Fossil Beach Cement Works

Mornington Victoria

An Essay in Industrial Archaeology

by
William Culican
and
John Taylor

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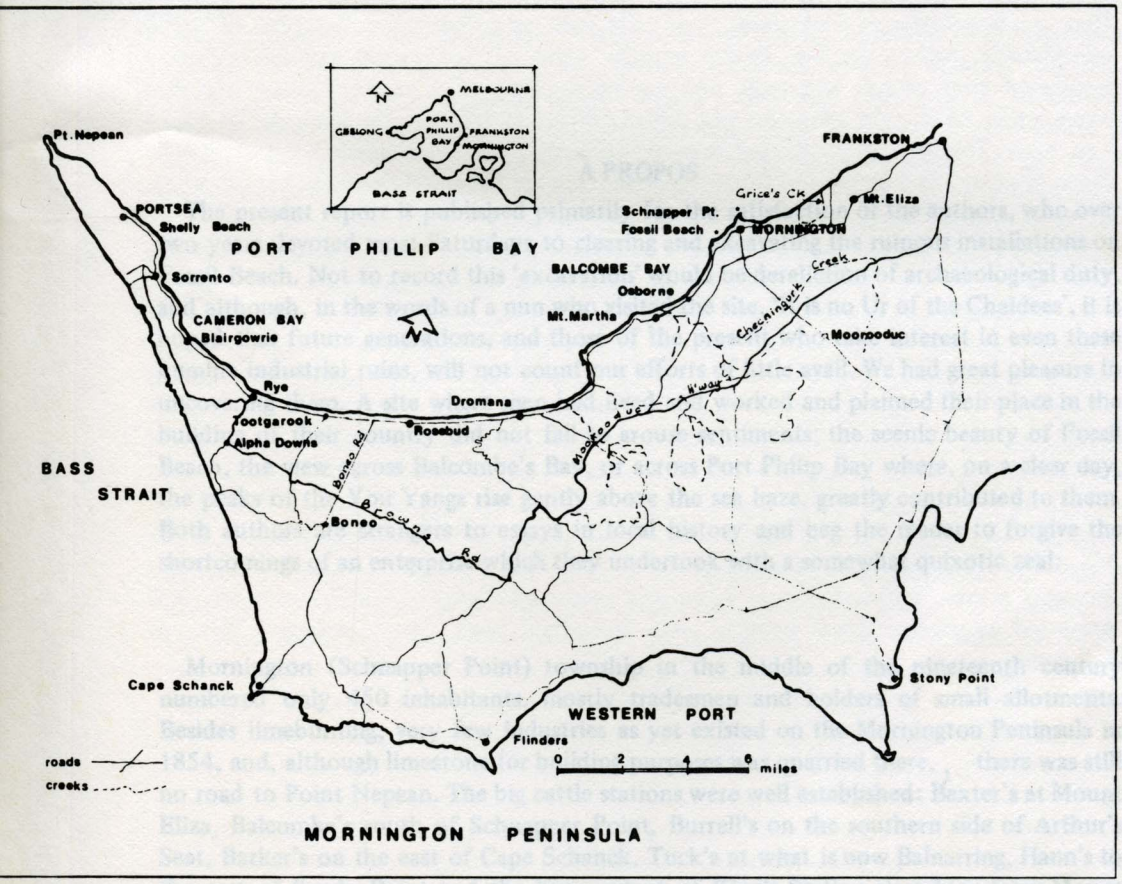
MELBOURNE
GEELONG
PORT PHILLIP BAY
FRANKSTON
MORNINGTON
BASS STRAIT
Pt. Nepean
PORTSEA
Shelly Beach
PORT PHILLIP BAY
Sorrento
CAMERON BAY
Blairgowrie
Rye
Tootgarook
Alpha Downs
Rosebud
Dromana
BALCOMBE BAY
Osborne
Mt. Martha
Schnapper Pt.
Fossil Beach
MORNINGTON
Grice's Ck
Mt. Eliza
FRANKSTON
Creeks
Moorooduc
Bonea Rd
Boneo
Cape Schanck
BASS STRAIT
WESTERN PORT
Flinders
Stony Point
0 2 4 6 miles
roads
creeks
MORNINGTON PENINSULA

FOSSIL BEACH CEMENT WORKS, MORNINGTON

by
William Culican and John Taylor

À PROPOS

The present report is published primarily for the satisfaction of the authors, who over two years devoted most Saturdays to clearing and excavating the ruinous installations on Fossil Beach. Not to record this 'excavation' would be dereliction of archaeological duty, and although, in the words of a nun who visited the site, 'It is no Ur of the Chaldees', it is hoped that future generations, and those of the present who take interest in even these humble industrial ruins, will not count our efforts of little avail. We had great pleasure in uncovering them. A site where men had lived and worked and planned their place in the building of their country did not fail to arouse sentiments; the scenic beauty of Fossil Beach, the view across Balcombe's Bay, or across Port Philip Bay where, on a clear day, the peaks of the You Yangs rise gently above the sea haze, greatly contributed to them. Both authors are strangers to essays in local history and beg the reader to forgive the shortcomings of an enterprise which they undertook with a somewhat quixotic zeal.

Mornington (Schnapper Point) township in the middle of the nineteenth century numbered only 450 inhabitants, mostly tradesmen and holders of small allotments. Besides limeburning, very few industries as yet existed on the Mornington Peninsula in 1854, and, although limestone for building purposes was quarried there,[1] there was still no road to Point Nepean. The big cattle stations were well established: Baxter's at Mount Eliza, Balcombe's south of Schnapper Point, Burrell's on the southern side of Arthur's Seat, Barker's on the east of Cape Schanck, Tuck's at what is now Balnarring, Hann's to the east of Sandy Point and the huge extent of King's Station stretching from Mount Eliza to Westernport Bay. The only other pursuits noted were victualling ships, cutting wood and fishing. Blandowski noted in 1855 the existence of oyster beds employing twenty to thirty men of King's Station on the Westernport side, supplying oysters to Geelong as well as Melbourne.[2] A decade later the question was raised of appointing an Inspector of Fisheries at Schnapper Point.[3] Indeed a small hamlet of fishermen, perhaps numbering thirty or forty souls, was the nearest settlement to Mornington on the southward coast and was situated at the mouth of Balcombe's creek which enters on to the beach at the beginning of what is now Mt. Martha. Then, as today, it was blocked by beach sand to form a lagoon.

To the workers on Fossil Beach, Osborne was the nearest visible human habitation. Access to it had been given by a new bridge erected over Balcombe's Creek in 1859.[4] It had originally been intended, it seems, to establish a township at Osborne,[5] but the concentration of facilities at Mornington was well under way in 1858 when the jetty at Schnapper Point was constructed 'for the unloading of duty free goods and supplies'.[6] The township was surveyed in 1859-1860 (Plate V a) and grew considerably in importance during the two ensuing years. The Illustrated Melbourne Post, May 24, 1862, p.37, gives what appears to be the earliest picture of the locality (Plate V b) taken from the Newsletter of Australasia, June 1858, and notes 'Schnapper Point has advanced considerably within the last twelve months, some of our leading merchants having purchased large estates and built fine marine residences.' A regular steamer run was operated in 1862 : the Diamond left Queen's Wharf at 10 a.m. and Sandridge at 11.30 a.m. every Tuesday, Thursday and Saturday, returning from Schnapper Point at 11 a.m. every Monday, Wednesday and Friday. Occasionally the Diamond extended her run to St. Leonard's and Point Nepean;[7] besides passengers, she took cargo from a depot established (along with the Queenscliffe steamer) at Cole's Wharf (The Argus, July 23, 1862, p.3). In the 1860's the Peninsula was becoming a playground : hunting was considered good for quail, duck, kangaroo, and, by 1868, Boneo, Dromana and Tootgarook boasted a joint hunt club.[8] From about 1862 Rennison's Hotel was well known to Peninsula travellers and was used as a hostelry during hunting and sightseeing expeditions. But already in 1858, the Mornington Hotel had opened under the proprietorship of Harley Goodall and was offering week-end accommodation at 25s. 'including attendance', 10s.6d. board per day, good stabling at 8s.0d. per night, and a car to attend the steamers (The Argus, Dec. 16, 1859, p.3). At the Schnapper Point Hotel improvements were made for family accommodation in 1860 (The Argus, Jan. 3, p.3). Of the state of the roads and land transport we need scarcely comment, except to note that the very scenic 'Esplanade' from which the road runs down to Fossil Beach was first projected in August 1862, with a road one chain wide from Schnapper Point to Osborne.[9]

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LIME AND CEMENT

In the late fifties of the last century the supplying of lime for the expanding building industry in Melbourne became a matter of intense interest. Although since the late 1830's lime had been produced in the Mornington Peninsula and other parts of Victoria, it remained an expensive commodity, and good quality lime was not available in sufficient quantity to supply the demand.[10] In 1858, 3,400 bushels of lime were imported from England at 5s.0d. per bushel, whilst 12,000 bushels were exported at a cost of 1s.10d. per bushel.[11] This latter was common lime; the lime imported at 5s. per bushel was hydraulic lime, costing an estimate of three times the current price in England. Common lime is produced by the calcination of lime carbonate (chalk), limestone or the freestone and marble which are the forms of lime more economically used for building purposes. Lime made from these materials usually retains a very high percentage of its soluble lime carbonate and, thus, mortars and plasters made from them quickly deteriorate if exposed to rain. The lime manufactured in the Mornington Peninsula by the small enterprises of the 'Limeburners', operating their simple kilns in Portsea-Sorrento area using the dune limestone which, except for a small area behind Rosebud, is limited to the Nepean Peninsula to the west of Selwyn's fault, and freshwater lime in Limeburners Bay at Corio[12] (now Limeburners Point in Corio Bay)–the "Heads Lime" as it was called, was unsatisfactory. These small private limeburning industries had already reached their peak in the early 1850's.[13] The burning of lime for commercial purposes began in 1839. This can be shown from the Fawkner papers. There is also the interesting account written by 'Resident' in Glimpses of Life in Victoria, Edinburgh 1872, p.5, who tells of entering Port Phillip Bay in winter 1839. The ship anchored inside the Heads because the captain was unsure of the channel. The passengers bemusedly observed the wooded shores. At night a fire was seen on the headland and a boat was lowered to investigate. It turned out to belong, not to savages as had been feared, but to limeburners, 'probably Tasmanian convicts', who treated the crew to kangaroo meat and damper. The coastal survey of 1841 by George D. Smythe, (Lands Dept. Melbourne) shows the positions of ten kilns, including a concentration of six at Tootgarook. In the Blue Book for 1858, fortyseven lime kilns are listed as operating in Victoria, twentyeight of which were situated in Mornington county, including the Heads, Westernport and the southeast coast of Hobson's Bay.[14] A special port was opened on the Yarra in 1849 (The Argus, 16 Feb.) to unload the twentyfive small lime boats operating in the bay.[15] It is frequently stated that the growing scarcity of she-oak contributed to the decline of the limeburning, as well, incidentally, as changing the vegetation of the Peninsula. On the 1841 survey map the Nepean Peninsula is noted as timbered with she-oak, box and wattle trees. Tea-tree is limited to the swampy areas immediately to the south of Arthur's Seat. On the 1855 map is written: 'Little timber remains, having been used for limeburning purposes' The statement by G. Byrne loc.cit. p.185 that at that time the beach tea-tree was confined to a narrow fringe in the sand just above the high water mark, is based on local information. More certainly, we can see the over-supply of the industry. In the following decade[16] the limeburners, and their mixed bunch of men,[17] turned their hands on the Mornington Peninsula to that building and road-making which formed much of the present aspect of human settlement in the Peninsula and quarried the free limestone for its buildings. For some, the discovery that the free limestone was a suitable building material[18] temporarily preserved a livelihood.

A letter was written by Edward Ford [19] to the Assistant Commissioner Lands and Survey on June 22, 1864 on behalf of the Point Nepean Limeburners, in order to prevent the proposed sale of the land called Lower part of the 'Cups' by the big swamp (Low Cups) at Tootgarook (Secretary-General's Correspondence G.6234). The refusal of the request, since 'the land comprises the only portion of the 'Low Cups' not as yet entirely denuded of timber by the limeburners' throws some light on conditions. 'Since the destruction of the oak, honeysuckles and cherry trees, large patches of well grassed country have been invaded by dense scrub, and rendered not only unsaleable at the minimum upset price for country lands, but almost useless for any purpose.' The Assistant-Commissioner's reply goes on to note that the remarkable sylvan beauty of the wooded rises in the Low Cups has previously been an inducement to sale of land 'which now is in danger of ruination.'

Another reason for refusal was that 'the number of people now holding limeburning licences in the Point Nepean district is very small—probably less than ten.' Furthermore, 'plenty of timber was still to be obtained in the comparatively valueless country eastward of Barker's pre-emptive right'.

It is indeed remarkable that so much timber survived in the Tootgarook region, since James Bonwick in Geological Notes and Description of Minerals of South Australia, Tasmania and Victoria (London 1861) notes that whilst Sorrento is a village of limeburners, Tootgarook (modern Rye properly) is the main lime station. On the Peninsula as a whole, the numbers of men engaged in licensed trades may be gathered from the letter sent by the Mount Eliza Roads Board on October 12, 1865, suggesting that, together with the Kangerong Roads Board, they should combine with the parishes of Bittern, Balnarring, Flinders and the islands of Westernport Bay to form a Shire. Under the authority of a Shire, the licence dues would be collected and spent locally. It was estimated that there were 200 publicans, 150 limeburners, 300 woodcutters and fifty fishermen. If these estimates are correct one must suppose that most of the limeburning was now operating to the north of 'Point Nepean District'.

Hydraulic limes are those which set under water. They contain alumina, and a thirty percent admixture is considered to produce a strong hydraulic lime which is virtually cement. Such basically is the composition of the famous Portland Cement invented by Joseph Aspdin in 1824 in Wakefield, which was being exported in quantity to Australia—largely as ship's ballast. The lime in the Geelong area was slightly hydraulic. but, as is stressed by the author of the Victorian Government Prize Essay for 1860 (Vic.Govt.Printer, 1861, p.291) other weak hydraulic limes existing in the colony had never been tested.

The importance of obtaining good lime led the Victorian Contractors' and Builders' Association to form a company for its manufacture. The prospectus of this 'Melbourne Consumers' Lime Company', published in The Argus, Dec.10, 1859, p.7, sought a capital of £5,000 in £1.10s. shares and was 'to produce a works in the vicinity of Melbourne'. In addition to producing common lime, the Company was to install machinery for the production of hydraulic lime. Their complaint was not only about the price (which they

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hoped to cut by one third) and shortage of lime, but also 'the staleness of the article when delivered'. The more detailed prospectus published in The Australian Builder, Dec.10, 1859, p.399 makes it quite clear that the aim of the Company was to by-pass the Melbourne lime merchants who had 'associated themselves together to keep the price of lime high', and to bring in limestone from the Heads by sea and burn it in Melbourne. Somewhat vague proposals are made here to make cement and plaster by machinery as well as enunciating a scheme to use machinery to unload the boats. Shares were certainly taken out (see correspondence in The Australian Builder, Mar. 17, 1860 and meeting of shareholders, ibid., Feb.4, 1860). In Feb.11, 1860, The Australian Builder p.40, notes that 'The Melbourne Consumers' Lime Company have chartered a vessel which has started on her voyage to procure a cargo of lime'. But there is no evidence that the proposed works were ever established; certainly the price of lime was not forced down (see note 21). In response to the same situation, another company calling itself the 'Melbourne Lime Company' [20] advertised lime, plaster and cement in 1860 (The Argus, June 18, 1860, p.7) at 47 William Street.

'The manufacture of cement in this colony is of more immediate importance than the manufacture of lime' wrote the essayist in 1860 (see above). [21] The government geologist Mr. A.R.C. Selwyn in his report of July 1854 (Victorian Government Geological Survey, 17) had already given the first scientific description of the clayey limestone bed in the Tertiary formation on the eastern coast of Hobson's Bay in the Peninsula as a 'bed of stiff blue clay containing bands and septaria of hard grey argillaceous limestone.' 'Although existing in no great quantity, it might be found highly valuable for making hydraulic cement.' The septarian nodules were in fact of the very same geological formation as those which outcropped in the London clay and the Isle of Sheppey, and elsewhere on the east and south coast of England; they were the source of certain kinds of cement imported from England.

In October 1861 James M. Robertson, architect, applied for a patent to manufacture cement from septarian nodules in Victoria. 'It is well known', he wrote, 'that the manufacture of cements hitherto attempted in this colony have proved ineffectual, especially as regards artificial hydraulic cements.' In the wording of the Patent (W.H. Archer, Registrar General of Victoria, Patents and Patentees, 1854-1866, printed John Ferres, Govt. Printer in 1868, Registrar General's Office, 479; Chief Secretary's Office 498)–'Improvements in the manufacture of hydraulic and other cements from certain indurated marble called septarian indigenous to the colony of Victoria', Robertson outlined the process, but without detail. He later, in an amended application, slightly revised it, as follows:

> 'Having procured a sufficient quantity of "Septaria" to be acted upon, I then proceed to roast and calcine it to such a point of heat where the lime and silica act and react upon each other and partially enter into each others constitution; after which I pulverise it to a fine powder, where the stones differ materially in their composition; I calcine them partially first and then compensate them by mixing either clay or lime intimately with the newly slaked stones until the silicate of alumina is from twenty to thirtyfive percent that of the lime : after which the material is dried, calcined and

powdered as before described. I would further remark that to increase its hardness in setting, I propose adding powdered alkaline silicates in proportion to the stuffs acted upon'.

James M. Robertson was a successful and highly versatile Melbourne architect,[22] who, at the time of his venture into cement manufacture, was in partnership with one Thomas Hale, later chairman of the Public Works Committee of St. Kilda Council. The partnership was short-lived, existing only from 1856 to 1862;[23] but these appear to have been highly successful years and the tenders called by the company in The Argus and especially in The Australian Builder for 1856 and 1859 (Jan.8, p.8; Jan.22, p.24; Jan.29, p.32; Feb.5, p.40; Feb.26, p.64; etc.) show the range of their activities, which included the erection of a number of suburban houses and a hotel at Richmond.[24] But there was perhaps an element of defiance in the outburst of activity in early 1859. In June and October 1858 charges were brought against them by fellow builders for not having observed the schedule of charges laid down by the newly formed Victorian Institute of Architects. After long investigations and 'special meetings' of the Association, Robertson and Hale were censured and suspended from the Victorian Institute of Architects because of these charges of unprofessional conduct brought against them by fellow architects. Charges of 'having accepted bribes' were brought against them by the Oriental Bank, for the design of whose head office Robertson and Hale had won an open architectural competition.[25] At a meeting of the Association on the 21st Feb. 1859 Robertson declared that he was willing to show the company's books, and, on acceptance of the offer, walked out of the building, apparently convinced that he was not being treated as a gentleman.[26] Later, in another charge, this time of job-snatching, brought against them by Mr. Scanlan, bona fides of the partners was established to the satisfaction of the Association,[27] but neither Robertson nor Hale sought readmission to the Association.[28]

In addition to his partnership with Hale, Robertson had other business. He was appointed Surveyor by the Council of Kew in January 1861.[29] In this capacity he carried out the survey of Studley Park; he drew a plan of Kew and was responsible for planning roads. However, the Council saw fit to 'accept his resignation' in October and gave at least some of the complaints against him.[30] The main complaint seems parochial : he was thought to be letting many of the tenders (mostly for road-metal supplies) in his charge to tradesmen outside the Kew area. The local tradesmen had complained. Nor do the other complaints mentioned amount to more than could be levelled against a man who quite clearly had too much to handle. 'He had not', complained the Council, 'been available enough around the district.' Clearly his rates were modest (at £25 per half year in half yearly audit)[31] and the Council learned a sharp lesson when Robertson's successor demanded £25 for his first quarter[32] for what the Councillors considered less work. Whilst Robertson erred in not keeping the Council informed of what was going on, they must at least admit that he had not been idle. But perhaps they well knew that in the month of his resignation he had planned to embark on cement making.

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Clearly Robertson was the more versatile of the partners. In 1866 he was registered as an architect and surveyor, [33] but by 1870 styled himself a civil engineer as well, and in 1875 a Mining Surveyor (The Melbourne Directory, listed from 1858-1875 intermittently). His interest in the manufacture of cement was not limited to practical purposes, for in 1861 further patents were asked by him for 'ornamental stones and stones for other purposes' (pavements etc.)–Vic. Patents, etc. R.G.O.'s 542; C.S.O.'s 501. He appears, in short, to have been an early contestant in the race to provide the familiar concrete paving clabs in Melbourne [34] and this demand is further instanced by the issue in 1869 of patents to other patentees for concrete, coloured cement and "artificial stone slabs" (ibid, 1023). [35]

Unfortunately Robertson's application for a patent to work the spetarian nodules does not indicate the lcoality of his works, or its name, but his placing of inverted commas round "Septaria" gives the clue to his choice of "Patent Septaria Cement Company", which, as we can establish on other grounds, was operated on Fossil Beach at Mornington. The experimental climate of the time was a driving force behind his enterprise: the Builders magazines were treating their readers to crude chemistry lessons on lime and cement and deploring the haphazard mixtures concocted on the building site. M. L. J. Vicat of France had invented a hydraulic cement suitable for underwater installations which, The Australian Builder notes, would obviate here the use of bluestones for piers and other marine structures. [36]

FOSSIL BEACH

The newly formed (1852) Geological Survey directed by Selwyn undertook a survey of the Peninsula in 1854 as one of the first tasks, and gave the earliest geological description of the coast between Tangenong and Chechingurk creeks north of Mount Martha and next to Balcombe's Station. Shortly there followed the first description of the immediate area of Fossil Beach by Mr. W. Blandowski, Curator of the Museum of Natural History, printed in Transactions of the Philosophical Institute of Victoria in 1855, p.28f. He describes the rock stratification 'strikingly exhibited' between Schnapper Point and Balcombe's Creek and notes: 'A few chains to the southwest from this point lie two small islands or reefs a short distance from the shore. At low tide they are about one foot above the sea and are the resort of hundreds of white-bellied shags (Phalacrocorax leucogaster) and Bass Straits tern (Thalasseus policercus).' The name 'Shag Rock', was established on the map of 1862 (Plate IIIb). He noted also that the settlers had noticed the 'curious rounded blocks of limestone' which occurred in the area and had compared them to dampers, 'by which name they are generally known'.

The early surveyors were seeking openings for new industries. Relevant to our inquiry into Fossil Beach, Blandowski noted that the area between Frankston and Arthur's Seat was rich in she-oak and other trees and suggests that the area could supply Melbourne with firewood. He also tells us that in the low and swampy plain south of Mount Martha (present Dromana) an excellent clay was obtained for the manufacture of bricks 'which some enterprising Americans have already turned to account and erected a powerful engine on a spot contiguous to the shore to assist in their object'.[37] This undoubtedly is the Brickworks which appears in the Statistical Return for Mornington between 1858-1862.

The commercial possibilities of the septarian nodules had been recognized by Selwyn,[38] but there does not survive any further detailed report of the precise quality or quantity of the cement stone.

The geology and palaeontology of Fossil Beach is a study in its own right with a large literature.[39] Briefly the rock sequence at Fossil Beach has three main elements : on top, the friable Baxter sandstones mixed with harder iron-stones. Beneath this there is a wide band of clays of various colours. These are underlaid by bands of non-calcareous and calcareous clays (Balcombe clay), the latter containing the calcareous concretions, or septaria[40] (Plate XIX a-b). The total length of the calcareous and highly fossiliferous clays is a little over 400 yards. The grey-blue clay underlies the sea on Fossil Beach and can be seen easily at the water's edge. These strata are part of a land-slipped formation, so that the beds narrow obliquely as they pass inland[41] and as they dip steadily towards the southwest.[42] The Moorooduc bore shows that the nodule bed is not much more than one foot deep. The relation of the Balcombian clay to the granite bed 'exposed at the first point south of the Cement Works'.[43] is not certain. We do not know if anyone had previously experimented in making cement from the septaria in the colony, but a 'blue lias cement' had been tested by Mr. J.G. Knight, the resident architect at the Houses of Parliament (The Australian Builder, April 30, 1856 p.72,) and was very likely an attempt to reproduce lias cements used in England.[44]

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Robertson's optimism was perhaps secured by the as yet uncertain progress of slightly earlier ventures in cement manufacture. In August 1860 Thomas Passmore Edwards had applied for a specification for 'A new manufacture of cement' (V.373, of State Specifications, Australia, Department of Patents) which he intended to call 'Victoria Patent Cement'. He was to employ the shelly limestone (Muschel-Kalk) which was obtained in quantities on the seashore at Geelong. He was to burn, cool and grind the lime and mix it with a quarter of its weight in ironstone, also ground to fine powder.

In September of that same year William Henry Hughan took out the specification (V.378 ibid.) for making cement by mixing quartz tailing with lime nodules found in the clay near Flemington. Hughan was obviously intending to experiment widely and had in mind the use of [alkaline] soap waste and the lime waste from gas works–mixed with natural marl and limestones.

> 'The materials require to be well ground and mixed in a Chilean mill, from which they were to be conducted into a pug-mill or mixing tubs, in which they were finally well-mixed with water. The material then flows into walled tanks to the deepness of six inches in which it is allowed to deposit and dry; when it has attained a consistency to support manipulation it is cut up or moulded into bricks and burnt in kilns or furnaces to a cinder, after which it is ground by edge or horizontal stones into unpulpable powder, and is then ready for use.'

Hughan's experiment was undoubtedly successful. One year later (August 1861) he registered the specifications of his 'Victorian Portland Cement' (ibid., V.482) from the magnesian nodular lime clay bed situated in Collingwood Flat, which in those days could be seen on either side of the municipal drain between Smith Street and the River Yarra. Refuse lime from the soap and gas works [45] in one-fifth or one-fourth part was added to the lime clay or other lime source. A flue house was constructed for drying the unfired cement bricks after they had been taken from the settling tanks. In burning it became hard as a fire brick and had thereafter to be ground.

It is true that the urgency of obtaining a satisfactory local cement was not the result of the planning of any major constructions; but the Australian builders of the 1850's cannot have been unaware of the enormous benefits brought to the building and construction trade in America by the discovery of a natural cement limestone in Madison County, New York State, and the production from it in 1819 by Mr. Canvass White of a Roman-type hydraulic cement. This discovery was instigated by the urgency of providing cement for the construction of the canal between Lake Eyre and Lake Erie during 1817-1823 and by 1825 the patent had been purchased from Mr. White by New York State for a very large sum. [46]

The Installation of Patent Septaria

The installations first appear publicly marked in the original Port Phillip Survey Map of 1864 No. 1171 (Plate IIIa), and indeed continued to be marked on it long after they had ceased to be visible from ships in the bay. [47] Two years before this they appeared in larger scale on the map from which the 1864 published survey was taken (Plate IIIb). Here some six buildings are marked as 'Cement Works', contained within the arc-shaped path leading from the Esplanade road. [48]

In The Argus of January 9, 1862, p.3, appears a public notice in the name of the Patent Septaria Cement Company (signed by James Robertson, manager) warning that parties removing septaria from the coast of Mornington or South of Geelong "unless authorized" will be proceeded against. Thereafter, the period of construction can be ascertained fairly accurately. On April 11, 1862, p.3 of The Argus, the Patent Septaria Cement Company invited three separate tenders: (1) – machinery : an engine from ten–twelve horsepower for cash, also for the erection of same at Mornington near Schnapper Point, and two pairs of edge stones and gear complete for cash, also tenders for erecting same. (2) Patent Septaria Cement Works (labour only) for the erection of kiln and tanks etc. (3) Patent Septaria Cement Works : erection (labour only) of a jetty, sheds and other works. These same tenders were printed again on April 14, p.3; April 15, p.3; and on April 17, p.2, the day on which the tenders closed. Tenders were to be delivered to the Company's office at 56 Flinders Lane East, where plans and specifications could be seen. Obviously Robertson intended speed : already in The Argus of April 26 of that year he invited tenders (repeated ibid., April 28 and 29) for '500 tons of firewood delivered to the Company's ground at Schnapper Point.'

The new industry was welcomed by the local residents. The following public notice appeared in The Argus on May 16, 1862, p.8.

To Mr. J. M. Robertson, Esq., Kew, near Melbourne.

We, the undersigned, inhabitants and landowners of the county of Mornington, noticing with pleasure the (pr)ogress of your Cement works in this neighbourhood and feeling assured of the great benefit the whole of the community must derive from it (independent of the desirability to develop our natural resources) trust that every possible facility will be given you by the Government to assist your undertaking; and we hereby wish to assure you that no opposition will be raised on our part to any grant of land, or other aid the Government may think proper to give you.

A.W. Balcombe, J.P.	Thomas Smith
E. Lintott, J.P.	Joseph Roberts
W. Preston Cobb, J.P.	Thomas Forward
W. E. Pentecost [Carrier]	James Jennings
W. Armstrong	John Stone
J. Crawford	Thos. C. Allchin
C. Davies	W. Scott
Jas. Smith	John Hindshaw
Jas. Martin	W. Griffiths
John Jones	Henry Yewers
Wm. Rendell	B. Baxter Jnr.
William Fox	William Hamilton
Wm. Mitchell	William Jones
John Mann	Benjamin Parkinson

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John Price
John Bourne
William Jennings
Wm. Collings
Thomas Enveh
P. P. King
Alleyn Jeffreys
W. Irons
Daniel Nicolson
Josiah Perrett
J. S. Rodd
Frank Cavell
Robert Olley
John G. Kelley
Charles Brown
Denis Magrath
John Henry Ricketts
B. E. Benters
James Sedgwood
Thos. Rennison [Licensee]
Joseph Porter
H. C. F. Knifperr
George Marsh
David Morgan Davies
Chas. Begant
William Gibbons
John Brotherston
W. Gn. Potten
George M. Smythe
Jas. J. Coles
Alex McLellan
Thomas Coxhell
William G. McBean
Stephen Bryant
James Alison
Edward Harrup
Thomas Williams
Thomas Ritchie
John M. Roe Jnr.

John Smith
Timothy Quin
James Leighton
Thomas P. Lanlys
James Earon Cook
John Percy
George Stevens
Joseph Thomson
George Wright
George Stevens
Robert Stevens
Thomas Harper
John Harkins
James Coyle
Thomas Godkin
Solomon Reece
R. C. S. Let
John M. Row
Henry Summers
James Pickup
John Nicholls
George Glover Birklyn
Robert Godwin
H. J. Harrap
George Baxter [Captain]
D. A. Andrews
Wm. Johnson
John Holland [Green Island]
John Smeht
Thomas Brown
Edward Hammond
Henry H. Moss
Robert Neale
John Williamson
David Robson
James Johnston
William Irons
James Dimond
William Houri

April 28, 1862

Gentlemen,–

We have the honour to acknowledge the receipt of your polite and encouraging communication, and beg to assure you that it shall be our study to carry out our Cement works in such a manner as to be beneficial to the colony at large, and to your district in particular.

Thanking you for your good wishes,
We have the honour to be, Gentlemen,
Your most obedient servants,
James M. Robertson and Co. May 15, 1862

We can understand Balcombe's personal enthusiasm. W. Vale gave an account of his visit to Schnapper Point and Mt. Martha in The Argus, Dec 27, 1855 p.7. He visited 'Mr. Balcombe's pre-emtive, who thinks he has coal on it.' (Lignite does in fact outcrop in small quantities on Balcombe Bay, cf. R. A. Keble, Vic. Geol. Survey Memoir 17, p.34.)

This was a month of great expectations at Schnapper Point. The Illustrated Melbourne Post, May 24, p.38 extolled both its beauty and prospects, noting the establishment of a cement works, 'which have been started within the last two months and will give employment to a hundred men'.

In August Robertson wrote to the Mount Eliza Roads Board, then under the guidance of Balcombe and Lintott, who were in charge of the very active road and bridge building in the area. On the 4th August 1862 [49] the Board called the first tenders for the clearing of the coastal road to Osborne, which they had agreed to call The Esplanade. A letter from Mr. Robertson was read at the meeting of August 16 offering to clear the road from Burton's Creek to the Cement Works. This offer was accepted 'subject to him giving to the Surveyor sufficient security for the completion of the same'. At the same meeting another was read from Robertson, offering to clear the road near the Cemetery 'for the timber on the said road'. [50]

The impact of the new company on the Melbourne market was anticipated in a paragraph in The Argus for April 14, 1862, p.4. For a long time past, it notes, £3,000 per month has been sent out of the colony for cement: 'we learn with some satisfaction that there is a probability of this drain being stopped'. Samples of septaria had been obtained from Geelong and exhibited in the museum connected with the Mining Department as well as in the recent exhibition. 'It has lately been ascertained that the true material exists in large quantities in the County of Mornington, not far from Schnapper Point and close to a small bay which offers facilities for the shipment of the prepared material. Works have recently been erected there and a specimen of the produce has been shown to us, which is pronounced by the judges to be of the best quality. The process has been patented for fourteen years and the raw material and timber for fuel are abundant. The raw material, we may add, has been submitted to the best geologists in the colony and has been recognized as a true cement stone possessing the characteristics of the stone from which the imported article is made.' The paragraph adds that the patentees have secured a lease of the ground. This was probably from Balcombe, since no Crown lease survives.

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Septarian concretions occur in the Geelong area at Batesford on the Moorabool river : this is not however *south* of Geelong. Mount Duneed, south of Geelong, has white and yellow calcareous marls like those of the Mornington area, but these are not on the coast. Robertson's warning is therefore not specifically informed. But it is noteworthy that Parker's specification 2120 in England (see p. 19) had claimed rights over all argillaceous stones wherever they occured.

Registration of companies was not enforced in Australia until 1864. Of the Patent Septaria Cement Company there is therefore no official notification known to us. Nor does the Statistical Register overtly mark it amongst the manufacturies of Mornington. A peculiar difficulty does however surround the Mornington statistic for 1862 (Statistics of the Colony of Victoria p.39) where only one lime kiln is noted as operating in Mornington. Since the statistic for 1864 gives eleven operating lime kilns and for 1865 ten, the sudden 1862 drop (from twentynine kilns in 1859) seems very unlikely—unless the one lime kiln noted is that for Mornington *town,* not for the entire county, in which case the Fossil Beach kiln must be intended for this was operating by mid 1862.[51] Again, the 1864/5 drop, from eleven to ten, might well indicate the elimination of the Fossil Beach kiln in 1864. But all this is too conjectural to be of any present value, though the figures, together with the further drop in kiln numbers, indicate clearly that Melbourne's needs for lime were now being met from other sources.

The steam engine, almost certainly required to drive the edge-stones for grinding, should also appear in the Statistical Return for horsepower. In 1862 p.38, one 14 h.p. engine is listed; in 1863 (p.42) one steam and one water engine are listed, but in neither case is the purpose specified. The fact that the 1863 return also lists the presence of a saw mill, unlikely to have been worked by a water engine, suggests that in this year the steam engine was needed for the sawmill and that the engine for the cement works is no longer working or is not listed. But in 1862, no saw mill is listed, only lime kilns, and therefore possibly this is the cement works engine.

In The Argus August 25, 1862, p.6 the Septaria Company is briefly discussed among the other "new enterprises" of the year, many of which had gained opportunities of land by Gavan Duffy's Land Act of 1862. It is said to be successful. 'The cement which the Company has for some time been sending to the market is of a quality superior to the celebrated Portland Clay, and as it is supplied in abundant quantity has almost superseded the use of the imported article.' The diary of Bishop Goold, the Catholic bishop of Melbourne, records his visit to the Works on Sunday, September 14th. It is possible that some of the labourers at the works were amongst the forty Catholics who attended his mass at Schnapper Point that day[52] —and likely that the bishop had an eye for building materials for a local Catholic church.

There are other testimonies to success. The Argus, October 18, 1862 notes 'The Patent Septaria Cement Works at Schnapper Point are now in full work, and supplies of the cement have, this week, been placed on the market : 400 barrels can be supplied weekly. If builders and contractors can be satisfied with the cement, the imported article will speedily disappear as an item in the manifests of ships arriving from England. Encouragement at the hands of the public is all that is necessary to foster this deserving enterprise.'

On November 3, 1862, the Commercial column of The Age added the Septaria Cement Company to the 'miscellaneous' section of the Stocks and Shares table–with the note : 'The cement has proved itself to be of excellent quality, is now being used in the erection of the Bank of Victoria, Collins Street, and it is expected it will supersede importations from England. This is a satisfactory practical development of a new industry.'

The Company had a paid-up capital of £20,000 in £5 shares. The Age Commercial column enables us to chart their rise and fall. In November 1862 the shares rose from £5.7s.6d (at which they had been steady for a month) to £6 (November 28) and on November 4-8 had even touched £7 a share. By December 19 they had dropped to £4, and although the selling price rose to £5 on December 31, there followed a sharp decline which returned 5s.0d (buyer's) and 20s.0d (seller's) prices in March (26th). After this date, no details are inserted in the stocks column through until October 31, 1863 when the Company appears for the last time. The Patent Septaria Cement Company was a failure.

The period from mid 1862 to late 1863 appears generally to have been one of slight commercial recession in Victoria and there appears noticeably less optimism in the atmosphere of the "new enterprises" which followed the Land Act. The cement trade was stagnant. There was little Portland on the market and Roman cement prices were 'nominal and quite unsaleable' (The Herald, October 3, 1862, p.3). Portland cement maintained its price at 14s.–16s. a bushel whilst Roman 'continues neglected' (The Age, November 24, December 19, 1862). By April 1863 the market for Portland cement had made a comeback and the price rose sharply to 20s. and 25s. a bushel, but Roman cement 'was still neglected' (The Age, April 6, 1863, p.4). From this information and the ensuing sales notices in the 'Builders Materials' advertisements, it is quite clear that Septaria Cement was no rival to Portland cement : it was in fact Roman in composition and therefore must have either shared in the general decline of interest in Roman cement, or, indeed, caused it.

But decline in the fortunes of the Company does not explain the positive statements in the newspapers about the quality of the cement. Either these statements are purely propagandist or else it is a question of two types of cement made at Fossil Beach, one from the septaria, which was found to be satisfactory, the other from the marl, which was not. We suggest that both these facts played their part. The claims that 400 barrels could be produced in a week seems exaggerated. Cement works with a number of running kilns and with far more extensive installations than are evidenced at Fossil Beach should, according to Lipowitz,[53] aim at producing 30,000 barrels in a working year to be economically viable. Robertson must have claimed that he could approach that amount (400-times fifty working weeks). He must surely have known that the amount of septaria was insufficient.[54]

The Septaria

The Septaria nodules belong to what is called 'natural cement', i.e. limes containing a natural component of twentysix to thirty per cent of clay in the form of a compact or indurated marl. Ure's Dictionary of Arts, Manufactures and Mines, 1850, notes that

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'cement stone, a reniform limestone which is found in nodules or lenticular cakes in beds of clay' was the substance most used in England for making hydraulic lime. These are called by the older mineralogists 'Septaria' or 'Ludus Helmontii' (van Helmont's coits).[55] 'When sewn across they show veins of calcspar, traversing the siliceous clay and are sometimes polished and placed in the cabinets of virtuosi'. More strictly speaking, the name Septaria was applied to nodules of ferruginous marls containing a considerable intermixture of oxide of iron, like those of Fossil Beach. Successful experiments had been made in France also from the galets occurring in the Boulogne coast. These are described by Wissocq, 'Rapport fait à la Société d' Agriculture . . . au nom d'une Commission chargée d'examiner les propriétés d'un plâtre-ciment.' Journal des Mines, 1802 (I, 12, pp.459-89).

Cement had been manufactured commercially in England from septaria nodules since 1796, when Messrs. Parker and Wyatt obtained the royal patent for the manufacture of cement in London and established a works at Bankside in Southwark. 'Natural' or 'Roman' Cements are those consisting of the natural combination of calcium carbonate (lime), and silica oxide together with alumina and ferrous oxides. In comparison with 'Portland' cements which have a lime-silica ratio of about sixty to twenty, the proportion of silica is higher in Roman cements.[56] Parker's product, which became extensively manufactured in the Harwich region, was initially called 'water cement' (a misnomer apparently for 'mortar cement') and eventually 'Roman Cement'. It had nothing to do with the Romans except that Romans had employed the septaria as building stone in ancient Camulodunum (Colchester) near Harwich.[57]

In London, Roman cement had considerable success both as a building mortar and for underwater installations. In Melbourne it was the cheapest of the imported cements, selling at £1 for five bushels (The Argus, February 23, 1861, p.38); for since 1850 it had become differentiated from the superior to 'Portland Stone' (Journal des Mines XII, p.145). Captain Smith (loc.cit. note 36, p.221) gives a comparison of the English and Boulogne septaria stone as follows:

	English Stone[58]	Boulogne Stone
Carbonate of lime	657	616
Carbonate of magnesia	5	
Carbonate of iron	60	60
Carbonate of manganese	19	
Clay — Silica	180	150
Clay — Alumina	66	48
Clay — Oxide of iron		30
Water	13	66
	1000	970

'The English stone is of a brown grey colour, compact, fine grained, and susceptible of polish; its specific gravity is 2.59. That of Boulogne is also compact, very fine grained, and susceptible of polish, but it is of a yellowish grey colour; it has never been met with except in rolled pebbles on the sea beach; while the English stone is dug out from the marls, where it is found imbedded in the form of nodular masses.'

'Saint Petersburg has now, like London, its natural cement; it owes this advantage to Messrs. Clapeyron and Lame, French mining Engineers, temporarily attached as professors to the Polytechnic Institute of Russia. This discovery has already effected important saving in the execution of the great hydraulic works to which the natural cement has been applied.' (Extract from M. Berthier's Memoir on Hydraulic Lime-stones).

Robertson's patent quoted no formula : only the outline of a process is described; and it is very unlikely that he had any specific formula in mind. His product was similar to the Roman Cement made by Parker in that it relied primarily on the natural admixture in the cement stone of the necessary ingredients and merely processed them. Portland Cement on the other hand derived its superiority from a formula based on a number of years of experimentation by Joseph Aspdin, who obtained a patent for its manufacture from George IV in 1824 and established his works at Wakefield in England. For many years after Robertson's enterprise, Aspdin's formula, which proved superior to all others, was a guarded trade secret and apparently he behaved with considerable eccentricity in preserving it. Robertson cannot have known of it; but what he and his predecessors in Melbourne had probably heard of was the English patent taken out by Edgar Dobbs in 1810 for making cement by mixing chalk or pure limestone with clay, forming the mixture into bricks, burning like lime and finally grinding to cement. It was Dobbs who introduced the blending in water and settling in a slip-pan for evaporation, a process followed by Aspdin and apparently becoming pretty general.

However, for the simple process of making cement out of septaria, Robertson had no need to employ a washing and mixing process. Parker simply burnt the cement stones in conical kilns with running fires and thereafter ground them to powder.[59] The fact that Robertson installed washmill and settling tanks shows that he was aware that the septaria at Fossil Beach were not chemically homogeneous: he anticipated having to reduce the stones and mix in lime. His process therefore was more complicated than Parker's : he needed two kilns—a lime kiln to reduce the nodules and a cement-drying kiln. (If he intended to make cement of the marl he would also have needed the proximity of the Peninsular lime industry to supply the pure lime additive). Short of subjecting each batch of nodules to chemical tests, it was safer for him to reduce all his raw material to powdered form.

Unfortunately the Schnapper Point nodules turned out to be less suitable than their European counterparts. In the Intercolonial Exhibition Essays of 1866-67, A.R.C.Selwyn and G.H.F.Ulrich report (p.35 of 'Notes on the Physical Geography and Geology of Victoria'), 'A septarian limestone from Schnapper Point analysed by the late Mr. Wood is a sample of the stone used by the late Schnapper Point Cement Company. The percentage of siliceous matter is too low for a good hydraulic lime. Its power of hardening under

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water would be considerably increased by the addition of clayey matters in such proportion as to raise the quantity of silica to about 25 per cent.' On p.73 of this same essay it is considered that the Schnapper Point septaria, whilst forming a moderately good hydraulic cement, was inferior to that from Mansfield. These statements do not finalize the matter, since they do not expressly state that Robertson's process for treating the septaria had not worked, and they do not reckon with the possibility that hydraulicity was not Robertson's chief aim–as it had not been Parker's. They do, however, taken together with Selwyn's optimistic statement in the 1854 geological survey about the possibilities of utilizing the septaria, suggest that hopes had been modified; and there is a *hint* that the failure of Robertson's enterprise had led to their modification. Whilst the finished product may well have been good (as the newspapers said), the possibilities are that either the process was too expensive or that the supply of raw material too limited. Another drawback may have been that the history of the Roman Cement manufactured from the Harwich septaria had shown that the ground cement powder absorbed humidity and carbonic acid from the atmosphere; it then passed gradually into the state of a sub-carbonate, but a second burning carried to a lower degree than that employed for the first calcination restored its useful properties.

In the Geological Survey Laboratory Result Book (National Museum), Report 18, is preserved the original report sent in September 10, 1863 by C. S. Wood on an analysis of Fossil Beach septaria. He writes:

'According to the researches and classification of M. Vicat the limestone septaria at Fossil Beach would yield upon proper calcination 'a moderately good hydraulic lime'.'

Mr. Wood notes that clayey matter should be added to twentyfive per cent and notes that the calcareous nodules from the Isle of Sheppey used in the manufacture of the so-called "Roman Cement" contain twentythree per cent of clay. The analysis of the two Fossil Beach specimens is:

	I.	II.
Carbonate of Lime	82.012	82.064
Carbonate of Magnesia	1.506	1.560
Carbonate of Iron	3.472	3.224
Clay	10.427	10.548
Soluble silica	0.720	1.655
Water	1.809	1.809
Organic Matter	0.054	0.140

Report 19 ibid. was an analysis of marly shale or rather clay from Schnapper Point sent in by Mr. Wood on October 7, 1863.

	I.	II.
Silicate of Alumina and Sand	88.12	87.84
Soluble Silica	0.48	0.88
Total Siliceous Matter	88.60	88.72
Iron Peroxide and Basic Sulphate	2.64	2.72
Sulphate of Lime	0.40	0.40
Salts soluble in water		
Chloride Sodium	0.80	0.80
Water etc. driven off at red heat	8.04	8.04

Wood concluded from this analysis that the 'marl' was a suitable substance to add to rich limestones to render them hydraulic but drew attention to the weathering properties of the sulphate of lime it contained, and the consequent risk in the use in any cement made from it, 'which might lead to the most serious consequences to structures'. He noted the rapidity with which the yellow deposit of sulphate of lime formed on the marl when it was exposed to the atmosphere. 'I suggest that any steps which are taken should at first be directed to the septaria', he writes. This statement strongly suggests that Robertson had used or contemplated using the marl and implies that the septaria were uneconomic.[60]

Mr. Wood's letter of October 8, 1863 (Letter Book, p.8) does not, however, close the matter:

> 'Sir/ I have the honour to return to you the report with the necessary addition. I also enclose a supplementary report (18 & 19) considering the commercial value of the two minerals taken together as the ingredients for the formation of hydraulic limes and it would seem that certain difficulties present themselves. Is it not possible that in connection with sources of lime at present in the soil, clay or other siliceous substance might be found which would have the property of rendering the "fat" or "rich" limes hydraulic? Would it not be well to submit these reports to Mr. Daintree to see if his opinion agrees with mine as he has carefully investigated the matter.' . . .

This opens incidentally the possibility that Richard Daintree, who had carried out part of the geological survey of the Peninsula, had made the initial analyses of the septaria. His connections with the Peninsula are well known (G. Bolton, Richard Daintree, pp.4-7.) But, more important, it states (as Wood's analyses show) that the trouble with both the septaria and marl was their small and variable amount of soluble silica (as compared with the English and Boulogne septaria) far below the required twenty silica to sixty lime proportion required for good hydraulicity. The condition of the silica present in impure limestones has an important influence on their value when employed for the manufacture of hydraulic limes. It occurs in a free state in greater or less quantity in all clays and clay limestones. If it exists as coarse grains, as quartz sand, it is not acted upon by the lime at the comparatively low temperature of the kiln, and continues as inert matter.[61] Because of this deficiency, Robertson's patent had proposed to add silicates. Providing the correct proportion and the right refinement together with the correct heat for combination was not an easy matter, especially as each batch of crushed and mixed septaria was variable in both silica and lime. The aggregate septaria-plus-marl of the region also had a variable calcium carbonate to lime ratio, examples from Balcombe's Bay containing about eightyseven per cent calcium and twentyone per cent lime, but the septaria-bearing marls from Grice's Creek contain an average of only 9.5 per cent calcium carbonate and 5.33 per cent lime in other calcareous combinations.[62]

The Rev. George Cox writing in The Peninsula Post December 23, 1941, gives a different version: '. . . our own esteemed townsman Mr. Thom. Green positively asserts that the material was never produced and put on the market, as the capital ran out before

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the works were completed.'[63] The results of excavation have shown that the Cement Works was certainly operated. The extensive wear of the washmill, the production of the cement blocks, a kiln which had certainly been well used must all indicate that Septaria Cement was produced, intermittently perhaps, but certainly for the best part of the year September 1862-September 1863. The product was not acceptable because the septaria contained too little soluble silica and the marl a damning trace of sulphates. Surely the very contortion of the land behind Fossil Beach is a mute testimony to the desperate attempt to reach the septaria nodules under and around the works by digging huge trenches, involving enormous labour, probably with little result.

The final death-blow of the whole project and the proof that the marl had been involved in the manufacture were delivered in the official Geological Survey of Victoria Report, Period June 1863-1864, p.17. Mr. Wood's findings are reported 'that septarian limestone and marl from Schnapper Point were substances which have been used for the manufacture of cement by a company which had erected kilns and the requisite machinery; but from want of the previous necessary enquiry regarding the exact properties of the more abundant of the two materials made use of (the so-called) marl and whether it contained the required constituents, lime and clay, and in the proper proportions, the undertaking did not succeed'.

From Mr. Wood's analysis, it appears that the nodules of "Septarian Limestone" contain the needful proportions of lime and clay for the manufacture of a 'moderately good' cement. As these however are only dispersed here and there amongst the mass of clay, miscalled "marl", the supply of them would be uncertain and the quantity insufficient. 'The 'marl' was, I believe, the principal material relied upon for the manufacture, on account of its abundance, and the ease with which it could be obtained.' Wood's analysis of it showed that it was quite destitute of lime (and consequently not a marl), and contained, besides, a quantity of basic sulphate of iron, which he was afraid would be detrimental to the permanent coherence of any cement in which such clay would form an ingredient.

'It is certainly unsafe to judge of any mineral mass by samples taken from it at random, but supposing, even that the clay generally was free from the basic ferric sulphate, there is good reason to believe that the "nodules" mentioned above have been formed by the segregation of the lime once contained in the clay and that therefore in this all important particular the clay would not be found to improve.' As only from twentyfive to thirty per cent of clay is required to constitute a good hydraulic lime, it is clear that the lime requisite to make up the balance would have to be brought to the spot before the clay could be made use of;[64] or, as Mr. Wood suggested, it would have been more economical to convey the clay to where the lime was known to exist in abundance.

'A very careful examination of the locality in the neighbourhood of the late cement company's works, together with some experimental trials, would be necessary before it would be prudent to recommence operations at Snapper Point. Yet there can be no doubt that the manufacture they were engaged in would, if the requisite materials were in abundance, be a highly lucrative one'.

From the terms of the patent, Robertson well knew that the septaria were deficient in silicates. He must also have known sufficiently well in the magazine discussions of his day that atmospheric durability was the all-important test his product must undergo. We must

conclude that he in desperation turned to the 'marl' for raw material *faute de mieux* and that this decline in the effectiveness of Septaria Cement gave rise to the conflicting statements by the Press and by the scientists. However, Robertson must have been held responsible by his company for not having sufficiently investigated the quantity of septaria available : the warning about removing septaria from Geelong (see above) might well have been wishful thinking and the 'sufficient quantity' of the patent an optimistic exaggeration. But even if he had believed or been advised that 'sufficient quantity' of septaria did exist at Fossil Beach, why did he build his works directly on top of the deposit? And why did he go to the expense of building so substantial a works? Our answers can only be guesses. The positioning of the works is probably determined by the Geological Survey Map of 1862 which shows the marl in two bands of blue immediately to the north and to the south of Fossil Beach. Robertson perhaps naively thought he was on barren ground if he built between them. The proximity of kilns to beach sites had been an important factor in the economic working of the Peninsula lime kilns, and he clearly intended to ship his cement. He was undoubtedly a fastidious man, insisting on beautiful masonry throughout and unnecessary stone revetments on the cliffs: obviously he had substantial backers[65] and, as the somewhat 'contrived' letter of welcome suggests, wished to come to Mornington with éclat. He may well have known that in England the manufacture of hydraulic cement from the septarian nodules south of Walton, Essex, had been undertaken as a government enterprise under Royal Ordnance and that he could look forward eventually to official backing.[66]

Wages must have eaten into his capital. The 1870 Statistics of the Colony of Victoria, p.40 show that a normal lime kiln employed six or seven men and Robertson could scarcely have employed fewer. There was neither work nor space for the 'hundred men' (p.16).

James Robertson's contribution to the industrial history of Victoria was small, and his site probably ill-chosen. But it was a true piece of pioneering in the unique circumstances of the 'new enterprise' years, and a 'planned industrial site' of some significance. More than a decade elapsed before any further such companies were formed—the Melbourne Builders' Lime and Cement Company, founded in 1874, operated the Duckponds freshwater lime quarry at Lara, Geelong, providing the best lime yet available to the colonial consumers. In 1875 the Victorian Lime and Cement Company (W. A. Blair and C. Campbell) operated a kiln at Limeburners Point.

Soon the Heads and Geelong were superseded as the chief supply areas of lime and cement in Victoria. By the 1880's the pure limestone at Cave Hill in Lilydale began to be quarried by its owner David Mitchell. In the same decade a new quarry opened at Coimadai, near Bacchus Marsh, and the lime works at Waratah Bay which have left impressive ruined kilns at Walkerville, were established.[67]

In New South Wales and South Australia patents for making Hydraulic Cement[68] were not taken out until 1863 and were of a nature which did not necessarily involve native Australian minerals. In fact the search for formulae for making native cement in these colonies does not appear to have been nearly as active as in Victoria.

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Robertson was certainly not completely daunted in other respects. By 1865 he was calling tenders for a number of houses in Melbourne and suburbs and had an office at 81 Collins Street.[69] His business appears to have flourished in these years, and in 1869 he joined partnership with J. Climie.[70]

James Möller Robertson died at Heidelberg on June 21, 1883 (Registrar's Official Entry 6168/83D), in his 58th year. The funeral notices appear in The Age and The Argus on June 23rd. He was buried at Kew Cemetery in grave B1551 of the Church of England section. There is no headstone and the cemetery records note merely that he was buried from the Asylum.

His was the third of ten Victorian patents taken out for making cement before 1869.[71] The all important 'Portland' cement had still not been made in significant quantity in Australia: The Argus, May 18, 1863 advertised for a 'person acquainted with the practical side' of Portland cement: 'No-one need apply unless he has been engaged in similar trade in England.'

In 1917 the commercial possibilities of the septaria beds at Mornington were once more examined, this time for the purpose of obtaining phosphoric acid from them, or, alternatively using the marl as agricultural fertilizer. The report on this by R. A. Keble, Victoria Geological Survey Records, IV (1), 1917 p.55ff gives a clear survey of the extent of the nodule beds, which stretch not more than a mile inland from Balcombe Bay. The area behind Fossil Beach is marked as the area of least overburden of the sandstone. It seems very doubtful that a commercial amount of phosphoric acid could have been obtained from them. But the interesting point of Keble's report is that, although he does not state it directly, he is well aware that layers with a good percentage of nodules are not obvious, but could be identified from the chemical testing of the matrix marls for phosphoric acid which, he claims, was in direct proportion to the amount of nodulation. It all seems a rather odd speculation; but for us it underlines the fact that the excessive labour needed to obtain the septaria demanded some short cut. 'The nodules' he adds 'were used in the early days of the State for the manufacture of hydraulic cement. This cement is spoken of by old residents of Mornington as being of excellent quality'. In 1917, little first hand recollection of Robertson's cement was possible.

THE EXCAVATION

It must firstly be stated that there is no excavated or documentary evidence that the works on Fossil Beach were put to any industrial use after 1863-4. The remains therefore must be taken to relate to Robertson's enterprise. A century of picnickers has covered the area with bottles. All that can be said is that none of the bottles found immediately associated with the ruins (e.g. beer bottles placed to cool in water channels) contradicts by its dating the abandonment of working parts in the 1860's

The areas in which remains of buildings are observed have been numbered A-J on the site plan, Plate VI.

AREA A, Plate VI

There is today no visible structure in this area. A short stretch of well-built stone wall placed at right angles to the cliff, together with a patch of lime-plaster floor on its southern side, was uncovered in 1967. These have since been eroded. The impression gained was that a small building stood here, quite possibly connected with hoisting stones from the rich septaria bed and the rocky beach below. There is severe erosion of the cliff face in this area.

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THE WASHMILL AND SETTLING PANS, AREAS B, C. Plates VIII-X

The washmill uncovered at Fossil Beach is circular in plan, the outside diameter of the moat being 19ft. 4ins. The moat itself is 3ft. wide by 18ins. deep. The walls surrounding the moat are 18ins. thick constructed of local stone and rendered with a thin coat of cement. The floor of the moat shows signs of having been paved with local bricks, many of which were found lying on the bottom of the moat, many coated with lime on one face only (Plate VIII a). A row of bricks was laid obliquely under the walls. The hub or central drum, approximately 13ft. in diameter, was originally covered with a thick coating of stucco on its convex surface (Plate VIII b). A hole in the centre of the drum held the iron centre pole, 2ft. of which were found *in situ.*

In a general way the design of washmills of this type can be illustrated from those used in the goldfields (Plate XXVIII b.c.). Horse-drawn machinery was erected to rotate in the moat a pair of stone rollers ('edge stones') or else a series of knives set like a harrow. The brick floor as well as the scratch marks on the stone skirting inside the moat are inconsistent with the use of stone rollers. The proportions and the convex top of the drum together suggest that the Fossil Beach mill is modelled after the type illustrated by H. Reid in A Practical Treatise on the Manufacture of Portland Cement, London 1868, pp.5-7 (here Plate IX) which has a series of fixed knives. This model required the power of eight horses to work it, but there seems no reason, since the moat at Fossil Beach is much shallower, why here a single horse or an engine of lower power than eight horses cannot have been used. If horses were used there is room on the surrounding platform for two in file.

Around the base of the metal pole in the centre of the washmill drum were found pieces of the iron tyre which had been fixed to the circumference of a wooden wheel by nails placed at 5in. intervals. The graining in the fragments of wood attached to the inside of this tyre show that it was a solid wheel, a slice cut from a log. It may well have been a control wheel like that on the superstructure of the mill in Plate XXVIII c. An outlet from the moat permitted the slurry to be sluiced out into the settling bays or pans, a total area in this case extending 53ft. in length by an average width of 42ft. in front of the washmill, surrounded by 18in. thick stone walls. There are two settling bays divided by a very low 18in. thick stone wall. Deposits on these give a clear indication of the depth of 6ins. by the slurry.

The washmill is built on an elevation above the settling bays (or 'backs' as they were known in the cement industry). The stone retaining wall between the two areas is 20ins. thick and was beautifully constructed in a random bond, using large corner stones and slightly smaller facing stones (Plate X a).

The paving of the settling bays and that around the washmill was of rough pebbles with some signs of coating by cement mixture of a yellow brown colour (see p.70). A considerable area of floor plastered with this yellow cement was uncovered immediately below the large eastern retaining wall of the washmill platform. (Plate X a). Since this area had not been disturbed by the growth of larger trees this cement flooring of the settling pans had survived; but fragments of it were also found at the base of the walls of the eastern pan, though major vegetation prevented a thorough examination of its floor. The juncture of the dividing wall and the southern wall of these pans was

uncovered beneath the present pathway to the washmill. The south eastern corner, solidly built like a bastion, was uncovered in the dense scrub lying towards the carpark. There is no doubt about the overall trapezoidal plan of the two pans, obviously determined by features of the landscape no longer obvious. The 'propugnaculum' on the south eastern corner implies that the ground fell away here more precipitously than today.

The working of such a mill and pans is perhaps best conveyed by the description of a similar apparatus described in the treatise by Monsieur L. J. Vicat, translated in 1837 by Captain J. T. Smith : A Practical and Scientific Treatise on Mortars and Cements, p.22 f.

'There is at Meudon, near Paris, a manufactory of artificial lime set on foot by Messrs. Brian and Saint Leger. The materials made use of are the chalk of the country, and the clay of Vaugirard ("A hundred parts of this clay consist of silica sixty three, alumina twenty eight, oxide of iron seven, loss two."–General Truessart, p.65) which is previously broken up into lumps of the size of one's fist. A millstone set up edgeways, and a strong wheel with spokes and felloes, firmly attached to a set of harrows and rakes, are set in movement by a two-horse gin, in a circular basin of about two metres (six feet and a half English) radius. In the middle of the basin is a pillar of masonry, on which turns the vertical arbor to which the whole system is fixed : into this basin, to which water is conveyed by means of a cock, they throw successively four measures of chalk, and one measure of clay. After an hour and a half working, they obtain about 1.50 metres cube (nearly fifty-three cubic feet English) of a thin pulp, which they draw off by means of a conduit, pierced horizontally on a level with the bottom of the basin.

The fluid descends by its own weight; first into one excavation, then into a second, then a third, and so on to a fourth or fifth. These excavations communicate with one another at top. When the first is full, the fresh liquid, as it arrives, as well as the supernatant fluid, flow over into the second excavation; from the second into the third, and so on to the last, the clear water from which drains off into a cesspool. Other excavations, cut in steps like the preceding, serve to receive the fresh products of the work, whilst the material in the first series acquires the consistency necessary for moulding. The smaller the depth of the pans in relation to their superficies, the sooner is the above-mentioned consistency obtained.

The mass is now subdivided into solids of a regular form by means of a mould. This operation is executed with rapidity. A moulder, working by the piece, makes on an average five thousand prisms a day, which will measure about six cubic metres (211.8 cubic feet English). These prisims are arranged on drying shelves, where in a short time they acquire the degree of desiccation and hardness proper for calcination.'

The main function of the washmill on Fossil Beach was therefore to mix the slaked limestone nodules with clay. It could not have operated without an abundant supply of water. A small well some 8ft. deep is situated behind the washmill and tanks (Area E, Plate X b) but it is a simple affair without channels or signs of a pumping apparatus. The whole operation on Fossil Beach demands the presence of a creek. Memory supplies it. Two independent memories recall that a narrow stream ran into the sea on the south side

Footnotes: Please refer to page 73 *Plates: Please refer to page 33*

of the settling tanks. Its narrow course can still be traced there. Some of this water must certainly have been diverted through the washmill. Probably the Area E 'well' served no important purpose. A trough for experimental mixings or merely for soaking brushes and shovels in water are more suitable explanations than that it was a 'well' or storage tank. Certainly the stream would not have been permanent and must have been dammed.

AREA D–the Deep Tanks, Plate XV, b.

This structure is entirely below ground and consists of a rectangular tank, 43ft. 3ins. long by 15ft. 10ins. wide, with three compartments. The perimeter and two interior dividing walls built of large, roughly squared blocks below, and smaller course stones in the upper parts, are 2ft. thick. They are of a coursed random bond, with spawls to fill in the irregular areas between the larger blocks, and is laid in a yellow lime mortar. The internal rectangular tanks vary in size and depth. The southern tank, 11ft. by 7ft. 10ins. is 6ft. deep; the central tank is 11ft. square and 3ft. deep; the northern pit is long and shallow–11ft. by 16ft. 2ins. and only 2ft. deep. None of the tanks has a surviving floor, though there are signs here and there of a compact earth flooring.

THE KILNS

The washmill and tanks are some 100 yards distant from the kiln site. The inconvenience of this distance was caused by the necessity, on the one hand, to place these parts beside the stream and to obtain, on the other hand, a cliff face in which to build the kiln. All early lime kilns on the Mornington Peninsula were built against a cliff in order to enable them to be filled from the top. Inconvenience of this cartage distance was compensated by other advantages. The burning nodules gave off sulphurous fumes, for the disposal of which the headland siting of the kilns was ideal.

There are no signs surviving of buildings between the washmill and kiln areas : they most probably did exist since the map (Plate III b) shows a fairly regular spread of buildings rather than two groupings. However, the area has been shaved down about 4ft. to form the present carpark, leaving but a small 'island' of the previous land surface (marked X on the site plan) whose soil structure is undisturbed and shows that the land rose towards the cliff edge at this point. Thus the area occupied by the carpark was originally not a flat one. Although there are slight traces of a plaster floor in the exposed cutting of the eastern edge of the carpark, it is extremely unlikely that buildings existed on the east (between the carpark and the slope) since here there exists the very large hollow shown as Y on the site plan. This hollow is the work of man, a huge oval excavation of which the northern edge can be seen in the hollow (Z) on the northern side of the present access road. The soil sequence in this hollow is disturbed and inverted around its edge. It is well drained and porous : it is today a very dry hollow and there is no question of its having been formed by natural water drainage, or dug to retain drainage waters for purposes of the industry. The soil thrown up in digging it covered part of the conduit to Area F. The obvious explanation is that this excavation attempted to reach the septarian layer and in doing so would naturally avoid any operational buildings.

The complex of buildings in loci, F, G and H constitutes the real centre of the Works. It contains the Lesser and Larger kilns, the masonry supports for boiler and sedimentation channels, and the large retaining wall supporting the cliff face below the elevated path which gave access to the top of the kiln. A large retaining wall was also built on the southern side separating the working platform of the Cement Works from the low-lying sandy beach.

Any study of this area must begin with the oil painting of the Cement Works now hanging in the Shire Offices in Mornington (Plate I). A faded label on the back identifies the scene as the 'Cement Works, Schnapper Point' and records that it was 'Presented by Miss Scott.' The handwriting of these labels undoubtedly points to a date not later than about 1870 and this is consistent with the information kindly supplied by Mr. D. R. Morell of Mornington, great nephew of Miss Florence Scott who painted it. W. Scott appears in the list of Mornington landowners who welcomed Robertson's enterprise to Mornington, and Ada and Florence, his daughters, were both school teachers there. Ada is known to have married in 1869 and therefore a date about 1870 is not unlikely for Florence to have turned her accomplishments to painting Fossil Beach. The painting was in the possession of Mr. Harry Low until it was acquired by the Shire Offices in 1960.

Footnotes: Please refer to page 73

Plates: Please refer to page 33

The painting is 'romantic' and difficult to reconcile with the present topography of Fossil Beach, although, of course, it gives valuable–if exaggerated–indications of the differences in land levels between former and the present landscapes. The outstanding feature of the painting is the way in which the kiln towers over the sea and the sheer sides of the rectangular building to the right of it. This building can scarcely be other than the Lesser Kiln–and it is indeed possible to make out the base of the circular chimney in the centre of the rectangular building complex, although the alignment of this appears to be quite false. An interesting point is the area of whitened treeless cliff behind the kiln, obviously the access road to the top. It does not connect with the chimney top of the kiln–far from it–so that presumably the artist was aware that this kiln was different from the lime kilns she knew and that it was not loaded from the top of the chimney.

Miss Scott has left us several pieces of valuable information. She clearly shows that the back of the kiln is built out with obliquely cut walls. The curtain wall cutting into the side of the kiln on the left has been verified by the excavations; and clearly it does not appear to have been built merely as a retaining wall for the cliff but to have served some other purpose. Structurally it appears connected with the elements jutting out on the left of the wall and at right angles to it; but here the painting of this highly important area F is obscure. Two upstanding semicircular objects edged in white can be made out, too far apart to suggest vertical millstones, so perhaps a tunnel. Another important feature, granted the poor perspective and the exaggeration of height, is the implication of a sharp drop from the level of the Cement Works to that of the beach beyond. At the point of this drop, beyond the end of the path leading down on to the beach, a shaded area extending into the sea suggests a short rocky bluff. The survey map of 1862 (Plate III b) also indicates this bluff at the end of the Cement Works and cuts off the Works from the beach by a firm contour line coming in from the bluff and joining the cliff at right angles. The suggestion is that the Works sat high and dry above the beach and quite possibly was walled off from it.

The water colour owned by Mrs. Gleadell dated 1879 (Plate II a) shows how another artist saw Fossil Beach in quite different proportions. Obviously it had already been tidied up. The remains of the Lesser Kiln in the centre mid-ground appear to have been concreted over. The Larger Kiln is not the noble tower which Miss Scott painted though it still has four drums, and, consistent with Miss Scott's observation, the top access road meets the back of the kiln at the base of the second stage down. An important feature of this water colour is the access road to the kiln base, which runs round the seaward side of the Lesser Kiln and its tanks. On the outer edge of this road there is implied a severe drop to the level of the beach.

A few years after the water colour was painted, a banksia tree took root in one of the draw-off chambers of the Lesser Kiln. On the next dated picture of the ruins, published in a small guide book to Mornington issued by the Mornington Progress Society in 1902 (Plate XI b) the banksia appears to be about twelve years old. This same tree, six years or so younger, appears in a photograph in the possession of Mr. C. Allchin of Mornington (Plate XI a). Thus, by the turn of the century it is clear that the Larger Kiln was

completely ruinous and mostly hidden from view and that the Lesser Kiln and tanks were tidied up and cared for. Its chimney had been carefully cemented over and the bushes removed (cf. both photographs Plate XI). Since the date of these photographs the access road to the Larger Kiln passing round the Lesser Kiln has largely fallen away together with its seawall. The retaining wall is clearly visible in both photographs and is marked by a row of trees on the right of the pictures. A picture postcard postmarked 1907 (Mornington Historical Society Museum) shows a view of the Lesser Kiln taken from about the top of the Larger Kiln. This not only confirms the existence of a curved revetment on the seaward side, but also shows the certainty that X is the level of the original land surface to the north. The conclusion is therefore that the ruinous high walls built around the Lesser Kiln in Miss Scott's painting were pulled down and concreted off before 1879.

The cart track by which the kiln was approached at the top is extremely difficult to trace on the ground, but the tree cover of the cliff face shows quite clearly a recession of shrubbery on a line parallel to the extant top of the kiln (arrowed Plate II b). Clearly the beaten surface of the track has not been so heavily colonized by medium-sized shrubs as the rest of the cliff. It was obviously necessary to shore-up part of the cliff face beneath this track and there are a number of pieces surviving of the huge curtain walls which were built (at least in part) against the cliff face. The masonry of these is excellent quality and it is very likely that lean-to buildings of timber and corrugated iron were built against them. The major storage area must have been situated against the curtain wall on the southern side of the kiln. Here in Area I there is a beautifully constructed wall set off at right angles to the curtain (Plate XXIV a) and aligned on the fragment of substantial walling in Area J (Plate XXIV b). It looks very much as though there was a large retaining wall between the working area and the beach. This would agree with the impression given by Miss Scott's painting–that the works was an enclosed complex of buildings rather than open and accessible.

AREA H–The Lesser Kiln, Plates XI-XV

The Lesser Kiln in Area H is difficult to understand. It is set within four tanks or chambers built in the ground to a depth of 4ft. Quite possibly it is the 'kiln and tanks' for which tenders were called in The Argus, April 11, 1862. These are built of coursed close-set ironstone and rendered with cement. A thick surfacing about 1ft. wide cantered slightly inwards covers the tops of the outer walls. This is of thick cement rather like concrete and is of different composition from the rendering of the walls. As already explained, at a time before 1879 this building was dismantled and concreted over, presumably to make a picnic place. We have seen that this building was cared for: the Rev. George Cox (The Peninsula Post, December 1941) remarks that the Council had built a fireplace in the old kiln. This square box-like structure, made of modern bricks stamped 'Hoffman' is clearly distinguishable, set into the circular foundation of the brick chimney of the Lesser Kiln (Plate XIV a-b).

Footnotes: Please refer to page 73

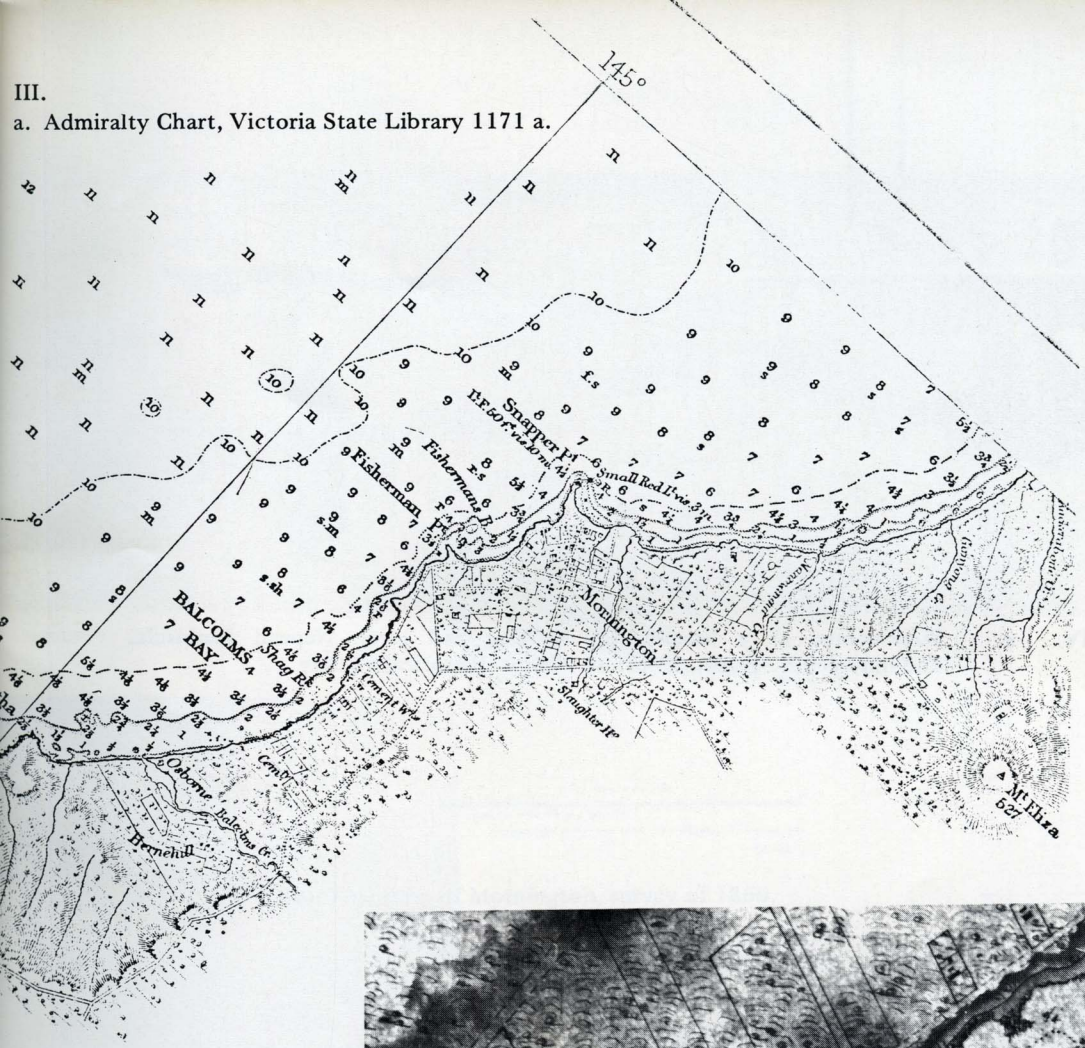
I. Oil painting labelled 'Cement Works near Snapper Point' and 'Presented by Miss Scott,' now in the Shire Offices, Mornington. Both the style of painting and the handwriting of the labels on the back of the painting suggest a date not later than 1870.

II. a. A water colour of the ruins of Fossil Beach owned by Mrs. L. Gleadell, dated 1879.

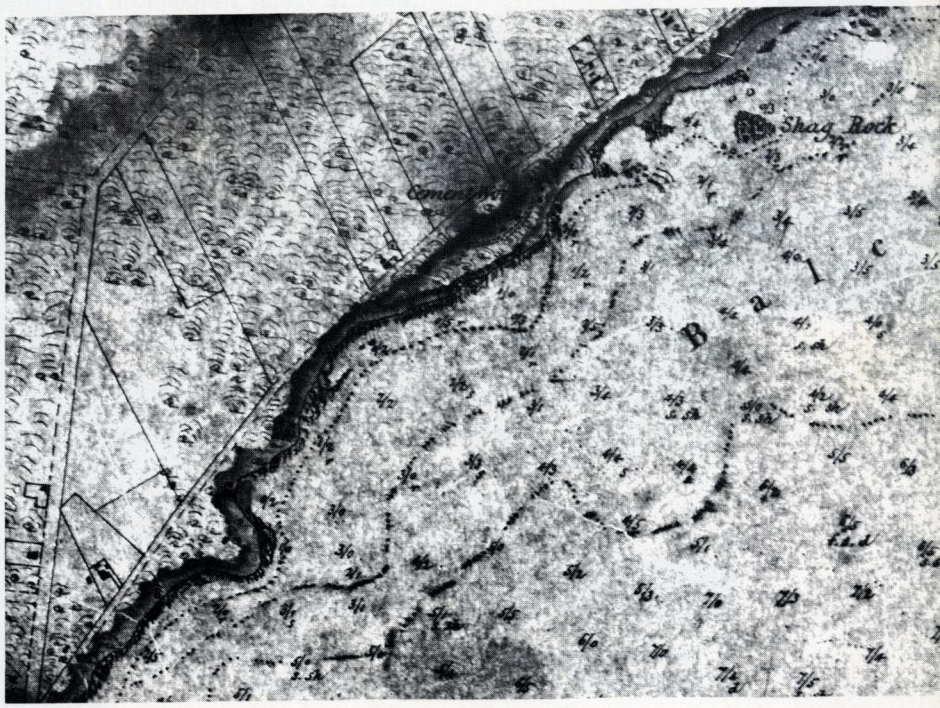
b. Fossil Beach looking southwards towards Mt. Martha, before the 'excavations', 1967.

III.

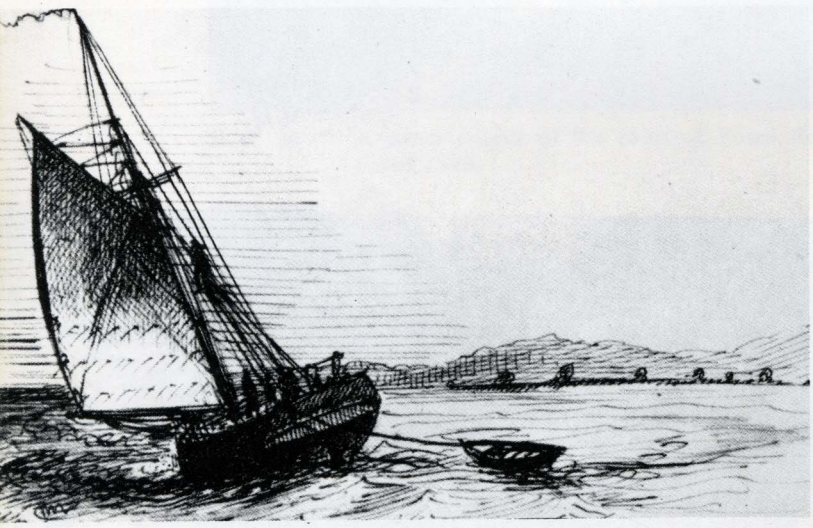
a. Admiralty Chart, Victoria State Library 1171 a.



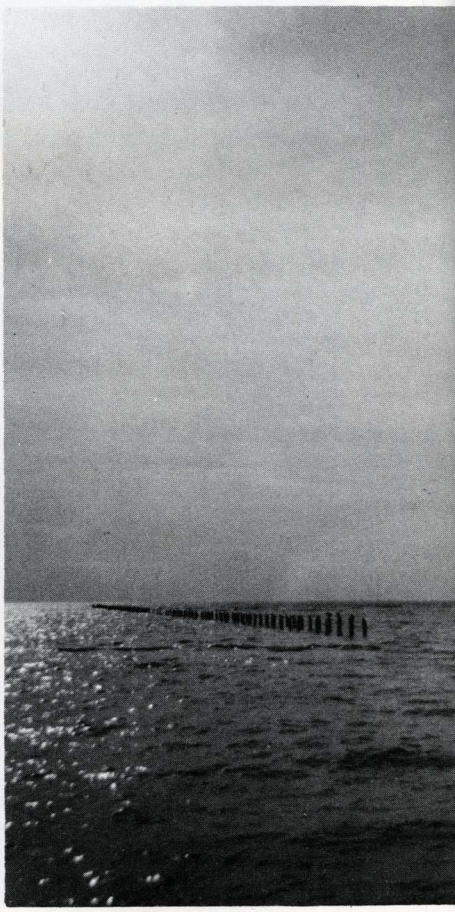
b. Survey Map of 1862, Lands Department, Melbourne, sheet X, No. 22 surveyed by Commander Henry L. Cox, R.N.



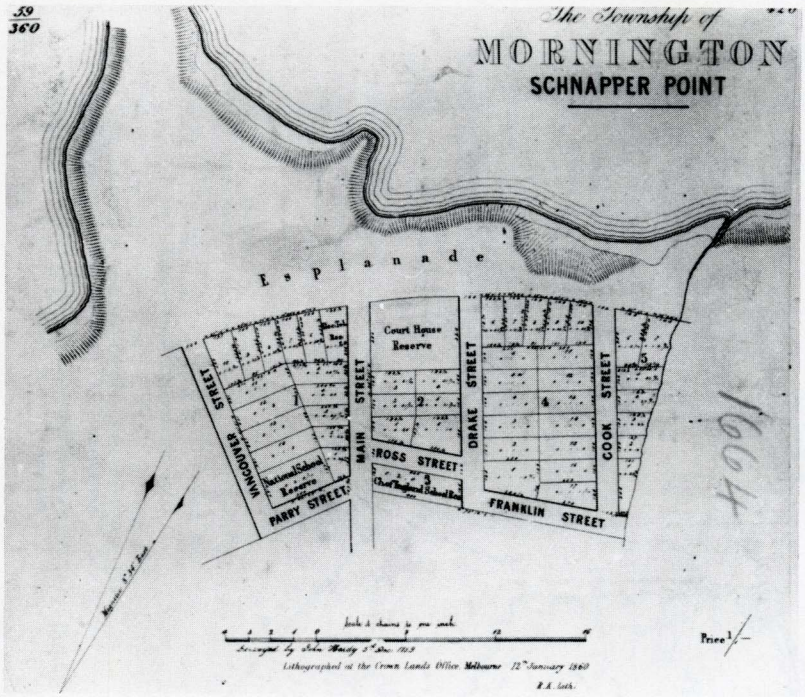
IV. a. Watercolour of a limeburner's cottage and jetty, Nepean Peninsula, mid-nineteenth century. Courtesy Nepean Historical Society.



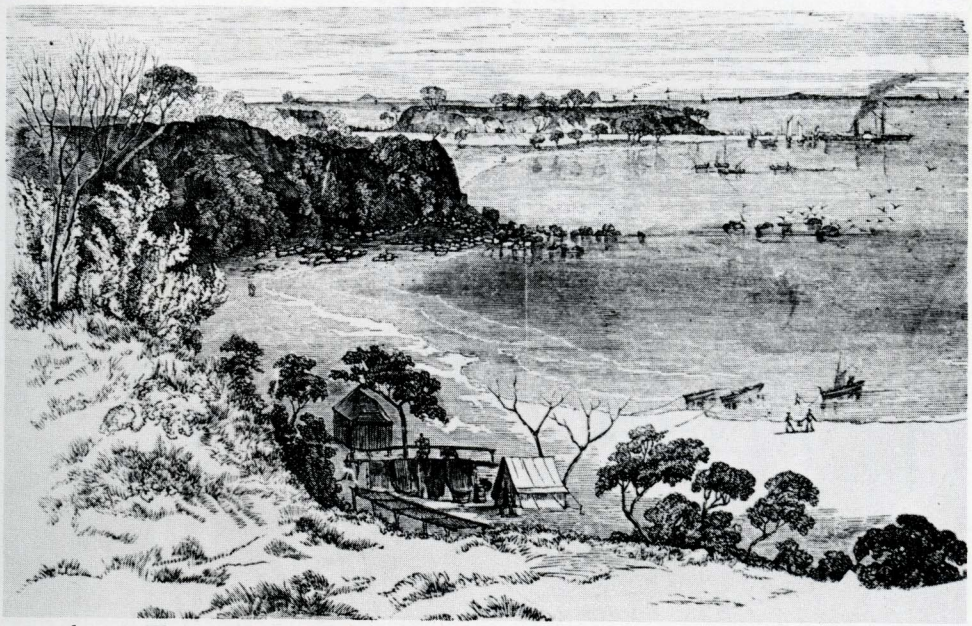
b. The Sloop 'Jemima', for Arthur's Seat from Melbourne, from a pen-drawing by George Gordon McCrae. Courtesy Angus and Robertson Ltd.



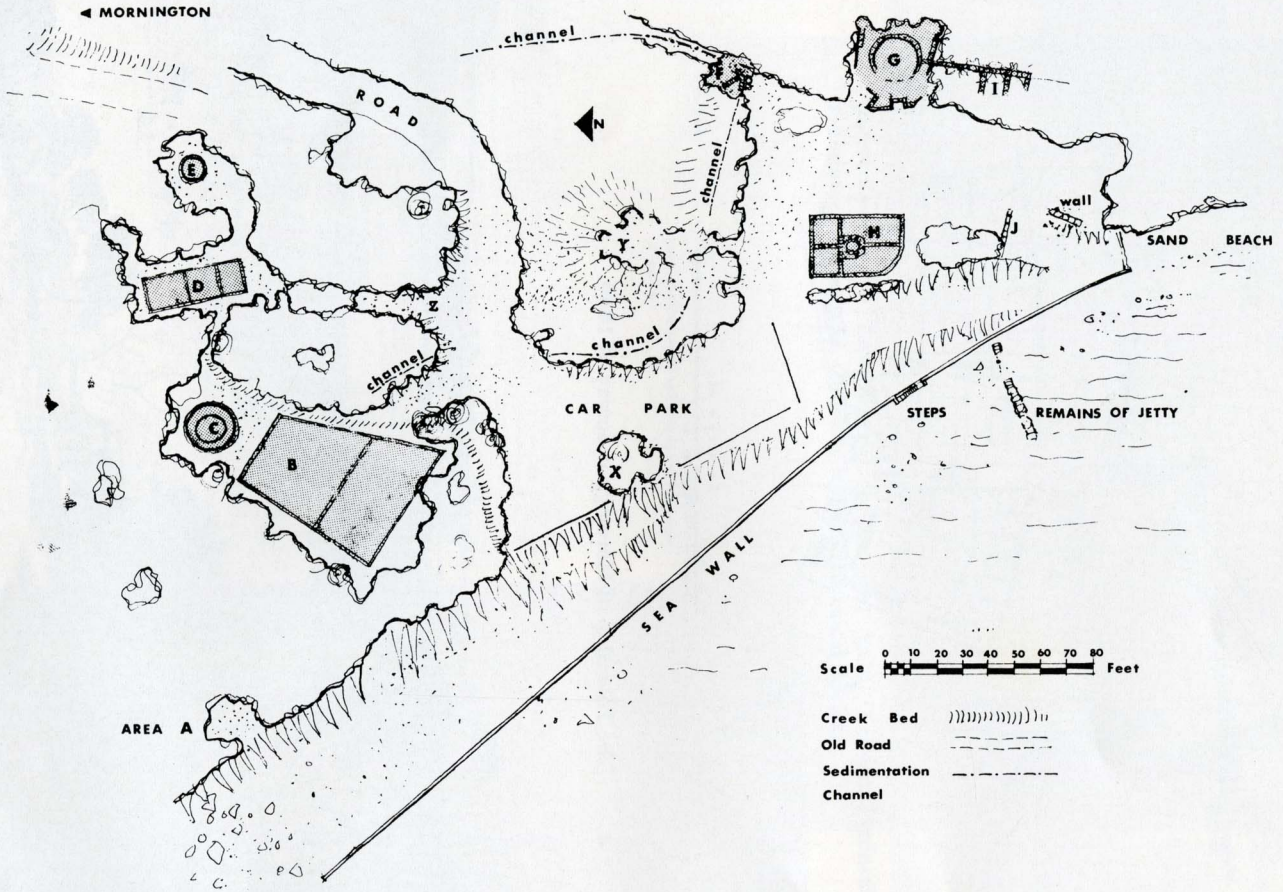
c. The 'Old Limeburners' Jetty' at Portsea, photograph taken 1930's. Courtesy Mr. Bryan Francis.



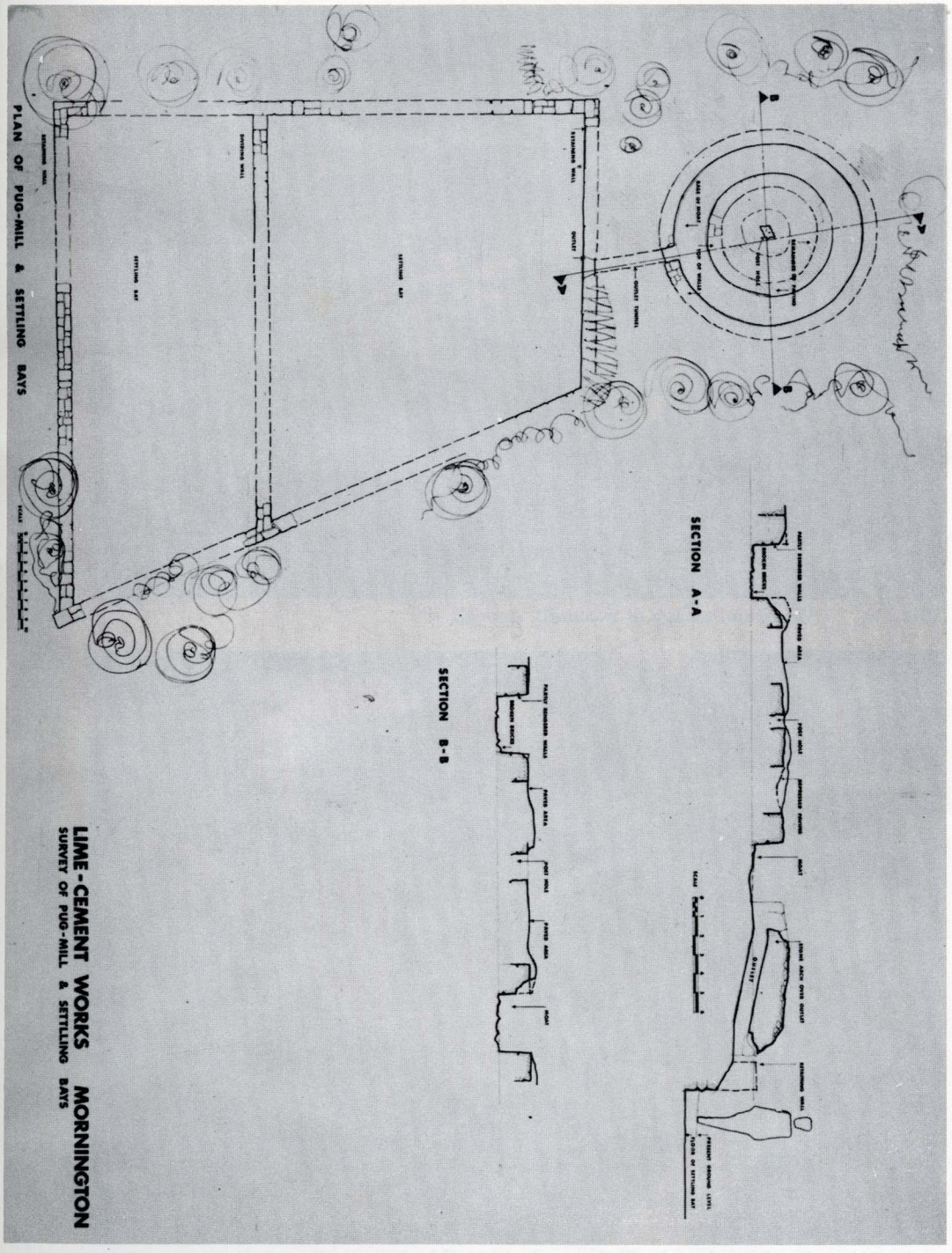
V. a. **The Township of Mornington, survey of 1860.**



b. **The earliest published view of Schnapper Point, from The News Letter of Australasia, 1858.**

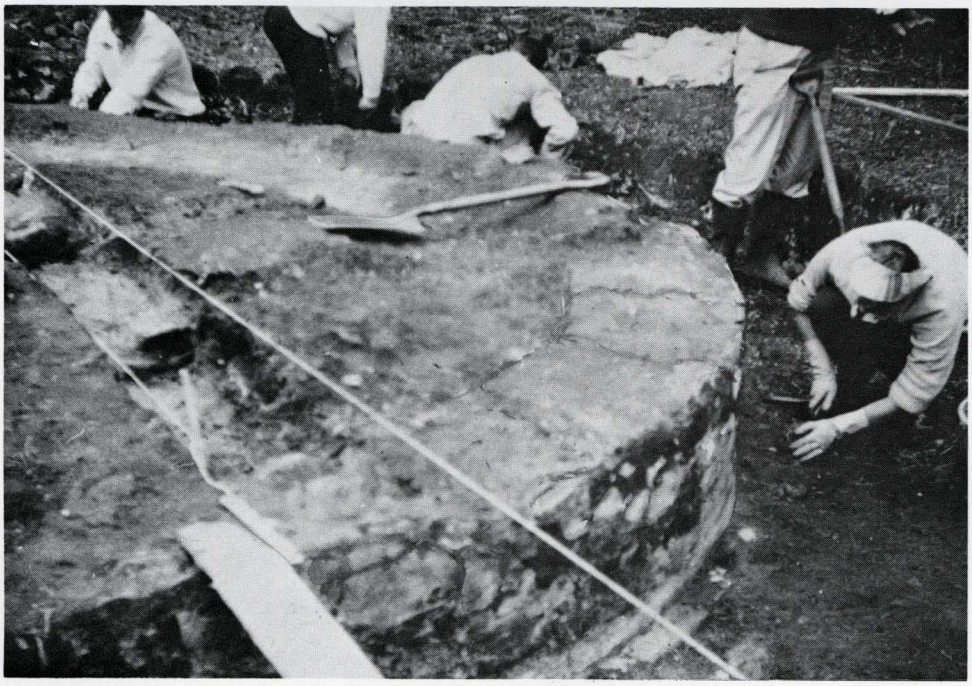


VI. The excavated remains on Fossil Beach.



VII. Plan and elevation of the washmill and settling bays Fossil Beach.

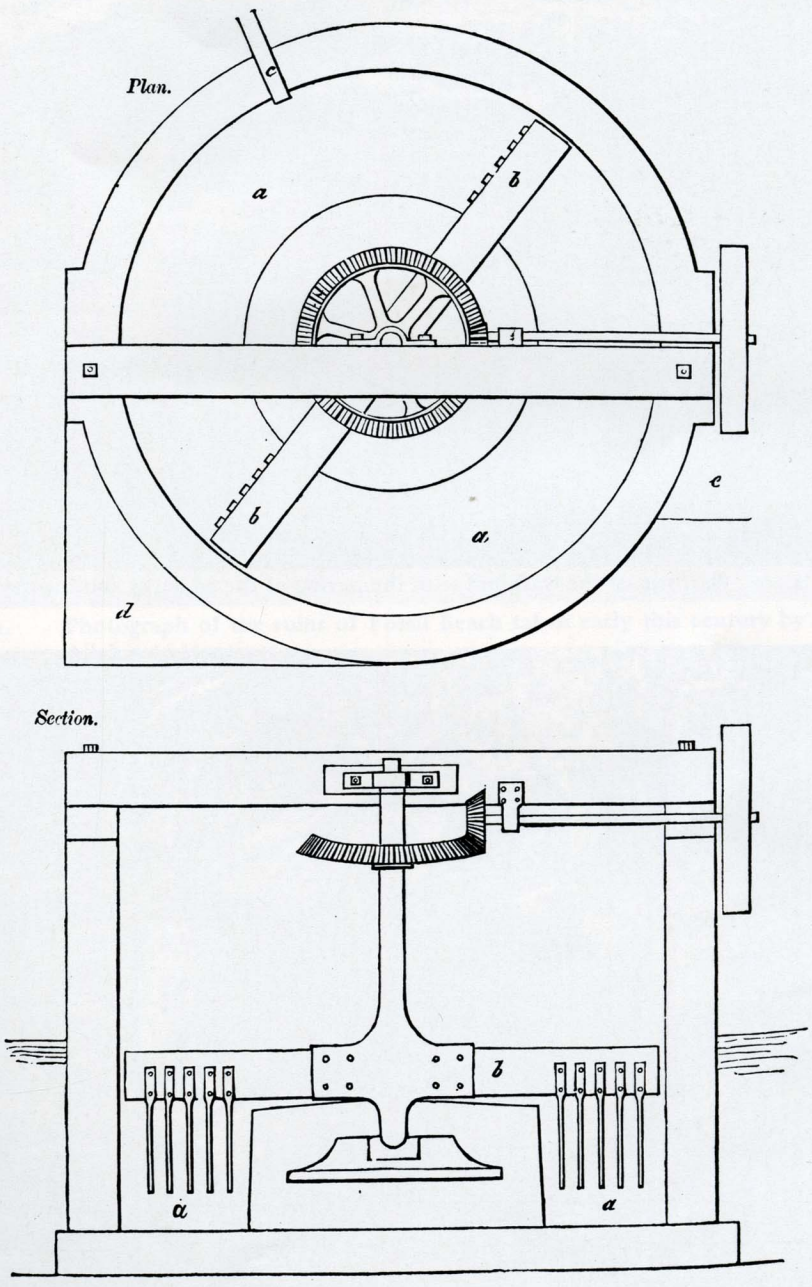
VIII. a. Drum and trough of washmill, Area C.



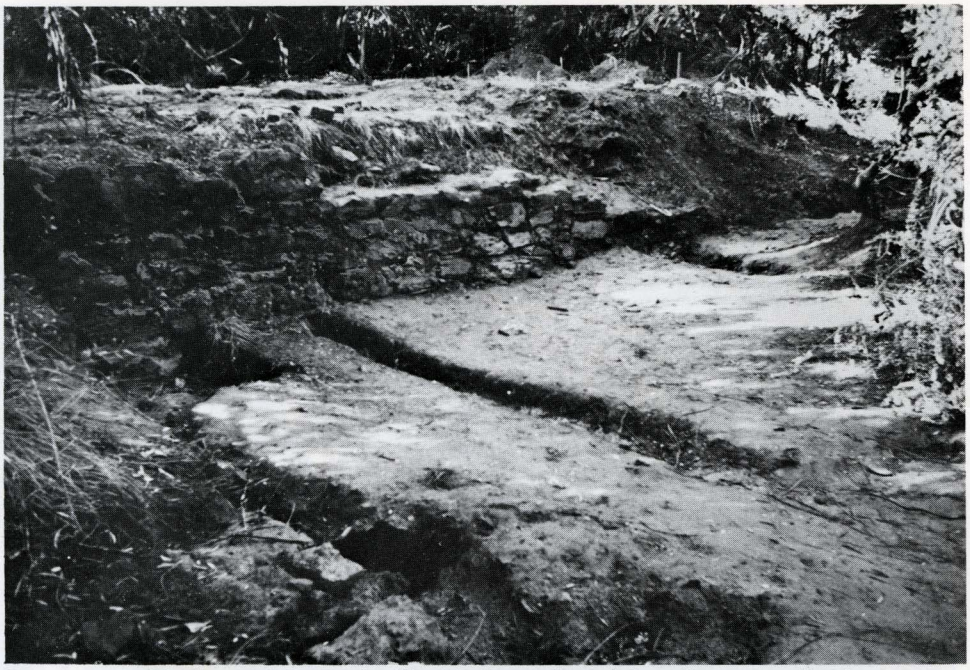
'b. Section of washmill drum, showing dished top and concrete coping at the base.

WASH-MILL.

Fig. 1ª.

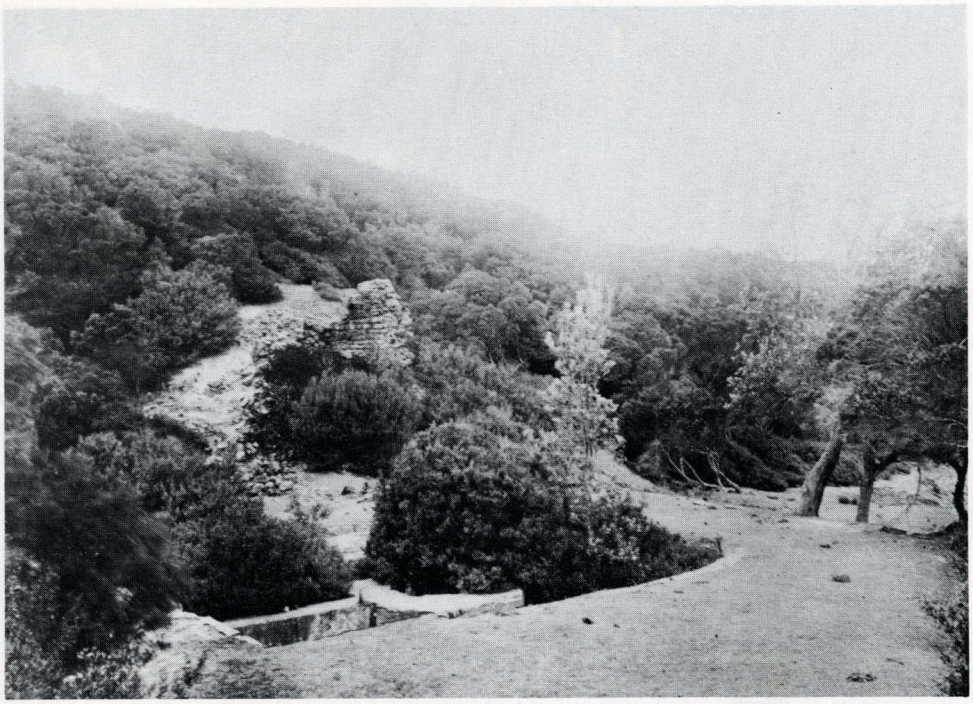


IX. Washmill after H. Reid, A Practical Treatise on the Manufacture of Portland Cement.

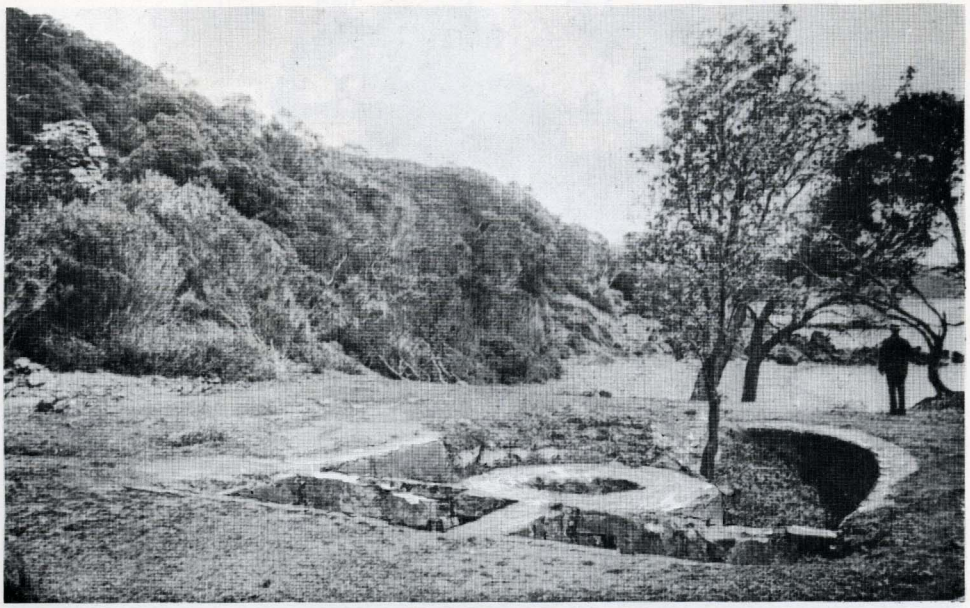


X. a. Platform of the washmill with the paving of the adjacent settling bay.

b. 'Well' in Area E.

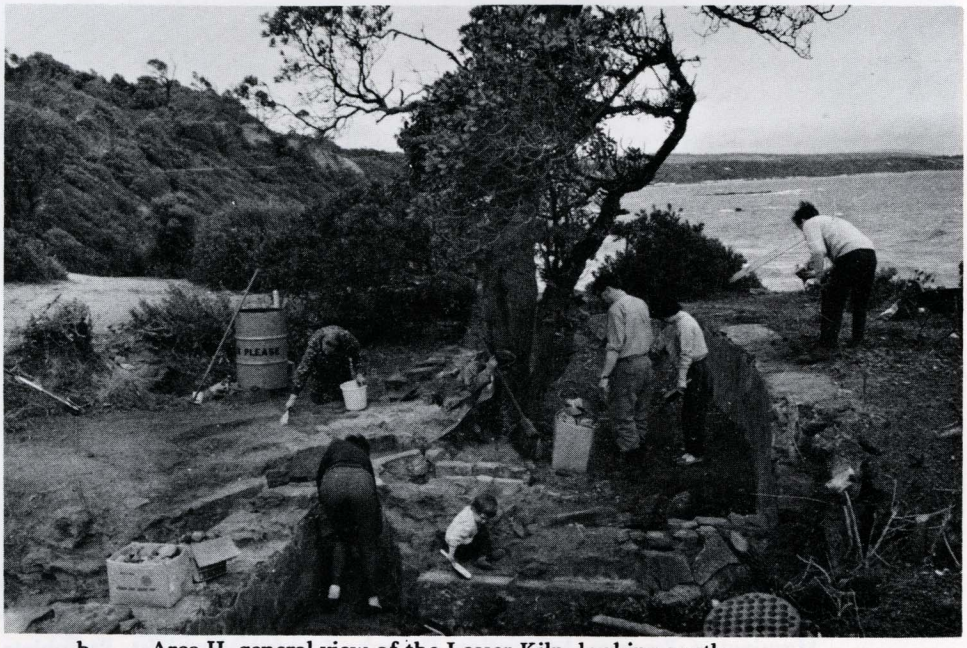


XI. a. Photograph of the ruins of Fossil Beach taken early this century by Mr. C. Allchin of Mornington.

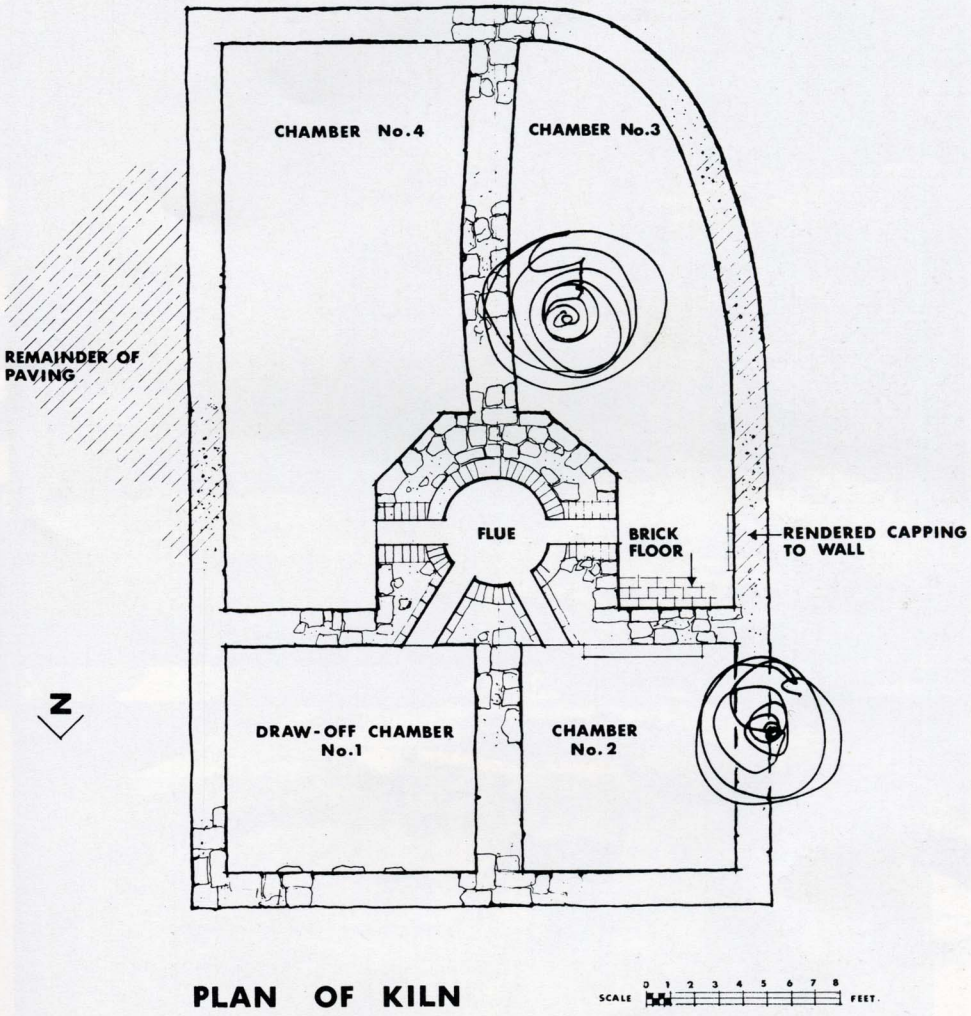


b. Photograph of the ruins of the Cement Works published in 1902 by the Mornington Progress Association (Latrobe Library Vict. Hist. Pamphlets VII).

XII. a. The Lesser Kiln area H, shute or draw-off channel into chamber 2.



b. Area H, general view of the Lesser Kiln, looking south.

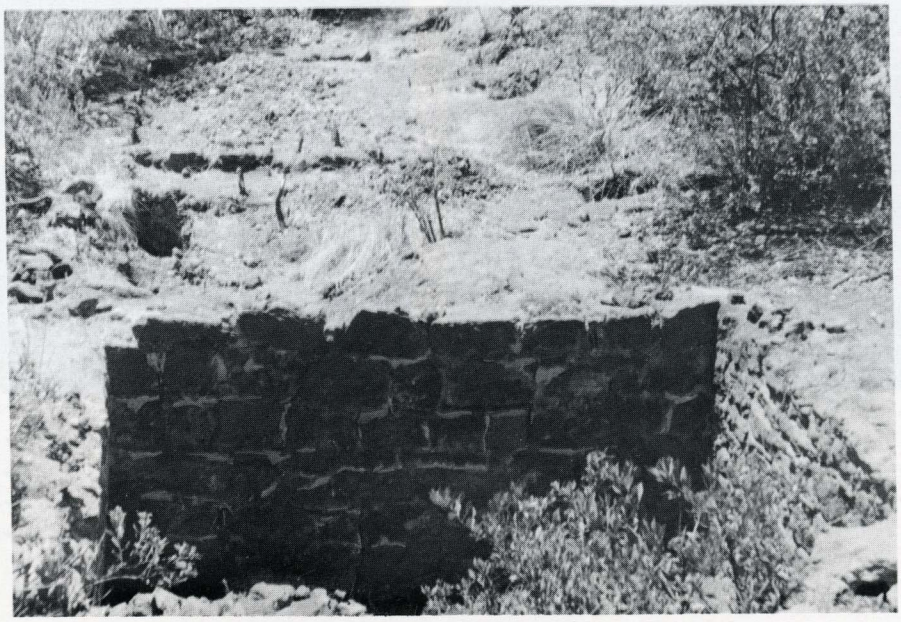


XIII. Plan of the Lesser Kiln in Area H.

XIV. a. Lesser Kiln foundations.

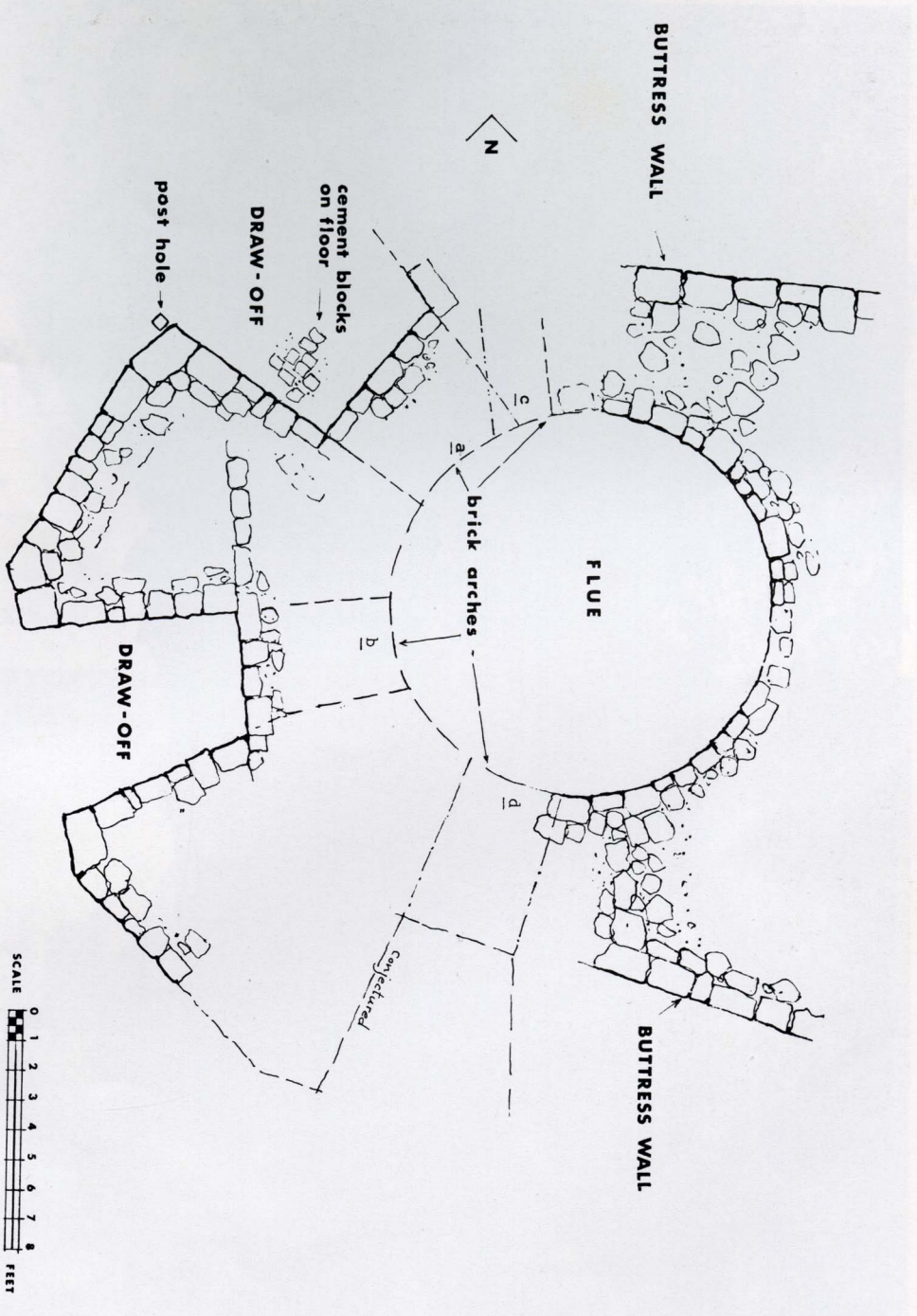
b. Shute of the Lesser Kiln into chamber 2

XV. a. The eastern outer wall of Area H showing three structural stages. View from exterior.



b. The Deep Tanks in Area D, view looking NNW.

XVI. The Larger Kiln, Area G : A, view of final excavation looking into arch a; B, view showing the oblique encircling wall above arch b; C, posthole by the curb of draw-off a; D, brick springing of arch d.

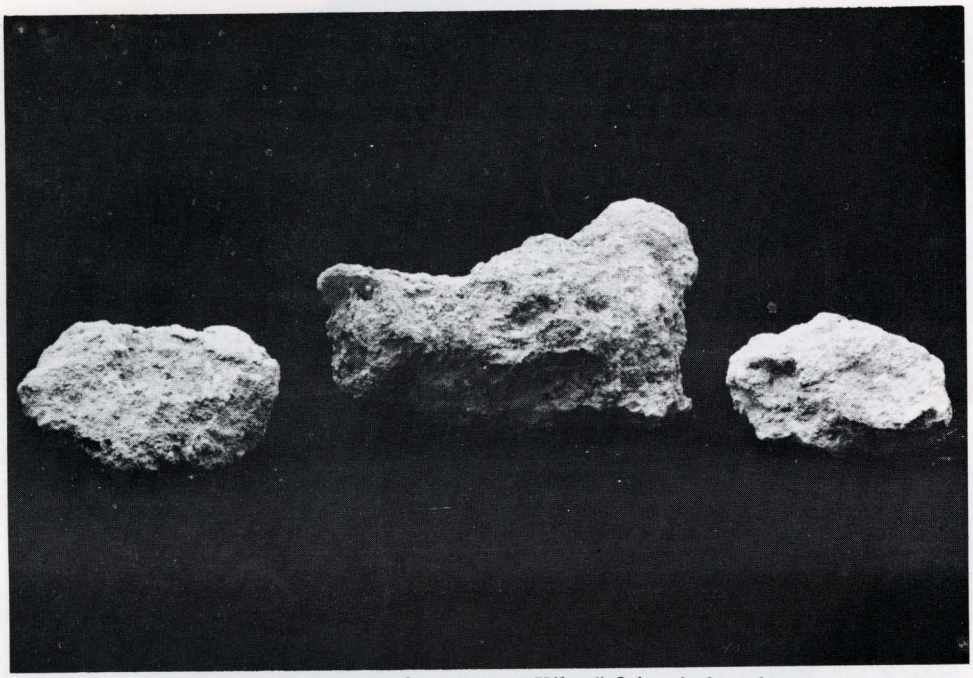


XVII. Plan of the Larger Kiln, Area G.

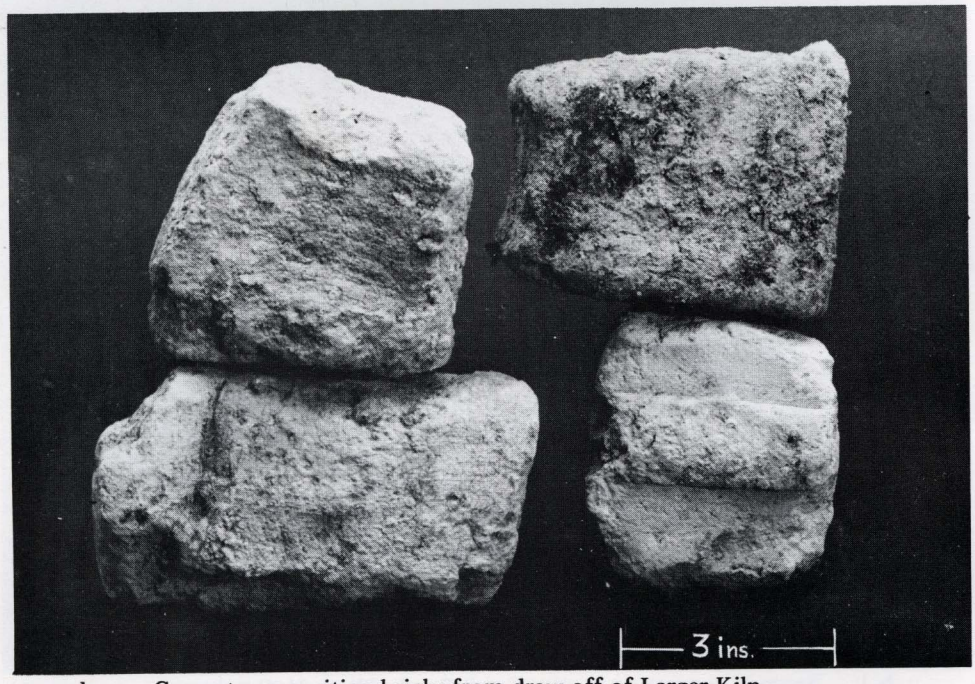
XVIII. Archway b in the Larger Kiln.

XIX. a. Broken septaria concretion from Fossil Beach showing dark core and fossilized shell.

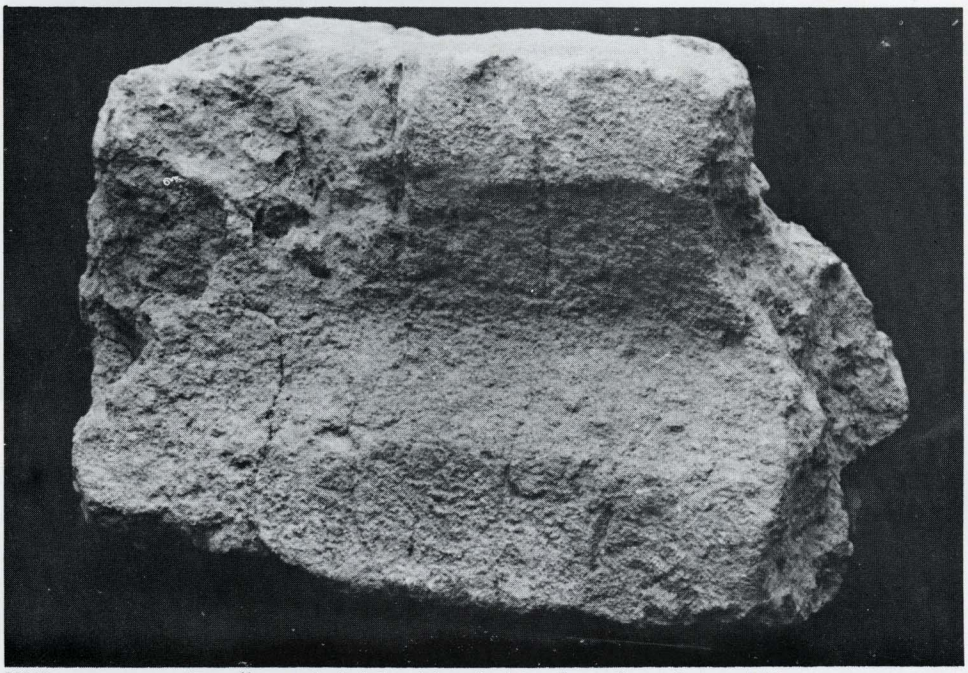
b. Septaria concretion in situ, Fossil Beach. Photo V. Gostin.



XX. a. Burnt septaria nodules from Lesser Kiln, 5-8 ins. in length.



b. Cement composition bricks from draw-off of Larger Kiln.

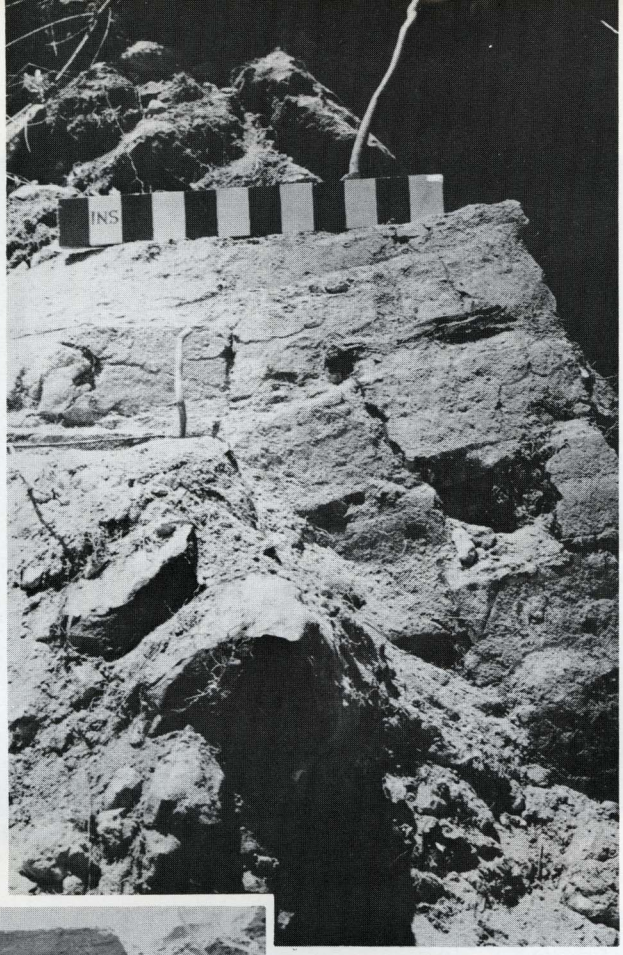


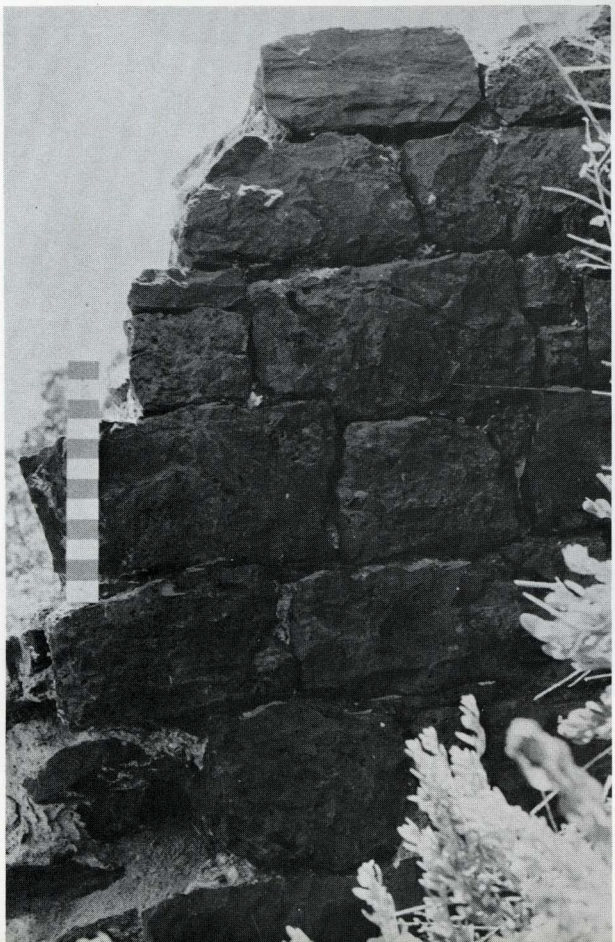
XXI. a. Locally made brick with primitive frog, from Larger Kiln.

b. Wallyford fire brick from the Larger Kiln (obliquely cut) ht. 4½ins.

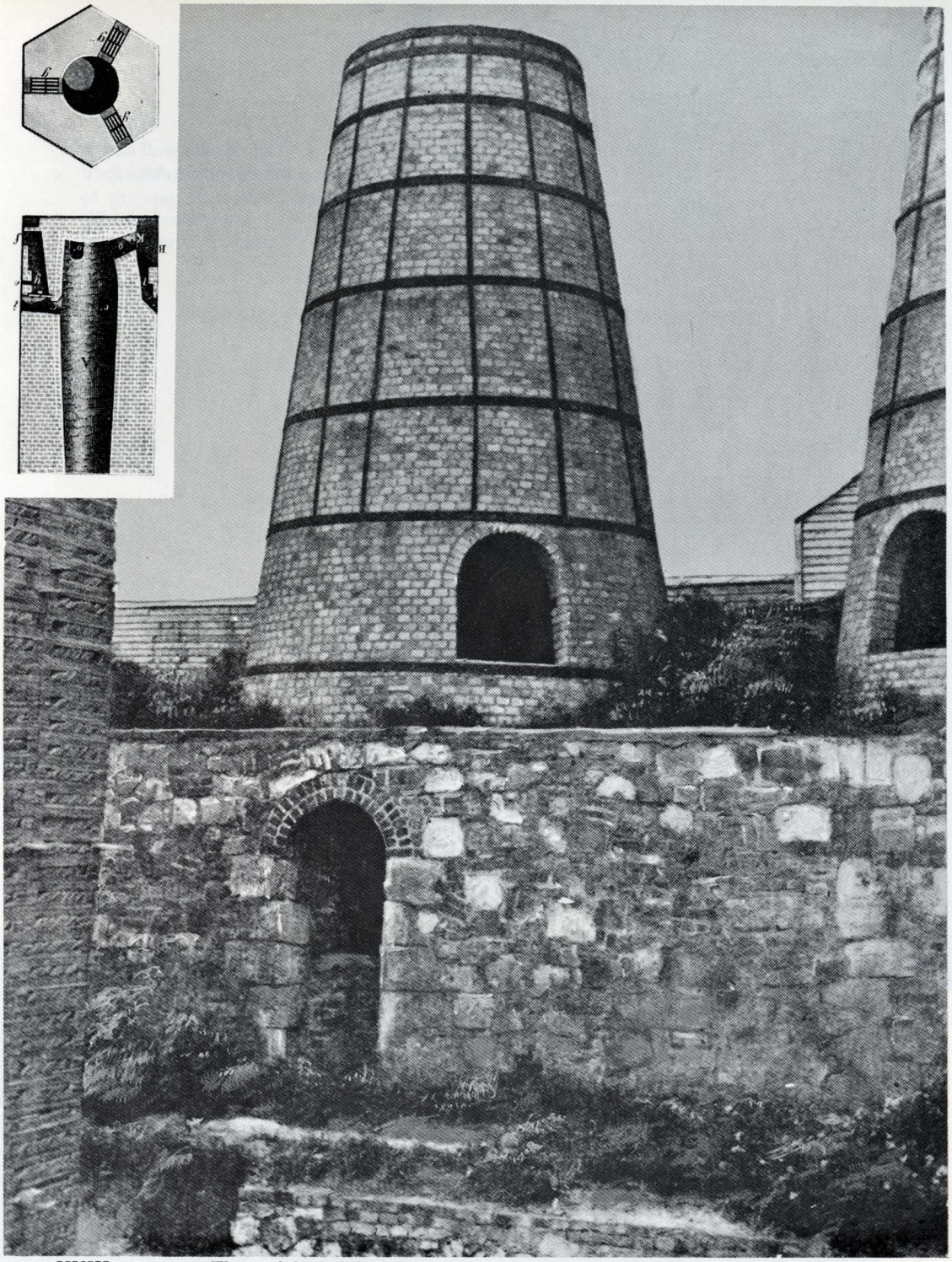
XXII.

a. The brickwork of arch c, Larger Kiln (side view).





b. Upper Stonework of southern buttress wall of Larger Kiln showing below the arched course over arch d.



XXIII. a. The original kilns of the Aspdin Cement Works, Northfleet, Kent, England.

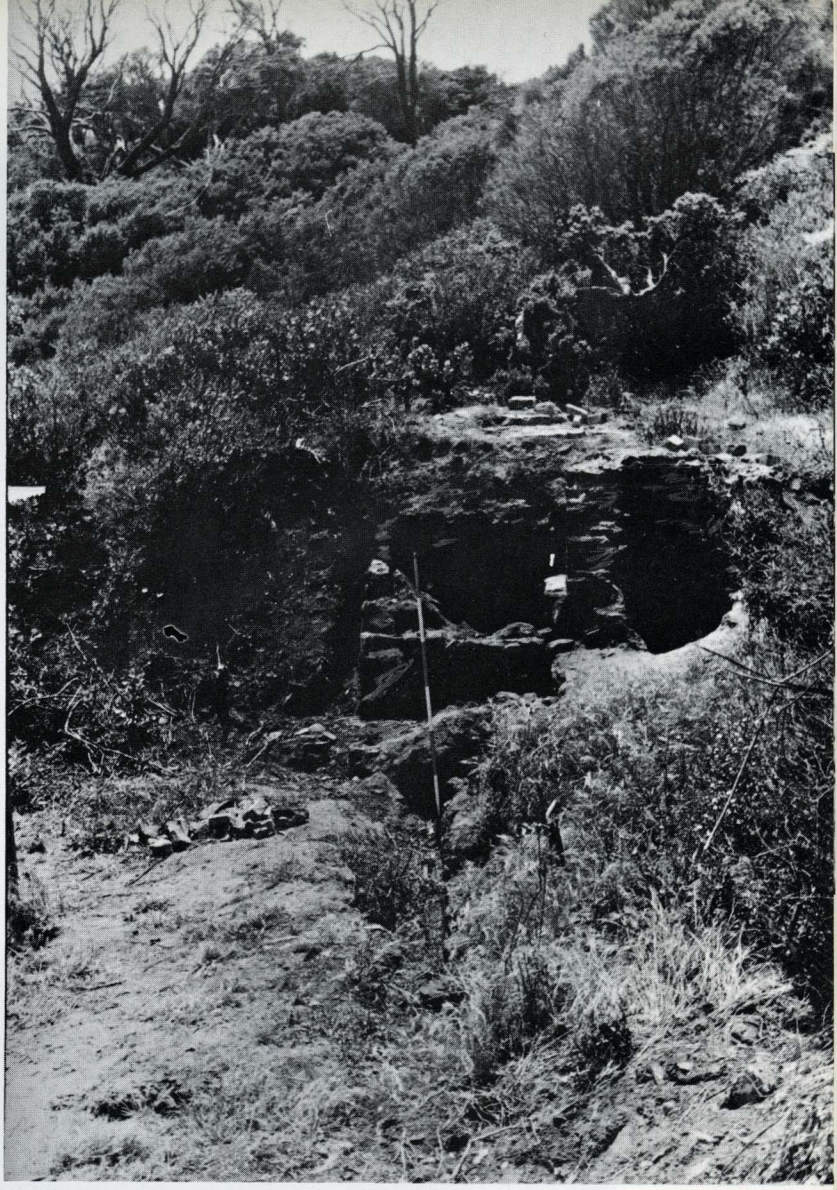
INSET b. Kiln from Otto's Lehrbuch.

XXIV. a. The curtain wall and offset wall in Area I.

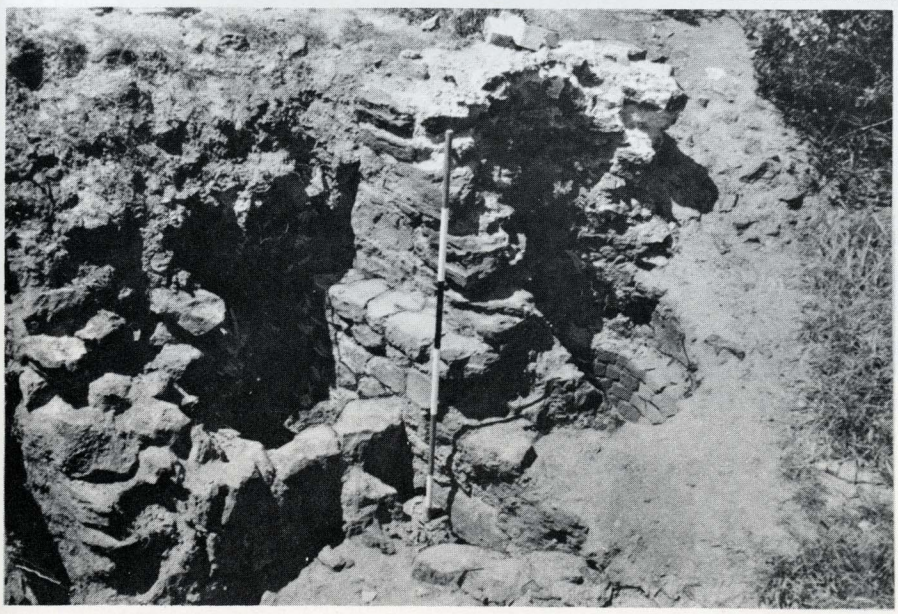
b. Offset wall and superimposed curb in Area J.

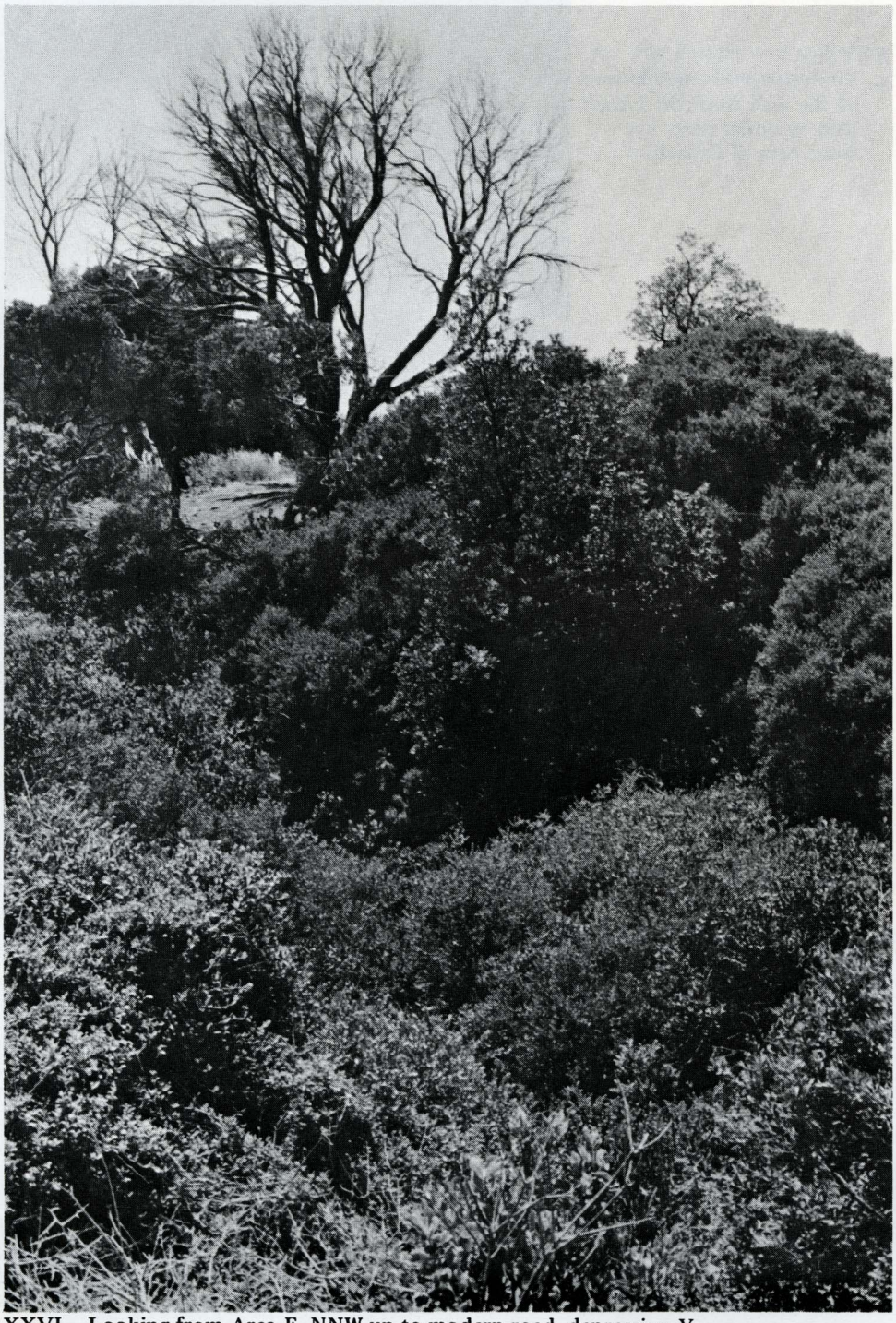
XXV.

a. View along the foundations of the wall from the Larger Kiln to boiler base, i.e. from Area G towards F.



b. The installation in Area F.



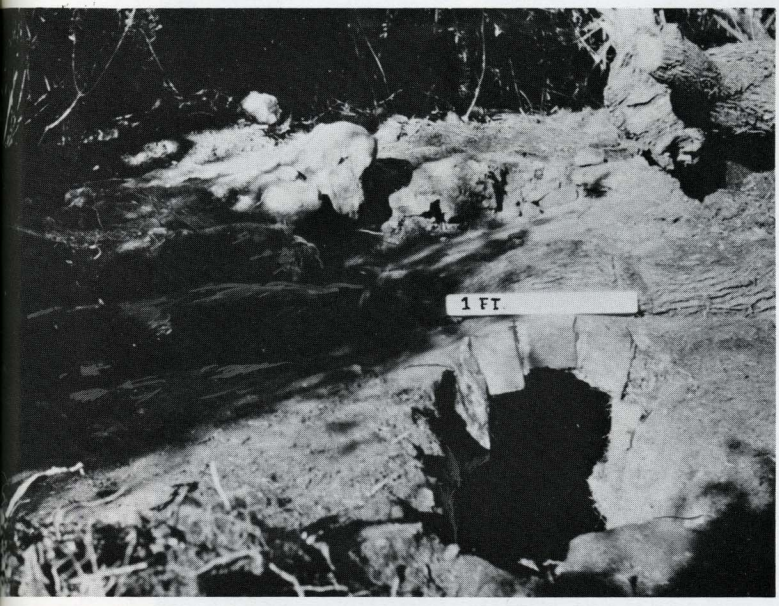


XXVI. Looking from Area F, NNW up to modern road, depression Y.

a

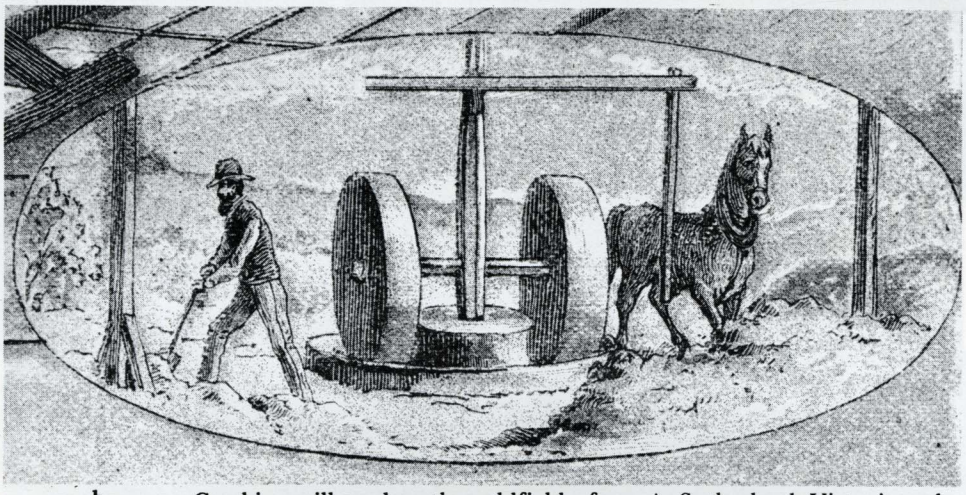
b

c

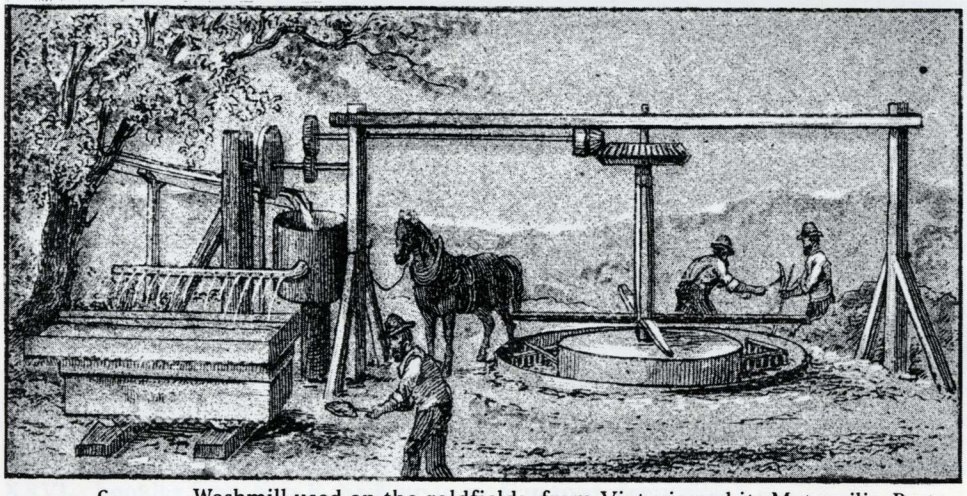


XXVII. The conduit channels: A, open channel in Area F ('sedimentation channel'). B, brick arched channel in Area F, arrowed in A, and passing under the above channel; C, cemented channel floor, Area F looking southwards.

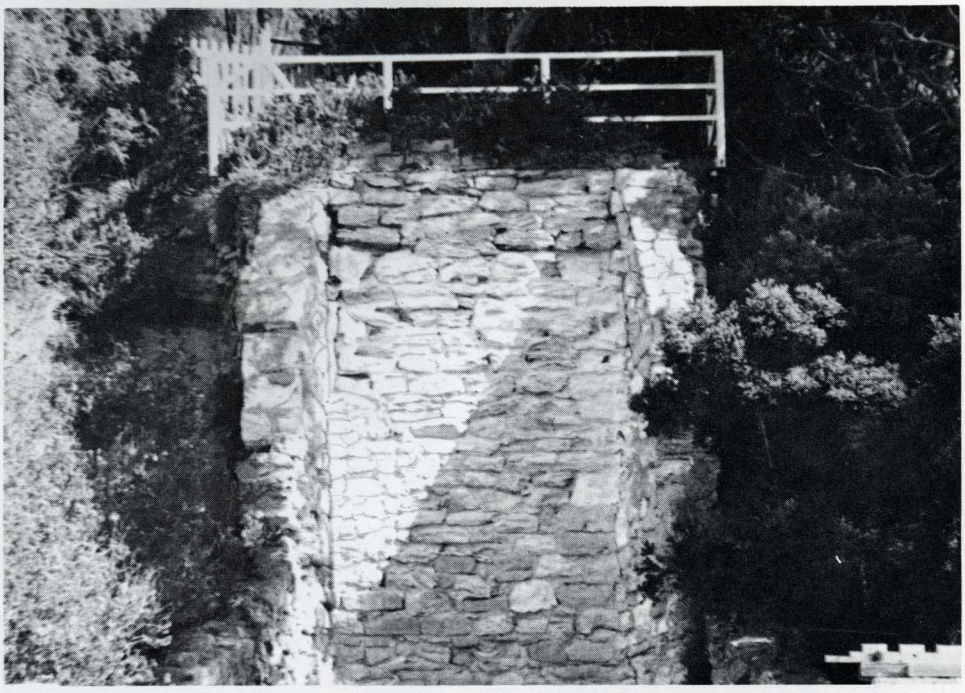
XXVIII.a. Mid-nineteenth century copper plaque found in Area B, probably a buckle for a hat-band. L. 1½ins.



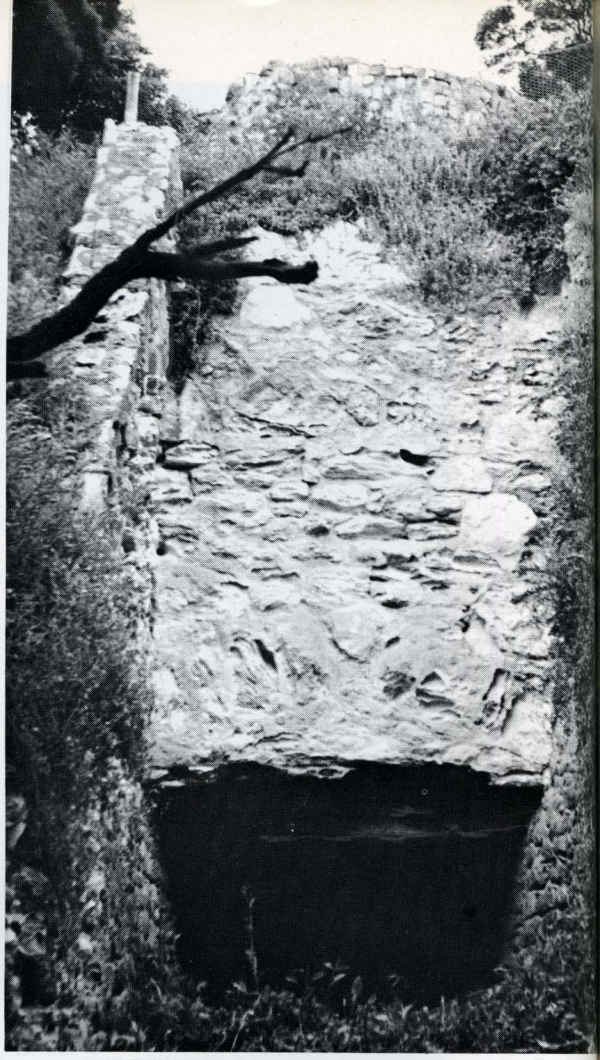
b. Crushing mill used on the goldfields, from A. Sutherland, Victoria and its Metropolis, Past and Present, 1888.



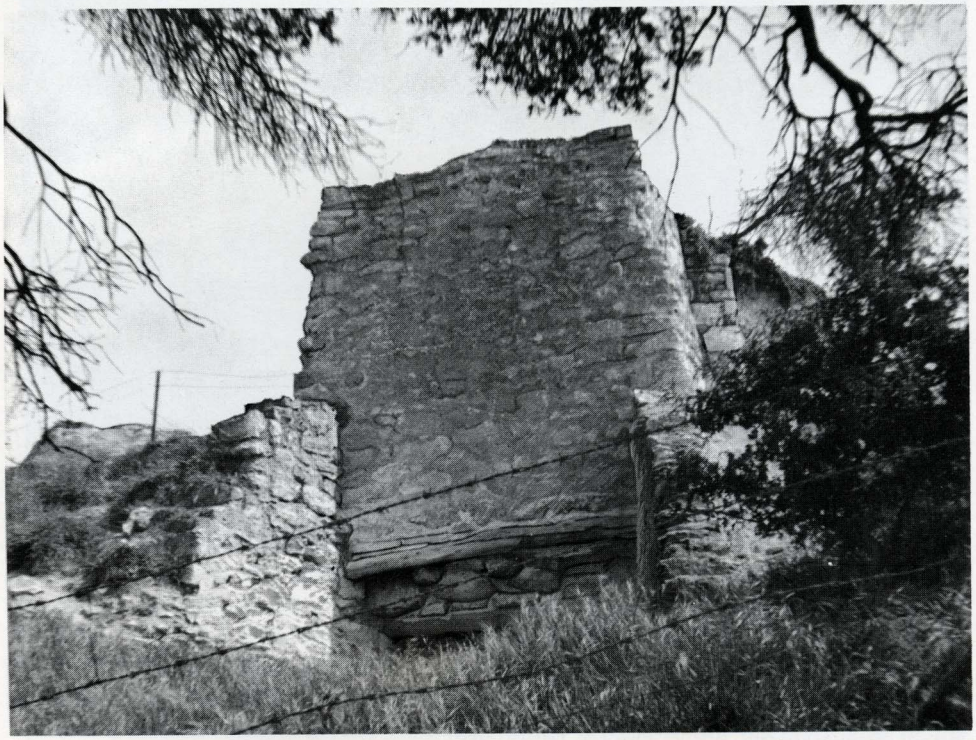
c. Washmill used on the goldfields, from Victoria and its Metropilis, Past and Present.



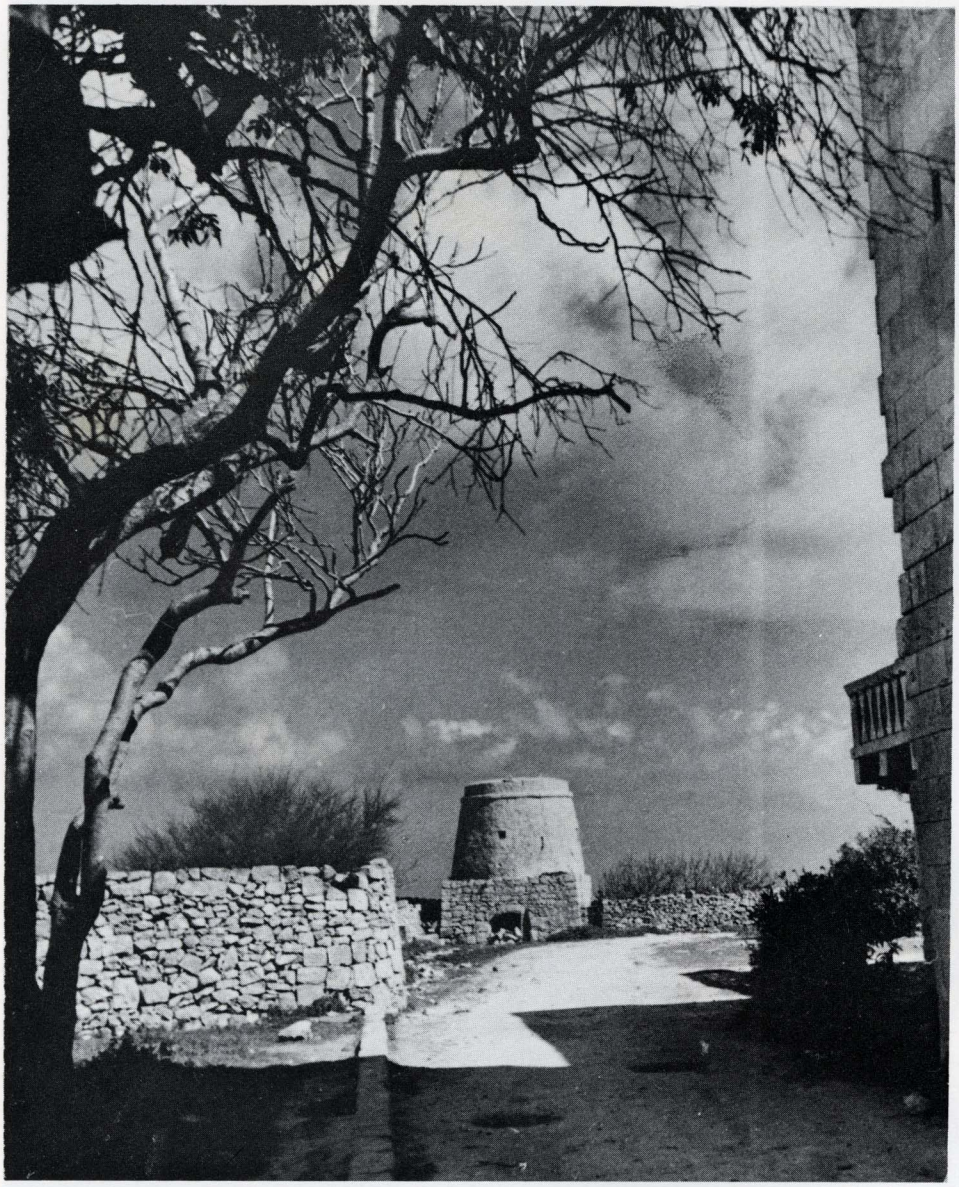
XXIX. a. & b. Breastwall and base of a lime kiln on Shelley Beach, Sorrento, Courtesy Nepean Historical Society.



XXX. a. & b. The lime kiln in Merrilands Court, Sorrento, overlooking Shelley Beach and the flue of the Merrilands Court kiln.



XXXI. a. & b. The 'Great Sullivan' lime kiln, Alfa Downs, Rye. Courtesy Nepean Historical Society. Detail.



XXXII. Mid-nineteenth century kiln at Ta'Cenc, Gozo, Malta.

This kiln was used for burning lime. Many calcined and partly calcined septaria nodules were found in the two northern chambers 1 and 2, and in the central chimney (or flue), alternating layers of white lime (about 1in. thick) and grey lime dust (about ⅓in. thick) but without indications of charcoal.These alternating layers suggest precise combustion control.

Presumably the two larger draw-off chambers on the southern side (3 and 4) were for removing the burnt fuel from the kiln. In these chambers a thick black deposit of soil and charcoal covers the floor.

During the 'excavation' of this building large numbers of bricks specially cut for building an arch were found in the immediate vicinity of the shutes leading into the two northern chambers. From this and the surviving anchorings, it appears certain that originally one large brick arch had spanned both the draw-off channels into chambers 1 and 2. From this it follows that the central east-west wall had originally a high elevation (and indeed may be the high wall running at right angles to the entrance of the big kiln in Miss Scott's painting) whereas the north-south wall was probably originally built little higher than the outer walls are at present.

The shape of the outer basin with its rounded edge was something of a puzzle until it was realised that there must have been between it and the sea a curving driveway leading to the area between draw-off tunnels A and B of the Larger Kiln. This driveway can clearly be seen flanking the outer edge of chamber 3 on the photograph Plate XI a; but clearly also the curved wall superimposed on the foundation wall in Area J must follow the curved outer edge of this drive (Plate XXIV b). The fact that it was necessary to accommodate the shape of chamber 3 to the curve of the driveway indicates that it was not possible to move the drive further out, for it is more than likely that a curved sea-wall had been built in this area before the installation of the Lesser Kiln, or at least of its tanks. There are indeed other grounds for the supposition that a substantial sea-wall existed at this point and that the whole of the Lesser Kiln and its surrounding complex was contained within it. Firstly, the unsubstantial oblique wall in Area J could not have withstood the battering of the sea unless it abutted on to a stronger protective wall. Secondly, a surviving iron drainpipe which juts out from the crumbling bank parallel to the oblique wall in Area J is directly aligned on a brick and concrete drain now under the edge of the sea and underlying the modern sea-wall. The horizontal distance between the present end of this pipe and the conduit is some 14ft; the vertical distance about 15ft. There seems little point in the substantial structure of this drain, which was made of early local bricks and lined with thick concrete, unless it was to receive the falling *cascade* of water from the iron spout.

Such substantial walls on the seaward side are certainly implied in Miss Scott's painting. Today, the soft crumbling soil on the outer slopes of Area H are separated from the modern sea-wall by the modern path. Foundations of the sea-walls must be beneath this path, where it is now impossible to investigate them. The Map of 1862(Plate III b) clearly shows the rounded projection of land, no longer present, but almost certainly that into which the Lesser Kiln and its flanking driveway were constructed.

There is another feature of the 1862 map which is basic to our understanding of the present site. The present access road to Fossil Beach was made in 1927. Before that the path began about two hundred yards further towards Mornington and followed a gentle

curve towards the shore. The surface of this old track can still be traced in many places: its lime-spotted surface is still hard. For part of the distance it follows the outer side of the dried-up stream bed, but it must at some point have bridged the stream and continued up to and beyond the ruins. Its whitened surface is to be seen in the foreground of Miss Scott's painting. Areas A B C D E of the ruins were on the seaward side of this track, and there were very probably other buildings, as the map shows, between this track and the sea.

When one considers the surviving groundwork of the Lesser Kiln (Plate XIII) there is one factor perfectly obvious–the difficulty of lighting and maintaining a fire in its narrow confines. It must therefore fit into the general typology of kilns used in Germany in the mid-nineteenth century. These had a narrow cylindrical shaft or flue [72] set in a hexagon of brickwork or masonry, into the sides of which were set fireboxes whose flames were drawn into the main flue without contaminating the limestone with ash. The structure of such a kiln is shown in Friedrich Otto's Lehrbuch der rationellen Praxis der landwirtschaftlichen Gewerbe, p.166 of the sixth edition of 1862. (reproduced here Plate XXIII b). Both scale and ground plan have remarkable similarities to the Fossil Beach kiln. It will be noticed that an arch, described in Otto's text, covers the three (in our case two) sloping draw-off channels for the lime. The two horizontal channels into chambers 3 and 4 of the Lesser Kiln must therefore be for the draw-off of ash fallen from fireboxes placed above them and no longer extant. A larger and wider version of Otto's kiln is illustrated in Tomlinson's Cyclopaedia of Useful Arts, 1862, p.295 figs. 1474-5 and is said to have been used in lime burning at Rüdersdorf in Prussia. This has five fire-boxes set in a decagonal stack of masonry and leading into a relatively narrow flue lined with a shirt of firebricks. Kilns of this type are said to have been fuelled with wood, even brushwood. It must be stressed that Robertson's kiln was simpler than its German comparisons, but the archaeological evidence is entirely consistent: burnt lime was found in chambers 1 and 2; a thin layer of uncontaminated fine ash in chambers 3 and 4. The layering of lime and fine ash found in the chimney and described above is more consistent with the calcination of layers of nodules in the chimney than with the burning of alternating layers of lime and fuel.

Clear though it is that the building in Area H was cleared up soon after the Cement Works went out of use, it must be emphatically denied that it was never completed.

One thing is clear: it is later than the Larger Kiln. The primitive yellow stucco which is typical of all other buildings (see above p.27 and below p.70) is absent. The cement renderings of the walls and the cement linings of the sloping draw-off channels is superior to that found elsewhere on the site. Its analysis strongly suggests close relation with the cement blocks found in the entrance to the Larger Kiln: the inference is therefore that at least some of the cement used in Area H was produced by the works itself. Plate XVa shows the evidence for reconstruction of the outer walls of the building in Area H, the latest stage incorporating bricks from the Larger Kiln–evidence therefore of repair for a picnic area in which the walls and chimney were levelled off and topped with *modern* cement, quite different in composition from the cement incorporated in the structure

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itself. This obviously was the state of the building in Plates XI a, b: Plate XII b shows by comparison that the level of the chimney was considerably lower at the time of excavation.

AREA G—The Larger Kiln, Plates XVI-XVIII.

Before excavation the Larger Kiln was completely buried with earth and shrouded by shrubs of seaberry salt bush (Rhogodia baccata) and myrtle-leaved milk-wort (Polygala myrtifolia—an introduction from South Africa). In construction the Large Kiln is reminiscent of an Italian Brick kiln, built in drum-like stages of coursed stones. Little of the facing survives, but a small stretch of fine walling on the southern side has remained intact (Plate XXII b) and serves to give an impression of what the surface was like. The coursing inside the facing was kept in position by thin iron bands (like barrel hoops) circling the structure and lying horizontally inside the walls.[73] The impression given by the paintings of a structure composed of superimposed circular drums is misleading. The back of the kiln was a massive wall built into the cliff face with two lateral projecting arms at an angle. Although the kiln was built in tiers, only the upper free-standing drums could have been circular. For fully two thirds of the total height the drums backed into this massive spinal matrix of the kiln which enfolded them in its lateral projections or buttresses (Plate XVII). Their rounded sections were therefore less than semicircular. At the back of this wall, two other buttress walls fell obliquely to the cliff face, as can be seen in the paintings. The front buttress walls descend in stages on the surface of the cliff and are constructed on a specially laid bed of compact clay. The 'spine and arms' are built of large dressed squarish blocks on the inside with narrower sub-rectangular stones on the outside. The mortar is whitish. The drums are of coursed rubble, surprisingly loose, but with a smoothly dressed face. The mortar here is a deep golden yellow clay. Its condition is dilapidated. It has been robbed of stone, deliberately cast down and filled. One can see that the drum structure was not simple: the bonding included obliquely rising eccentric courses, one of which can be seen above arch b, Plate XVI B.

Bricks were not extensively used in the buildings of the Works and are largely confined to the lining of flues, the arches of the kilns and the flooring of tanks. These bricks, very probably a local product, are of a dull orange porous material with lumps of bright orange in the clay. There is a characteristic flange running centrally long side, indicating the overflow from the pressing machine. Many have thumb and finger prints on opposite corners; and a few have a primitive frogging (Plate XXI a). Identical bricks are used in Saint Peter's Anglican Church in Mornington, which was built in 1859. They are almost certainly the product of the local brickworks. According to the Statistical Register, a brickworks existed in Mornington from 1856 onwards and an entry in the Minutes of the Mount Eliza Roads Board (6 May 1861) refers to Lintott's brickfield.

Firebricks were placed in the keys of the arches as well as in the base of the flue in Area F. These are well made gritty white firebricks baked to a smooth cream exterior. They bear a stamp: "A. A. Christie, Wallyford Brickworks" (Plate XXI b).

A J. Christie made bricks in Commercial Road, Prahran, in these years, [74] but there is no record of a Wallyford brickworks there. The source is Wallyford near Musselburgh in East Lothian, Scotland, near which there is a long, if intermittent history of brickmaking [75] near the historic battlefield of Prestonpans.

The body of the kiln was cylindrical to about 7ft. of its height: above this the chimney was a truncated cone. In Britain by this time kilns in the shape of inverted bells or bottles had long been in use, a shape already used for the lime kilns on the Nepean Peninsula. [76] A number of references indicate that a high temperature was not necessary in the firing of cement: Parker and others had in fact been mistaken in overfiring their Roman cement. There can be no doubt at all that cement bricks were burned in this kiln: several were found in both entrances, some with knobbly patches of a slight greenish glaze noted by Jameson (loc.cit. p.564) as typical of septaria: 'before the blowpipe it intumesces and melts into a greenish black slag'. These cement bricks (Plate XX b) are uneven in shape, but bear the clear imprints of having been crudely moulded in a machine.

No representation survives of the kilns used in the manufacture of Roman cement in Britain, but the description given in Cresy's Encyclopaedia of Civil Engineering, 1856 [77] shows that Parker was by then using an inverted conical kiln in a cylindrical skin with an inner basal conical device for separating the cement from the clinker—nothing so simple therefore as Robertson's big kiln. There are photographs of the kilns used by William Aspdin (son of Joseph Aspdin) who set up a works for making Portland cement at Northfleet, Kent, about 1846. These are inverted bell-shaped kilns with conical chimneys or 'domes', each with wide arched doorways, which in some respects resemble those of Robertson's kiln. Basically the Aspdin kilns are of a shape very generally used in manufacture of cement in the second half of the nineteenth century and which became the prototype of the kilns erected for lime-burning at Coimadai, Waurn Ponds, Lilydale and other places in Victoria. They are not like the Larger Kiln: among the immediately obvious differences are the two small arched flues entering the walls up the side of the Larger Kiln 8ft. above ground level. The side view of one of these is shown in Plate XXII a. See also the coping of the chimney rim, which compares with that of European kilns (Plate XXXII).

The most telling parallel to our structure is that on p.268 of Otto's Lehrbuch, where he describes the cement manufactury in Wollin Island, Stettin, Prussia. The kiln in use was cylindrical, 10ft. wide at the base, 50ft. high and narrowing towards the top. There are threee draw-off channels at the bottom and three doors placed at a certain height above the base. The cement bricks were sandwiched between three thick layers of wood, one at the base, another in the middle and one on top. The access doors above the base level were for firing the middle layer of wood. This arrangement agrees perfectly with the Larger Kiln, not only in explaining middle-level flues but also the necessity for access to

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the upper back of the kiln. Above the extant level of the chimney there must have been an arched entrance into the back of the kiln through which the upper layer of cement could have been loaded, topped with fuel and fired. The sloping buttress walls at the back of the kiln, like those in the lime kilns at the Nepean Peninsula, protected the entrance to this door. Access to the side firing channels of the kiln was provided by the tops of the curtain walls.

AREA F AND THE SEDIMENTATION CHANNEL, Plates XXV and XXVII

Area F is by far the most difficult to understand and to describe. Probably there existed a boiler of some kind. A beautifully built well of locally made bricks, not circular but ovoid in plan, 1ft. 6ins. in its greatest diameter, has placed beneath it a small firebox with two Wallyford bricks set in the base. This whole structure is set in ironstone masonry and is placed to the eastern side of a very solid revetment wall (Plate XXV a-b), to the top of which an arched channel leads, under an open conduit which leads towards and curves away from the stone platform above the well. At the base of this revetment wall, especially in the area of the adjoining firebox, the stones are burnt to a pinkish hue. The inside of the brick 'well', however, above the firebox, shows no sign of burning, but the inner surfaces of the bricks appear rubbed and cracked, suggesting that perhaps a cylindrical metal boiler was placed inside them.

Running at right angles to the revetment walls in the direction of the kiln was found the base of a large wall aligned with the firebox. On the outside of this wall ran a 2½ inch iron water pipe equipped with a stopcock and gasket. The interpretation of this installation can only be determined by the following factors:

(i) It is set into the side of a platform of artificially built-up ground.

(ii) On the platform above it a shallow cement lined conduit channel leads towards it and away from it. This is marked on plan, Plate VI, and can be seen for 20ft. leading towards the top of Area F. Beneath it and away from area F is a brick-arched channel (Plate XXVII C) of which several feet survive.

(iii) As stated above, the brick-built well has not been burned: the inner surfaces of the bricks are crackled and compacted by pressure against them.

(iv) The area was supplied with water.

Our opinion is that it was all part of an evaporating or sedimentation process. The ovoid-section well can only have been intended to hold a cylindrical boiler and a pipe. Steam passing through this pipe was channeled into the arched channel under the shallow conduit. It seems cumbrous; but there seem only two alternatives in view of Robertson's requirements. He would need to grind his product to powder and very likely used steam-powered machinery to do this. But to erect it in such proximity to the Larger Kiln, which by all accounts would have been unapproachable for many days during firing, would have been madness. Placing an evaporation unit by the kiln would have had advantages, and in this case might well have been helped along by an occasional ancillary source of heat.

The open conduit can be picked up at many points along the line indicated in the site plan. Its lining is of a distinctive yellow ochre colour and can be picked up for a stretch of 10 yards south of Area B. Here the making of the path to the picnic table and washmill has shaved the conduit along its length leaving fragments of bricks and the yellow cement lining in a well defined layer about 2½ feet above the surface of the pathway.

Fragments of the cement recovered from this layer make up a shallow section of a neatly dished pan, so that there is no doubt that they lined a channel of about the same width as the conduit to Area F. This cement is of a basic yellow sandy constituency mixed with black grits and small light brown pebbles. Despite its crudity and a certain porosity, it is reasonably durable and practical enough. Analysis shows that it contains only twelve percent of Ca.O. and no magnesium, and is largely clay stained yellow by traces of iron.

The existence of the open conduit south of B is of prime importance for understanding the earlier topography: it ran across the area of the modern road, proving that this was not the original access to the site. It must have taken water from a higher to a lower point–from F to B, which is lower, and cannot have extended across the settling tanks, beyond which the ground is higher. Very possibly it led to the washmill or the stream, for a stream, possibly dammed, ran on the southern edge of the settling tanks. The line of the stream bed on the site plan is not entirely based on this deduction or yet upon report of a stream on the seaward stretch of the line. It is based also on the existence on east and west of the pathway of two stretches of the original stream declivity and a vegetation change clearly indicating the continued underground flow of moisture. The point of origin of the conduit is problematical. In view of Robertson's need to purify sand, there seems one obvious suggestion: the three deep tanks (Area D) were intended as sedimentation pits (one overflowing into the other) and the final solution of fine sand was run in a long channel round to the kiln area and back to the mixing area. The surplus flowed into the stream. The fine sand deposited in the channel was then washed out with clear water and used for the cement mix. Exactly such a long, narrow sedimentation channel running from tanks was used for purifying chalk for adding to marl in a German cement works at Wollin Island, described in Dingler's Polytechnisches Journal, CLXIV, p.433 and CLXXVI, p.405 This theory gains some weight from the thick deposit of extremely coarse sand grains examined in the central deep tank.

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THE JETTY

Although Robertson's tender called for the construction of a jetty and both Rev. George Cox (loc.cit.) and local tradition say there was one; and despite the fact that an imaginary reconstruction of the Cement Works by Mr. Hunter Rogers in a water-coloured drawing (Mornington Historical Museum) shows a jetty, no precise information about its location could be obtained. It is not marked on any map and scuba divers have been repeatedly questioned by us about it. It is clear from their reports that no substantial remnants of a jetty exist undersea. It would obviously have been impossible to drive wooden piers in to the hard slippery shelf of limestone that forms the immediate sea bed around Fossil Beach; a stone structure must have been envisaged by Robertson, and one at least thirty yards long to reach sufficient depth for laden boats. We believe that at the point marked 'remains of jetty' on the site-plan we have found parts of a structure originally intended to form the base of a jetty. There is not much: the main evidence consists of three well-dressed rectangular granite blocks, closely fitted together in a straight line and situated some 15ft. out from the modern sea wall. They are carefully cut into the limestone sea bed. 8ft. further out, there is a mass of about sixteen cubic feet of dressed stones cemented together by the typical yellow cement used in the construction of the Works. This mass appears to have fallen over from an upright position, but there is no guarantee that it belonged to a jetty: it might easily be a lump of old sea wall rolled out to sea. The position of this mass is 58ft. out at right angles to the modern sea wall at a point 83ft. from its southern end.

There are, however, other factors which support the theory of the existence of a jetty at this point. The three dressed and laid blocks mentioned above are directly aligned on the drain-like structure previously alluded to (p.65). This 'drain' is a pier or a channel constructed of bricks laid in concrete and is not more than 1½ft. in length. It is made of the same bricks used in the Works together with machine-made Clifton bricks of a very recent date. Embedded in the limestone sea bed about 5ft. out from the 'drain' remnant is a group of early bricks. There are a number of Clifton bricks lying about the sea bed nearby. Clearly this 'drain' is some secondary structure; but there is the distinct possibility that it replaces and incorporates an earlier one consisting of low brick piers supporting a wooden bridge on to a jetty. Or indeed, even if it is entirely secondary, it is difficult to understand the function of any brick structure at this point unless it was connected with launching boats. The Clifton bricks might well be relics of more recent attempts to refurbish Fossil Beach as a picnic area. It should further be remarked that a jetty could certainly not have been conveniently situated anywhere else for easy access, since the cliff is elsewhere too steep. That it would be logical to have the jetty placed near the storage area and that its suggested position is conveniently aligned on the edge of the Works. The Map of 1862 (Plate III b) shows a shoal of rocks at this very point which may well have formed a natural base for a jetty. Robertson must have envisaged shipping his cement: carting it out of Fossil Beach would have been tedious and cartage to Melbourne more expensive. Yet why is no jetty shown in the Admiralty map (Plate III a)?

Seemingly we have raised in this report as many problems as we have solved. Documents may one day come to light giving some more precise indication of what James Robertson aimed to do here. Meanwhile we hope to have at least preserved an interest in the fast disappearing ruins which enhance this beautiful beach. A visitor informed us that

he could remember visitors playing on the 'lawns'. Indeed the early photographs (Plate XI a) show clearly the well trimmed grass verge in Area H. And was there *cricket* after the picnic (Plate XXVIII a)?

No ordinary limeburners built it. It was a 'planned industrial site', however humble–and one of Victoria's earliest. The walls throughout are built by the same builders, the stones fitted with an extraordinary care. The stepped drums of the Larger Kiln, the internal 'heliacal' wall, the coping on top of the chimney which we see in Miss Scott's oil painting and Mrs. Gleadell's watercolour do not suggest haphazard work. The German connections we have noted are a little surprising, but we must remember Robertson's middle name Möller and the fact that a considerable amount of German cement was reaching Australia in 1862 (note 21). With the information available it is not possible to be more specific. We must at the same time remember that the manufacture of cement in England and Germany had advanced well beyond what was practised at Fossil Beach: but quite clearly there appear to have existed in Europe pockets of more primitive manufacturing.

The digging was done by us both, our wives and our children. We are grateful to the folk of the Archaeological Society of Victoria and the Mornington Historical Society who came to help, and to local advice and legend: to the gentleman who said it was all a gun emplacement in the First World War: to the gentleman who said it was all 'built by Iti's who danced naked on the lawn': to the lady who 'quite distinctly remembered it working when she was a girl'. And to the man who asked 'How much an hour do you get for doing this?' Above all to the American's praise : 'There is nothing like this back in the States'. They sharpened our wits. W.C. wrote the report; J.T. did the surveying, drawing and photographs, with Joan Henderson some photographs. The Newcomen Society and the Cement and Concrete Association of Great Britain supplied photocopies of unobtainable books. Doreen Cross interruped her social life to do much newspaper searching: we are grateful to her. Members of the Archaeological Society of Victoria made a financial contribution towards publication. The Mornington Foreshore Reserves Committee obligingly fenced off the site permanently: may God preserve it.

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Footnotes

1. Geological Surveyor's Report, 1st Nov. 1854, p.5

2. See p. 12.

3. Secretary General's correspondence B.6410, letter from Mr. Goodall.

4. Tender called by A.B. Balcombe and the Central Roads Board, The Australian Builder and Practical Mechanic, Oct. 2, 1856.

5. According to the Handbook to Australasia, 1856, p.11, Osborne was surveyed and laid out for a township by 1856. On the survey map of 1848 it already appears as reserved.

6. The full extent of the jetty was not completed until 1869, A.B. Balcombe's letter requesting the completion of the work is preserved in the Secretary General's correspondence C.10492. See Leslie N. Moorhead's, Mornington in the Wake of Flinders, 1971, pp. 67-75 for the development of Schnapper Point in the 'Golden Fifties'.

7. The Argus, May 23, 1862, p.1, and following issues.

8. The Guide for Excursions from Melbourne (H. Thomas, Melbourne 1868), p.44.

9. Minutes of the Mount Eliza Roads Board, 4 Aug. (Frankston Municipal Offices).

10. The Autralian Builder, Aug. 6, 1859, notes with enthusiasm the discovery of good lime in the Beechworth district.

11. Local builders' prices are preserved in The Australian Builder, Feb. 16, 1861: Heads Lime and slaked lime at 3s. 0d. a bag; Geelong Roach Lime at 5s. 3d. a bag. These prices had obviously risen steeply in the two years 1859-1861, for the Prospectus of the Consumers' Lime Association (see below p.9) already complained of Heads Lime landed on the wharf at 2s. 4d. per bag and Geelong at 3s. 9d. in 1859. The only existing record before that is in the Patriot and Melbourne Advertiser, July 22, 1839, where lime at £ 2 a ton was given free cartage to any part of the town.

12. For 'Lime Kiln Point' in the Geelong area cf. P. L. Brown (ed.) The Narrative of George Russell, (1841) p.17. The Geelong burners had already established an export industry as early as 1841, when the Dusty Miller and other schooners took cargoes of lime to the Launceston market, W. Randolph Brownhill, The History of Geelong and Corio Bay, 1955, pp.402-403. By 1848 the partnership of Taylor and Boucher was operating the kilns in Corio Bay.

13. The fullest account of the lime industry is contained in C. N. Hollinshed's article 'The Nepean Peninsula in the Nineteenth Century,' Victorian Historical Magazine, 28, 1958, where some of the information is gathered from local tradition. The main deposits of lime were at Portsea and Rye, but there were also kilns at Cameron's Bight, Sorrento and at White Cliffs. George C. McCrae (loc.cit.infra) recalls that the bulk of the lime in the 1840s was shipped from the White Cliffs and Hollinshed suggests that limeburning developed more rapidly at Portsea because of the better loading facilities (p.163).

14. Seventeen kilns were burning lime at the Heads in 1845. There are two kilns extant between Point King and Point Arthur. One of these, about fifty yards to the west of Point King, has been incorporated into an elaborate limestone beachhouse. The breast wall and the two 'fly' walls at right angles to it are fully preserved. The small flue is set in a vertical facing wall of brick (Plate XXIX a-b) and is topped by a pointed arch. The entrance is covered with a substantial brick arch.

The chimney is filled in, but was clearly of brick and very likely bottle-shaped. It is about ten yards from the water's edge and has the remains of a jetty in front of it. Fifty yards along the cliff in the same direction is a kiln of more primitive structure, situated in the back of the garden of Mrs. Swanson of Merrilands Court, Sorrento(Plate XXX a-b). This is a bottle kiln of handmade pressed bricks. The entrance is set back towards the flue and the breast above it is supported by large wooden beams stepped downwards above the flue. The draw-off is small, square, with a low arch above it. The wing-walls, like those of its neighbour, are cut obliquely towards the top. There is a large pile of burnt lime in front of the kiln and the road leading up to its top can still be traced.

There are sites of two adjacent kilns in the garden of Mr. C. Arnold, 30 Napier Street, Rye, in a bluff of land facing the modern jetty at Rye. A larger structure is entirely covered, though the substantial loading platform at the top still survives and bricks from it are built into a circular sandpit on the site. A substantial portion of the chimney of a smaller kiln is extant, built entirely of rubble limestone and mortar. The bricks have been robbed from this, but its primitive structure suggests that it was an early example. According to local tradition these kilns were the property of W.A. Blair who selected much of the land at Rye in 1859: and it is very likely that the larger kiln was erected by him.

A house built from the material of a once adjacent kiln belonging to the Wallace family is to be seen at 100 Dundas Street, Rye. Further up the same road on the southern side is the site of 'Russell's Kiln' said to have become obsolete in 1909. The property to the north of this road, locally known as 'Cess Jennings' property,' is said to contain the sites of other kilns.

The kiln and cottage of the three Cairn brothers are largely extant at Boneo in the property of Cnr. T. Barker immediately on the northwestern side of the crossing of Cape Schanck and Brown's Roads at Boneo.

Fully preserved is the kiln on the property of Alfa Downs at the back of Rye. This is structurally very close to the Merrilands Court kiln and stands close to the site of the former Alfa Downs homestead (Plates XXXI a-b). A short typescript by Mr. Norman Hall sent to A.E. Bottomley, former owner of the property, identifies this kiln as that built by Patrick Sullivan, who leased this region in 1856, and claims that it was built close to that date. Mr. Norman spent some of his boyhood with the Sullivans and is certain of the family tradition that this kiln dates from the earliest period of occupation. It is built into the side of a low hill and the position of the loading ramp, now cut away on both sides, can be clearly seen. According to this authority, Edward Skelton's kiln stood at the corner of Browns and Jennings Road on the northern edge of the Alfa Downs property. The site, especially the thick limestone loading platform, can quite clearly be made out a hundred yards beyond the field gate on the northwestern side of the road junction.
There is no record of the whereabouts of the kiln on Cameron's Bight, but there are some 19th century bottles from Cameron's Creek preserved in the Rosebud Aquarium Museum. I am grateful to Mr. T. C. Le Souef for details of them.

For the role of the Limeburners in the settlement of Sorrento, see Gerald Byrne, 'Early Days in the Mornington Peninsula,' Victorian Historical Magazine, XIV, 1931, p. 185-6. The Prospectus of The Consumers' Lime Company, of December 1859 places 29 lime kilns at the Heads and 4 at Geelong for the Melbourne Market. These together, working below capacity, the Prospectus claims, were producing 16,500 bags per mongh. Notes by George C. McCrae, Victorian Historical Magazine, 1, 1911, describe the limeburning as concentrated between Point Nepean and White Cliffs and records the names of Limeburners in the Nepean area: Sullivan, Ford, Thomas and William Devine; in the White Cliff region: Owen Cain, Cameron, White, Sherlock, Tonks, Home. Of these Ford, Cain and Sullivan are also recorded by S.H. Wilson in an account of the Limeburners in The Argus, March 12, 1932, who adds Watts, Hughes, Spunner, Moss, Sutton, Blair, Campbell and Walker to the list of family names of limeburners. Ford is stated to have constructed the wooden jetty at Portsea, remains of which were visible in the 1930s (Plate IVc). The list of Limeburners is augmented by the reminiscences of E.J. Williams in The Peninsula Post, Oct. 4, 1940, who gives J. Swan, E.Williams, E. Skelton, George White and Sons, R. Quinan, Harry Hall, Benjamin Stenniken, as well as the names of two limeburners operating at Boneo— Cairns Bros and James Paterson, he also names Pat and Ted Sullivan and Owen Cain. A short reference to Edward Skelton, limeburner (Sorrento) is given by James Skelton, The Peninsula Post, Sept. 13, 1940. A more extensive list could almost certainly be compiled; but it seems unlikely that the date-range of the various limeburners can be established.

15. The limeboats were a mixed lot: George McCrae recalls schooners, ketches and cutters ranging from 20 to 50 tons, and mentions that there was not a square-rigged ship among them. Incidentally, he speaks of a fleet of 'over 40 vessels' and records that some limeburners built their own ships and employed sailors. The only limeboat known to us in illustration is The Sloop Jemima, in which Georgiana McCrae made jouneys to Melbourne (Plate IV b). According to McCrae (Georgiana McCrae's Journal) this limecraft transported the family to their run at Arthur's Seat, then continued on to Point Nepean. The skipper, Walter Maclaren, was a Scotchman with crisp curling hair turned red at the ends through constant association with lime. [1845]

16. The decline of the industry is clear from F.F. Bailliere's, Victorian Atlas, which lists only one lime kiln in Mornington County in 1862 (but see p.17). But the Survey of Lands 1865-75 reserved several blocks for kilns between Rye and the Quarantine grounds and the Staticstical Return of 1867 gives 9 operating kilns.

17. Hollinshed loc. cit., speaks of the carting and general work performed by Chinese and Portuguese immigrants. A tradition is still known at Rye that certain of the participants came from Cape Verde Islands. These Portuguese were probably refugees from shipwrecks.

18. This was not before 1856 when, during the great interest shown in building materials and builders exhibitions, it is noted that only Geelong limestone had been used hitherto: The Australian Builder, Jan 19 1956, p.127– and that apparently seldom.

19. See note 14.

20. This is clearly different from the Consumers' Lime Company and is a body whose Deed of Settlement survives in Melbourne University archives. It was established in January 1860, and sought a capital of £5,000 in £5 shares. Its operations were generally stated in the Deed, but there is nothing of specific interest here except to note that the chartering of vessels was envisaged and that the making of 'Cement Plaister' and prospecting for Cement Stones were not to be undertaken without a special meeting of the shareholders. I thank Mr. Frank Strahan for calling my attention to this document.

21. Imported Portland Cement was 7s. a bushel in 1861, The Australian Builder, Feb.13, 1861, p.38. The quantities of cement imported to the colony are given in the Statistics of the Colony of Victoria as 1,692 tons in 1862 (p.77) and 1,909 tons on 1863 at costs of £10,823 and £12,857 respectively. The bulk came from England, but there were small amounts from France, U.S.A., and Germany, together with some transhipped from New South Wales. The cement from U.S.A. was natural cement; that from France most likely natural; that from Germany almost certainly 'Portland' type from the works established at Buxtehude near Hamburg – cf. P.E. Halstead, loc.cit., n.56, p.44. Atkinson's 'Roman' cement was the English cement most widely advertised in Victoria.

22. He was living in Kew and was appointed surveyor to Kew Town Council in January 1861, F.G.A. Barnard, A Jubilee History of Kew, p.20. The South Bourke Standard, May 31, 1861, p.3 notes his report on the survey of Studley Park, Kew, to the Municipal Council and his estimate of £410 for fencing it.

23. Registered 1856-7 as Robertson and Hale 'architects and estate agents' and 1858-62 as 'architects' simply, 9 Elizabeth Street and 57 Flinders Lane East. Cf. The Melbourne Directory, 1858-1862.

24. The Australian Builder [and Practical Mechanic], June 26, 1856 received tenders for driving the piles for the construction of St. Kilda baths, which had been called by the St. Kilda Municipality in May 1856 ibid. This appears to have been their first large operation. Previously they had called tenders for alteration to a bank at Beechworth, ibid, May 21, 1856. Ibid, Aug. 14, 1856, p.1 tender for basement vault of the Oriental Bank Buildings, corner of Queen and Little Flinders Streets. Further Tenders: The Aust. Builder. Oct.15. 1859, p.354; Nov.29, 1859, p. 59 (Bank at Hamilton): Dec. 3, 1859, p.3 (House on corner of Cotham and Barkers Roads, Kew). The Argus July 7, 1860 for work at the Grange for the Bank of Victoria. The Argus, July 18, 1860, p.8 for erection of a blue stone building. The Argus, Nov.1, 1861, for the erection of a grandstand at Melbourne cricket ground appears to be the latest published tender of the joint partners.

25. The Australian Builder, Aug. 14, 1856, p.194.

26. The setting of this rather obscure controversy against the legislation and regulations of the time is given by D. Sutherland Lyall, The Architectural Profession in Melbourne 1835-1865 (unpublished M. Arch. thesis, University of Melbourne, 1965). (I am grateful for his permission of reference). Mr. Lyall concludes that 'it is doubtful whether Robertson and Hale received justice' p.64ff. The fact remains, however, that they consistently refused the opportunities to clear their name before the Association, of which Robertson appears to be one of the founding members. The Minute Book of the Association is preserved by the Institute of Architects

27. The Australian Builder, Mar.12, 1859, p.75.

28. This affair might have had something to do with Hale's resignation from the chairmanship of St. Kilda Public Works Committee, which he had held for three years, and his decision in March 1860 not to offer himself for re-election to the Council (The Australian Builder, Mar. 17, 1860, p 17). But the faith of his colleagues was manifest the following week (ibid., Mar. 24, p.85) when he was unanimously elected valuator for the district. His work was probably now concerned with land value assessments and it was possibly he who had brought the 'real estate' interest into the partnership. There is also some suggestion that he was originally a carpenter, and at least one of the tenders put out by the firm (The Australian Builder, Jan.8, 1859, p.8) was for a timber residence. J.B. Cooper in A History of St. Kilda, II, Appendix A, lists Hale on the Council from 1857-1861 and mentions his obdurate stand on the St. Kilda plaque affair. A letter from Thomas Hale M.C. to The Argus, Dec. 28, 1859 on the subject of the Aurora australis is written from 'the look-out of his campanile' (in Merival Street, St. Kilda). It shows his scientific interests, but at the same time is pedantic beyond the normal acceptability. He quotes a Russian poem by Loinonosov. In 1863 Mr. Hale was established as a carpenter and builder at 2 Station Street, Windsor and called a number of tenders for carpenters and bricklayers (The Argus, 1863, May 2, 6, 7, Sept. 15,). His main job in this year was the erection of a Grandstand to hold 200 spectators on the Melbourne Cricket Ground (The Argus, Oct. 19, p.3 and Oct. 21, p.7) for the occasion of the matches with the English cricket team which was coming out for the summer (see 'Cricket News', The Argus, Dec. 26, 1863, p.6).

29. South Bourke Standard, Jan. 15, 1862. See note 22.

30. South Bourke Standard, Sept. 20, p.3; Sept. 27, 1861, p.3 See also ibid., Oct. 5, p. 3 and Oct. 11, p.3, 1861.

31. Ibid., Aug. 16, 1861, p.4, col.3 There was an additional sum of £11.15s.0d for surveying instruments.

32. Ibid., Jan. 10, 1862, p. 3, col.3.

33. The addition of surveyor was not perhaps particularly significant, since it was commonly assumed by 'architects' and builders of the period.

34. The paving of Melbourne with stone slabs had begun about 1855, The Australian Builder, Aug. 30, 1855 p. 39: 'Now that we are able to communicate more easily with each other in our locomotion, we hope that we shall the more readily catch our opportunities and mature more effectually our designs, upon true go-ahead principles.'

35. Apparently until 1859 city flagging was still being contracted for in England (The Australian Builder, Mar. 26, 1859, p.91) and a slightly indignant letter, ibid., Feb. 5, 1859 p.36, points to the folly of taking this capital outside the colony unnecessarily. We may take this as another 'opportunity' seized by Robertson, but which in fact was not granted the the Registrar.

36. See below p.19, and L.J. Vicat, A Practical and Scientific Treatise on Calcareous Mortars and Cements, trans. Capt. J.T.Smith, London, 1837.

37. This is puzzling. It is not impossible that some American goldrush 'relicts' opened such a works, but I can find no other direct reference to it. American brickmaking machinery came into use in Victoria in 1856 and a brickworks using it was established on Saltwater river (The Australian Builder, April 30, p.72, also May 21, June 26, 1856; The Argus, Dec. 18 and Dec. 22, 1856— references owed to the kindness of Mr. Miles Lewis). See also Brayton and Berry's Patent Brickmaking Machine, The Australian Builder, Jan. 21, 1860, p.9. American machinery might well have been in use at Mt. Martha, rather than men — but this is only a suggestion. Miss Jean Olley of Mornington kindly informs me that Mr, Robert Olley made bricks at Mt. Martha before being employed at Fossil Beach Cement Works.

38. See p.9.

39. E.M. Davies, 'Balcombe Bay, A Classic Area for Victorian Geology', The Victorian Naturalist, 77, May 1960, pp.14-18.

40. The more detailed sequence, confirmed by a Geological Survey Bore situated 150 yards to the north of the present entrance road to Fossil Beach, is given in V. A. Gostin, 'Tertiary Stratigraphy of the Mornington District', Proceedings of the Royal Society of Victoria, 79, 2, 1966, p.449ff. especially p.485.
I am grateful to Dr. Gostin for the photograph which appears on Plate XIXb, and for pointing out that the formations at Fossil Beach are strictly speaking concretions rather than nodules.

41. F.A. Singleton, Proceedings of the Royal Society of Victoria, 53, p.82 regards it as a fault with a northerly downthrow.

42. T.S. Hall and J.B. Pritchard, 'Geological structure about Mornington', Proceedings of the Royal Society of Victoria, 14, 1901.

43. F.A. Singleton, loc. cit.

44. 'Knight, Bevan and Sturges' cement was widely advertised in Victorian newspapers of the late 50's and early 60's (e.g. The Argus, Dec. 16, 1861, p.3). Lias cements were well known in England.

45. Doubtless the recently opened Collingwood gas works was intended.

46. Joshua V.H. Clark, Onondaga; or Reminiscences of Earlier and Later Times, 1849, pp.65-66.

47. See letter to The Age, March 25, 1967 by G.S. McLaren.

48. Lands Department, Melbourne. This map is in poor condition and is difficult to reproduce.

49. Minute Book of the Mount Eliza Roads Board, Shire Offices, Frankston.

50. The Board was empowered to give permission to take timber and stone from Crown Land without licence.

51. Another interpretation is that the selection by W.A. Blair at Rye in 1862 under the Land Act (see n.14) had put all Rye-Tootgarook private kilns out of action and that only the Blair kiln at Rye was returned. Thus the Mornington kiln, which was not strictly speaking a 'lime kiln' (in the sense of a part of a lime-producing industry) was not registered.

52. This reference is owed to Mrs. L. M. Moorhead's The Story of St. Macartan's (R. C. Church, Mornington) 1970.

53. In appendix to H. Reid, Practical Treatise on the Manufacture of Portland Cement, 1868, p.71

54. Selwyn had noted that they existed in no great quantity; see p.9.

55. See also Ure's Dictionary of Chemistry and Practical Mineralogy, 1834, under 'septaria'. The reference is to Jean-Baptiste van Helmont, the sixteenth century Belgian chemist. Cf. E. Chambers (ed. Rees) Cyclopaedia etc., 1781,sv. Septaria were dredged in large quantities at Chichester, Weymouth, Harwich, Sheppey and Broadbench in Dorset. Cf. Jameson's A System of Mineralogy, 1830, p.564. Ibid, Vol II (p.86) indicates in a footnote that the raw material for making Parker's cement was the septaria of Isle of 'Shepey' in the Medway. 'From these septaria are manufactured that excellent building material for building under water known by the name of Parker's Cement.' Conybeare and Phillips, Geology of England and Wales, p.27 note that the Sheppey nodules used for making cement had been separated from the clay by the action of the sea. They were in fact dredged by boats from the sea bed at Harwich.

56. P.S. Halstead, The Early History of Portland Cement, Newcomen Society, 1961, gives the early differentiations between Portland and Roman Cements.

57. A;P; Thurston, 'Parker's "Roman" Cement', Transactions of the Newcomen Society, XIX, 1938-9 pp.193-206; ibid, Engineering, 147. 1939, pp.757-8. Smith's appendix LXXI to Vicat. p.220. Cf. Morning Chronicle, London, April 15, 1802, where Parker's enterprise is described.

58. The same analysis is given in Cresy, Encyclopaedia, 1847, p.721. H. Reid, Practical Treatise etc., pp. 14-15 gives many other analyses of cement stones. From these it can be seen that some of the Fossil Beach septaria analysed by Wood (p.21) had a lime content well above average.

59. A.C. Davis, Portland Cement 1824-1924 (London 1924) p.63. For a comparative treatment of early cement making (including Aspdin's and Dobbs' work) see C.J. Jameson, Portland Cement, Its Manufacture and Uses, New York, 1898.

60. This analysis is, incidentally, published in A.R.C. Selwyn's A Descriptive Catalogue of the Rock Specimens and Minerals in the National Museum, 1868, p.56, no.12.

61. G.R. Redgrave and C. Spackman, Calcareous Cements, 1924, p.11.

62. This detail I owe to a memorandum on Victorian limestones by John C. Liddy of the Applied Science Department of the National Museum.

63. Mr. Cox's suggestion ibid., that any cement which actually reached the market may have come from the company's Geelong works is unsupported. There is no evidence of any operations at Geelong.

64. Fat limes were sometimes mixed with natural cement stones in U.S.A., cf. H. Reid, A Practical Treatise on Concrete and How to Make It, 1869, p.80.

65. It is very likely that Captain Charles McMahon (later, Sir Charles McMahon M.L.A.) was one of them. The McMahons owned property on Frankston and at Long Beach, Mornington (minutes Mt. Eliza Roads Board, August 4, 1862). The Geological Survey Laboratory Register shows that two letters requesting an analysis and report of the septaria nodules were sent by Charles McMahon in September and October 1863. McMahon was a director of the Melbourne Banking Company.

66. Conybeare and Phillips, Geology of England and Wales, p.27.

67. A.W. Cresswell 'Notes on Lilydale Limestone', Proceedings of the Royal Society of Victoria, 5, 4, 1, 1892, p.38ff. The history of the development of the cement industry in the Geelong region has been written by W.B. McCann, History of the Descendants of Peter McCann, etc. 1943, especially the undertaking by P. McCann and Sons, Dryden estate, Fyansford nr. Geelong in the 1880's. In the late '60'x the McCanns had operated a kiln at Waurn Ponds. The process followed in making cement at Fyansford was considered to be the old fashioned method traditional in Victoria and involved the burning of cement bricks in bottle-shaped kilns. R.A.F. Murray, 'Report on Limestone Quarries on the Bacchus Marsh District', Geological Survey Progress Report, N.S.I, 1899, p.51 states that the Coimadai lime made by the Hydraulic and Alkamade Companies had only recently been brought prominently before the public although limestone had been quarried at Coimadai for more than thirty years. N. Ferguson, 'Notes on the Occurrence of Limestone at Merrimu', ibid, nos. 8-9, 1894-98 mentions two firms operating at Coimadai. Ibid, 8, 1894, p.68 gives the Waratah Bay kilns as working from 1878.

68. General Indexes to the Letter of Registration for N.S.W., 1885-1880. Specification of Letters of Registration 1848-68, Adelaide, 1883 gives the first patent of 1863 transferred through an agent by Frederick Ransome of Ipswich.

69. The Argus, January 12, p.8; January 14, p.7; March 1, 1865, p.3; March 3, p. 3; March 14-20; March 27-April 1. See also The Melbourne Directory, 1865, p.34. He was living in Catherine St., Richmond and already in September 1863 (The Argus, Sept. 2, p.1) he advertised for 'steady labourers' for building. He is listed in The Melbourne Directory until 1876 and apparently changed the location of his city office several times.

70. The Melbourne Directory, 1869, p.531. The partnership with Hale had broken and is not listed in the 1863 and 1864 Melbourne Directories. Nor do future tenders appear in their names. Thomas Hale was in construction business on his own and took out a patent for improvements in struts and floor joists in July 1862 (C.S.'s 560, R.G.O.'s 505), publicly demonstrated at the Carlton Foundry, Leicester Street, on October 6, 1862, according to The Herald of that day.

71. Statistics of the Colony of Victoria, 1870, pt. VI, p.43.

72. Shaft kilns were generally popular in Germany: for the structure of a simple intermittent type, less evolved than the Lesser Kiln at Fossil Beach, see Percy C.H. West, Manufacture of Portland Cement, 1910, p.183, fig.110.

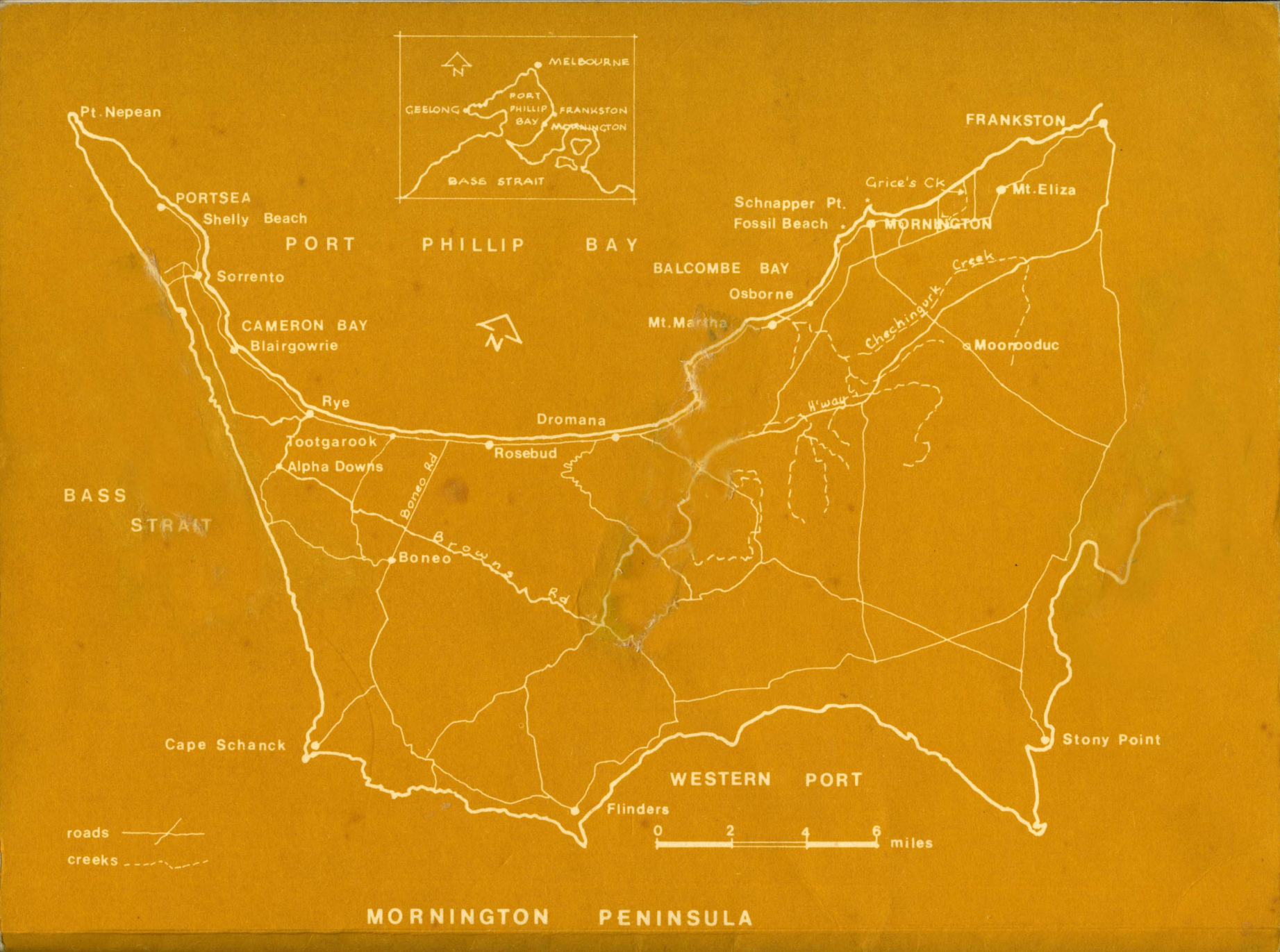
73. This form of iron hoop 'bonding' is not instanced in the Peninsular lime-kilns but is a prominent feature in the stonework of the Coimadai kilns (see n.67). It must be stressed that these iron bars lie horizontally inside the walls and are in no way equivalent to the iron hoops used in binding kilns in Britain as on Plate XXIII a. These bars in no way demarcate the drums of the Larger Kiln.

74. Sands and McDougall, Directory of Melbourne, 1860.

75. Mr. D.J. Bryden of the Royal Scottish Museum identified the brick. Other firebricks of similar composition have come from mid-nineteenth century buildings on the Peninsula. From the limeburner's cottage at Boneo (see n.14) come bricks marked 'I SHARP' in a rectangular incuse: bricks from a demolished building at Sandy Point, Flinders, are marked with the separate letters 'COWEN'. Both are Edinburgh names. On the importation of firebricks see Intercolonial Exhibition, Official Record, Melbourne 1866-67, p.392.

76. A.C. Davis, op.cit., p.63.

77. Quoted in A.P. Thurston's article: Engineering, Vol.147, 1939, p.758: 'Kilns for Burning Parker's Cement." That in Her Majesty's dockyard at Sheerness [Sheppey] is circular, 17ft. in diameter from out to out, and about 21ft. 6in. in height; an inverted cone occupies the middle, which has a clear diameter at top of 8ft. and at bottom of 5ft. 6in., where there is a conical mass of brickwork, which spreads the cement as it falls through the ash-holes or 'eyes'; there are four of these,placed at regular distances, each 30in. in width and 18in. in height to the crown of the flat arch that covers them; within are fire holes a foot square, which have iron bars to support the brickwork above them. Around the entire cylindrical kiln are four wrought-iron hoops 3/8in. of an inch in thickness and 3in. in width, for the purpose of holding the work together; these are placed at regular distances from above the lower arches to the top, and are held by vertical iron bolts where they join; the kiln will hold a charge or 30 tons of broken cement-stones measuring 20 cub. ft. to the ton, as well as the fuel required for burning it. When used,the bottom is covered with wood, and the coal and cement-stones are arranged in alternate layers, each about a foot in thickness; after it has been lighted for three days, the lower part may be drawn, and then by constantly filling up, this may be done every 24 hours; the cement-stones and coals are thrown in from the top, and every ton of cement-stones yields 21 bushels of cement powder. In the mill for grinding this cement, the materials are thrown by a labourer into a sieve containing 17 wires to and inch, which is shaken by the machinery attached to the steam engine, after which it is packed into casks and kept ready for use; two tons of cement powder are ground during the day."


MELBOURNE
PORT PHILLIP BAY
GEELONG
FRANKSTON
MORNINGTON
BASS STRAIT
Pt. Nepean
PORTSEA
Shelly Beach
PORT PHILLIP BAY
Sorrento
CAMERON BAY
Blairgowrie
Rye
Tootgarook
Alpha Downs
Boneo Rd
Rosebud
Dromana
Boneo
Browns Rd
BASS STRAIT
Cape Schanck
WESTERN PORT
Flinders
Stony Point
FRANKSTON
Grice's Ck
Mt. Eliza
Schnapper Pt.
Fossil Beach
MORNINGTON
BALCOMBE BAY
Osborne
Mt. Martha
Creek
Chechingurk
Moorooduc
H'way
roads
creeks
0 2 4 6 miles
MORNINGTON PENINSULA