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Convict Brickmaking at Port Arthur: 1830-1877 ¹

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During the mid-nineteenth century, the convict penal settlement of Port Arthur (1830-1877) represented one of the larger and more complex industrial operations in the colony of Van Diemen's Land. Here, multiple industries — ranging from primary resource extraction through to complex manufacturing — were carried out concurrently. The output of the convicts' labour not only supplied the needs of the settlement, but also met demand from the wider convict system and the free community. A constant reminder of the scale and durability of this production can be found across the present landscape of the Port Arthur Historic Site (PAHS) in the form of bricks. Incorporated into structures which represent the whole span of the settlement's existence, bricks are an utterly ubiquitous presence on the site. Yet in their form and function we are provided with a superb opportunity for considering the nature of Port Arthur's penal industrial operation. This article examines bricks as industrial artefact, using archaeological methods to derive understanding of how they were made and used. Combined with historical analysis, this will be used to discuss how convict labour was deployed and how the needs of industry were mapped onto those of penal management.

There is much scope for comparative studies of the Port Arthur brick industry to convict brick production elsewhere in Australia. However, while there are several studies of Australian colonial bricks available,² none address the peculiarities of production in a secondary punishment settlement hampered by technological and labour restrictions. Compared to early production in Sydney and Hobart, the

¹ This research was supported by an Australian Research Council Discovery Project, Landscapes of Production and Punishment (DP170103642) administered by the University of New England and the Australian Archaeological Association's Student Research Grant Scheme 2019.

² For example, W. Gemmell, *And so we graft from six to six*, North Rhyde., 1986; R. V. Varman, 'Bricks and nails: building materials as criteria for dating in Sydney and environs from 1788', PhD Thesis, University of Sydney, 1993; R. Ringer, 'Bricks', *The Dictionary of Sydney*, 2008 <dictionaryofsydney.org/entry/bricks> (18 October 2020); I. Stuart, 'The analysis of bricks from archaeological sites in Australia', *Australasian Historical Archaeology*, Vol. 23, 2005, pp. 79-88; S. Waight, 'Hobart brick heritage', conference paper given at Fabric: The Threads of Conversation, Australia ICOMOS Conference, Adelaide, 2015.

outputs from Port Arthur were very modest. By November 1790, just shy of three years after settlement, the Brickfields located on the outskirts of Sydney had three kilns producing 52,000 bricks per week with 52 labourers working under a skilled brickmaker, peaking later that year with 98 men working at the site.³ In Hobart a kiln capable of firing 30,000 bricks and tiles per month was operational as early as November 1804.⁴ However, in both instances the brick quality was identified as being very poor, beset by problems of inadequate tempering and variable mould sizes.⁵ Compliance also was an issue, with Commissioner Bigge's investigations suggesting that government bricks made in Sydney by convicts were of an inferior quality to those made by the same convicts during private time.⁶

The bricks, brickmaking sites and brick structures at the PAHS have been the subject of various studies from the 1970s onwards. These were largely oriented towards meeting specific heritage management and conservation goals, especially arresting degradation of the fabric.⁷ Yet, there has been limited consideration of brick manufacture as an integral part of the overall industrial complex that operated at the penal station, nor how the use of bricks changed in response to temporal and spatial factors. Such analysis is difficult because the historical record only affords occasional insight into brick production and use, mostly in the form of statistical accounts of labour and outputs. Additionally, these sources rarely dwell upon the nature of production or processes, nor on the decisions behind the use of particular materials for particular structures.

In this article we consider evidence for the industrial processes behind brick production, with particular concern for the technological and environmental restriction imposed by a frontier and penological setting. The core research on which this article is based was undertaken by Julie Sebanc-Butler for her B.A. Honours, under the

3 Varman, *op. cit.*, p. 59.

4 Waight, *op. cit.* p. 3,

5 *Ibid.*, p. 4; Gennell, *op. cit.*, p. 2; Varman, *op. cit.*, p. 3.

6 Varman, *op. cit.*, p. 64.

7 Crawford de Bavay and Cripps, 'To Conserve Port Arthur: Report on the Conservation of Building Fabric at Port Arthur', Vol. 1, unpublished report produced for Port Arthur, 1979; J. Hutton, *Clays and Bricks of the Penal Settlements at Port Arthur and Maria Island, Tasmania*, Glen Osmond (SA), 1981; G. Jackman, 'ARG Brickfield's Report', unpublished report produced for Port Arthur, 2011.

aegis of the *Landscapes of Production and Punishment* project.⁸ The main foci for the *Landscapes* project was an exploration of the interplay within the convict system between the competing requirements for punishment and reform, versus ensuring economic sustainability.⁹ Here, we demonstrate that by exploring the historical archaeology of brickmaking at Port Arthur and the Tasman Peninsula there is the opportunity to better understand some of the decisions and capacities of the convict system as an industrial enterprise. We begin by tracing the evidence for brickmaking as an industry at Port Arthur and the use of bricks within the settlement through the several major periods of the site's operation. The historical phases we employ here are consistent with usage throughout the rest of the *Landscapes* project.¹⁰

* * *

During its first phase, from 1830 to 1833, Port Arthur operated as a timber-getting camp, replacing an earlier timber operation at Birch's Bay (1824-30).¹¹ At this stage Port Arthur more resembled a specialised industrial work camp of skilled convict mechanics rather than a penal station. The first structures built in September 1830 were bark huts and prefabricated buildings, with brick only utilised for chimney structures.¹² By 1831 a military barracks, officers' quarters and a commissariat (supply) store had been added (see Figure 4 in Introduction).¹³ The first indication of brickmaking on site was in May 1831, when the southern limit of the Port Arthur station was described

⁸ J. Sebanc-Butler, 'An Historical Archaeological Case Study of Bricks from the Tasman Peninsula', BA Honours thesis, University of New England, 2019.

⁹ R. Tuffin, M. Gibbs, D. Roberts, H. Maxwell-Stewart, D. Roe, J. Steele, and S. Hood, 'Landscapes of Production and Punishment: Convict Labour in the Australian Context', *Journal of Social Archaeology*, Vol. 18, No. 1, 2018, pp. 50-76.

¹⁰ R. Tuffin and M. Gibbs, 'The Archaeology of the Convict Probation System: The Labor Landscapes of Port Arthur and the Cascades Probation Station, 1839–55', *International Journal of Historical Archaeology*, Vol. 24, No. 3, 2020, pp. 589-617; R. Tuffin and M. Gibbs, 'Early Port Arthur: Convict Colonization and the Formation of a Penal Station in Van Diemen's Land 1830-35', *International Journal of Historical Archaeology*, Vol. 23, 2019, pp. 568-95.

¹¹ P. Macfie, 'Government Sawing Establishments in Van Diemen's Land, 1817-1832', in J. Dargavel, D. Gaughwin, and B. Libbis (eds), *Australia's Ever-Changing Forests V: Proceedings of the Fifth National Conference on Australian Forest History*, Canberra, 2002, pp. 105-31.

¹² Memorandum by George Arthur, Lieutenant-Governor, 7 September 1830, in Colonial Secretary's General Correspondence 1824-1836 (CSO1) 483/10748, Tasmanian Archives (TA); Russell, Commandant, to Burnett, Colonial Secretary, 20 December 1830, note by Arden, 12 December 1830, CSO1/484/10750, TA.

¹³ *Hobart Courier*, 15 January 1831.

in regulations as 'The Rocky Point near the kilns in Opossum Bay'.¹⁴ The only feature in Opossum Bay (now renamed Carnarvon Bay), which fits this description is the small peninsula later known as Brick Point, approximately 1.6 km southeast of the original settlement (Figure 1). In March 1831 labour returns listed five bricklayers at work.¹⁵ Within months several men were specifically identified as brickmakers.¹⁶ From 1832 the industrial base of Port Arthur was being allowed to diversify, with convicts employed in an expanding range of trades, including tailoring, shoemaking, blacksmithing, broom-making, and wood-working.¹⁷ Little is known of the specifics of brick production at this time, although in December 1832 the settlement's commandant, Lieutenant John Gibbons, was offering to produce 50,000 bricks and 1,000 tiles per month for the public service, from clay of 'a most excellent description ... discovered near the water's edge about a mile from the settlement'.¹⁸

It is unknown whether Gibbons' claim reflected actual capacity, or was merely a wishful projection for developing the station's industrial output. However, appended to Gibbons' letter are notes from the Civil Engineer requesting clay samples.¹⁹ There is difficulty in accurately gauging the station's early brick output, with production statistics only surviving in a partial form. A return from October 1833, three years into the life of the settlement, indicates that the team of six brickmakers and an overseer were making 100,600 bricks (Table 2).²⁰ Though the indications are that the bricks were in process, such a large scale output does suggest that the settlement was moving toward a more permanent footing and producing bricks for construction. The October 1833 return also indicates that large production facilities had been created at Brick Point. These were likely the kiln and drying shed

14 'Orders and Regulations for the Government & Management of the Settlement at Port Arthur', 12 May 1831, CSO1/551/12027, TA; Jackman, *op. cit.*, p. 10.

15 'Return of 90 Prisoners employed in the Public Works at Port Arthur for the preceding Two Months', 1 March 1831, CSO1/511/11180, TA.

16 'Two monthly return of Convicts at Port Arthur from the 1st September to the 31st October 1831', CSO1/511/11180, TA.

17 Tuffin and Gibbs, 'Early Port Arthur', pp. 581-84.

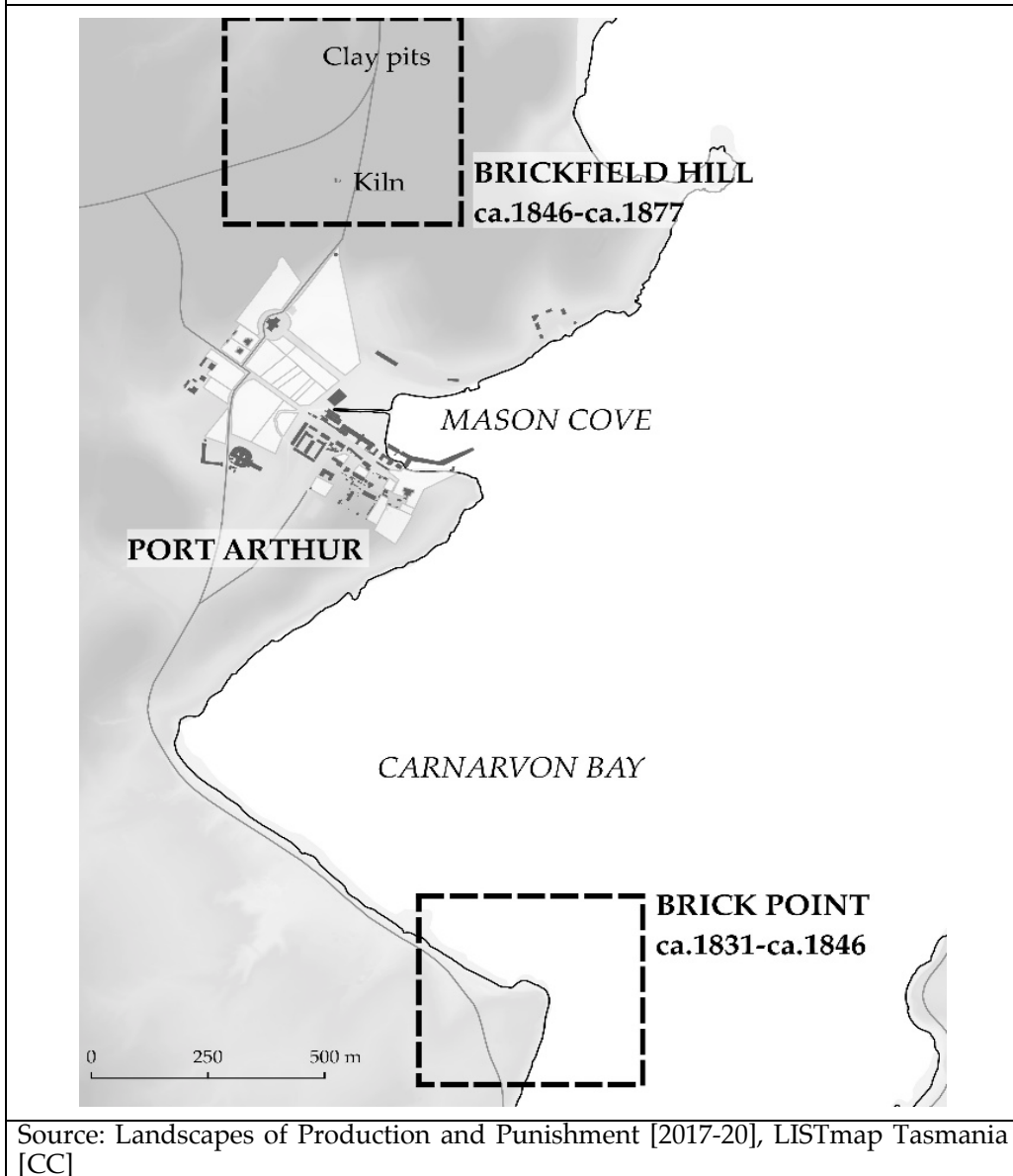
18 Gibbons, Commandant, to Burnett, Colonial Secretary, 4 December 1832, CSO1/630/14256, TA.

19 Note by Archer, 27 December 1832, in Gibbons, Commandant, to Burnett, Colonial Secretary, 4 December 1832, CSO1/630/14256, TA.

20 'Return of work done by mechanics at Port Arthur in the month of October 1833', CSO1/511/11180, TA.

which was shown in an 1836 plan and elevations, produced by convict Henry Laing at the behest of the authorities (see Figures 2 and 3).²¹

Figure 1: Map showing the location of Brick Point, Brickfield Hill and Port Arthur



²¹ Henry Laing, 'Shed in Brickfields', c.1836, CON87/1/52, TA; Henry Laing, 'Kiln in Brick Fields', c.1836, CON87/1/53, TA.

The Port Arthur settlement entered a new phase from 1833 which, lasting into the 1840s, saw a fundamental shift in the nature of the settlement's landscape and its operations. After the closure of the penal outposts of Macquarie Harbour (1822-1833) and Maria Island (1825-1832), convicts from those settlements were moved to the newly-declared penal settlement of Port Arthur, where a new commandant, Captain Charles O'Hara Booth, was appointed.²² As a consequence, the relatively ephemeral timber huts of the early period made way for more substantial structures for the accommodation, management and punishment of prisoners, accompanied by the barracks, residences and offices required for the military and civil populations.²³ From 1834 industrial activity increased, with boatbuilding introduced (see Figure 5 in Introduction) as a means of providing a self-sustaining economy and, hopefully, generate a profitable return.²⁴ Timber continued to be a major industry, although the timber-getters were having to travel farther from the station to access the timber stands.²⁵

Although brick production outputs for this period are unclear, a production report for March 1834 says that ten brickmakers under one overseer produced 68,300 bricks.²⁶ The following month seven brickmakers under two overseers produced 34,600 bricks.²⁷ It is notable that structures built during this period, such as new officers' quarters (1833) and large commissariat store (1833), were still of timber construction. The first masonry structure at the settlement (a goal and store, built 1833-1834) was constructed of sandstone.²⁸ This suggests that brick output did not supply more than what was required for footings and chimneys. An indication of the amount of bricks required for building works comes from some later requisitions, which show that:

22 Tuffin and Gibbs, 'Early Port Arthur', pp. 585-87.

23 Booth, Commandant, to Burnett, Colonial Secretary, 29 April 1833, CSO 1/584/13194, TA.

24 M. Nash, 'Convict Shipbuilding in Tasmania', *Tasmanian Historical Research Association*, Vol. 50, No. 2, 2003, pp. 83-106.

25 R. Tuffin, M. Gibbs, D. Clark, M. Clark, and P. Rigozzi, "'... One of the Most Severe Duties...': Landscapes of Timber-Getting at a Former Tasmanian Convict Station', *Industrial Archaeology Review*, 2020, in press (September 2020).

26 'Return of work done by mechanics at Port Arthur from 1st to 31st March 1834', CSO1/511/11180, TA.

27 'Return of work done by mechanics at Port Arthur during the month of April 1834', CSO1/511/11180, TA.

28 Tuffin and Gibbs, 'Early Port Arthur', p. 586.

- construction of a new detached stable for the Commandants' quarters required 15,000 bricks
- an addition to the Commissariat Store required 23,000 bricks
- conversion of a former cell building into officer accommodation required 6,000 bricks²⁹

In its third phase, from the 1840s to the 1850, Port Arthur was a punishment station under the Probation system, after the assignment system was abolished in the wake of the 1837 House of Commons Select Committee on Transportation (usually referred to as the Molesworth Report).³⁰ Probation introduced a new system of classification that required convicts to be separated into specific classes in work and accommodation settings.³¹ Many new government establishments were required to house the convicts, the Tasman Peninsula becoming home to nine of these labour stations by the mid-1840s.³² Existing stations were also required to build new or adapt existing structures to accord with the new system. In this phase, Port Arthur was re-cast as an ultra-punishment station, meaning that it took the worst reoffending convicts from other stations throughout the probation system. A revitalised building program in the 1840s saw aging structures replaced and new facilities added, in response to the changing economic and penal requirements. Brick began to be used to construct entire structures, with a hospital (1842), five new officers' quarters (1843-1848) and separate prison (from 1848) added during this time (see Figure 6 in Introduction). The largest brick structure was the flour mill and granary, constructed between 1842-1845 to provide flour for the burgeoning convict establishment across the Tasman Peninsula.³³ The four-storey building measured 50m x 11m, with an adjoining granary store measuring 20m x 11m, clearly visible to anyone approaching the settlement by sea (Figure 4). Despite this surge of

²⁹ Acting Foreman of Works to Victor, Commanding Royal Engineer, 25 January 1839, CS05/174/4142, TA.

³⁰ I. Brand, *The Convict Probation System: Van Diemen's Land 1839-1854*, Hobart, 1990, pp. 5-12.

³¹ Tuffin and Gibbs, 'The Archaeology of the Convict Probation System', pp. 594-96, 600.

³² J. Thompson, *Probation in Paradise: The Story of Convict Probationers on Tasman's and Forestier's Peninsulas, Van Diemen's Land, 1841-1857*, Hobart, 2007.

³³ R. Tuffin, 'A Monument to Folly? The Port Arthur Flourmill and Granary', *Tasmanian Historical Studies*, Vol. 9, 2004, pp. 124-8.

activity, Port Arthur's own population declined sharply as men were drawn away to work in the new stations, falling from a peak of over 1,200 in 1845, to over just over 300 by the close of the decade.³⁴ By 1840 there were 26 prisoners labouring at Brick Point, capable of producing over 100,000 bricks during the productive months.³⁵ Some of this was exported from the settlement, including 30,000 in 1839 for the construction of the Swansea (eastern Van Diemen's Land) gaol.³⁶ In 1841 a workforce of between 18 to 41 produced nearly one million bricks, as well as a diverse range of secondary products (Table 1).

In January 1842 a visitor to Port Arthur, David Burn recorded his impressions of the working of the brick kilns:

There is a factory, hitherto overlooked, where bricks, tiles, gutter tiles, flower pots, and other similar articles are manufactured. From the excellence of the clay, the commodities are of the most superior quality, so much so that the use of a pug-mill and a careful selection of material might prove the means of creating a pottery of infinite value, whence a ware little inferior to Wedgwood might be produced. As it is the Port Arthur brick kilns not only supply all the wants of the settlement and Point Puer, but export largely to Hobart, both for Government appropriation as well as for general sale: in fact, the excess of production (in numerous articles) available for exportation leaves a large balance to the credit of the penal settlement.³⁷

It is unclear if Burns' description pertains to the operation at Brick Point, or whether he was describing activity at a new brickmaking area known to have been opened around this time. This new operation was carried out in an elevated area to the north of the main Port Arthur station which became known as Brickfield Hill (Figure 1).³⁸ The new

³⁴ R. Tuffin, 'The Convict Population of the Tasman Peninsula, 1830-77: Landscapes Project Database 5', Armidale, 2020 <<https://hdl.handle.net/1959.11/28634>> (5 October 2020)

³⁵ 'Yearly Return of Work performed by Mechanics and Laborers at Port Arthur Tasman's Peninsula from the 1st December to 30th November 1841', CSO50/1/8, TA.

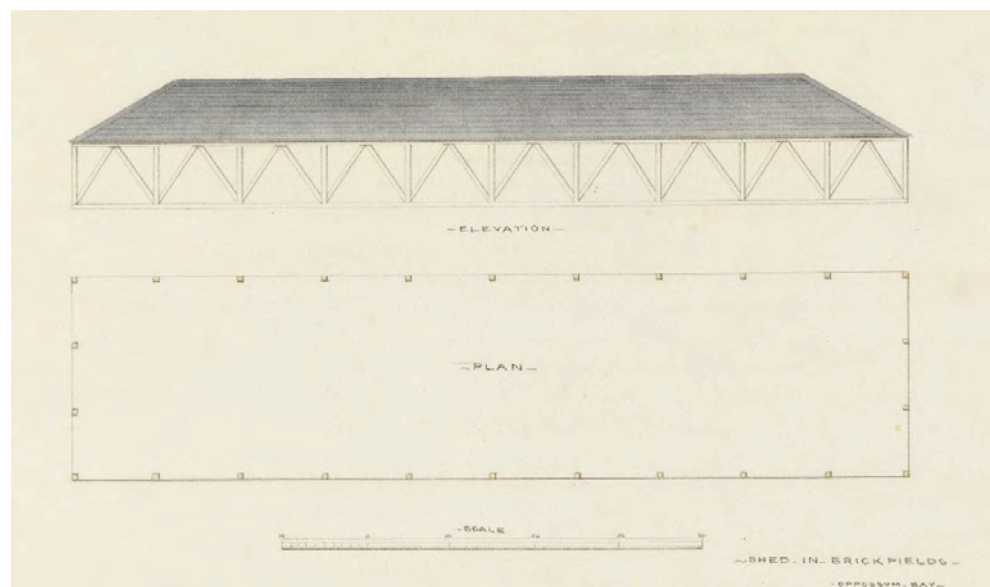
³⁶ Note, September 1839, Colonial Secretary's General Correspondence 1837-1841 (CSO5), 109/2423, TA.

³⁷ D. Burn, *An Excursion to Port Arthur in 1842*, J. W. Beattie (ed.), Hobart, 1850, pp. 36-37.

³⁸ Jackman, *op. cit.*, p. 121.

site appeared on an 1846 plan, depicting one small and one large rectangular structure labelled 'brick kilns'.³⁹ Why the decision was made to move to the new site is unclear, however it was nearer to the station which increased ease of surveillance and lessened the transportation of men and products.

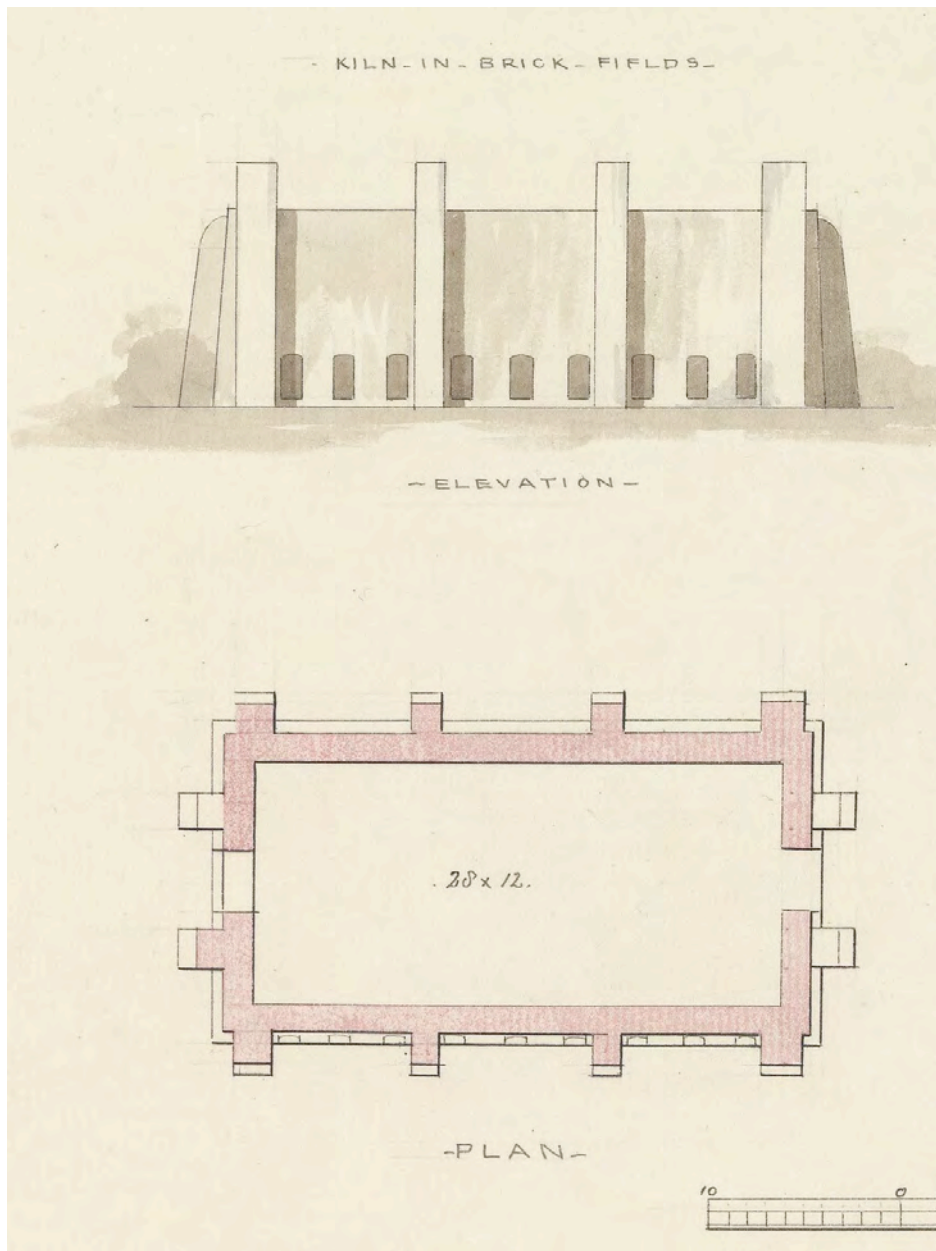
Figure 2: Henry Laing's 1836 plan of the drying shed



Source: Henry Laing, 'Shed in Brickfields', ca.1836, CON87/1/52, TA.

³⁹ Plan No. 2, in MacFarlane, Clerk of Works, to Champ, Commandant, 16 May 1846, MM62/1/17 A1107, No. 5895, TA.

Figure 3: Henry Laing's 1836 plan and elevation of the kiln



Source: Henry Laing, 'Kiln in Brick Fields', ca.1836, CON87/1/53, TA.

Figure 4: View of Port Arthur from Mason Cove in ca.1856 (showing the former flour mill and granary, at that time undergoing conversion to a penitentiary).



Source: Unknown artist, 'Port Arthur', ca.1856, W. L. Crowther Library, TA

Sporadic returns between 1843 and 1846 indicate that brick production varied from between 280,000 — 360,000 per quarter.⁴⁰ Labour returns show increasing numbers of men listed as brickmakers, with thirty-three individuals engaged in digging clay, brickmaking, and the cutting of firewood for kilns in 1846.⁴¹ Throughout this period brickmaking was also carried out at the other probation stations scattered across the Peninsula, as well as at the Coal Mines.⁴² Between

⁴⁰ Returns of the Commissariat Department, 1843-46, in Colonial Office, Original Correspondence Tasmania, CO 280/170, CO 280/181, and CO 280/208, National Library of Australia (NLA), transcribed by Elsie Jakeman for the Port Arthur Historic Site Management Authority.

⁴¹ Eardley-Wilmot, Lieutenant Governor, to Gladstone, Secretary of State, 29 August 1846, *Convict Discipline and Transportation*, British Parliamentary Papers (BPP), London, 1847, pp. 138-40.

⁴² R. Tuffin, D. Roe, M. Gibbs, D. Clark, and M. Clark, 'Landscapes of Production and Punishment: Lidar and the Process of Feature Identification and Analysis at a

1842 and 1846 the boys from the Point Puer reformatory situated across the bay from Port Arthur, were also engaged in significant brick production at the site of their proposed new establishment at Safety Cove, located to the south of Port Arthur.⁴³

The fourth and final phase of Port Arthur's development, from the 1850s until the closure of the settlement in 1877, can be described as one of resurgence and decline. By the 1850s dissatisfaction with the perceived failure of the probation system led to its gradual disassembly, culminating with the 1853 arrival of the last convict transport ship in Hobart.⁴⁴ Many of the probation stations had already closed, including several of those on the Tasman Peninsula, with convicts being centralised back to the urban areas and dedicated settlements — including Port Arthur.⁴⁵ As a result there was a reinvigoration of activity at Port Arthur and a rise in the settlement's population. New building projects were undertaken during this time to repair the existing facilities and build new ones. With the original prisoners' barracks no longer usable, works got underway in 1856 on the conversion of the abandoned flour mill and granary building into a penitentiary. Another consequence of the contraction of the overall convict system was that Port Arthur witnessed a renaissance in industrial activity, symbolised by the construction of a new workshops complex (1856) adjacent to the penitentiary.

From the 1860s onwards the convict population started to dwindle as men served their sentences and departed the station (see Figure 6 in Introduction). Even though prisoners were still engaged in heavy labour, there was an increasing proportion of aging convict or former convict paupers and invalids unwilling or unable to enter the free workforce. The station entered a new phase of operation, this 'welfare phase' (discussed by Andrew Piper elsewhere in this volume) leading to the construction of paupers' dormitories (1863) and an asylum

Tasmanian Convict Station', *Australian Archaeology*, Vol. 86, No. 1, 2020, pp. 37-56, pp. 47-49.

43 'Return of Work performed at the Juvenile Establishment of Point Puer during the Year 1844 and showing the Value thereof - Bricklayers', CSO49/1/10, TA; 'Statement of the value of materials acquired by the labor of convicts, & expended at the various Probation Stations during the Quarter ending 31st December 1846', CO 280/208, No. 48, NLA.

44 R. Tuffin and M. Gibbs, "'Uninformed and Impractical"? The Convict Probation System and Its Impact Upon the Landscape of 1840s Van Diemen's Land', *History Australia*, Vol. 17, No. 1, 2020, pp. 87-114.

45 Tuffin and Gibbs, 'The Archaeology of the Convict Probation System', p. 609.

(1864). By 1868 Brickfield Hill had fallen into disuse, with the brickyard buildings reported as being in disrepair.⁴⁶ Some production was, however, kept up, with works even briefly recommencing at Brick Point.⁴⁷ This reduced operation likely accounts for the small quantities reported in the station returns into the early 1870s, which continued until Port Arthur's closure in 1877. Although Brick Point was not used after the convict period, the Brickfield Hill site was reused by potters James Price (from 1886-1912) and Tom Mason (for a short period in the 1890s).⁴⁸

* * *

Although the records are incomplete, it is possible to partly reconstruct the yearly brick production of Port Arthur (Table 2). The documentary record provides sufficient detail to suggest a fairly straightforward narrative of local brick production related to the needs of the Port Arthur settlement, accompanied by a small export focus. However, while there is limited information on production, there is an absolute paucity of descriptions of the brickmaking processes as carried out at Port Arthur. To attain better insight into the labour processes, as well as the products and related trade networks, of this activity, the *Landscapes* project deployed a multi-scalar archaeological approach: from macro-level investigation of landscape, through to physical examination of examples of brick and materials analysis. The latter was primarily achieved through Fourier Transform Infrared (FTIR), a non-destructive test which identifies the elemental composition of the bricks, as well as dilatometry which measures firing temperatures for baked clay.

This sampling regime was undertaken as part of the research for Sebanc-Butler's thesis. Bricks were selected for both non-invasive and invasive recording and testing, in collaboration with staff at the Port Arthur Historic Site Management Authority (PAHSMA). The availability of good historical documentation for the PAHS meant that the dates and circumstances of construction for many of its convict-period buildings are known. This allowed bricks to be tightly provenanced, spatially and temporally. Using the expertise of the

⁴⁶ Station Officer, Port Arthur, to Boyd, Commandant, 10 September 1868, Tasmania Papers 315, Mitchell Library (ML), in I. Brand, *Transcripts*, Vol. 2, PAHSMA, p. 58.

⁴⁷ *Mercury*, 25 March 1870.

⁴⁸ A. Bagshaw, 'An Examination of Pottery Manufacture in New South Wales and Tasmania (Van Diemen's Land) in the Period of 1788-1850', PhD Thesis, La Trobe University, 2018, pp. 133-34; Jackman, *op. cit.*, p. 20.

PAHSMA staff, sections of buildings that had been conserved post-convict period were identified — making sure post-convict brick repairs were not included in the analysis. In the following discussion we benchmark the documentary and archaeological evidence of brick production at Port Arthur against evidence of social and technical processes documented at contemporary labour (free) sites in Britain.

Average daily no.	Month	Gutter Tiles	Paving Tiles	Bricks	Flower Pots
26	Jan		1200	120,000	57
26	Feb	1440		115,200	21
19	Mar	960		80,600	69
25	Apr	1620		104,400	33
24	May	1500		92,400	
22	Jun	1440		61,400	72
22	Jul	1260			78
22	Aug	1620			81
18	Sep	1580		15,200	63
27	Oct	1560		105,900	
36	Nov	1530		107,400	
41	Dec	1020		160,700	
TOTAL				963,200	

⁴⁹ 'Return of Work performed by Mechanics and Laborers [sic] at Port Arthur Tasman's Peninsula from the 1st December 1840 to the 30th November 1841', 17 February 1842, in Returns for the Compilation of the Annual Official, Financial and Statistical Reports (CSO49) 1/8, TA.

Table 2: Known total for Port Arthur brick production, 1830-73 (shaded cells denote record gaps)				
Date	Quantity		Date	Quantity
1831			1853	
1832			1854	
1833	100,900		1855	
1834	68,300		1856	
1835			1857	183,160
1836			1858	242,000
1837			1859	190,000
1838			1860	48,000
1839	30,000		1861	121,375
1840	66,000		1862	189,550
1841	962,800		1863	82,350
1842			1864	286,500
1843	464,781		1865	188,350
1844	932,900		1866	201,450
1845			1867	159,900
1846	350,400		1868	70,175
1847			1869	44,095
1848			1870	9,475
1849	9,000		1871	
1850			1872	10,000
1851			1873	15,000
1852			TOTAL	5,026,461

* * *

In the first half of the nineteenth century, brickmaking in Britain was generally carried on as a traditional seasonal occupation undertaken by agricultural families or itinerant brickmaking gangs. The explosion in urban development on the heels of the Industrial Revolution soon saw it become a full-time occupation where a professional labouring class worked year-round in semi-permanent yards. Given the locational, technological and ideological constraints on the Port Arthur brickmakers, a combination of both the traditional and industrial processes are considered here. Contemporary trade manuals such as those written by Edward Dobson and Andrew Ure condense brickmaking processes into five basic steps (Table 3): clay mining, clay processing, brick moulding, brick drying, and clamp or kiln burning. These five steps can be broken down into nine sequential actions.⁵⁰

Step	Process		Actions
Clay Mining	1	Clay Getting	Removal of vegetation and topsoil from the surface.
	2	Clay Digging	Excavation of clay from pit and wheeling to a storage site to be placed in a heap.
Clay Processing	3	Clay Weathering	Clay is turned over and stones removed by hand. Clay then left to dry over winter.
	4	Clay Grinding	Dried clay is ground into a powder.
	5	Tempering	Clay is turned over with wooden spades or by treading while ashes or flux are added.
	6	Pugging	Water is added to dried clay and mixed, using either human or animal labour, or via a pugging machine.
Clay Moulding	7	Moulding	Clay is mixed with water and possible tempers, is dashed into a mould and the brick then extracted.
Drying	8	Drying	Bricks dried on ground or wooden planks for 1-6 days, then stacked in low walls (hacks) in a drying shed. Drying times varied according to climate and time of year.
Firing	9	Firing	Bricks stacked to fill the interior of the clamp or kiln.

⁵⁰ A. Ure, *A Dictionary of Arts, Manufactures and Mines*, London, 1840; E. Dobson, *A Rudimentary Treatise on the Manufacture of Bricks and Tiles: Containing an Outline of the Principles of Brickmaking*, London, 1850.

Landscape archaeology and geological studies have only identified two areas in the immediate vicinity of Port Arthur which have clays suitable for brick manufacture: the historically-documented areas of Brick Point and Brickfield Hill. Given the primary purpose of the station in 1830 was a short-lifespan timber-getting camp, it is evident that the early administrators would not have had the labour to prioritise identifying sources of high quality brick clay. This indicates that the choice of the Brick Point site may have been the result of ready visibility of the clay source, such as from an erosion face. Modern geological studies have characterised the soils of the Port Arthur vicinity as originating from Jurassic dolerite and Glacio-marine Triassic sandstone, without the dense, high quality clay required to manufacture high strength bricks.⁵¹ While not ideal, this was the resource available to the convicts. Though early surveys had been carried out of the peninsula, the first geological survey of the area was not until 1837.⁵² Though undocumented, this survey may have led to the identification of the clay source at Brickfield Hill, triggering the 1840s relocation.

In traditional rural brickmaking the clay was mined in the autumn months after farmers had harvested their crops.⁵³ Topsoil was removed and the clay then excavated and piled into heaps (covered or uncovered) and then allowed to 'weather' throughout the winter. Weathering allowed large clumps of clay to disaggregate and — if stored outside — excess salts to be removed through frost, wind, and snow action. Weathered clay, according to Dobson, was less likely to warp during the firing process.⁵⁴ Even so, extended weathering was often skipped in industrialised brickyards where brick manufacture occurred year-round and high demand necessitated truncated processes.

While there is no specific mention of weathering in the processes at Port Arthur, there are two factors that we can consider. There was often a lag of months or years between approvals for construction of buildings and commencement of work. Unless there were existing

51 W. C. Cromer, V. M. Threader, and C. J. Knights, 'Geology of the Port Arthur Area', report for Mineral Resources Tasmania, Hobart, 1976, p. 2.

52 M. R. Banks, E. Colhoun, R. Ford, and E. Williams, 'A Reconnaissance Geology and Geomorphology of Tasman Peninsula', in E J Smith (ed), *Is History Enough? Past, Present, and Future Use of the Resources of the Tasman Peninsula*, Hobart, 1986, pp. 7-23.

53 S. Quelch, *Brickmaking*, Sussex, 2006.

54 Dobson, *op. cit.*, p. 24.

stockpiles, such delay may have represented the need for the prisoners to quarry and weather clay, before the processes of preparation and manufacture could occur. There is also the fact that the available returns do indicate that brick production was largely undertaken during the period from Spring through to mid-Autumn. A sample of detailed returns of brick production by the Point Puer boys shows manufacture from November through to April, leaving the six months from late Autumn through to early Summer for quarrying and weathering.⁵⁵ Port Arthur returns show a similar pattern of manufacture in the October to December and January to March quarters.⁵⁶

There is no specific information on clay quarrying at Port Arthur, although the extraction of clay was undoubtedly manual. Given the incomplete nature of brick production records, an investigation of possible clay extraction volumes at both Brick Point and Brickfield Hill was undertaken using LiDAR (Light Detection And Ranging). This remote sensing method uses airborne laser-mapping of the terrain to create a digital surface model. This can then be interrogated for features of interest and the results analysed. LiDAR has been a signature method for the *Landscapes* project, allowing the investigators to examine large areas of otherwise heavily vegetated or inaccessible terrain for evidence of penal and industrial activities.

Figures 5 and 6 show LiDAR-derived models of the works at Brick Point and Brickfield Hill. These clearly show the extent of the quarrying that the convicts were involved in. This data can also be used to estimate the extent of the labour involved, using volumetric analysis to work out the amount of clay removed and thereby the potential number of bricks made. The method used to do this have been detailed elsewhere.⁵⁷ Using this methodology, we estimated that the Brickfield Hill clay pits produced enough clay to make 2.9 — 3.2 million bricks, most of which would have been during the convict period. At the minimum known rate of brick production per man as detailed in taskwork returns (125 bricks per day), this represented over 20,000 person days of work (equivalent of one person working for 65

⁵⁵ 'Return of Work performed at the Juvenile Establishment of Point Puer during the Year 1844 and showing the Value thereof - Bricklayers', CSO49/1/10, TA

⁵⁶ Returns of the Commissariat Department, 1843-46, in CO 280/170, CO 280/181, and CO 280/208, NLA, transcribed by Elsie Jakeman for the Port Arthur Historic Site Management Authority.

⁵⁷ Tuffin et al., 'Landscapes of Production and Punishment: Lidar and the Process of Feature Identification and Analysis at a Tasmanian Convict Station', pp. 54-56.

years).⁵⁸ At the faster rate of production (326) it represented nearly 10,000 days (25 years). These totals can, of course, only be taken as an estimate, not taking into account shrinkage during firing (meaning more clay volume was used than represented by the volume of a fired brick) or wastage. Despite this, the number accords with Table 2, which indicates that during the known operational period of Brickfield Hill (1846-77), at least 2.4 million bricks were produced.

Processing the clay through grinding, pugging and moulding usually began in the Spring. The weathered clay was first ground to crush clods as well as remove stones. It would then be pugged, a process whereby the clay was mixed with water and churned into an homogenous mass suitable for moulding. Pugging also forced air out of the clay, which might otherwise cause a brick to expand and fracture in the kiln. Pug mills had wooden augers or lathes attached to the central portion of the mechanism (later evolving into animal or engine-driven pugging machines with iron baffles), which kneaded the clay into a consistent texture. However, we know from Burns' 1842 description that a pug mill was not available, while there was a general prohibition on the use of animal labour at Port Arthur during the 1830s and 1840s. This means that the Port Arthur bricks were almost certainly pugged by the traditional but less effective method of placing the clay into a shallow pit of water to be soaked for several days and then worked by people treading on the mixture.⁵⁹

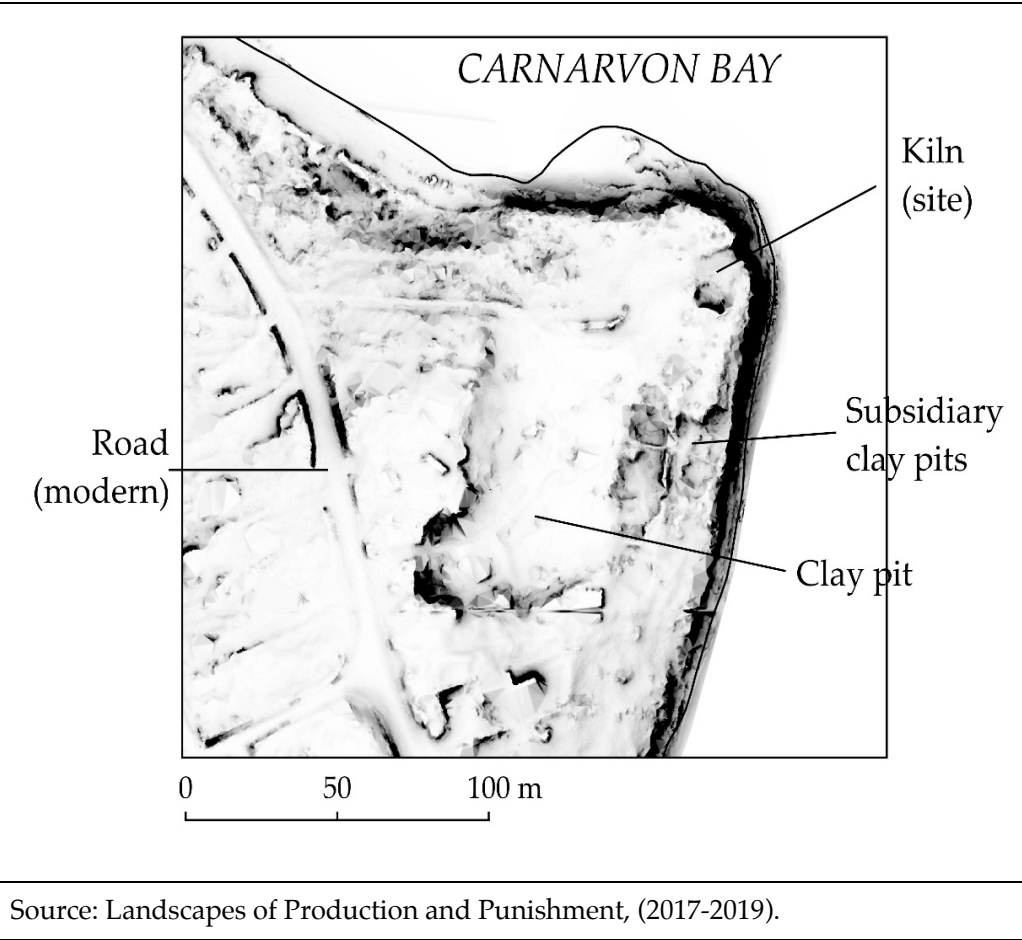
At the pugging stage a temper or additional material could also be added as required to alter the qualities of the clay, reduce firing times, discourage shrinkage during firing, or achieve particular colour effects. In Britain this included materials such as crushed shale, lime, chalk, sifted coal ash or timber potash.⁶⁰ London brickmakers for instance were known to add at least a 1:3 ratio of coal to siliceous clays, obtained through the scavenging of domestic coal soot. However, some tempers also reduced durability and sometimes resulted in disaggregation, so that in many yards there was a professional temperer whose job was to consider the correct mixture.

⁵⁸ 'Scale of task Work adapted to the capacity of several Classes of Convicts and proportioned for the various Seasons of the Year', Enclosure No. 10, in Hampton, Comptroller General, to Denison, Lieutenant Governor, 15 November 1847, *Convict Discipline and Transportation*, 1849.

⁵⁹ Ure, *op. cit.*, p. 184.

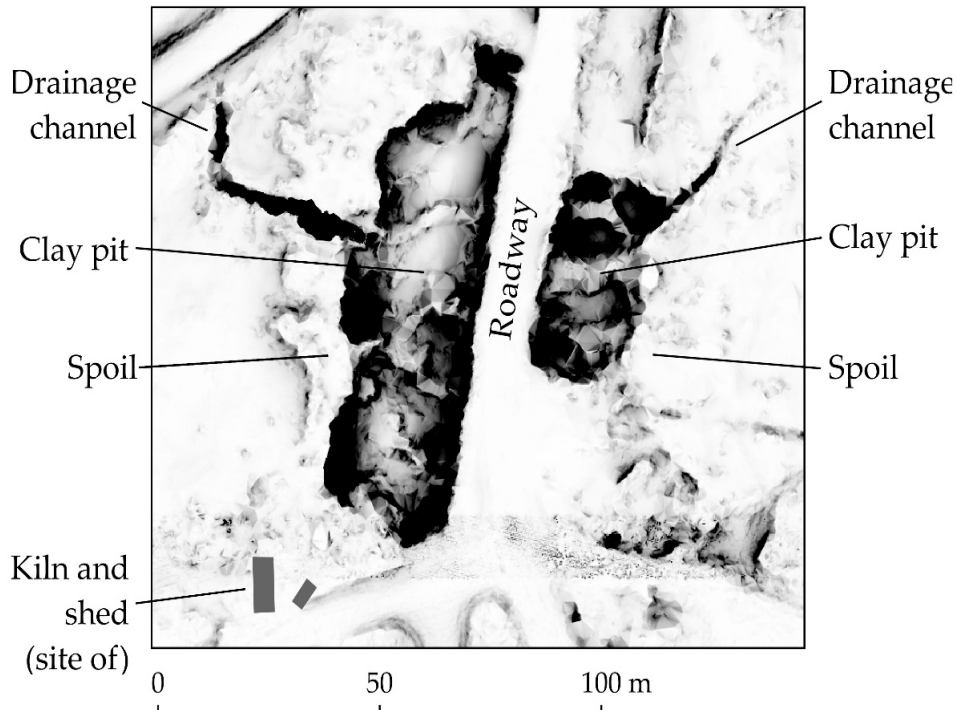
⁶⁰ Dobson, *op. cit.*, p. 18; R. V. Varman, *Bricks and Nails: Building Materials as Criteria for Dating in Sydney and Environs from 1788*, Sydney, 1983.

Figure 5: LiDAR-based visualisation of Brick Point works (SVF model, 10m/16 directions).



Source: Landscapes of Production and Punishment, (2017-2019).

Figure 6: LiDAR-based visualisation of Brickfield Hill works (SVF model, 10m/16 directions,



Source: Landscapes of Production and Punishment, (2017-2019).

Analysis of *in situ* Port Arthur bricks indicated that they often contained a large amount of coarse and uneven aggregates, with occasional evidence of intrusive sediment layers. This indicates the lack of extensive mechanised pugging. Some of the bricks from an early (1833) structure had a composition that suggested the early brickmakers were even experimenting with adding coarse aggregates as temper in the form of crushed shell and charcoal. There is also a note from Commandant Booth in February 1836, addressing the Colonial Secretary's inquiry as to Port Arthur's capacity to produce 'pan tiles, gutter tiles' for use in Hobart. Booth responded that, while it was possible to produce serviceable articles, the possibilities for quality

products was diminished as there was 'no clay at the present moment dug or tempered'.⁶¹ Analysis of some Port Arthur bricks in the 1980s suggested that many had a high salt content, potentially indicating that clay was not being weathered for any length of time, with tempers possibly added to increase their strength and appearance.⁶²

Once the clay had been processed, it was wheeled or carried to the brickmaker's bench to be moulded using one of several methods. A brick mould is a rectangular frame without a top or bottom made of wood, iron, brass or copper (Figure 7).⁶³ Those of wood required that the clay-filled mould be dipped in water (water struck), as bricks would not leave the mould unless wet, while iron moulds were sanded but not wetted (sand struck), to discourage rust.⁶⁴ While brass or copper moulds did not require either sanding or wetting, they were expensive and wore down quickly, making them less common. The majority of the brick samples examined for this study had the smooth texture of water struck moulding. This is supported by the survival of a brick mould in the curatorial collection of PAHSMA. The mould is metal, encased in wood on its two longest sides, measuring 79.5 mm high x 247 mm long x 141 mm wide. 'B.O.' (Board of Ordnance) is clearly marked on its side and it has a metal plate marked 'BOSTON' signifying its place of manufacture in England. A number of exceptions to water struck moulding was identified in the samples, predominantly from bricks relating to the 1860s conversion work to the penitentiary (see below). These have the unmistakable gritty and sandy surface of being sand struck. While this may suggest changes across time, as will be discussed below this may also be indicative of a different, non-Port Arthur source for these bricks.⁶⁵

⁶¹ Booth, Commandant, to Montagu, Colonial Secretary, 12 February 1836, CSO1/847/17919, TA.

⁶² Hutton, *op. cit.*, p. 160.

⁶³ Ure, *op. cit.*, p. 184; Dobson, *op. cit.*, p. 29.

⁶⁴ Dobson, *op. cit.*, p. 29.

⁶⁵ Another feature of moulding was the creation of a 'frog' or depression on one face of a brick. This increased adhesion between brick and mortar, while also reducing the amount of clay used. The frog could sometimes include a maker's mark. None of the bricks analysed at Port Arthur identified with production at Brick Point or Brickfield Hill displayed evidence of frogging.

Figure 7: Brick mould from the PAHSMA collection



Source: PAHSMA 2019

A different form of marking at the moulding stage evident on some bricks was the 'broad arrow' or 'Board of Ordnance' symbol, a mark denoting government ownership which would have been impressed into the wet clay with a metal or wooden stamp.⁶⁶ Informal marks, such as thumb prints, might have been used for tallying, or simply occurred as a consequence of handling the unfired clay. The presence of animal hoof and pad marks resulted from animals making their way across piles of unfired bricks.

After moulding, the unfired brick was removed to a drying shed (hovel) where they were dried for between one and six days. From there the unfired bricks were stacked in low, walled formations called hacks for several weeks.⁶⁷ The drying process and hack process could be combined, with bricks remaining in drying sheds for a period of six weeks or more. Many Port Arthur bricks displayed hack marks or raised linear surfaces, these occurring when the bricks were stacked on

⁶⁶ Waight, *op. cit.*, p. 6.

⁶⁷ Dobson, *op. cit.*, p. 35.

top of each other to dry. If drying stacks were close to the kiln, the excess heat helped to reduce the drying time required, with flues sometimes run from the kiln to the drying shed or hack. Laing's 1836 illustrations of the Brick Point infrastructure show a large open-sided structure measuring approximately 100ft x 30ft [30m x 9m]. This shingle-roofed shelter most likely was the drying shed for the unfired bricks. The 1846 plan showing 'brick kilns' on Brickfield Hill (Figure 2) depicts one small and one large rectangular structure, in relative proportions not dissimilar to the kiln and a drying shed drawn by Laing for Brick Point.⁶⁸ Recalling the site in the late 1850s, a former convict noted:

When we reached a place called Brickfield Hill, situated about half a mile from the settlement, a heavy shower of rain began to fall. The brickmakers had gone to dinner, and we therefore took shelter under one of the sheds beneath which the bricks were laid in a hollow to dry.⁶⁹

In traditional settings with limited production, bricks might be fired in the open in what was called a clamp.⁷⁰ The bricks would be systematically stacked on a bed of clay, ash or wasters (sometimes previously-fired bricks), with the rows of bricks interspersed with narrow gaps that would be stacked with combustible material. These gaps also allowed heated air to draw through the clamp. Clamp burning did not demand the time or expense of kiln construction, but did require additional fuel. The temperature was also far more difficult to control due to heat wastage, with a greater potential for uneven firing temperature across the clamp. Prior to the construction of the kiln at Brick Point, it is likely that bricks were fired in such a clamp. A clamp producing even moderate quality bricks was often a necessary first step towards the construction of a permanent kiln structure.

A more permanent industrial brickyard would invest in the construction of kilns which, depending on size and design, might hold from 20,000 and 120,000 bricks per firing.⁷¹ Bricks within kilns were stacked closely together, with tunnels left between them for fuel and ventilation. Once loaded the open side would be bricked up and the top sealed with a thick stratum of earth or soot laid on top of the

⁶⁸ Plan No. 2, in: MacFarlane, Clerk of Works, to Champ, Commandant, 16 May 1846, MM62/1/17 A1107, No. 5895, TA.

⁶⁹ M. Jeffrey, *A Burglar's Life*, Sydney, 1968 [1893], p. 87.

⁷⁰ Ure, *op. cit.*, p. 185.

⁷¹ Dobson, *op. cit.*, p. 41.

bricks.⁷² An initial 3-4 days of firing at a lower temperature to further dry the bricks was known as annealing and typically used wood as a fuel source. In areas where timber was abundant it might then be used for the remainder of the firing. However, in Britain the rest of the firing was often done using cheaper and more available pit coal.

At this point the draft holes would be closed to regulate heat loss, stoked regularly to maintain the temperature. Depending on whether a clamp or kiln, as well as the fuel type and firing regime, firing could continue for between 2 and 6 weeks with temperatures between 900° C to 1300° C dependent upon the firing regime used.⁷³ Once cooled the bricks could then be removed and stacked in preparation for movement to the building site. A brickyard with several kilns could fire them in sequence (loading, firing and unloading) to ensure consistent production. Laing's 1836 drawing shows an updraft 'Scotch' kiln with an internal dimension of 28 feet x 12 feet [8.5m x 3.6m] and approximately 10ft (3m) high, with approximately 2ft (0.6m) wide tapering and buttressed walls and two narrow openings at either end for loading/unloading. The general plan accords with other historical examples and it is not impossible that the design (Figure 3) was taken directly from contemporary manuals.⁷⁴ Curiously, there are draft holes only along one side, while the buttresses project above the top edge of the kiln suggesting the possibility of a scaffold, wind screen or roof structure as suggested for some kilns by Dobson.⁷⁵

Dobson's manual estimated kiln loading capacities based on about 10 bricks per square foot, or 25,000 bricks for a kiln approximately 12ft by 20ft and 12ft high (3.6m x 6.1m x 3.6m). Based on Dobson's guide, a rough figure of ca.33,600 bricks per firing of the Brick Point kiln would be possible. That accords well with some of the returns for that period, with 100,600 bricks in October 1833, 68,300 bricks in March 1834, and 34,600 bricks in April 1834.⁷⁶ This suggests anywhere from 1-3 firings

⁷² *Ibid.*

⁷³ K. Mason, 'Ten rules for energy efficient, cost effective brick firing — a guide for brickmakers and field-workers', *Appropriate Technology*, Vol. 31, No. 4, 2004, p. 1; D. Dawson and O. Kent, 'The development of the bottle kiln in pottery manufacture in Britain', *Post-Medieval Archaeology*, Vol. 42, No. 1, 2008, p. 220.

⁷⁴ Dobson, *op. cit.*, pp. 75-79.

⁷⁵ *Ibid*, p. 79.

⁷⁶ 'Return of work done by mechanics at Port Arthur in the month of October 1833', CSO1/511/11180, TA; 'Return of work done by mechanics at Port Arthur from 1st to 31st March 1834', CSO1/511/11180, TA; 'Return of work done by mechanics at Port Arthur during the month of April 1834', CSO1/511/11180, TA.

per month, a feat that might be possible allowing a very tight 2-3 week turnaround for loading, firing, cooling and unloading. The higher number in October 1833 may indicate even shorter firing times, or data capture across three burns at the start, middle and end of the month.

There is no specific information on the nature of the kiln or kilns at Brickfield Hill, although it is not unreasonable to expect that they would be a Scotch design similar to Brick Point. A c.1920 photograph of James Price's pottery on the site show the remains of what may have been the lowest several courses of a kiln, much degraded (Figure 8). The ready availability of timber close at hand to both the kiln sites suggests that wood would have been the favoured fuel. Even though coal from the nearby Coal Mines (1833-48) was available, this would have been an extra burden of transporting large quantities of material from the north coast to the main settlement. Various reports indicate timber cutting and collecting for the brick kilns.⁷⁷ The firing of the kilns was likely attended to around-the-clock, with fuel needing to be continuously loaded into the charge holes during the firing.⁷⁸

In conservation studies of Port Arthur bricks undertaken in the 1970s and 1980s, there are some references to them being 'under-fired'.⁷⁹ Visual investigation of bricks during our research also indicated many were underfired or overfired. Variable baking of bricks was a function of where they were stacked within the kiln. To test this, cores taken from the sample sites were analysed at the University of New England archaeology laboratories using a dilatometer. Preliminary data from this suggested that the Brick Point samples had generally been fired just below 1000° C. This is below (but not significantly so) the optimal temperature of 1050° C. In commercial brickyards any underfired stock would be set aside for a second firing. However, the consistent demand for bricks at Port Arthur may have seen this step excluded, resulting in the incorporation of underfired bricks into the building stock.

⁷⁷ Eardley-Wilmot, Lieutenant Governor, to Gladstone, Secretary of State, 29 August 1846, *Convict Discipline and Transportation*, British Parliamentary Papers (BPP), London, 1847, pp. 138-40.

⁷⁸ In 1842 there were reports of the murder of the overseer of the brickmaking gang, who lived in a hut at the brickmaking site to look after tools. *Colonial Times*, 26 July 1842; Booth, Commandant, to Colonial Secretary, 9 June 1842, CSO22/83/1714, TA. In: I. Brand, *Transcripts*, Vol. 11, PAHSMA, p. 69.

⁷⁹ Crawford de Bavay and Cripps, *op. cit.*; Hutton, *op. cit.*, p. 153, 60.

Figure 8: Photograph of John Price's workshop, with the potential ruins of the former convict period kiln in the foreground



Source: PAHSMA photograph collection #1432

Bricks were transported from Brick Point to the main settlement by barge or boat. In May 1834 it was reported that a landing place for boats was constructed near Brick Point.⁸⁰ Further correspondence was carried on in 1842 regarding repairs to the settlement brick launch.⁸¹ At the Brickfield Hill site the bricks were likely transported to the settlement by cart. Correspondence associated with an attempted absconding from the Brickfield Hill party in March of 1849 mentions a

⁸⁰ 'Return of work done by Mechanics and others at Port Arthur during the month of May 1834', 1 June 1834, CSO1/511/11180, TA.

⁸¹ List or repairs by shipwrights, 1842, in M. Glover, *Glover Papers*, Vol. 1, PAHSMA, p. 23.

chain gang pulling carts to the kiln site.⁸² Similarly, there are references to a cart gang attached to the brickfields in 1856.⁸³

Traditional and industrial brickmaking operations could require anywhere upwards of six workers, depending on the speed and scale of operations. The available returns for Port Arthur indicate a variable number of prisoners employed on the works. Though a number of different tasks were carried out at the brickfields, the majority of Port Arthur labour returns simply list 'brickmakers' with little or no differentiation in terms of tasks. Returns from the 1830s indicate that there were usually less than six men employed as 'brickmakers'. It is likely that associated labour, such as timber felling or clay quarrying, was carried out by gangs of labourers not specifically enumerated as part of the brickmaking gang. For a brief period in the 1840s we do have a more specific breakdown of the division of labour. In January 1841 a return lists one overseer and 27 brickmakers and labourers 'Making and burning Bricks and Tiles ... [and] ... splitting wood for burning bricks'.⁸⁴ A June 1846 return reports 33 brickmakers: '4 cutting wood, 2 getting loam, 1 working quarries, 11 digging clay, 15 carrying wood'.⁸⁵ Surprisingly, no men were listed in actually producing bricks (pugging, moulding or firing the kilns), although this may be further indication of the seasonality of brickmaking. The June (Winter) period possibly being when materials were prepared for the Spring production period.

Indications are that prisoners with prior skills in brickmaking were deployed at the task. Greg Jackman, in his study of Brick Point, noted that convict William Barton, who had previously applied to be placed in charge of the Government Pottery on Maria Island, was listed as a brickmaker at Port Arthur in October of 1831.⁸⁶ Throughout this period the commandant, Lt John Mahon, wrote several times to the

82 Gurnett, Assistant Superintendent, to Hampton, Comptroller General, 2 April 1849, MM62/25 A1123, TA.

83 An 1856 trial report notes the cart gang waiting for their carts to be loaded, before proceeding down to supply works on the new penitentiary. MM62/38, TA. In: M. Glover, *Glover Papers*, Vol. 1, PAHSMA, p. 26.

84 Franklin, Lieutenant Governor, to Russell, Secretary of State, 19 January 1841, *Secondary Punishment*, BPP, London, 1841, pp. 136-38.

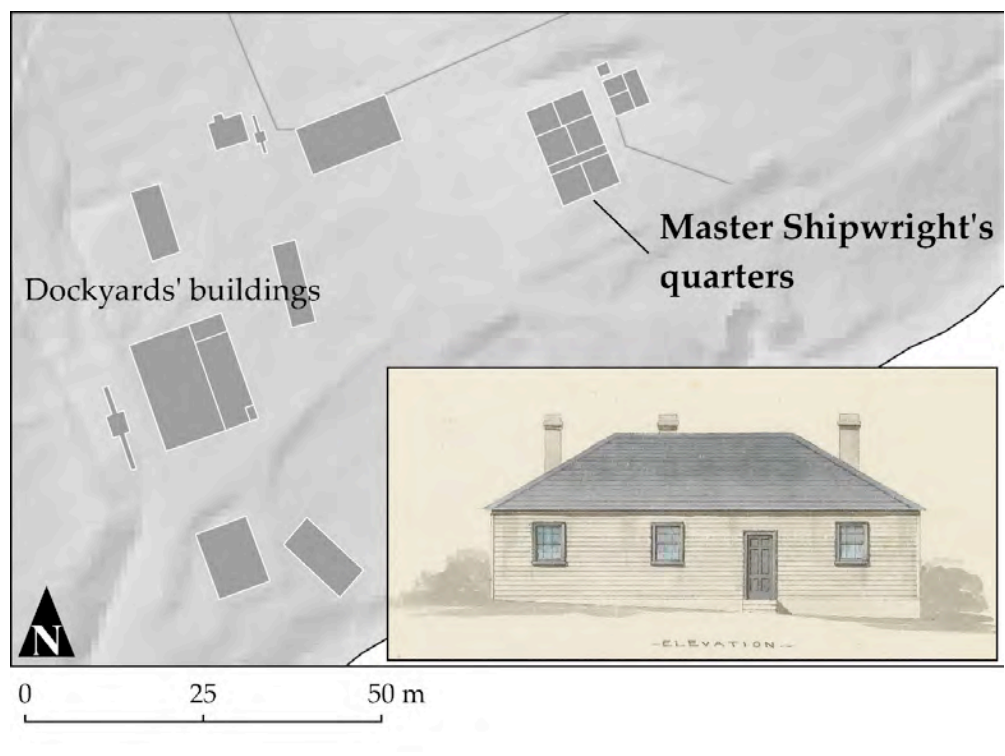
85 Eardley-Wilmot, Lieutenant Governor, to Gladstone, Secretary of State, 29 August 1846, *Convict Discipline and Transportation*, British Parliamentary Papers (BPP), London, 1847, pp. 138-40.

86 Jackman, *op. cit.*, p. 10.

Colonial Secretary requesting brickmakers be sent to the settlement.⁸⁷ Further examination of prisoner labour histories and their deployments at Port Arthur is a fruitful avenue of further study.⁸⁸

* * *

Figure 9: Master Shipwright's quarters in relation to other dockyard structures (as at 1838). The inset is an elevation drawn by Henry Laing of the quarters



Henry Laing, ca.1836, 'Master Shipwright's quarters, Dockyards', CON87/1/47, TA.

⁸⁷ Mahon, Commandant, to Arthur, Lieutenant Governor, 6 March 1832, CSO1/483/10748, TA; Memorandum, 16 March 1832, CSO1/483/10748, TA.

⁸⁸ See, for example: R. Tuffin, 'Convicts of the "Proper Description": The Appropriation and Management of Skilled Convict Labour', *Labour History*, No. 114, 2018, pp. 69-92; H. Maxwell-Stewart, 'The Rise and Fall of John Longworth: Work and Punishment in Early Port Arthur', *Tasmanian Historical Studies*, Vol. 6, No. 2, 1999, pp. 96-114.

In addition to an analysis of the processes of brick production at Port Arthur, we also researched the products themselves. One of the purposes of the FTIR elemental analysis was to determine whether the bricks in the different buildings at Port Arthur could be linked to specific sources (Table 4). The historically-known quarries at Brick Point and Brickfield Hill were sampled, as well as clay sources at the Cascades probation station (1842-55) and the Coal Mines station, both of which had brickmaking enterprises. As can be seen from the tables, while a number of samples matched the Brick Point and Brickfield Hill sources, many matched neither. Two of the buildings from which these samples are drawn are considered in detail below.

The first building which serves as a case study for our analysis is the Master Shipwright's quarters. Originally built for Master Shipwright John Watson and his family in 1834, the cottage is a timber-framed and weatherboarded structure built on a coarse rubble foundation (Figure 9). It is still extant on the historic site. Bricks were used to build an interior chimney as well as to provide infill for the timber framing (and then covered by weatherboards) in a traditional English construction technique known as 'nogging'. Eight bricks from four separate rooms known to have been part of the original 1834 structure were sampled by FTIR, with an analysis of provenance relationships based on quantitative peak-matching methods. Only one of the eight bricks could be firmly linked to the Brick Point clay source.

Despite historical evidence documenting the presence of clay quarries and skilled brickmakers at Port Arthur during the time the cottage was built, this disparity forces consideration of other possibilities: that there is a previously unidentified clay source at Port Arthur, or that the brick is an import from elsewhere. Of these, the latter seems most likely. We know that brick was imported from the government kilns in Hobart in late 1830.⁸⁹ We also know that brick was recycled from the decommissioned penal settlements at Macquarie Harbour and Maria Island. A return in 1833 includes 'A quantity of broken bricks, stated in the invoice from Macquarie Harbour, 2000'.⁹⁰ Conceivably, some of the bricks imported in the early 1830s were salvaged during demolition/renovation of the earlier structures and repurposed.

⁸⁹ Russell, Commandant, to Burnett, Colonial Secretary, 20 December 1830, note by Arden, 12 December 1830, CS01/484/10750, TA.

⁹⁰ 'A Return of Stores received from Macquarie Harbor per Government Schooner *Penelope*', 25 January 1833, CS01/483/10748, TA.

Building Number	Building Name	Date Built	FTIR Test Number	Clay Source (FTIR)
7	Store and Gaol	1833-34	07-01	No match found
			07-02	Brick Point 2019 clay sample 2
			07-03	Brick Point 2019 clay sample 2
			07-04	No match found
			07-05	No match found
			07-06	No match found
			07-07	Brick Point 2019 clay sample 2
			07-08	No match found
6	First Hospital retaining Wall	1833	06-01	No match found
			06-02	Brick Point 2019 clay sample 2
			06-03	No match found
9	Commissariat Officer's Quarters	1833	09-01	
			09-02	No match found for clay sources sampled but FTIR data indicates that all bricks match each other.
			09-03	
			09-04	
20	Master Shipwright's Cottage	1834	20-01	Bricks 20-01, 20-02, 20-03, 20-04, 20-05, 20-06, and 20-07 had no match for clay sources sampled but FTIR data indicates they match each other.
			20-02	
			20-03	
			20-04	
			20-06	
			20-07	
			20-08	
3	Separate Prison Receiving Block	1849	03-01	No match found
			03-02	Cascades clay sample 1 & 2
			03-03	No match found
			03-04	Cascades clay sample 1 & 2
4	Pauper's Mess	1864	04-01	Brick Point 2019 clay sample 2
			04-02	Brick Point 2019 clay sample 2
			04-03	Brick Point 2019 clay sample 2
1	Asylum Bakehouse	1868	01-01	No match found
			01-02	Coal Mines clay sample 1
			01-03	No match found
			01-04	Coal Mines clay sample 1
2	Asylum Officer's Quarters	1868	02-02	No match found

Our second case study is the Penitentiary ablutions yard (1856-1877). This sample comprised a collection of thirty-eight bricks, constituting mainly half bricks, excavated in 2016 as part of the archaeological excavations of the penitentiary (Figure 10).⁹¹ These bricks were sourced from features related to the period post-1862, after major remodelling in the yards had taken place. Many of the bricks displayed a grainy matte surface associated with sandstock bricks, providing evidence for a sand struck brick moulding process. Some contained flux material, which had been added to prevent drying or cracking during firing, as well as carbonised material in the interior. The latter suggested the addition of coal cinders, small coal and ashes or timber-based pot ash to enhance the workability of the raw clay.

Analysis of the bricks using FTIR indicated that they had been sourced from clay around the Coal Mines — over seventy kilometres away by sea from Port Arthur (see Figure 2 in Introduction). At the time that the remodelling work was taking place in the 1860s, the Coal Mines had been taken over by a private operation.⁹² This suggests the possibility that, upon the 1848 closure of that station, the remnant masonry buildings were viewed as a resource to be salvaged for other works. Whether the bricks were sourced directly for the penitentiary works, or were a by-product of another process, remains to be determined. We know that bricks for the initial conversion of the flour mill and granary into the penitentiary in the 1850s were sourced from Brickfield Hill, so it is likely that the Coal Mines bricks were part of an opportunistically-sourced batch.⁹³

* * *

The focus of this article has been on the industrial and technical aspects of brickmaking at the Port Arthur penal station. The historical sources indicate that brick production was primarily oriented towards supplying the needs of the settlement, increasing in volume as it shifted from the short-term wooden structures and brick fireplaces adequate for the timber-cutting camp, into the substantial brick and

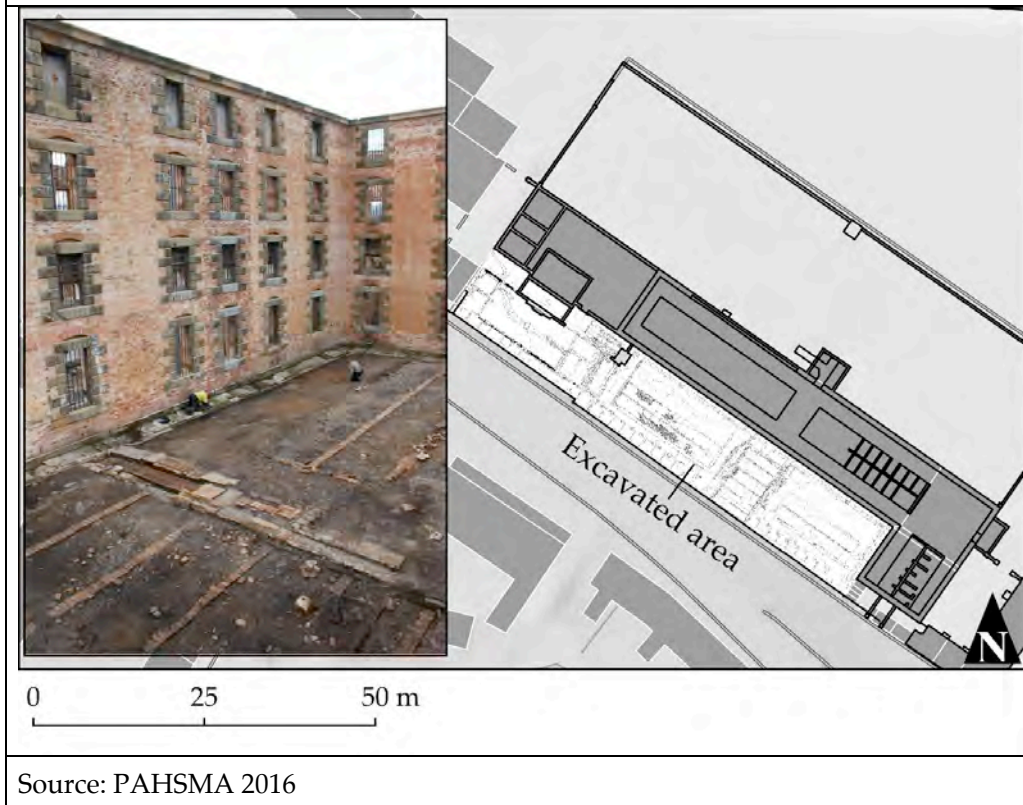
⁹¹ R. Tuffin, 'Technical Report for 2016 Archaeological Investigations of the Penitentiary Ablutions Area, Port Arthur, Tasmania', report prepared for PAHSMA, 2016.

⁹² D. Bairstow and M. Davies, *Coal Mines Historic Site Survey: Preliminary Report*, Occasional Paper No. 15, Hobart, 1987.

⁹³ An 1856 trial report notes the cart gang waiting for their carts to be loaded, before proceeding down to supply works on the new penitentiary. MM62/38, TA. In: M. Glover, *Glover Papers*, Vol. 1, PAHSMA, p. 26.

stone buildings required of a permanent prison. As indicated by accounts like those of David Burn in 1842, this production was enough to sustain a small export market. Historical and archaeological evidence suggests that the early Port Arthur brickmakers faced challenges in converting what appears to have been sub-optimal raw clay materials into a brick product. By techniques like adding tempers, they did manage to produce a viable product.

Figure 10: The penitentiary brick sample was derived from 2016 excavations of the former ablutions area



Source: PAHSMA 2016

When seen through the framework of contemporary brickmaking, the moulding techniques evident on the samples, as well as the kiln and shed infrastructure recorded by Laing, are consistent with contemporary small-scale industrial brickfield production. Evidence does indicate that certain processes, such as weathering or even firing, were truncated as a result of demands for greater output. However, it seems likely that the main deficiencies in the Port Arthur bricks were a

consequence of the poor quality clay and the restrictions of the penal environment which favoured, at least during the 1830s and 1840s, human power over mechanised or animal. This meant that the material to be moulded was not fully mixed with the tempers and did not have the plasticity required for higher quality bricks. Further, our research indicates that Port Arthur's penal environment did not encourage the deployment of the full range of expertise (such as temperers or moulders) usually seen in a free brickmaking operation. Additional research may also reveal evidence of convict resistance and non-compliance which impacted brick production and output in convict brickyards.

One of the intriguing outcomes of the research is the evidence that an appreciable number of the bricks subjected to FTIR sampling did not in fact originate from the known local brickfields. Although the source of the Shipwright's Cottage brick has yet to be firmly established, it seems most likely that this material represents import from the Hobart kilns, or from one of the closed penal settlements Port Arthur replaced. The presence of Coal Mines bricks in the penitentiary ablutions is equally fascinating. This suggests several possibilities, including that demand may have at times outstripped the supply capacity of the Port Arthur brickfields. In consequence we need to ask whether these bricks represent new brick production at these other sites to supplement the Port Arthur output, or the demolition and recycling of bricks as these other sites wound down their operation. This potential for a system-wide redeployment of materials from one convict station to another was one of the original questions that inspired this study and, from the limited mention of such movements in the documentary record, supports the need for ongoing material analysis.