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1976/36. Geology of the Port Arthur area.

W.C. Cromer

The National Parks and Wildlife Service is conducting an extensive study and documentation of Port Arthur prior to the restoration of this historic site. The programme involves the rebuilding and repair of three major structures and many smaller ones. Implemented in full the restoration will alter the appearance of the township.

The National Parks and Wildlife Service has obtained the assistance of private consultants who in turn have invited government and semi-government institutions to aid the programme. The approach is multi-disciplinary with engineers, architects, surveyors, historians, chemists, archaeologists and geologists involved.

The Department of Mines was asked to investigate the geology of the Port Arthur area, to report on possible sources of building stone and clay for restoration purposes, and to indicate aspects of the geology which may affect the programme and need further study.

INVESTIGATION METHODS

Field mapping was undertaken during the period June 1975-March 1976. Data were transferred directly to aerial photographs, and 1:25 000 contoured map sheets supplied by the Lands and Survey Department. An area of about 30 km^2 (including the Port Arthur township) was mapped, extending south from Long Bay and to Remarkable Cave, and west to Radnor.

Various sites near Port Arthur have been the subject of more detailed investigations. Stevenson (1974, 1975) reported on the geology of proposed pipeline routes and of a dam site 2 km west of the town, and Threader (this paper) has briefly investigated clay deposits in the area. Knights (1974, this paper) conducted vibration studies in the township to determine the effect of heavy traffic on buildings. Cromer (1974) investigated groundwater prospects at Safety Cove.

TOPOGRAPHY AND ACCESS

The eastern and southern parts of Tasman Peninsula are rugged with the relief related to the form of dolerite intrusion. An annual rainfall of 750-1000 mm supports a wet schlerophyll forest with areas of rain forest in gully corridors. Old logging activities and fires along the flanks of Mt Arthur have produced a scrambled, dense and almost impenetrable undergrowth and access is sometimes difficult in these more elevated parts. Elsewhere, the more gentle slopes, especially those underlain by Triassic sediments, have been cleared for agricultural purposes.

GEOLOGY

Jurassic dolerite and marine and non-marine sediments of the Parmeener Super Group are the main rock types in the area (fig. 1). The marine sediments are assigned to the Permian Ferntree Formation, and the non-marine sediments are Lower Triassic.

Both groups of sediments have been intruded by Jurassic dolerite, and all observed contacts have an intrusive form. The dolerite occurs at all levels in the Triassic sequence, and although locally transgressive, is broadly sill-like in form.

LOWER PARMEENER SUPER-GROUP

Ferntree Formation

Glacio-marine pebbly mudstone and sandstone occur at topographically low levels in the area. The rocks crop out at sea level along the Point Puer headland, the south-western side of Carnarvon Bay, on the Isle of the Dead, and at two small localities in Crescent Bay [704169]*. The sediments dip west at low angles (5-8°) and are generally prominently and sometimes massively bedded.

On the Isle of the Dead, the rocks dip 5° toward 270°M, are strongly and irregularly fractured, and consist of relatively thick (2 m) beds of grey sandy mudstone and white-buff sandstone. Worm casts are common in the finer grained units, but otherwise the rocks are apparently unfossiliferous. Small quartzite dropstones occur frequently.

A sequence of interbedded sandstone and mudstone forms sea cliffs along the eastern side of Point Puer, but the exposures are only accessible at the northern end of Safety Cove. The headland is a cuesta, and only limited exposures occur between high and low tide marks in Carnarvon Bay on its western side. Fossils occur at [702206].

Regularly bedded grey, sandy and pebbly mudstone dipping 5° towards 255°M is exposed in shore platforms and small sea cliffs along the south-western side of Carnarvon Bay. Quartzite, quartz and granitic dropstones are locally abundant and the sequence contains at least one conglomerate horizon near the jetty at [696205]. At the western end of Briar Paddock Beach the sediments are deeply weathered to grey-white clayey sand, which may have been used as a low-grade brick-making material for the settlement.

A small outcrop of strongly fractured, iron-stained and metamorphosed quartzite and hornfels occurs at sea level beneath high aeolian dunes in Crescent Bay. Bedding appears to be sub-horizontal. Dropstones and worm casts are present, but are not abundant. Rare spiriferids occur. Less metamorphosed sandstone crops out in a small creek behind the beach at [703169].

The area between Carnarvon Bay and the Triassic cliffs to the west is gently sloping farm land. Exposures are virtually absent and are obscured by grey clayey sand soil. Evidence for Permian rocks is confined to scattered cobbles in excavations and dams.

The soils on Permian rocks are similar to those derived from Triassic sediments, and the boundary between the marine and non-marine sequences is difficult to determine. Its position is inferred near the base of the Triassic cliffs. No evidence of fresh water carbonaceous sediments equivalent to the Cygnet Coal Measures was found.

UPPER PARMEENER SUPER-GROUP

Non-marine sediments

Triassic non-marine sediments are widespread throughout the area. They consist broadly of sub-horizontal massively bedded quartz sandstone and grey sandy mudstone. The rocks form rugged sea cliffs in Maingon Bay and elsewhere the predominantly sandstone units are topographically expressed by cliffs and breaks of slope. Many of the cliffs are inaccessible. Generally the mudstone units are not exposed, forming gentle slopes and flat areas.

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*All localities in this report lie within the AMG 100 kilometre grid square EN.

Non-marine sediments are exposed on a shore platform and in a small sea cliff in Basket Bay [687177] immediately east of Remarkable Cave where they have been intruded by Jurassic dolerite. The well-exposed contact is locally irregular and transgressive, but generally sill-like in form. The sediments exposed in the cliff section dip 5° toward 190°M, and comprise interbedded and massively cross-bedded quartz sandstone, pebbly sandstone and mudstone. Dark cherty lenses and quartz gravel horizons are common in the coarser grained units. Similar rocks are exposed at the rear of a small boulder beach, immediately east of the cliff section, and also at the eastern end of the beach [688176] where a dolerite contact inclined at 30° is exposed. The dolerite contains small pods of strongly metamorphosed sandstone.

The sediments in the shore platform [687177], and at the base of the cliff to the rear, are finely laminated alternating bands of indurated grey mudstone and paler sandstone. The laminae, each about 2-3 cm thick are ripple marked and in places disrupted by intra-formational slumping. The rock is apparently unfossiliferous. The ripple marked alternating fine and coarser grained nature of the sediments suggest a very shallow marine(?) environment possibly transitional between the glacio-marine and non-marine sequences. The rocks may be equivalent to the Cygnet Coal Measures but definitive evidence is lacking.

Triassic sediments are also exposed in a cliff and shore platform in Long Bay, [694253], and also nearby in small shoreline exposures along the western side of Stingaree Bay. The rocks dip 8° toward 260°M.

The 7 m high cliff section comprises at least seven recognisable units. Brown grey sandy mudstone at the base grades vertically through clayey quartz sandstone, mudstone, white fine-grained sandstone, to finely fractured mudstone. In the sandstone units, small clay pellets have aligned themselves in cross-bedded depressions while dark minerals delineate ripple marks in the lower beds.

The shore platform at the base of the cliff is cut in more resistant unfossiliferous grey, white and brown clayey quartz sandstone. The platform is strongly fractured, with honeycombed joint faces heavily stained with iron and magnesium oxides. These sediments resemble the marine sediments in Crescent Bay in general appearance.

Triassic sediments are rarely exposed in other locations; outcrops are confined to creeks and quarries or isolated occurrences on otherwise smooth hillsides. These exposures are of medium- fine-grained brown and white quartz sandstone with mudstone rarely cropping out. At the headwaters of an unnamed creek [657219], near Radnor, weathering of Triassic mudstone near a dolerite contact has produced a small dickite deposit.

JURASSIC DOLERITE

Dolerite is widespread throughout the area. North of Port Arthur, a single sill at least 300 m thick constitutes the Mt Tonga-Mt Koonya massif, with isolated outliers of Triassic sediments on the southern and eastern flanks of Mt Tonga. North of Nubeena Road, the Triassic sediments are probably a thin veneer overlying dolerite. Parts of Nubeena Road closely follow the Triassic-Jurassic boundary. A well exposed contact dipping about 30° south is exposed in a quarry [673231] near the road, and here the dolerite appears to be locally transgressive, dipping south beneath the sediments.

The Triassic rocks thicken south of Nubeena Road and up to 200 m of sediments separate two dolerite sills. Prior to denudation, the sills appear to have been connected by at least one large feeder or transgressive plug, now represented by a roughly circular exfoliated outcrop of medium-coarse grained dolerite intruding sediments south of Nubeena Road near [675225]. The lower sill intrudes Lower Triassic (and possibly Upper Permian) rocks on West Arthur Head with the upper sill forming the higher levels of Mt Arthur.

All observed contacts between dolerite and Triassic sediments are intrusive, and the dolerite is invariably fine-grained. Metamorphic effects are generally minor, although in the quarry exposure at [675225] the sediments are baked to hornfels and quartzite up to 10 m from the contact. The contact is locally irregular and complex and often transgressive, but is generally sill-like in form. The obscured contact between dolerite and Triassic sandstone on the north-east flank of Mt Arthur is delineated by a line of springs, with some flowing at more than 80 *l*/min.

A well exposed dilational dyke of fine-grained tholeiitic basalt (trending 80°M) representing a late stage doleritic phase, has intruded medium-coarse grained dolerite near Standup Point at [711174]. This rock is described in Appendix 1 (specimen a).

RECENT AND QUATERNARY DEPOSITS

Superficial Quaternary(?) talus deposits have formed on the flanks of Mt Arthur and Mt Tonga. Dolerite talus mantles the upper levels of both, and sandstone talus occurs at the base of cliffs of Triassic sandstone along the lower eastern slopes of Mt Arthur. Some of the latter appear to have been reworked by fluvial processes, but the geology is complicated by the presence of aeolian, marine, estuarine and marshy lacustrine(?) deposits in the low lying area behind Safety Cove Beach. All these deposits produce grey sandy top soil and it is difficult to distinguish between them.

Extensive deposits of aeolian sand overlie Jurassic dolerite on the headland north-west of West Arthur Head. The sand forms high (>30 m) foredunes in Crescent Bay, and thick stabilised longitudinal dunes extend north-east from Basket Bay. On the generally flat and elevated plateau in the centre of the headland, the sand cover is thin and the area is marshy in places. Small exposures of dolerite are common.

Aeolian sand overlies Triassic and Permian sediments at the western corner of Carnarvon Bay, and marshy sand deposits occur to the rear of Briar Paddock Beach, in Radcliffe Creek immediately south of Port Arthur, and at Radnor.

GEOLOGY OF PORT ARTHUR TOWNSHIP

Port Arthur township is entirely underlain by medium-coarse grained Jurassic dolerite. Good exposures occur on both sides of Mason Cove, in a quarry at [691224], in the lower reaches of Radcliffe Creek near the Model Prison, on Nubeena Road near the motel [685223], on and around Lookout Hill, and in isolated outcrops west of Commandant's Point near [690221]. It is seldom exposed among the ruins of the settlement, having been generally obscured by early cut and fill operations. On undisturbed land, solid bedrock can generally be expected at shallow depth (Stevenson, 1975).

Parts of the old settlement were constructed on fill. Mason Cove originally extended about 200 m west to the pond at the base of the slope beneath the church, and this flat area is frequently waterlogged after heavy rain. Most of the reclaimed land appears to be composed of dolerite and sandstone rubble and the penitentiary was piled in this material near the original water line.

An igneous contact between dolerite and non-marine quartz sandstone occurs west of the town near the motel and youth hostel. The contact trends about 20°M, but swings east near the old Wedge Bay track at [686226], and intersects the Arthur Highway near the old pottery kiln on the town boundary.

ECONOMIC GEOLOGY

BUILDING STONE

The non-marine quartz sandstone originally used for building purposes is widespread throughout the area. Exploitation was confined to the more accessible parts of the Triassic sequence along the eastern flank of Mt Arthur, and although many outcrops may have been mined on a small scale, only two major quarries have been located.

Quarry 1 [682224]

This is the largest quarry in the area. It was excavated in gently undulating land (now owned by Mr Plummer), about 0.5 km west of the township. It is difficult to estimate the amount of material removed, but approximately 7000 m^3, representing about 18 000 tonnes, of sandstone has been excavated. Reserves are probably much greater than this figure, but a drilling programme would be required to establish the suitability of the rock for building purposes. The site could easily be extended; access is excellent and the overburden only minor.

The quarry is still operable. Rubble and undergrowth need to be removed, but excavations could be recommenced at the existing partially worked faces left by the convicts.

The sandstone occurs as generally massive and sub-horizontally bedded units up to 3 m thick with some minor mudstone units. Jointing is generally absent, although the suitability of the stone is probably reduced in places by horizontal partings which impart a fissility parallel to, and near, bedding planes. Some worked faces at the western end of the quarry are massive joint-free surfaces over 10 m in length and 3 m high. Some bedding planes are irregular, and thinner units show pinch and bow structures. Cross bedding is absent.

In hand specimen, the sandstone shows considerable variation in colour, grain size, sorting and mineralogy. Much of the rock is friable and partly weathered, but the extent to which this has occurred since excavation is not known. In thin section (appendix 1, b, c), the rocks vary from buff slightly micaceous and lithic medium-grained quartz sandstone to paler feldspathic quartz sandstone. The cement constitutes only a small fraction of the rock. It appears to have been partly removed by weathering and is a siliceous-clay or a sericite-clay mixture.

As a source of building stone for restoration purposes, the quarry seems favourable but merits further study. It is easily accessible and workable, and the sandstones are massively bedded and relatively joint free. A small drilling programme is advisable to prove reserves of suitable material, and more work needs to be done on the mineralogy of the sandstone, which in the specimens studied is partly weathered and friable. Such specimens may not, however, be representative of undisturbed material.

Quarry 2 [680213]

Building stone has been excavated from the face and base of a Triassic sandstone cliff immediately south of the Palmers Lookout Road. Only small amounts of material appear to have been removed. The exposed sequence of about 15 m consists of two thick, massive and unjointed yellow-brown micaceous well-sorted quartz sandstone units separated by a thin, variable but distinctive clay-pellet conglomerate up to one metre thick. The beds are sub-horizontal. The conglomerate contains pellets up to 10 cm in diameter. A large variation in shape occurs, but most are tabular or platy and aligned parallel to bedding. The bed is apparently unfossiliferous.

The sandstone contains relatively large amounts of iron oxide cement and matrix. Its clay content appears minor. The rock weathers rapidly to a yellow-brown sand, and for this reason appears unsuitable for building purposes. Although access is easy any quarrying operations here would be more difficult than at Quarry 1 due to the steep nature of the single working face. The site is not recommended as a source of building stone.

CLAY DEPOSITS

V.M. Threader

Seven auger holes were put down in the area between the National Parks and Wildlife Service workshops and the cemetery (fig. 2), to determine the depth, thickness and quality of clay suitable for use in a local cottage pottery industry.

A partially filled and overgrown clay pit is located in the area together with a disused pottery kiln. The pit was apparently the clay supply for a brick works which supplied the penal settlement. The old pit has an area of approximately 5850 m^2. If an average thickness of 2m of clay was extracted from the pit the total volume removed would be approximately 12 000 m^3 or sufficient to make 3.5 million bricks. This estimate is given merely to indicate the probable magnitude of the operation.

Samples from the auger holes were taken, where possible, at approximately one metre intervals and these were tested at the Department of Mines laboratories for particle size distribution. No ceramic testing has yet been done, but the content of -20 μm material (the fine silt and clay content) gives an approximate guide to ceramic properties. Any material containing less than 50% -20 μm particles is not a ceramic material. The -20 μm content for each sample is given in Appendix 2. It should be noted that the depth of clay may be greater than that indicated by the drilling which stopped, in some cases, in hard clay which may be of ceramic quality.

Only Holes 2 and 5 showed good thicknesses of clay and thin overburden but sufficient drilling has been done to indicate that ceramic materials occur in the area. It is suggested that anyone interested in opening up a clay pit in the area concentrate on the area between Bore Hole 5 and the cemetery, east of the old pit.

The Triassic dolerite boundary shown in Figure 2 lies very close to the area in which up to 9 m of Triassic sediments have been drilled, indicating that the boundary must be steeply dipping or that the clay has been deposited in a local depression in the dolerite; neither explanation is entirely satisfactory. The clays are rather higher in clay content than is normal for Triassic sediments but the sandy loam cover is a typical weathered mantle on Triassic sediments.

Two holes were drilled in areas where clay is exposed in road cuttings. Bore Hole 8 [702204] was drilled on the Point Puer road at the entrance to the golf course and Bore Hole 9 [695205] was drilled on the Safety Cove Road,

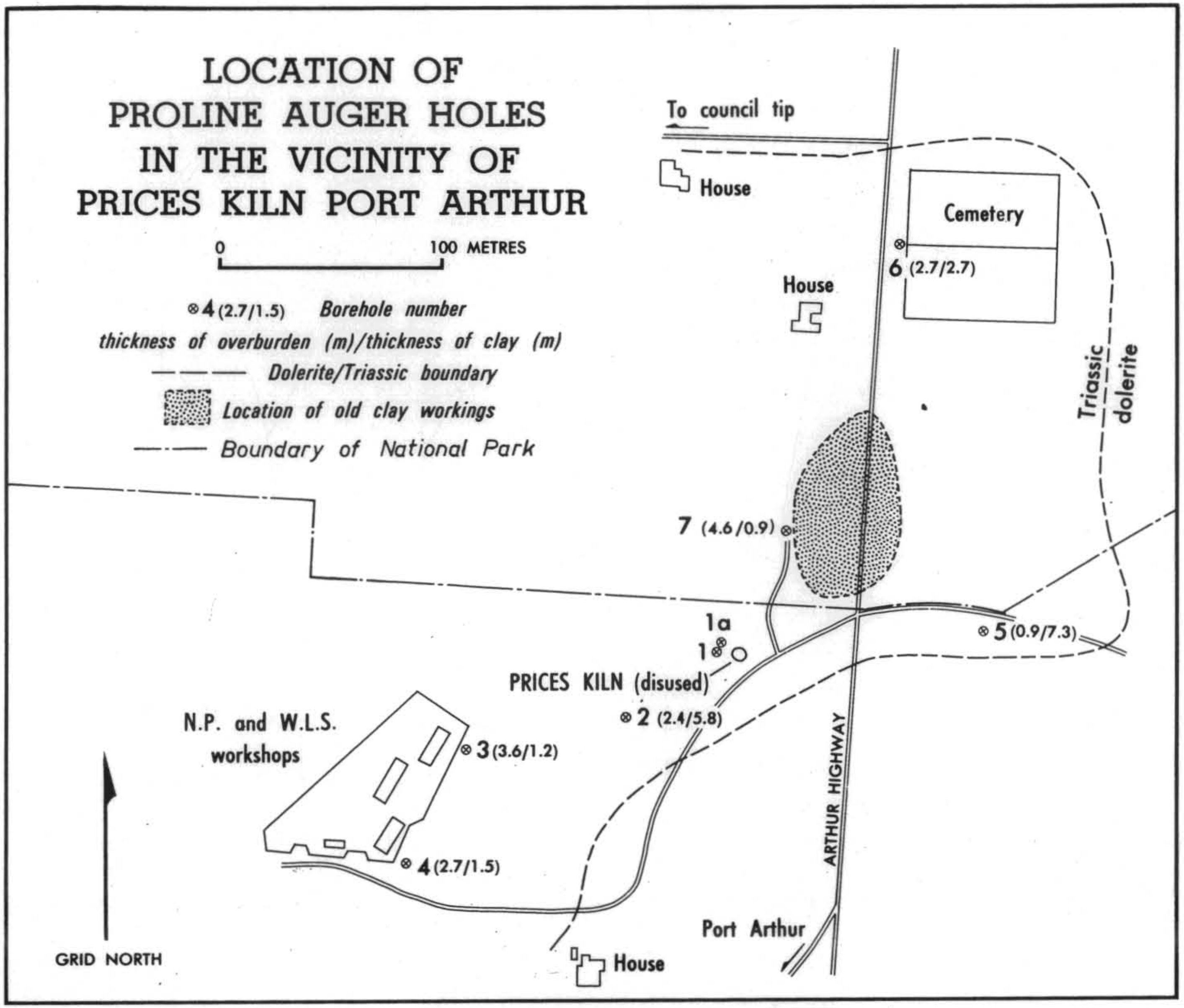

Figure 2

5 cm

36-7

0.7 km from Bore Hole 8. Both were shallow holes and it is not clear whether the material is *in situ* weathered mudstone or redeposited weathered Permian and Triassic sediments.

It is considered that the most promising area for closer examination is adjacent to the old brick pit west of the Tasman Highway. The area between the workshops and the council tip road is also in Triassic sediments and offers the possibility of ceramic materials. Access was difficult for the drilling equipment and the area is outside the limits of the present investigation.

GEOPHYSICS

SEISMIC SURVEYS

Stevenson (1974) investigated the geology of a proposed dam site near the Nubeena Road at [673230], and also investigated (1975) proposed pipeline routes at Port Arthur. He conducted a seismic survey at the dam site, and reported the presence of superficial deposits of clay and sand derived from the underlying Triassic sediments, and remarked on the instability of such material on steep slopes. Digging of trial pits was recommended prior to construction of the dam, designed to supply domestic water for the township.

Thirty-two weathering seismic spreads were fired in, and near, Port Arthur (Stevenson, 1975), revealing that over most of the area the underlying basement sandstone and dolerite are weathered to a depth of about 2 m, and would present no serious difficulty of excavation for proposed pipeline routes.

VIBRATION STUDIES

C.J. Knights

Traffic vibrations near the Port Arthur church

Two three-dimensional vibration sensors were used to measure traffic induced vibrations in the structure of the church. Vibrations were measured at each of the lower window ledges, on the top of the north-east wall of the tower, and above the large north-west windows.

Readings were taken while slow moving buses, trucks and light vehicles drove past. The levels of vibration were low in each case, less than 0.5 mm/s, and were generally well below those considered damaging to old buildings. Some magnification of vibration amplitude was noted between lower and upper levels of the church. Predominant frequencies were between 20 and 30 Hz.

Condition of walls in the Port Arthur penitentiary

The velocity of a vibration pulse along and through the walls was used as an indication of the condition of the brickwork.

The wall was tapped by a hammer on one side, and the time measured for this pulse to reach the other side. The velocity of the pulse was then calculated. In some cases the time was compared with pulse time to a geophone placed on the other side of the wall but 3 m along, or to a geophone on the same side of the wall as the input.

The instrument used was a 'Bison' seismograph which can be read to numbers as low as one millisecond with an accuracy of 0.2 milliseconds.

New section, north wall

Thickness of wall = 35 cm
Velocity directly along the wall for 3 m = 540 m/s
Velocity directly along the wall for 4.7 m = 590 m/s
Velocity along a diagonal path through the wall 3.06 m = 550 m/s

This wall is composed of solid brick, ten years old, and was used as a comparison for results from other walls. A direct reading through the wall did not give valid results because the time reading was too small for accurate measurement.

Eastern end wall

Thickness of wall = 80 cm
Velocity directly through wall = 400-450 m/s at different points
Velocity diagonally through wall over 3.10 m = 510-540 m/s

The direct velocity through this wall is comparatively low, and it is anticipated that this wall has many gaps and discontinuities in it.

There was no significant difference in readings between the renovated and unrenovated sections.

Eastern end of the front (north) wall, old section

Thickness of wall = 80 cm

Soundings were taken at the centre of each pillar and window. They started from the eastern end and continued westward until the danger of unstable masonry made it impracticable.

Pillar 1, window 1, pillar 2

Velocity directly through = 580-610 m/s

Window 2, pillar 3

Velocity directly through = 400 m/s

Pillar 4

Velocity directly through = 580 m/s

The strength of this wall appears to be quite variable. The eastern part, towards the corner is strong.

North wall, western end

Thickness = 45 cm
Velocity diagonally through 3.03 m = 680 m/s
Velocity diagonally through 2.05 m = 490 m/s

These two soundings give very different results, indicating that there is variability in the wall itself. More work is needed to pick out the weak parts of this wall.

CONCLUSIONS

If the velocity of a vibration pulse through wall is considered to be an indication of its density and solidity, then a pulse velocity may be used as a guide to the strength of a solid wall.

These soundings show that the old eastern wall and part of the old northern wall have low densities and should be treated with care. At the west end of the northern wall, densities are variable.

These findings may be enlarged upon and improved with further field study.

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[9 June 1976]

APPENDIX 1

Thin section descriptions of specimens from the Port Arthur area.

G.B. Everard

(a) 76-580 [EN711174] *Dyke intruding dolerite, Standup Point.*

The hand specimen is an aphanitic greenish-grey rock with a smooth sub-conchoidal fracture, and contains irregular cracks filled with calcite.

In thin section the specimen is a very fine grained igneous rock of mixed intergranular and intersertal texture, the intersertal parts appearing as irregular angular dark patches up to 0.5 mm across consisting of dark glassy or cryptocrystalline material containing minute laths of labradorite up to 0.2 mm long.

The intergranular parts of the section consist of labradorite laths averaging about 0.1 mm long in a network enclosing granules of colourless pyroxene. Some of the largest pyroxene crystals partly enclose laths of labradorite and show incipient ophitic texture.

There are a few isolated patches of emerald green radiating, fibrous or platy material with which an indeterminate brownish-pink zeolite is sometimes associated.

The rock is a tholeiitic basalt.

(b) 76-578 [EN682224] *Quarry 1, Port Arthur.*

In thin section the rock consists of irregular angular grains of quartz and feldspar averaging about 0.2 mm across and showing shattering and strain. Some of feldspar grains show multiple twinning and others without twinning may be recognised by biaxial interference figures. Some grains contain inclusions of white opaque clay minerals. The cement between the grains is partly silica and partly white opaque clay material and is minimal in amount.

The rock is a feldspathic sandstone.

(c) 76-579 [EN682224] *Quarry 1, Port Arthur.*

The hand specimen is a slightly friable and somewhat porous, fine grained, buff-coloured sandstone with scattered flakes of white mica up to about 1 mm across.

In thin section the rock is a close mosaic of irregular angular quartz grains averaging about 0.2 mm across. Some quartz grains show fine cracks, but the majority are fresh and unstrained.

Lithic grains are weathered to limonitic and sericitic materials and would not be in excess of about 10% of the whole.

Feldspar grains compose 1 or 2% of the whole and are generally fresh and show twinning.

The cement is also less than 10% and consists mainly of sericitic and clay minerals stained with limonite.

The rock is a quartz sandstone.

(d) 76-576 [EN673231] *Metamorphosed Triassic sandstone from dolerite contact in quarry near Nubeena Road.*

The hand specimen is a pale greenish-brown fine grained laminated rock showing current bedding.

In thin section the rock consists of angular grains of quartz, brownish carbonated feldspar averaging about 0.05 mm across set in a matrix of much finer grained quartz, carbonate, sericite and clay minerals. Graded and current bedding are prominent, but better seen in hand specimen.

The rock is a carbonated arkozic sandstone.

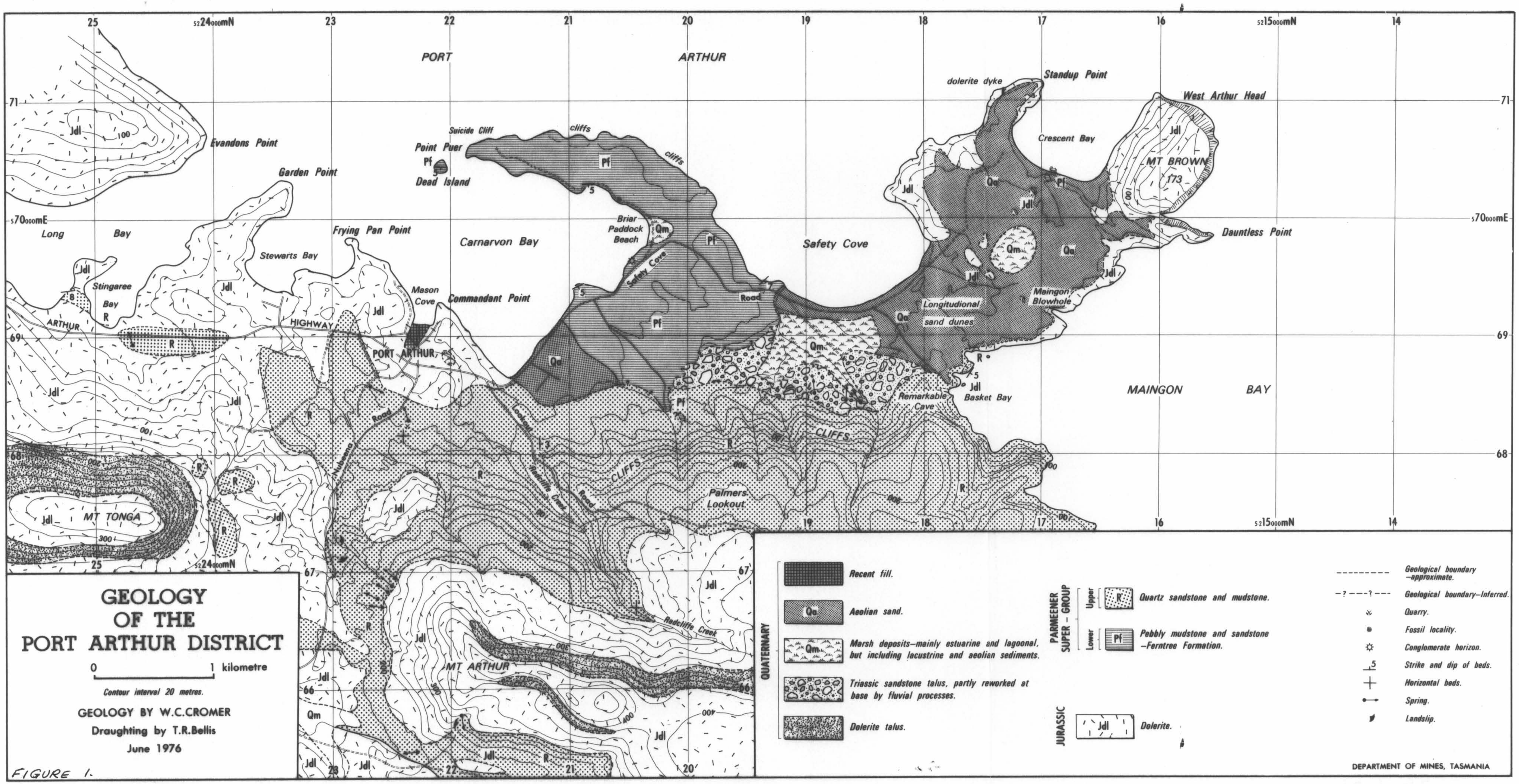
APPENDIX 2

Logs of auger holes at Port Arthur.

Bore hole No.	Depth (m)	% <20 μm	S.W.L.	Description	Remarks
1	0 - 0.3	-	-	White sand.	
	0.3 - 3.4	-	-	Black sandy loam.	
	3.4 - 3.7	-	-	Yellow sandy clay.	
1a	0 - 0.9	-	-	Black sand.	
	0.9 - 1.4	-	-	White sand.	Hard sandstone.
2	0 - 0.3	-	-	White sand.	
	0.3 - 1.5	-	-	Black sandy loam.	
	1.5 - 2.4	-	-	Yellow sandy clay.	
	2.4 - 3.7	72.1	-	Off white clay.	Average of 2 samples.
	3.7 - 5.5	70.9	-	Off-white clay.	
	5.5 - 6.4	77.2	-	Off-white clay.	
	6.4 - 7.3	73.4	-	Off-white clay.	Average of 2 samples.
	7.3 - 8.2	67.2	-	Off white clay.	Hard sandstone bottom.
3	0 - 2.4	-	3.9	Black sandy soil.	
	2.4 - 3.7	48.6	-	Buff coloured clay.	Average of 2 samples.
	3.7 - 4.6	51.9	-	Buff coloured clay.	
	4.6 - 5.0	63.6	-	Buff coloured clay.	Hard bottom.
4	0 - 2.7	-	3.7	Sandy clay.	
	2.7 - 3.7	62.6	-	Yellow clay with grit particles.	
	3.7 - 4.4	69.6	-	Grey clay.	
5	0 - 0.9	78.0	-	Sandy soil	
	0.9 - 1.8	78.0	-	Yellow sandy soil.	
	1.8 - 2.7	76.0	-	Yellow sandy soil.	
	2.7 - 3.7	74.1	-	Yellow sandy soil.	
	3.7 - 4.6	78.3	-	Yellow sandy soil.	
	4.6 - 5.5	77.0	-	Yellow sandy soil.	
	5.5 - 6.4	73.7	-	Yellow sandy soil.	
	6.4 - 7.3	67.9	-	Yellow sandy soil.	
	7.3 - 8.2	60.4	-	Yellow sandy soil.	
	8.2 - 9.1	45.3	-		Average of 2 samples, hard yellow clay with white sandstone fragments.
6	0 - 0.9	-	3.5	Sandy soil.	
	0.9 - 1.8	-	-	Soil and clay.	
	1.8 - 2.7	33.5	-	Yellow sandy clay.	
	2.7 - 3.7	66.2	-	Grey sandy clay.	
	3.7 - 4.6	68.7	-	Grey clay.	
	4.6 - 5.5	62.6	-	Grey clay.	
	5.5 - 6.1	50.7	-	Clayey sandstone.	Hard sandstone bottom.

Bore hole No.	Depth (m)	% <20 µm	S.W.L.	Description	Remarks
7	0 - 2.3	-	6.6	Black sandy soil.	
	2.3 - 3.7	18.1	-	Light brown clayey sand.	
	3.7 - 4.6	47.8	-	Grey clay.	
	4.6 - 5.5	58.8	-	Grey clay.	
	5.5 - 6.4	59.5	-	Hard grey clay.	Hard clay bottom.
8	0 - 0.9	-	-	Black sandy soil.	
	0.9 - 1.8	68.3	-	Hard yellow sandy clay.	
	1.8 - 2.7	59.3	-	Yellow clay.	
	2.7 - 3.7	-	-	Cream clay.	Sandstone bottom.
9	0 - 0.9	-	-	Fine sandy soil.	
	0.9 - 1.8	-	-	Yellow clay.	
	1.8 - 2.7	80.1	-	Yellow clay.	Hard sandstone bottom.

5 cm



GEOLOGY OF THE PORT ARTHUR DISTRICT

0 — 1 kilometre

Contour interval 20 metres.

GEOLOGY BY W.C.CROMER

Draughting by T.R.Bellis

June 1976

FIGURE 1.

QUATERNARY

- Recent fill.
- Qa — Aeolian sand.
- Qm — Marsh deposits—mainly estuarine and lagoonal, but including lacustrine and aeolian sediments.
- Triassic sandstone talus, partly reworked at base by fluvial processes.
- Dolerite talus.

PARMEENER SUPER-GROUP

- Upper — R — Quartz sandstone and mudstone.
- Lower — Pf — Pebbly mudstone and sandstone —Ferntree Formation.

JURASSIC

- Jdl — Dolerite.

- Geological boundary —approximate.
- Geological boundary—Inferred.
- Quarry.
- Fossil locality.
- Conglomerate horizon.
- Strike and dip of beds.
- Horizontal beds.
- Spring.
- Landslip.

DEPARTMENT OF MINES, TASMANIA