to cover~~

PENOLA

AUSTRALIA 1:253,440

GEOLOGICAL SURVEY OF SOUTH AUSTRALIA
DEPT OF MINES ADELAIDE

4 MILE GEOLOGICAL SERIES SHEET J 54 — 6 & 10

FIRST EDITION AUGUST 1951

139° 30' 139° 40' 140° 00' 140° 20' 140° 40' 141° 00'
37° 00' 37° 20' 37° 40' 38° 00' 38° 05'

Mount McIntyre
To Dergholm (granite) 23 MILES
Up and Down Rocks
The Bluff
Compton
Mount Salt
Mount Schank
Dolomites Sec. 333, 334 Hd. Caroline
Middle Point
Port MacDonnell

REFERENCE

RECENT
- Qrl — Swamp, marsh, lunette, and lake marls, clays and peats.
- Qrp — Deep flat lying sands and sand sheets, meadow podsols
- Qrb — Back shore, beach ridged calcareous and siliceous dune sands
- Qro — Osborne' high sea level marine deposits
- Qra — Anadara' high sea level marine deposits

PLEISTOCENE
- Qpe — Aeolianite consolidated beach sands and included travertinous horizons.
- Qpb — Sea beach and sea floor deposits of the Aeolianite systems
- Qpf — Basalts, olivine basalts and scoria.
- Qpv — Ash, lapilla and volcanic bombs.

UNCONFORMITY

LOWER TERTIARY
- GAMBIER LIMESTONE — Tg — Fossiliferous limestones, bryozoal limestones, marls, dolomites and flint beds.
- KNIGHT CLAYS — Tk — White and lightly coloured sands and clays with lignitic horizons, also thin marine sandy glauconitic and bryozoal beds.

GEOLOGICAL BOUNDARIES
- Observed
- Approximate
- Inferred

FAULTS
- Observed
- Approximate
- Inferred

BEDDING
- Strike and Dip
- Vertical
- Horizontal

- Structural contours
- Beach ridges
- Escarpment
- Main Road
- Secondary Road
- Track
- Railway
- Trig. station
- Stream or watercourse
- Form Lines (General)

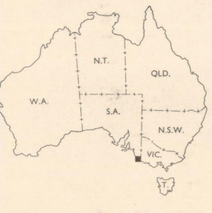
TECTONIC SKETCH

FAULTS FOLD AXIS

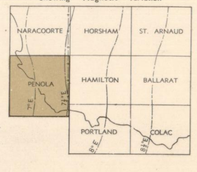
COMPLEX OF MEADOW PODSOLS WITH SWAMPY PATCHES
COMPLEX OF SWAMP AND MEADOW PODSOLS OVER CONSOLIDATED BEACHSANDS

Geology by R. C. Sprigg, M.Sc., G. W. Cochrane, M.Sc., and M. Solomon, B.Sc., 1949-58
R. C. Sprigg, M.Sc., Geologist in charge of Regional Map Preparation.
Base map and cartography by Photogrammetric Section, Department of Mines, S.A.
Compiled under the direction of S. B. Dickinson, M.Sc., Government Geologist.
Issued under the authority of the Honourable A. Lyell McEwin, M.L.C., Minister of Mines, S.A.
Published 1951
Printed by M.E.Sherrah Government Photolithogra

es of this map may be obtained from Geological Survey of
h Australia, Dept. Mines, Adelaide, or Bureau of Mineral Resources,
logy & Geophysics, Canberra, A.C.T.
ted by the Government Photolithographer for the Geological
ey of South Australia as a contribution to the 4 Mile
logical Map Series of the Commonwealth



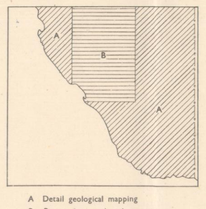
INDEX TO ADJOINING SHEETS
Showing Magnetic Variation



SCALE
4 MILES TO 1 INCH

MILES 2 1 0 2 4 6 8 10 12 14 16 MILES
KILOMETERS 5 0 5 10 15 20 KILOMETERS

GEOLOGICAL RELIABILITY DIAGRAM



A Detail geological mapping
B Reconnaissance based on traverses with photo-interpretation

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
PRELIMINARY REPORT			
BREAKWATER CONSTRUCTION MATERIAL—PORT MACDONNELL			
NON—METALLIC MINERALS SECTION	GEOLOGIST	Drn. T.P.	SCALE: 1 INCH = 4 MILES
		Tcd. A.McD.	69-965 Kdz.
		Ckd.	
Director of Mines	SENIOR GEOLOGIST	Exd.	DATE: 29 Nov. '69