

9. The clay resources of the Hobart area

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INTRODUCTION

This report sets out the present state of knowledge of clay resources in the Hobart area to assist the heavy ceramic industry. For the purposes of this survey, the Hobart area is defined as lying with a 40-mile radius of Hobart. This area extends to Orford on the E coast, Tunnack in the N, Ouse in the NE and Dover in the S. The outer limits of this area are sub-economic under present conditions for all but high-grade deposits or materials but the area defined forms a useful unit for discussion and it is possible that future demands may reach as far as this when the local resources become depleted.

High grade ceramic, filler and refractory clays are not known to occur in the Hobart area, although at Surges Bay a kaolinised syenite dyke was once worked and utilised as a paper filler clay. The deposit was worked out and no other has been found. This report deals solely with low grade plastic clays used for ceramic pipe manufacture, and brick clays. Almost any type of clay can be utilised for the manufacture of bricks but it is sometimes extremely difficult to find adequate resources which are both conveniently situated and which can be worked economically.

This report deals firstly with the geological nature of the ceramic materials in the Hobart area and secondly with individual deposits or areas of clay under regional headings.

Sources of information include proline auger holes in selected localities, records of water bores and diamond drill holes for coal, existing clay pits and geological maps by University honours students and Department of Mines maps and reports. The geological map (fig. 13) was compiled by the Department's draughting office staff from the abovementioned sources.

Records of clay production are not available prior to 1958; production figures for 1958-1967 are given in Table 2. During the last ten years there has been no significant change in brick clay production. This fact is due to the closing down of one of the major brickmaking companies in 1965 and the more economical use of clay by the Hobart Brick Company which is the present major producer. Therefore although clay production has been static, the brick production has been rising steadily over the same period and is expected to rise in the future. This matter can only be treated in the most general terms as certain factors such as competition from outside producers and from other materials would influence future requirements. Even accepting a static demand and therefore production of bricks over the next decade, a move towards establishing new supplies is warranted in view of the limited reserves of clay in pits which are currently being worked.

Ceramic test results, mainly from reports by the ceramics technologist of the Department of Mines, and in a few instances from more detailed analyses by Amdel in Adelaide are summarised in Table 1.

GEOLOGY

In the Hobart area brick and tile clay is derived from three types of deposit: Tertiary freshwater sediments, Triassic mudstone and shale, and Permian mudstone and siltstone.

Tertiary freshwater sediments

During Tertiary times, considerable thicknesses of sand and clay were deposited in fault-controlled sedimentary basins associated with river valleys. One of these is situated near Ouse on the Derwent River and another lies in the Richmond district on the Coal River. A small clay deposit of a similar nature occurs at Mangalore in the valley of the Bagdad Rivulet.

These clays are generally softer and more plastic than those derived from Triassic and Permian rocks as they are geologically younger and less indurated. They generally require the addition of sand for brick manufacture whereas the Triassic and Permian beds, particularly the latter, either contain sufficient sandy material or are interbedded with it.

Numerous other similar deposits undoubtedly occur in the river valleys of the Hobart area but probably only as isolated pockets of uneconomic size. Some may also underlie Recent alluvium in river flats.

This type of deposit frequently underlies valuable agricultural land and so may not be available for quarrying.

Triassic mudstone and shale

Triassic rocks have been and still remain the principal brickmaking material in Hobart. They consist of a freshwater sequence of sandstone, mudstone and coal seams. The exact sequence is not adequately known anywhere in the State

TABLE 1. SUMMARY OF THE RESULTS OF CERAMIC TESTS

Region	Locality	Material	Reference	Colour	Sand Content	Preparation
C	Austins Ferry (Hobart Brick Co.)	Triassic sandstone and mudstone	T.R. 5: 239-240	Buff		Coarse crushing
	Austins Ferry (McHugh)	Triassic sandstone and mudstone	T.R.7: 204-205	Buff		Two samples: A crushed to -3mm B crushed to -0.7mm A 71% < 76 μ B 85% < 76 μ
	Austins Ferry (report on Hobart Brick Co. material by Amdel)	Triassic sandstone and mudstone	C.A.C.	Buff	74% > 50μ 83.5% > 20μ	
	Claremont	Permian siltstone (Malbina Formation)	T.R.5: 254			Roll crushed to pass ¼ inch screen, c.33% < 250μ
	Knocklofty	Triassic sandstone and mudstone	T.R.9: 187-189			Jaw and roll crushed to < 1.67mm (-10 mesh B.S.S.)
	Mt Rumney	Triassic sandstone and mudstone	T.R.9: 187-189			Jaw and roll crushed to < 1.67mm (-10 mesh B.S.S.)
	Quarry at Glenlusk turnoff	Permian (Woody Island Siltstone)	D.L.R.		87%	
NW	Hamilton (McHugh Bros quarry)	Tertiary sediments	T.R.7: 203-204	Cream		Crushed to pass ¼ inch screen, 83% < 76μ
N	Mangalore	Tertiary sediments	D.L.R.	Yellow	61%	
E & SE ..	Cambridge- Richmond area <i>Proline Survey Holes:</i>	Mainly Tertiary sediments	D.L.R.			
	B.H. 3: 0-39 ft				48%	
	B.H. 5: 3-30 ft				46%	
	B.H. 10: 3-30 ft				57%	
	B.H. 11: 6-33 ft				53%	
	B.H. 17: 9-50 ft				56%	
	B.H. 18: 9-20 ft				46%	
	B.H. 21: 3-15 ft				66%	
	B.H. 25: 0-21 ft				57%	
	B.H. 25: 21-50 ft				41%	
	B.H. 28: 0-24 ft				55%	
	B.H. 29: 0-27 ft				64%	
	B.H. 29: 27-50 ft				36%	
	B.H. 30: 0-38 ft				49%	
	Dunalley Canal	Mainly Tertiary sediments	D.L.R.		75%	
	Copping	Decomposed dolerite			74%	
	Copping	Triassic sandstone and mudstone			86%	
	Seven Mile Beach	Triassic sandstone and mudstone			54%	
S	Howden (Hazel's pit)	Triassic sandstone and mudstone	C.A.C.		57% > 50μ 75% > 29μ	

TABLE 1. SUMMARY OF THE RESULTS OF CERAMIC TESTS—continued

Fabrication	Ignition Loss %	Drying Shrinkage %	Firing	Remarks
De-aired extruded brick	5.8	3.5	1,050°C: red colour, shrinkage 4.75%	
De-aired extruded brick and pipe			1,000°C, shrinkage: Brick A .. 2.5 B .. 2.0 1,200°C shrinkage: A .. 2.5 B .. 4.75 loss of weight (bricks): 3%	Pipe 3.0% 2.75% 5.0% 6.0%
Extruded brick	15	7	1,000°C: light red colour, no shrinkage 1,050°C: light red colour, shrinkage 1% 1,100°C: red, very hard, shrinkage 3% 1,150°C: dark red, very hard, shrinkage 5% 1,200°C: chocolate, vitrified, shrinkage 5.5%	Bricks fired light brown at 1,000°C, dark brown at 1,100–1,200°C; no efflorescence
Semi-dry pressed brick		1	Green strength poor. 1,100°C: fired strength fair	Marginal ceramic material
Stiff plastic pressed brick		4	1,050°C: shrinkage 3%, modulus of rupture 2,500 lb/in ²	Also satisfactorily tested in blends with clay from Kingston and Mt Rumney
Stiff plastic pressed brick		3	1,050°C: shrinkage 3%, modulus of rupture 1,200 lb/in ²	
				Non-clay content too high to warrant ceramic test
De-aired extruded pipe and brick		6.5; 7.0	Shrinkage @ 1,000° 1,050° 1,100° 1,150° 1,200°C % % % % % Brick: 1.25 2.75 3.75 3.75 3.75 Pipe: 3.0 4.0 5.0 5.0 5.0 Modulus of rupture of bricks fired at 1,050°C: 1,870–1,810 lb/in ²	Vanadium efflorescence in bricks fired below 1,100°C
			No bond at 950°C	Unsuitable for brick manufacture
		3	950°C: good bond, red colour 950°C: no bond 950°C: no bond 950°C: no bond	Suitable for brick manufacture
		3	950°C: very good bond, pinkish red colour	Good brick material
		1	950°C: very good bond, red colour Not tested—sand content too high Not tested	Excellent red brick material
		1	950°C: moderate bond, cream colour 950°C: no bond 950°C: no bond	Not recommended for brick manufacture
		3	950°C: moderate bond, pinkish red 950°C: no bond	Good brick material but overburden too thick
			Not tested	
De-aired extruded brick	17	3	Shrinkage @ 1,000° 1,050° 1,100° 1,150° 1,200°C 1 1.5 4 5.5 7.5% under-fired over-fired (slight vitrification)	

TABLE 1. SUMMARY OF THE RESULTS OF CERAMIC TESTS—continued

Region	Loca ity	Material	Reference	Colour	Sand Content	Preparation
	Kingston (<i>Wells and Fenton</i>)	Triassic sandstone and mudstone	C.A.C.		26% > 50 μ 51% > 20 μ	
	Electrona (<i>Proline survey holes</i>)	Triassic sandstone and mudstone	T.R. 13:22			
	1			Brown	51% > 20 μ	
	2a			White	48%	
	2b			Brown	55%	
	3a			White	42%	
	3b			Light brown	49%	
	4			Red-brown	53%	
	5			Red-brown	69%	
	Dover	Permian siltstone and Tertiary clay	T.R.7: 202			roll crushed to $-\frac{1}{4}$ inch +200 mesh 99% -200 mesh 90.1%
S	Surges Bay	Decomposed syenite dyke	T.R.5: 240-243		Roll Crushed	Semi-dry pressed brick
	Reg. No. 191			Cream		
	Reg. No. 192			Cream		
	Reg. No. 193			Yellow		
	Reg. No. 191					
	Reg. No. 192					
	Reg. No. 193					
	Trial Bay (<i>Clay pit</i>)	Tertiary sediments	D.L.R., 1969			
	1-6 ft			White	8.6	
	9-14 ft			White	50.0	
	15-16 ft			White	65.4	
	(<i>Auger hole samples</i>)		D.L.R., 1969			
	0-3 ft			White	57.6	
	3-6 ft			White	54.2	
	Woodbridge (<i>Woodward's property</i>)	Permian sediments	D.L.R., 1969	White	73.9	
	Middleton (<i>Roadcuttings</i>)	Permian sediments	D.L.R., 1969	White	69.6	
				White	21.9	

TABLE 1. SUMMARY OF THE RESULTS OF CERAMIC TESTS—continued

Fabrication	Ignition Loss %	Drying Shrinkage %	Firing						Remarks
De-aired extruded brick	23	7	Shrinkage @ 950° 1,000° 1,050° 1,100° 1,150° 1,200°C 1 1 2.1 3.6 4.7 5.2% hard hard						
De-aired extruded brick	3.5	nil	950° Shrinkage 1% pink			1,000°C Well fired			Good brick material
De-aired extruded brick	5.3	nil	Off white			Well fired			Good brick material
De-aired extruded brick	2.6	nil	No bond			No bond			Not good brick material
De-aired extruded brick	4.1	nil	Off white, good bond			Pinkish white, good bond			Not good brick material
De-aired extruded brick	3.8	nil	Pink, good bond			Well fired			Not good brick material
De-aired extruded brick			Pink, moderate bond						Marginal brick material
De-aired extruded brick	2.9	nil	Light red, no bond			Dark red, bonded			Marginal brick material
De-aired extruded brick		8.25	Shrinkage @ 1,000° 1,050° 1,100° 1,150° 1,200°C 1.75 2.75 3.75 6.75 6.75%						Marked vanadium efflorescence in all bricks
De-aired extruded pipe		6.25	Modulus of rupture of bricks fired at 1,050°C: 470-570 lb/in ²						Unsuitable due to leakage of pipe fired at 1,000-1,200°C under pressure of 20 lb/in ²
Semi-dry pressed brick			Shrinkage @ 900° 950° 1,000° 1,050° 1,100°C 1 1.5 3.5 7.5 8.5%						} Presses well but short firing range soft at 1,000°C and over-fired at 1,050°C } Presses well; soft when dry, well fired at 1,050°C over-fired at 1,100°C } No bricks showed fusion at 1,500°C
	15	0.5	1 2 3.5 7 8%						
	13.5	0.5	1 2 4.5 7.5 8%						
Stiff plastic pressed brick			Shrinkage @ 900° 950° 1,000°C 1 3 6% 1.5 3 5% 0.5 3 7%						} Weak, distorted on drying and firing
	20	4.5							
	19.5	4.5							
	20	4							
Extruded and de-aired brick			Shrinkage @ 850° 900° 950° 1,000° 1,050° 1,100°C 1 1 3.5 5.5 7 8% 1 1 3 5 7 7.5%						} Extrudes well; well fired at 950°C slightly over-fired at 1,000°C
	23.5	7							
	22	7.5							
	23	6	0.5 0.5 3.5 6.5 7.5 8.5%						Extrudes fairly well; well fired at 1,000°C and overfired at 1,050°C Bricks are subject to orange and green vandatum efflorescence
Pressed brick			1,000°C						Excellent quality; pinky white brick Good quality; light cream brick No bond No bond No bond
Pressed and extruded brick									No bond Excellent quality light cream brick

TABLE 2. CLAY PRODUCTION IN THE HOBART AREA (CUBIC YARDS)

(Information supplied by clay producers and published in the Annual Reports of the Director of Mines)

Clay Producer	Year										1958-67	
	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967		
Crisp & Gunn, West Hobart	20,590	25,546	24,216	18,765	16,141	17,234	16,419	9,446				148,357
Hobart Brick Co., New Town and Austins Ferry	25,139	18,350	18,944	19,495	10,279	10,201	11,718	10,686	10,262	11,018		146,092
Kings Bay Contractors, Kingston*					4,616	7,078	16,526	11,975				40,195
D. Wells, Blackmans Bay*								1,617	4,590	3,452		9,659
J. Fenton, Kingston*								3,879	4,743	4,559		13,181
Hazell Bros, Howden*							5,236	5,757	9,756	13,886		34,635
Humes Ltd, Austins Ferry (successors to McHugh Bros and Granton Brick Company)	13,200	16,150	15,975	14,800	11,130	12,000	11,600	12,200	12,500	14,100		133,655
Humes Ltd, Hamilton (pipe production)					130	1,948	1,054	2,555	1,295	4,049		11,031
TOTAL	58,929	60,046	59,135	53,060	42,296	48,461	62,553	58,115	43,146	51,064		536,805

* Suppliers to Hobart Brick Company

but the most complete section described consists of 2000 ft of sediments in the Western Tiers district (McKellar, 1957). Four formations were described in this area:

<i>Formation</i>	<i>Thickness (ft)</i>	<i>Rock Type</i>
Brady	540	Sandstone, siltstone, shale and coal seams.
Tiers	280	Thinly bedded sandstone, siltstone and shale with plant remains.
Clauun	460	Gradational: predominantly sandstone at the top to predominantly shale at the base.
Ross	650	Massive sandstone.

No exact equivalents of these formations are recognised in the Hobart area, where the succession consists of a coal measures sequence (similar to the Brady Formation) and an underlying Knocklofty Formation which is probably equivalent to the Tiers and Cluan Formations and, according to Banks and Naqvi (1967) may also include all or part of the Ross Sandstone. The disused brick pit belonging to the Hobart Brick Company at New Town is located in this coal measures formation and the disused brick pit formerly operated by Crisp and Gunn on Knocklofty Hill, West Hobart, is located in the Knocklofty Formation.

Triassic sediments are widespread throughout southern Tasmania and it is expected that they will continue to be the major raw material for the Hobart brick industry.

Outcrops of Triassic rocks are shown as shaded areas on the map (fig. 13). These are all potential clay producing areas but owing to the softness of the shale and mudstone beds they are rarely seen at the surface and therefore require prospecting by drilling.

Permian mudstone and siltstone

The Permian succession consists of:

- Cygnets Coal Measures
- Ferntree Group
- Malbina Formation
- Cascades Group
- Mersey Group
- Golden Valley Group
- Quamby Group
- Wynyard Tillite

Permian rocks are predominantly siliceous but several members have a clay mineral content of 50% or more and are therefore potential brickmaking materials. The following beds merit consideration: Woody Island Siltstone (Quamby Group), Bundella Mudstone (Golden Valley Group), and the Malbina Formation (formerly Woodbridge Glacial Formation). The Nassau Siltstone and Grange Mudstone, are both members of the Cascades Group but are in part calcareous and cannot be used for brickmaking. Due to their compactness, unweathered Permian beds do not provide a satisfactory brickmaking material when used alone.

Other rock types

Alkali syenite. A kaolinised alkali syenite dyke of probable Cretaceous age at Surges Bay was formerly mined for use as a paper filler clay. The quality

of clay dug for this purpose deteriorated and production ceased in 1959. There may be sufficient material of brickmaking quality remaining to warrant reopening the pit for this purpose.

Jurassic dolerite. Decomposed dolerite has not been used as a ceramic material in the Hobart district but a dolerite of Cambrian age was used for many years at Cooe near Burnie. Test bricks made from Jurassic dolerite at this brickworks from material supplied by the writer were underfired and crumbly. This refractoriness may be due to the presence of gibbsite which is a common decomposition product of basic igneous rocks. They may be suitable for the manufacture of refractory bricks for the maintenance of brick kilns. Apart from the probable presence of gibbsite in decomposed dolerite, the ceramic properties will be principally determined by the degree of decomposition of the constituent minerals. As some Tertiary and Quaternary deposits have a high doleritic content and are satisfactory ceramic materials, the decomposed dolerite should be also.

Dolerite is a very abundant rock type in Tasmania but rarely weathers *in situ* in sufficient quantity to constitute workable deposits. There are however, alluvial deposits on the lower slopes of most doleritic areas which may be sufficiently decomposed and of sufficient extent to warrant exploitation.

MINERALOGY

Almost any combination of clay minerals is satisfactory for the manufacture of common brick. Those analysed in the Hobart area are considered to be mixtures of kaolinite and illite. A high proportion of kaolinite tends to increase the firing temperature required. Montmorillonite is undesirable as it causes excessive firing shrinkage but this mineral is uncommon in Triassic and Permian clays.

The clay mineralogy of decomposed Jurassic dolerite is unknown but this material requires a rather higher firing temperature than most of the brickmaking clays used in Tasmania.

The alkali syenite of Surges Bay has weathered to a kaolin with small amounts of illite and quartz. One sample was found to contain a mixed layer clay mineral of illite and montmorillonite.

Many of the clays analysed contain up to 50% quartz which is within acceptable limits for ceramic use. Those brickmaking materials with too low a non-clay content are subject to excessive shrinkage on drying and firing.

TABLE 3. AGE AND DISTRIBUTION OF CLAY DEPOSITS

Sedimentary sequence	Region				
	Central	North-western	North and north-eastern	East and south-eastern	Southern
Tertiary- fresh water sediments	Hamilton-Ouse (W)	Mangalore (P)	Richmond (P) Pipe Clay Lagoon (P)
Triassic mudstone and shale	Knocklofty (D) New Town (D) Ten Mile Hill, Austins Ferry (W) Mt Rumney (I)	New Norfolk- Wayatinah (P)	Abundant Triassic rocks but no details of usable clay and/or shale	Saltwater River- Koonya, etc. (P)	Kingston (W) (Fenton) Howden (W) (Hazell) Electrona (W) Raminea Plain (P)
Permian mudstone and siltstone	Claremont (I) Collinsvale (P)	South Arm- Sandford (P)	Dover (W) Lucaston-Judbury (P)

D—defunct; W—working; I—investigated; P—potential

INDIVIDUAL DEPOSITS

Central region

The brick industry in Hobart commenced last century and all clay supplies were derived from pits in Triassic mudstone at West Hobart and New Town, both of which are now closed. A brickworks and clay pit were in existence on Knocklofty Hill for some years before the property was acquired by T. Gunn of Launceston in 1905. This became the Crisp and Gunn's brickworks and operated for approximately sixty years. Records of individual operators were not kept prior to 1958 and so total production can only be estimated. During the closing years of the company's operations, the annual production was five million bricks but earlier production was probably half this amount. Assuming an average annual production would have amounted to 240 million which would have utilised roughly one million cubic yards of clay and sand. This pit was examined by Blake (1960), who estimated that it had then only six years' reserves. There were two beds of mudstone, an upper bed 60 ft thick and a lower bed 23 ft thick with 30 ft of sandstone between them. The beds dipped 13° SW and quarrying was carried out down dip until the overburden:mudstone ratio became too high for economic clay extraction. At the time of Blake's visit the workings were becoming both uneconomic and unsafe. The life of this quarry could have been prolonged and working costs decreased if a dip face had been initiated rather than the strike face which led to the premature closing of this pit. Both beds of clay actually outcrop on the eastern flanks of Knocklofty Hill and are still untouched but cannot be worked now because of the proximity of residential areas.

New Town. The clay pit at New Town was located in coal measures mudstone and shale of Triassic age but stratigraphically higher than the beds worked in the Knocklofty pit. These beds were also quarried down dip into the side of a hill and operations ceased in 1959 due to the disproportionate amount of overburden. The floors of both pits are permanently under water due to the downdip nature of the workings.

Austins Ferry. Two brick manufacturers are currently operating brick pits on Ten Mile Hill, Austins Ferry. The sedimentary sequence is a typical succession of sandstone and mudstone of Triassic age similar to the Knocklofty Formation. The beds are weathered to a depth of 30 ft as indicated by a test proline hole, but below this depth the ground was too hard for further penetration with the auger. This deeper ground would require ripping or blasting before it could be handled. The beds being quarried are underlain and overlain by sandstone and the reserves of brickmaking material were estimated at 300,000 cu yd (Hughes 1960).

Mt Rumney. Two areas of Triassic shale cropping out on Mt Rumney were investigated by Hughes and Blake (1958). Estimates of reserves were 750,000 cu yd for the southern area near Howrah and 150,000 cu yd for the area near the Tasman Highway (Mt Rumney turnoff). The authors suggested a correlation of these beds with the Knocklofty Formation.

Collinsvale Road. An estimated 400 ft of Woody Island Siltstone (Quamby Group) in the Collinsvale-Glenlusk area has been described by Sutherland (1964). They contain 50% clay minerals, 30% quartz and 20% limonite and minor

amounts of feldspar, zircon and rutile. Several proline holes were drilled in the area but the ground was too hard and auger penetration was limited to the upper few feet of weathered rock. A 15 ft channel sample was cut from a quarry face at the Glenlusk turnoff but to obtain fresh rock for ceramic testing it would be necessary to resort to diamond drilling. Sutherland mentions the presence of pyrite in fresh rock, which is probably the source of the limonite in the surface exposure. The percentage of pyrite and its effect on ceramic properties of the material would need to be determined. This is a potential clay reserve but quantity and quality have not yet been assessed.

Claremont. A siltstone of Permian age (probably Malbina Formation) in the vicinity of Claremont and approximately two miles N of the Glenlusk quarry was described by Blake (1961). Banks and Read (1962) described a type section consisting of 300 ft of sandstone and siltstone. Samples of the Claremont material were found satisfactory for brick making. The quality of bricks is improved by fine grinding of the material before pressing. It is doubtful if it is sufficiently plastic for extruding, it may however be suitable for blending with plastic clay.

North-western region

Tertiary freshwater sediments in the Derwent Valley are utilised for the manufacture of glazed ceramic pipes. They consist predominantly of clay interbedded with sandstone and lignite. The deposit extends approximately eight miles in a NW-SE direction on the E bank of the river between Hamilton and Ouse and measures up to two miles in width. A depth of 600 ft of sediment was proven by diamond drilling (Hills *et al.*, 1922; plate XXIII). It is probable that much of the fertile river flats of Macquarie Plains and Bushy Park contain similar Tertiary sediments beneath Recent alluvium.

Triassic sediments occur throughout the Derwent Valley and although outcrops of the finer grained beds are poorly exposed, some boreholes drilled by the Department of Mines (Hills *et al.*, 1922; pp. 177-180) indicate a normal coal measures sequence of sandstone, mudstone and coal seams. Other boreholes drilled by the Hydro-Electric Commission in the Wayatinah area indicate both coal measures and the underlying Knocklofty Formation (Jennings, 1955; Woolley, 1959). As this area is between 20 and 70 miles from Hobart it is unlikely to be of interest as a source of brick clay in the foreseeable future, however should the need arise, it would not be difficult to choose suitable sites for further investigation from amongst the areas already drilled.

North and north-eastern region

Mangalore. A small area of clay occurs in the Bagdad Rivulet Valley at Mangalore. McDougall (1959) suggested that the clay was deposited in a basalt-dammed lake during late Tertiary times. Five foot sections of this material are exposed in the beds of several creeks but the full depth is unknown; the total area is roughly one square mile. X-ray and D.T.A. analysis gave the following result: 80% clay minerals (40% kaolinite and 40% montmorillonite) and 20% quartz. This result suggests that the material would have good ceramic properties.

Pontville-Dromedary-Campania area. Although Triassic sediments are widely distributed in the area, there are no known clay deposits and the lithology is predominantly sandstone. Some 5 ft sections of clayey Triassic sediments were recently exposed in a cutting on the Campania road near Pontville, but drilling for Etna Freestone Ltd, also near Pontville, did not pass through any mudstone or clay within 30 ft of the surface.

The Tunnack area has been extensively drilled for underground water without revealing any clay deposits. The area is mainly underlain by Fernree Formation which is highly siliceous and unsuitable as a ceramic material. Isolated areas of Coal Measures at Colebrook and in the Bagdad-Kempton area are potential clay deposits but no information concerning them is available and they would have to be drilled before they could be assessed.

The area to the north-east of Hobart is similarly lacking in known clay deposits. This area consists primarily of dolerite but contains small pockets of Triassic sediments as at Runnymede, Levendale, Buckland and Orford. Triassic beds probably underlie this main mass of dolerite and outcrop sporadically from St Marys in the N to the Tasman Peninsula in the S. None of this country is conveniently situated for serving the Hobart area.

East and south-eastern region

Richmond. Freshwater sediments in the Coal River basin have recently been investigated by Leaman (in press). A gravity survey has indicated deep buried channels reaching 600 ft in depth. The extent of the Tertiary sediments is indicated (T) in the accompanying map, they extend from Campania in the N to Cambridge in the S and Orielton in the E. These beds, mainly clay, are exposed on river banks at Richmond and along the Pitt Water shoreline. Proline holes which were drilled to obtain samples for testing, encountered an ironstone band at the water table which, in many cases, prevented further drilling. Those holes which penetrated the ironstone, passed through 50 ft of clay, which was the limit of the equipment. Forty-four holes were drilled, of which only twenty exceeded 15 ft in depth and only four of these reached 50 ft. Water boring in the area also indicates considerable thickness of clay. Samples for ceramic testing were taken from Proline Holes 39, 41, 54, 57, 61, 66, 69, 70 and 71.

Tertiary and Quaternary clay deposits are numerous around the coast from Sorell to Dunalley. A 12 ft section of clay is exposed in the banks of the Dunalley canal.

South Arm-Sandford. Clay is almost certainly present beneath the Quaternary sand and gravel which covers a large proportion of the area. Only a limited amount of drilling has been carried out in the area and this indicates that the overburden is too thick for economic clay extraction. Green (1961) has recorded sandstone and clay in the Pipe Clay Lagoon Beds of Tertiary age on the S side of the entrance to the lagoon but their thickness is not known.

The remainder of the South Arm-Sandford peninsula is largely composed of Permian sediments and Jurassic dolerite. The Permian beds mainly belong to the Malbina Formation, which elsewhere (Claremont and Dover) has been successfully employed for brick manufacture and the area is therefore a potential clay deposit.

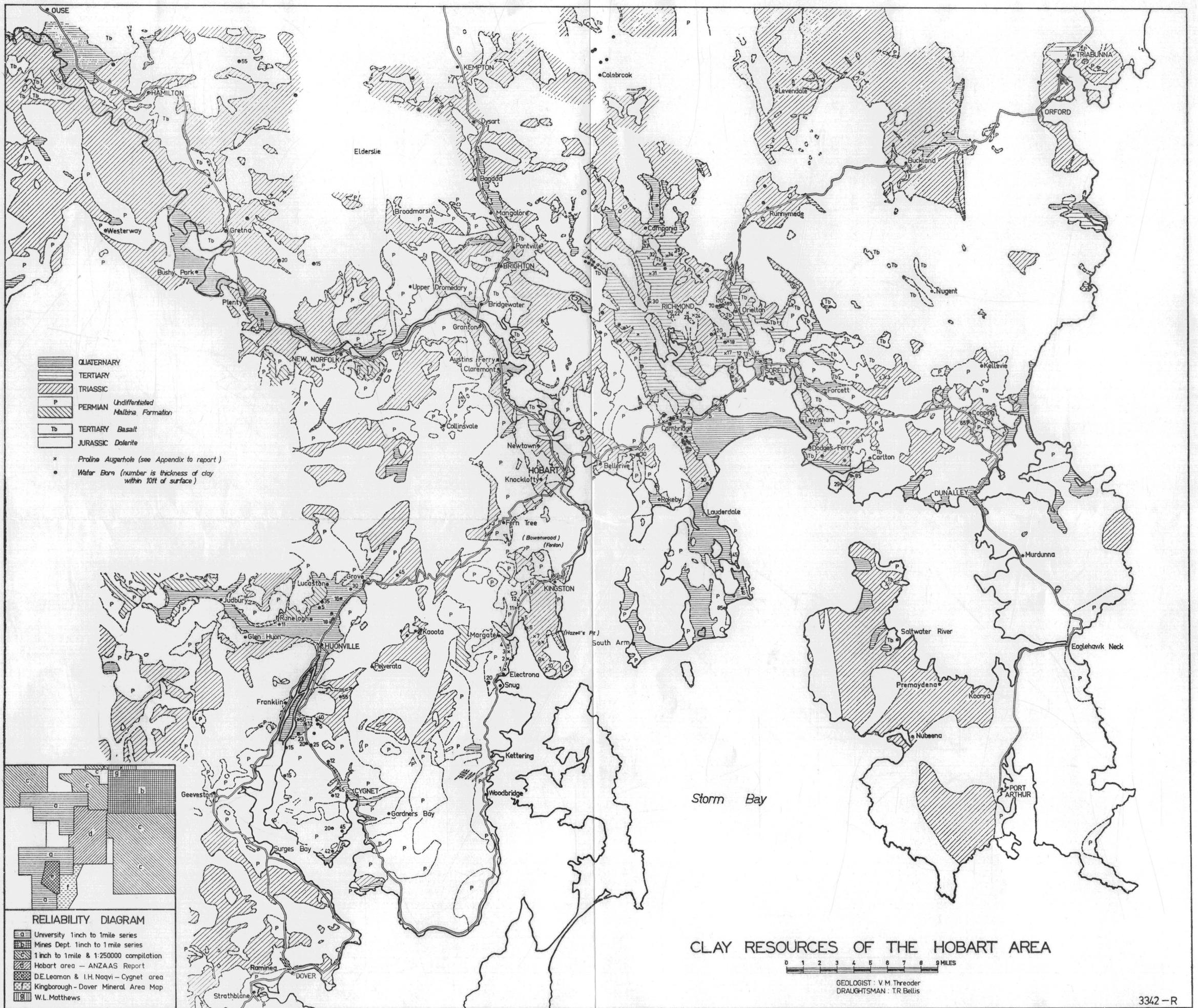


FIGURE 13

5 cm

Tasman Peninsula. Triassic sediments occur at Saltwater River, Dunalley, Copping and Kellevie but details of lithology are unknown except in the vicinity of coal workings and occasional road cuttings, as at Copping. Some mudstone beds occur in marine cliffs near Saltwater River but most would probably be unsuitable for ceramic use as they contain carbonaceous material. The Tasman Peninsula is rather too remote to be included as part of the Hobart area clay resources under present conditions.

Southern region

Hale (1953), Ford (1954, 1956), Mather (1955), Paxton (1968), Leaman and Naqvi (1968) have provided details of the lithology of the southern area.

Brick clays derived from Triassic sediments have been obtained from several localities in the Channel area. Knocklofty Formation beds are known in the Dover area (Hale, 1953), in the Huon district (Mather, 1955) and in the Franklin, Glendevie, Upper Huon and Arve areas (Ford, 1954). Outcrops of this formation are confined to the sandstone beds and the presence of the intervening mudstone beds can only be inferred. An extensive swampy flat, the Raminea Plain W of Strathblane is presumably developed in shale (Hale, 1963) and merits investigation but its distance from existing plants makes it uneconomic at present.

Clays from the Knocklofty Formation have been obtained from pits at Kingston, Electrona and Howden. At some of these pits there is an upper leached zone above the water table which has been used for the manufacture of cream brick. The thickness of this zone depends on the depth of the water table but it is nowhere more than 10 ft thick. The underlying clays are of various colours, usually red, yellow and purple. The Howden deposit consists of hard purple shale which needs to be loosened by ripping before extraction, this bed is similar to purple shales currently being worked at Austins Ferry and also at the disused Knocklofty pit.

Drilling for clay at 'Bowenwood', Kingston (Longman, 1962), revealed ferruginous sandy clay (fat sand) and similar material was found in test pits on Fenton's property, Proctors Road, Kingston. This material is probably the basal member of the Triassic succession; it is too siliceous for ceramic use but has some application as a building sand.

Coal measures beds at Kaoota were drilled for coal (Hills *et al.*, 1922) but the mudstone or shale content of the core was very low. Some clay beds are exposed in road cuttings near the Kaoota coal mine but no other information regarding brickmaking material in this area is available.

A brickmaking industry was once established at Dover using local clay. The plant is not operating now and the property belongs to Humes Ltd, who succeeded the Granton Brick Company. The Dover clay lies in a downfaulted block and consists of deeply weathered Malbina clay admixed with Tertiary or Pleistocene colluvial clay. The material is a semi-refractory clay requiring a firing temperature of 1100° C and shows only slight vitrification at 1580° C (Hale, 1953b). It is now used for making refractory bricks for the maintenance of the brick kilns at Austins Ferry.

A continuous 200 ft thick belt of Malbina Formation crops out on the lower slopes of Mt Misery extending from Lucaston to Ranelagh, Judbury and Lonnavaile. This material has not been tested but has been correlated with a similar

sediment at Claremont which has been successfully tested for use as a brick-making material. The Malbina Formation is a very low grade ceramic material but under suitable conditions (e.g., when deeply weathered as at Dover) or after fine crushing (Gillespie, 1961) can be used for brick manufacture. The material may be best utilised by blending with higher grade clay.

CONCLUSIONS

Twenty localities are listed in Table 1, twelve of these are quarries, either defunct or in operation, and eight are in new areas. The new areas are mostly either partially investigated, potential clay deposits or clay producing areas which merit investigation.

Two brickmaking materials which have not been used previously in the Hobart area are the Coal River Basin Tertiary clay and the Malbina Formation. The former is a plastic clay and the latter is a low grade ceramic material, suitable for blending.

Quarrying procedure is beyond the scope of this report but there are certain aspects of it which should be brought to the notice of workers in this field because they are of a geological nature and because they are important in making the maximum use of natural resources. There is a tendency among clay pit operators to win clay by stripping it in horizontal layers by ripping or bulldozing. Thus the material is being removed roughly parallel to the bedding and a highly variable quarry product results, particularly in a sedimentary series of interlayered sand and clay. The only reliable method under these conditions is to establish a working face perpendicular to the bedding even if this necessitates blasting rather than the relatively cheaper ripping or bulldozing. In establishing this face due regard should be given to the topography and the attitude of the beds to be worked. The face should be initiated perpendicular to the strike so that the difficulties associated with downdip faces viz., drainage problems, uneconomic clay overburden ratio and unsafe working conditions are avoided.

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