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Documents and Digs

Recurring Problems in the Field of Historic Archaeology with Illustrations from Recent Work in New Zealand's Copper and Clay Industries

Rod Clough
Department of Anthropology, University of Auckland

ABSTRACT

This paper assesses the value and constraints of historical archaeology, and examines some of the criticisms prevalent in the literature, with particular reference to industrial sites, specifically to examples of the heavy clay and copper industries of New Zealand.

Keywords: HISTORICAL ARCHAEOLOGY, INDUSTRIAL ARCHAEOLOGY, THEORY, HEAVY CLAY INDUSTRY, COPPER MINING, AUCKLAND, KAWAU ISLAND

INTRODUCTION

Historic archaeology, particularly in the United States and Australia, has come in for considerable criticism over the past decade from many quarters, often from within its own ranks (e.g., Deagan 1988; Cleland 1988). This is largely due to its apparent lack of a theoretical framework and the limited scope of its investigations. Deetz feels that the bulk of historical archaeology follows two roads: the confirmation of written documents, or determining the reflection of some artefactual pattern in the historic record. As an example of the latter, he cites the relationship between a class of expensive ceramics and the wealth of the estate owner (Deetz 1988), where the recovery of such artefacts adds nothing to the state of knowledge if the estate value is known from documentary records. Instead, he recommends a multi-evidential approach where archaeological and historical data are synthesised to produce conclusions unobtainable from either source alone.

Walker concentrates on the lack of a theoretical approach and the resultant "mindless collection of data that might be of value" (Walker 1978: 211). Perhaps such compilation is insufficient, though in fact evidence is rarely collected in a theoretical vacuum. There is always a theoretical perspective no matter how poorly developed. However, although critical, Walker recognises the constraints of 'rescue' excavation and the limitations of government funded archaeology on the formulation of adequate research designs. What he fails to recognise is that the theory oriented approach (hypothetico-deductive) was largely based on years of such 'mindless' (inductive) collecting.

It is apparent that a good deal of the problem stems from the traditional perceptions of history and archaeology.

> From the outset, historians and archaeologists work with different databases: the historian with documents and the archaeologist with 'material culture'—that sector of our physical environment that we modify through culturally determined behaviour. (Deetz 1988)

Material culture and archival data are treated as separate entities and the private property of the respective disciplines, while both should be seen as different forms of data (at times complementary) to be evaluated. Full cooperation between the two disciplines, history and archaeology, is the only route to a more complete understanding of our historical sites and their context.

It is in fact difficult to envisage historical archaeology without use of both forms of evidence, but even in recent contributions to the field, there are calls for historical archaeologists to make more use of the documentary evidence (Stone 1988).

To a considerable degree, historic archaeology in New Zealand is at the level of identifying the archaeological correlates of the documentary record and describing the materials utilised and imported by the European settlers. Although there have been some major pieces of historical-archaeological research utilising multi-evidential approaches, these are largely unpublished MA and PhD theses or are published as government reports with limited access (e.g., Ritchie 1986; Prickett 1981; Spring-Rice 1983, etc.). Apart from these, attempts are only now being made to examine sites in their overall economic, social and environmental settings. The problem lies in the narrowness of the database and the pressures (time and funding) of public archaeology. Many of the higher level questions suggested by Cleland (1988), such as the correspondence between control of production and social differentiation, are only now accessible through the gradual development of a broader database of survey, excavation and archival research.

Another common criticism is that excavation is unnecessary when we have archival evidence. As Deetz (1988) stresses, excavation is of little value if it largely serves to confirm what is already known from the documentary record (although even this has its place, for example in the interpretation of historic sites for public display). In fact archival evidence is never complete enough to enable a full reconstruction of a site in all its aspects.

This paper deals with one particular area of historical archaeology, where the importance of excavation and the interactive nature of the two forms of evidence are obvious, and that is the investigation of industrial sites. A good deal of information concerning the general history of an industrial site may be available in the documentary record, since in New Zealand much of it is prejudiced in favour of the activities of the entrepreneurs, or 'capitalists', as they were then known, who controlled the country's early industries. In the mining, timber and ceramic industries, for instance, it was often the activities of a few wealthy men (including some shady dealers) that established the industrial basis of many of our present towns and cities.

However, the amount of documentary information relating to these industries varies greatly within (geographically) and between industries. Information regarding details of the technology and operating history of industrial sites is generally patchy, and we often therefore rely heavily on excavation to reconstruct the history of the industry, including, for instance, technological innovations, and the adaptation of old techniques to new settings and to changing economic and political variables.

JAMES WRIGHT'S POTTERIES

An example of the extent to which archaeology can expand our knowledge of an industry is the excavation of James Wright's potteries at the Pollen Brickworks and Potteries, Whau Peninsula, West Auckland (Best and Clough 1988). Documentary evidence relating to the pottery of James Wright is slight. We know that he arrived in New Zealand from Staffordshire in 1863 as one of the Albertland settlers and that he chose to remain in Auckland in the employ of Dr Daniel Pollen (the latter was also resident medical practitioner to the miners on Kawau 1847–9 (see below) and Premier of New Zealand in 1875) as one of New Zealand's first known commercial potters. Although his pottery is briefly described in the catalogue of the 1865 Dunedin Exhibition (Anon. 1866), we are left with little information as to the techniques employed, materials (such as glazes) used, or the range of his products, as very few pieces survive in private or public collections (Reynolds and Reynolds 1985). The excavation has provided us with such information. A large collection of potters tools and stamps, fragments of various vessel forms, including stoneware bottles, and some complete telegraph insulators were recovered (Figs 1 and 2) and kiln furniture (Fig. 3). Analysis of some of the glazed ceramic indicated that lead was the predominant glaze used with various pigments to produce items such as decorative encaustic tiles. Many of the tools were forming ribs used for the production of specific items such as cups, jugs and plates, whose forms could therefore be reconstructed. In addition, three decorating tools were recovered: two sprigging moulds and one master mould, which were used to transfer thin clay designs to the vessel (Best and Clough 1988).

THE HEAVY CLAY INDUSTRY AND THE EXCAVATION OF POLLEN'S BRICKWORKS AND POTTERIES

The excavation of industrial sites should enable us not only to gain information about techniques and products, but to observe the relationship between these sites and contemporary political and economic conditions. Auckland, established in 1840, was a rapidly growing town, but like many early towns in Australasia, went through variable rates of growth, with periods of boom and bust. Building materials are urgent requirements of a new settlement and as a consequence the building industry is often seen as a finely tuned indicator of these periods of changing economic fortune (Birmingham 1983: 55). We would expect such changes to be reflected in the heavy clay industries.

To what extent will the excavation of the brick production sites reflect changes in the economy? The answer is complex—as it in part rests on the fortunes of individual capitalists, their perceptions and ability to invest in expansion (upgrading plant and equipment) and their maintained interest in the venture. Also exceptions will always be encountered: an industry may be established against the economic trend, where inappropriate technology is introduced, etc. There also might be, as Connah points out, "a certain nationalism that spurred on some industrial entrepreneurs, even when profits eluded them" (Connah 1988: 126).

Excavation of a single production site, though informative, will only provide answers to site specific questions rather than those relating to broader issues such as the industry in general or settlement. A good illustration is Pollen's Brickworks and Potteries, founded *c.* 1855 and continuing in production until the mid-1870s (Best and Clough 1988). Its establishment can perhaps be seen in the context of the Building Act of 1854, which

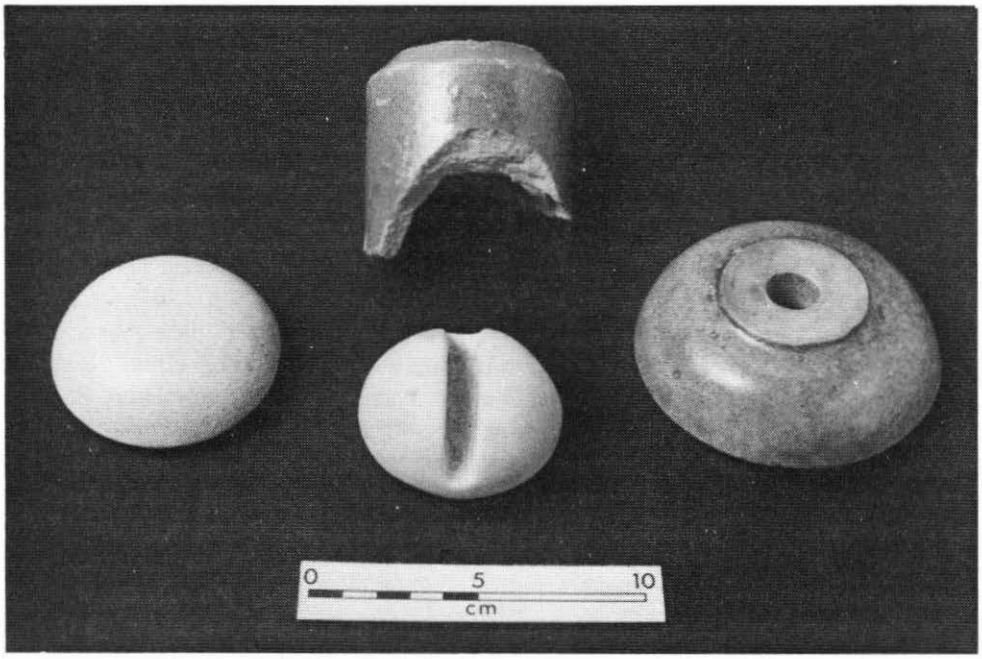

Figure 1: Insulator parts from the Pollen Site.

Figure 2: Insulator parts from the Pollen Site.

required the use of bricks or stone in specific parts of buildings to reduce fire risk. However, its eventual demise cannot be directly related to a depression or decline in the building industry at large, without reference to other heavy clay industries in Auckland. Its success or failure is linked not only to political growth and stability, and to Pollen's personal circumstances, but also to the extent of its raw resources (clay), the quality of those resources, the quality of the product (consistency, colour) and the efficiency (productivity) of the establishment relative to other works supplying the same market.

Unfortunately, although archaeology can observe modification and changes occurring at specific sites, unless detailed documentary evidence is also available to date these events it is not possible to relate, for instance, one brickworks to another. It is generally thought that the techniques of archaeology (seriation, typology, etc.), are not finely tuned enough

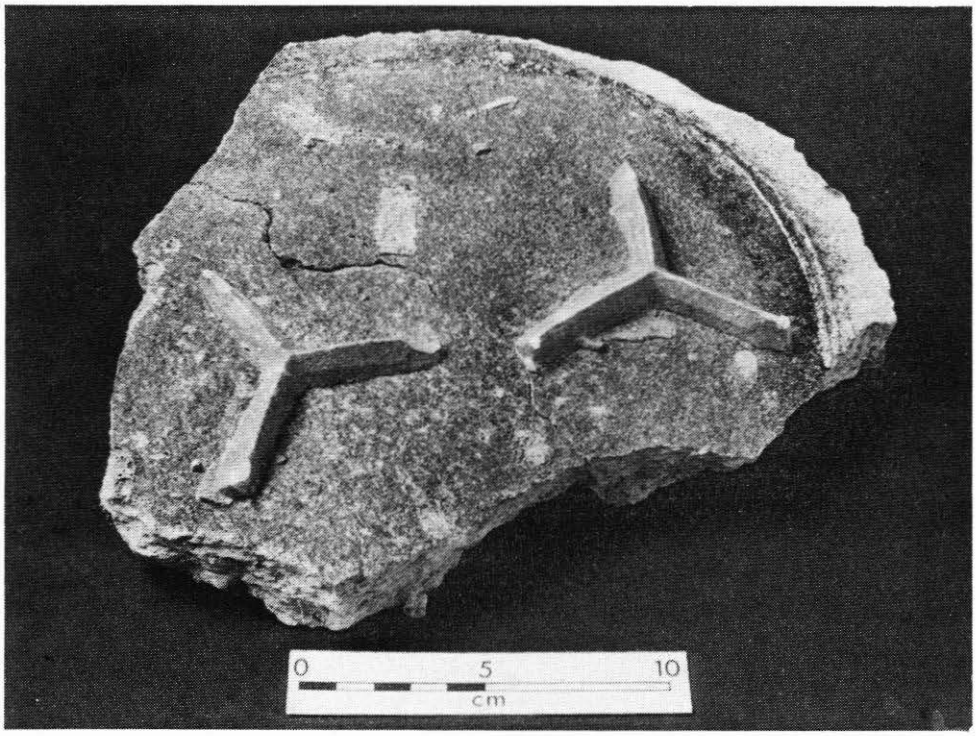

Figure 3: Kiln furniture from James Wright's Pottery, Pollen Site.

to be of value in dating changes on historical sites (Dollar 1978; Deagan 1988). For example, ceramics usually send archaeologists into fits of classification and seriation, but as Dollar observes, during the nineteenth century, Staffordshire alone (the source of much of the ceramic material exported to the colonies) had literally hundreds of potteries producing innumerable styles with different potters producing the same designs. Although there was a beginning and end date for the production of any particular style, these differed between potteries, considerably extending the date range if, as is often the case, the manufacturer cannot be identified. Such complexity and the difficulty of attribution make the use of these traditional archaeological tools of dubious value in the field of historic sites archaeology, where dating within a narrow time span (e.g., five years or less) is required.

This is still the case, even though the development of multi-evidential techniques—assessment of many lines of material evidence (pipes, ceramics, glass, etc.)—has refined our ability to date and relate sites. Dating information with the required degree of accuracy can usually be provided only by the documentary evidence, though even this is not always reliable and should not be accepted uncritically.

Little is known of the earliest attempts at brick production in Auckland. Some of it was carried out at the building site, since suitable clay was available throughout the Auckland area. Thus clay was quarried, formed and fired in clamps or 'open kilns' on the construction site and would have left little if any evidence of the process. Although we know from documentary sources that this occurred, no archaeological evidence of these early clamps has been found.

The Pollen brickworks is one of the earliest brickworks in New Zealand for which we have good archaeological evidence. It is also one of the few industrial sites to have been excavated. The works were in operation for some 20–25 years, although exact beginning and terminal dates are uncertain. For the most part it was operating during a period of economic growth. From 1865 to 1875, Auckland and Thames boomed because of the Coromandel goldfields and thus while the wars of the 1860s generally slowed development in the north, and a recession followed the peace in 1870, the gold booms kept Auckland relatively buoyant. This appears to be reflected in the modifications to plant at the site during its lifetime, particularly to the kiln installations.

Considerable information about the technology and operating procedures, in particular the kiln installations, was recovered during the excavation. The final kiln on the site was a 'Dutch Kiln', essentially a rectangular structure some 8 x 5 m, with thick (80 cm) walls and evidence for twelve fireholes, six on each of the long walls, operating on updraft principles (Fig. 4). The kiln was fired with coal, and the bricks were exposed directly to the flame with the heat escaping through the roof, a temporary structure usually of tiles (Birmingham 1983). In this case there was good evidence for a roof of corrugated iron, as iron with a covering of calcined shells was excavated immediately above the kiln floor, and interpreted as collapsed roof.

According to early reports, shell was collected from nearby shell banks and used for paving (Scott 1979). However, from the above evidence it seems that the shell was used also for the production of lime, a practice common in many early yards. Shell would have been thrown on to the roof of the kiln during firing and the heat from the kiln would have caused calcination or the breakdown of the carbonate and the formation of lime: $CaCO_3 = CaO + CO_2$. This would then have been used as the basis for mortar, the production of which makes a good deal of economic sense, utilising the heat of the kiln to manufacture an essential product both for on site construction of various installations, including the kiln, and for a saleable commodity along with the bricks. Its use around the site was confirmed in areas adjacent to the kiln wall where a calcareous deposit (concretion of lime mortar) had been laid after the construction of the foundation layers of the Dutch kiln.

The kiln had the remains of substantial long walls with partial walls at both ends (Fig. 4 and Fig. 5 feature A1). At the wicket end (loading end) the wall construction was relatively crude, reflecting its temporary nature, as it was this end that was built up before and broken open after each firing to enable loading and unloading of the kiln. At the opposite end there was a solid wall with a central doorway and the remains of a drain—blocked intentionally after its last use and designed to remove the water from the roof when the kiln was not being fired (Fig. 4).

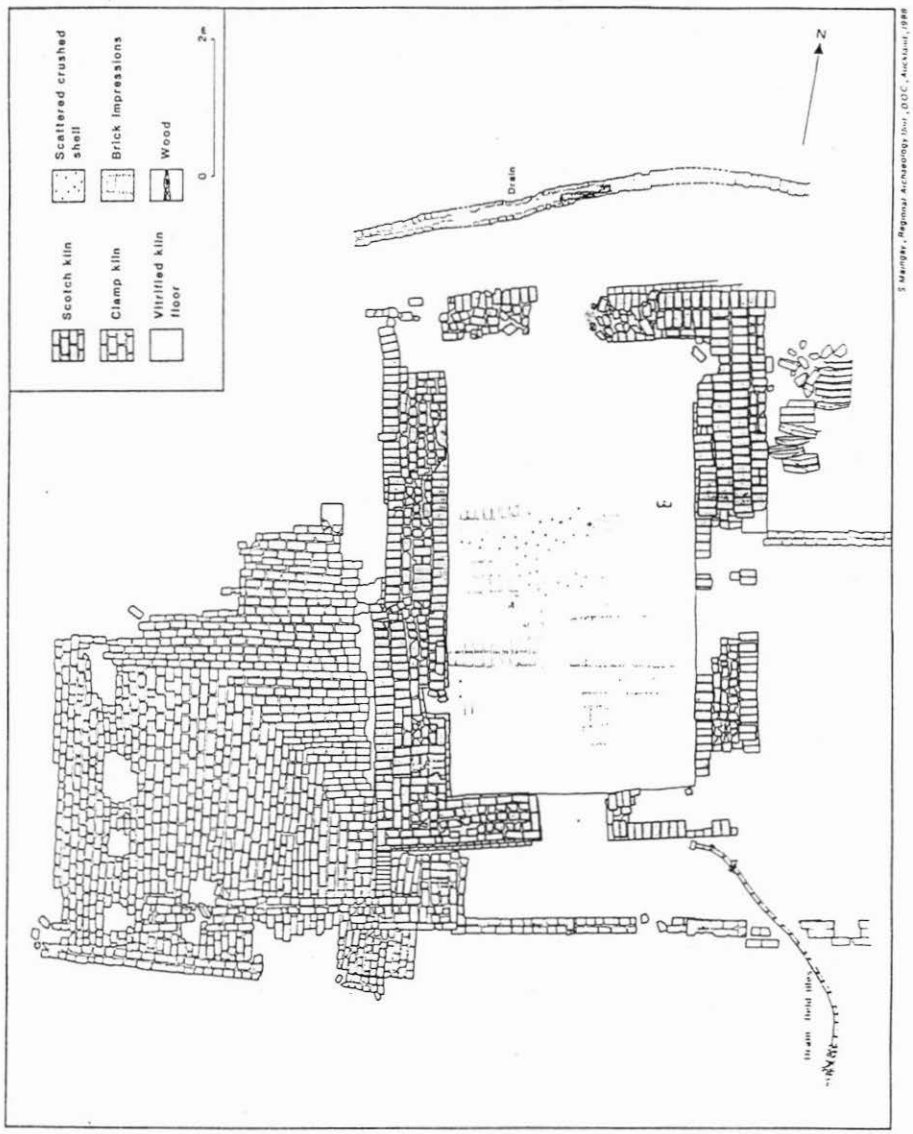

Figure 4: Plan of clamp and Dutch kilns, Pollen Site (N.B.: Dutch kiln marked as Scotch kiln on key).

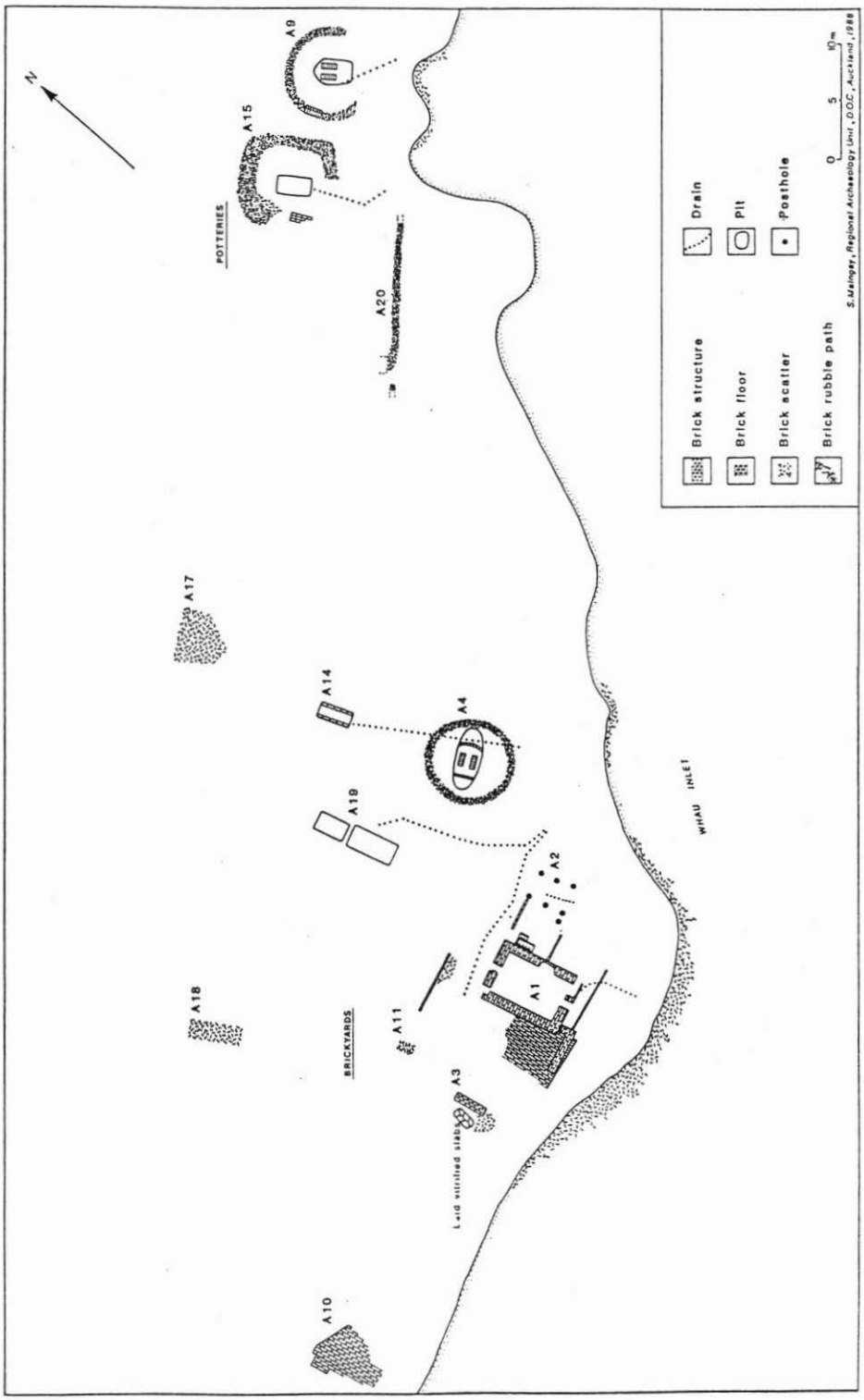

Figure 5: Excavation plan, Pollen Brickworks and Potteries, Site R11/1509.

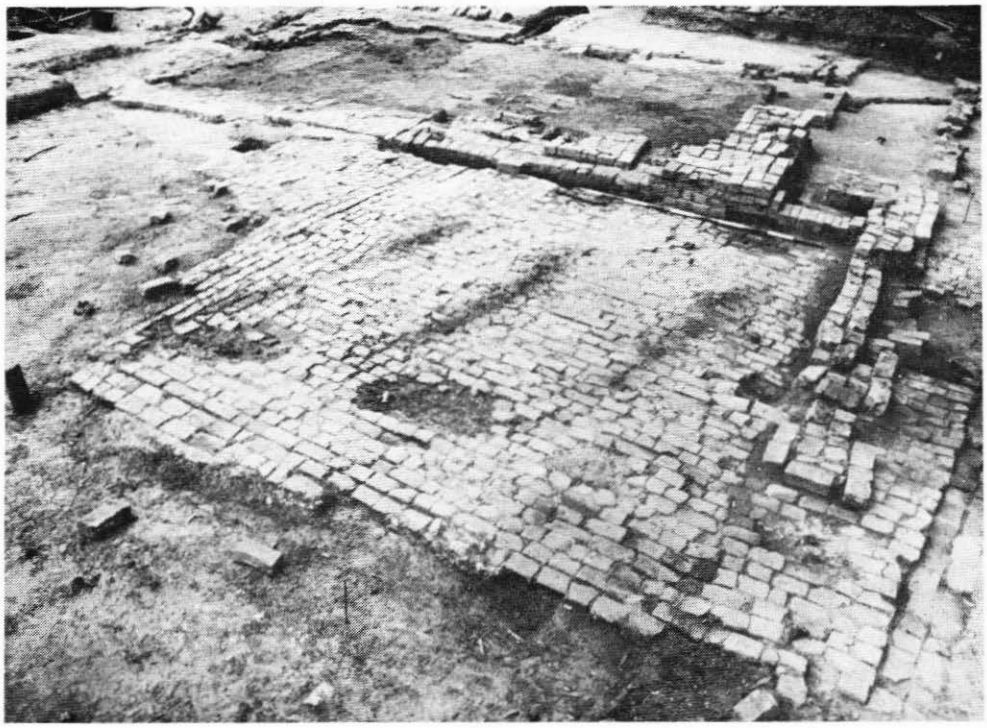

Figure 6: Remains of Dutch kiln and Clamp kiln, Pollen Site.

A cobbled brick floor to the west of the Dutch kiln was an earlier feature as it had been cut into during construction of the latter (Figs 4, 6). Postholes dug into the cobbles indicated that this floor had been modified by the addition of a superstructure and the presence of coal particles suggested that it had been used as a coal bunker and workshops, possibly a drying floor, contemporary with the kiln. Close examination of the brick surface showed it to be patinated and in parts deteriorating through fire damage. The damaged areas occurred in strips across the floor and were approximately the same distance apart as the fireholes seen in the later Dutch kiln. It is suggested that the damaged surfaces represent areas exposed to burning fuel and the relatively undamaged areas those where the bricks had been stacked as in a clamp. The patination was all over the surface and appeared to represent heat damage, surface vitrification and later weathering of this surface. Thus, it seems probable that the cobbled area was originally the base of a clamp.

A section beneath the east wall of the Dutch kiln revealed clear stratigraphic evidence for its construction, including a layer of earthy clay that had been levelled as part of the foundation layer for the lower course of the kiln wall. However, beneath this layer was a level surface of burnt clay, itself above a layer of brick rubble. In association with similar evidence from under the cobbled floor, it would appear possible that the burnt clay represented the remains of a still earlier clamp, with a levelled clay floor in contrast to the later brick-cobble construction. The fact that this overlay brick rubble suggested that there might have been yet earlier firing installations on the site. In addition, there was evidence that the Dutch kiln itself had been modified on many occasions.

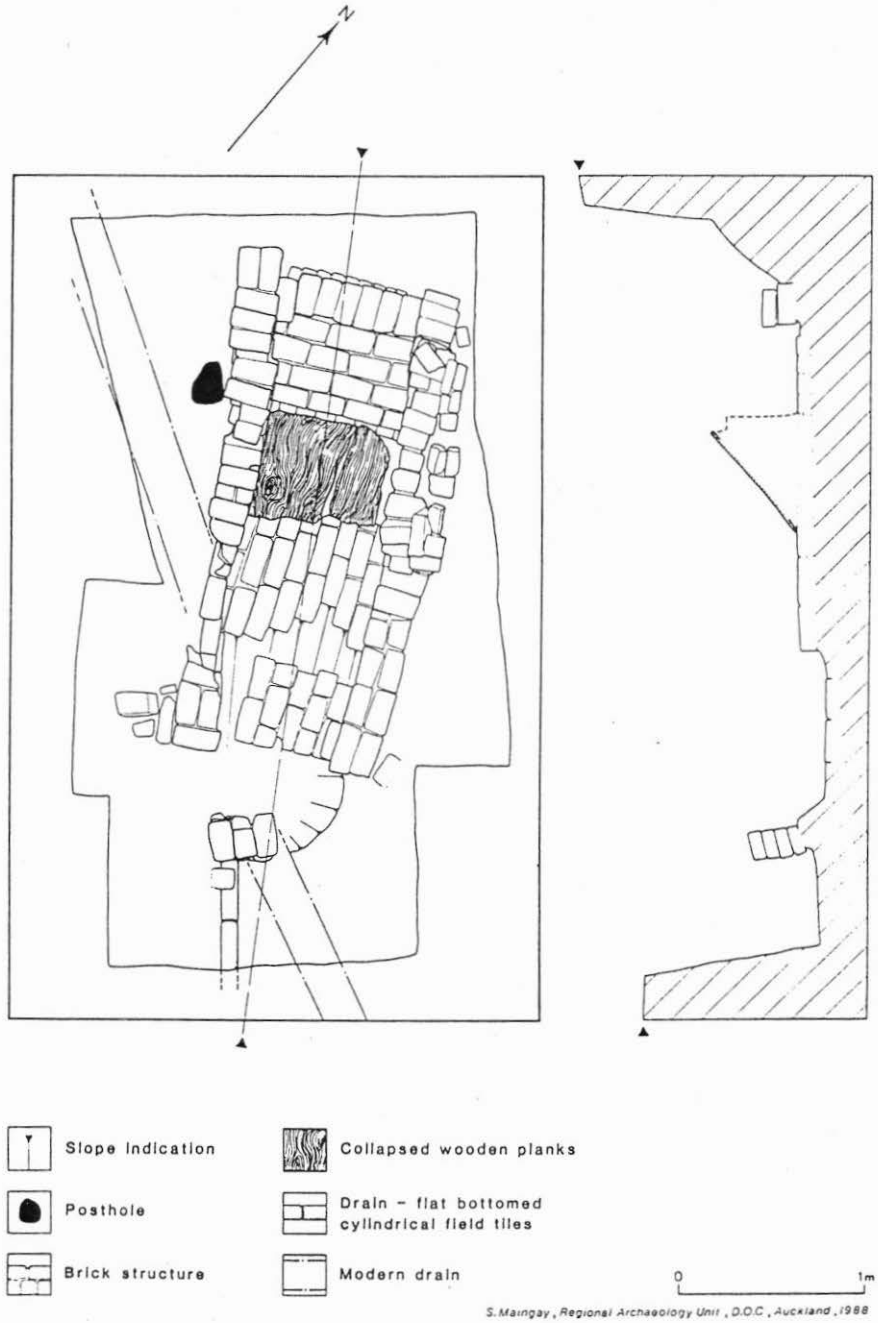

Figure 7: Plan and profile of clay preparation tank (A14), Pollen Site.

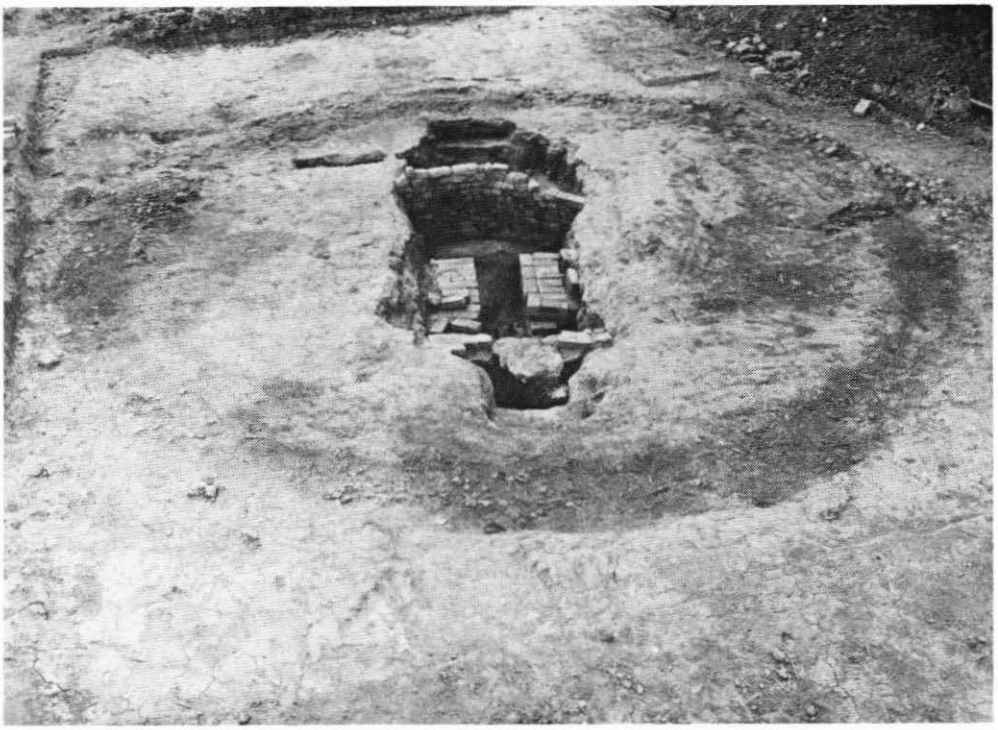

Figure 8: Remains of horse drawn pug mill, Pollen Site.

James Wright took over the running of the Pollen Brickworks and established a Pottery during the mid-1860s (see above). As pottery production requires clays of greater plasticity than that used in brick manufacture, we would expect to see the introduction of new technology with his arrival. Several of the installations excavated related to this event, as they are best interpreted as washing mills or blungers, plant specifically designed for the production of finer clays (e.g., Figs 5 (features A14 and A15), 7, 8).

Overall, the excavation provided excellent evidence for the upgrading and modification of kiln installations and other plant such as a pug-mill (Figs 5 (feature A4), 9, 10). The importance of this information needs to be stressed, not only because it relates to new developments in the industry or to the importation of new equipment, but also because the changing technology would have altered the impact of 'external' influences, such as labour availability, on the industry. For example, a shortage of skilled labour would not have been so disastrous to a mechanised industry (see Lawson 1971 for relationship of potteries with goldrushes in the 1850s in Australia). Thus awareness of the level of technology and any changes that may have occurred enables us to interpret more clearly the relationship between specific industries and their economic/political environment.

The output of the brickworks comprised a variety of heavy clay items, bricks and tiles of various sizes and function and a range of field tiles and decorative bricks (Figs 11–13). In general, one cannot assume that the quality and range of products manufactured at the site are accurately represented by the material recovered during excavation. Although it is possible that the range of material produced will be recovered from debris, it is unlikely that it will be representative as regards quality. For example, many bricks were almost certainly

Figure 9: Blunger or clay preparation tank, Pollen Site.

discards, 'the worst of the bunch', and do not reflect the quality of the material shipped out for construction work. They would have been useful in rebuilding the kiln and other installations at the works and providing material for fill, paths, grog, etc. This is borne out by the variable quality of the material used in the construction of the kiln and other installations around the yard. The very nature of the clamp, and to a lesser extent the simple updraft kiln, result in poor control over atmospheric conditions during the firing process. This is reflected not only in the surviving kiln structure which revealed differing degrees of fire- damage and fusion (vitrification), but also in the quality of the bricks—both friable underfired and vitrified overfired bricks were used in the structures excavated. It would be easy to understand the demise of this particular brickworks if they were in any way

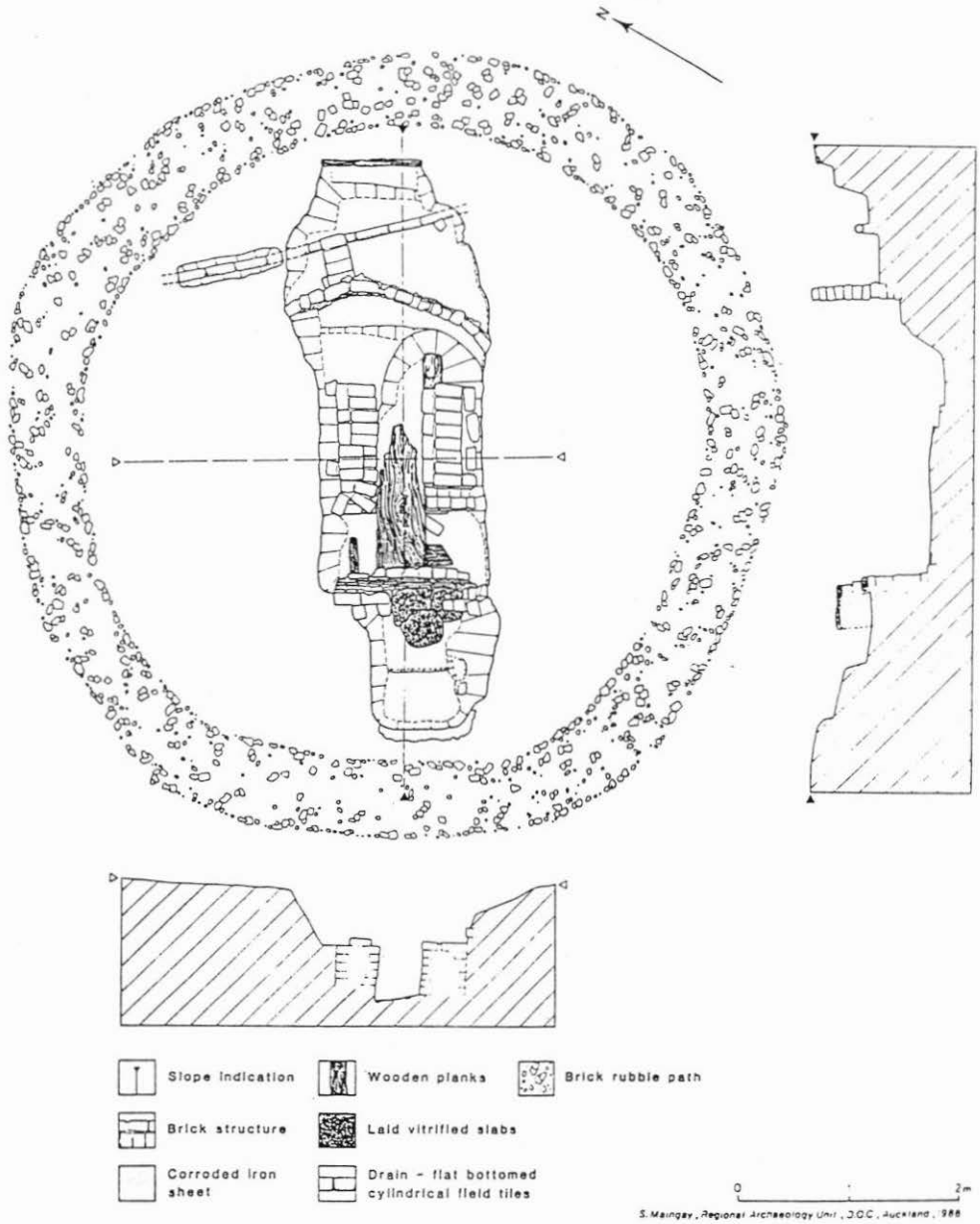

Figure 10: Plan and profiles of pug mill (A4), Pollen Site.

Figure 11: Bricks of various sizes and quality from the Pollen Site.

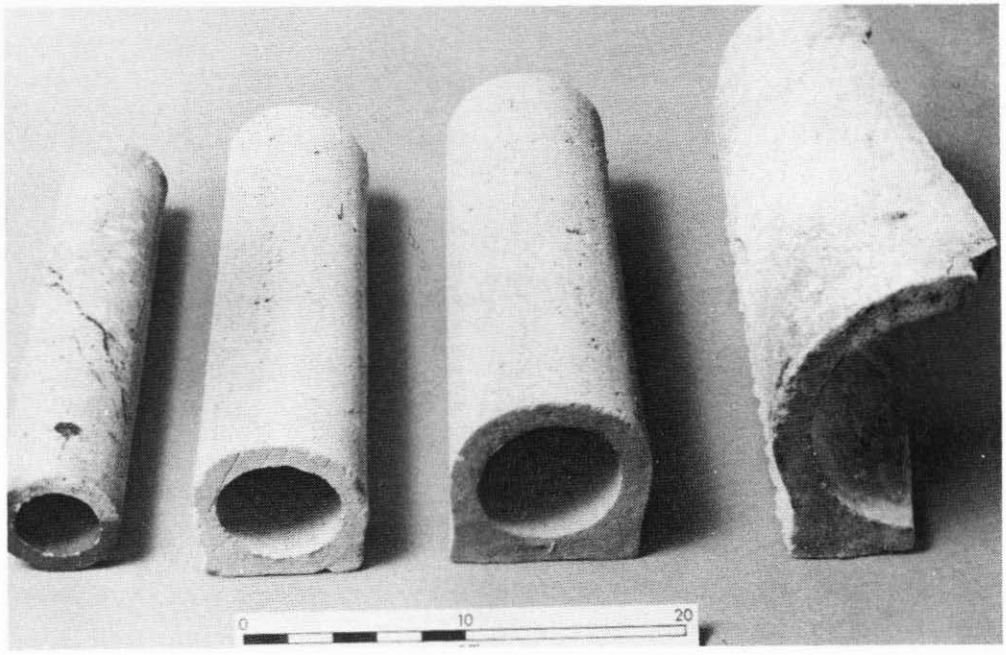

Figure 12: Field tiles from the Pollen Site.

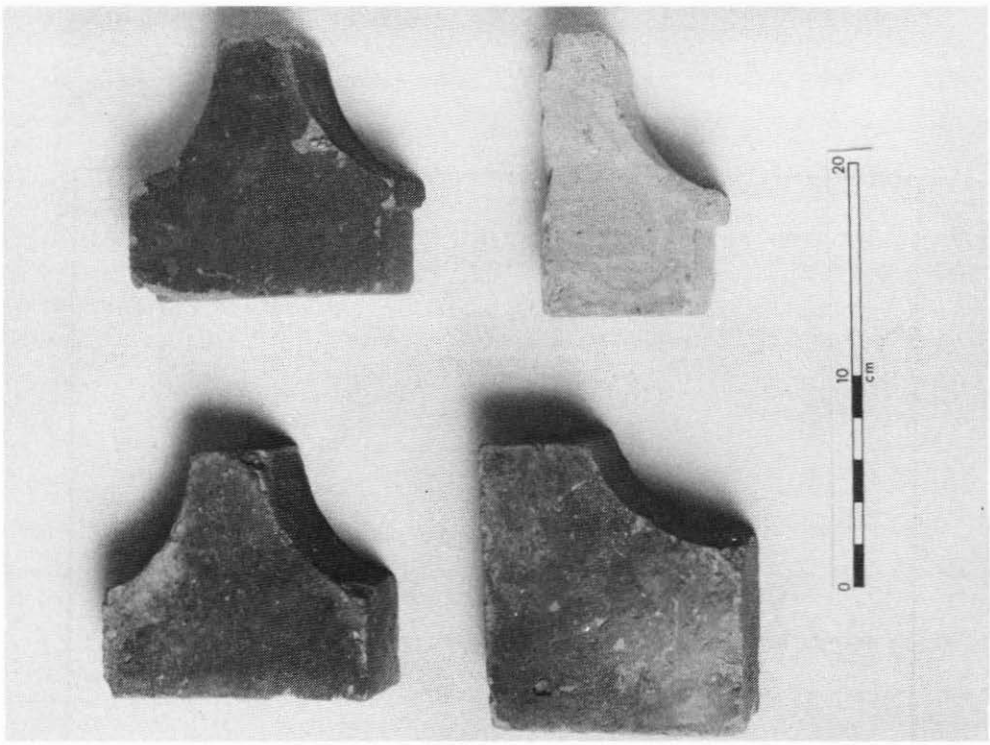

Figure 13: Decorative bricks from the Pollen Site.

representative of its products (Fig. 11). However, the archival material gives us no indication of either the range or quality of the goods produced and excavation is the only source of such information, even allowing for the problems outlined above.

THE COPPER INDUSTRY ON KAWAU

The copper industry on Kawau Island provides another example of the value of archaeology to our understanding of historic sites (Clough 1988). In this case, however, there is a great deal of documentary evidence available regarding dates of operation and changes in operating techniques, largely because of a lengthy legal debate over ownership of the mineral resources.

Kawau Island was the centre of one of New Zealand's earliest historic industries. At times between 1844 and 1855 over 200 people were engaged in the mining and smelting of copper, and remains of various aspects of the industry are still to be found at several locations on the island: Smelting House Bay, Miners Bay (South Cove), and Mansion House Bay (Fig. 14). Although the industry finally failed because of legal, technical and economic problems, it played a significant part in the history of the island and of New Zealand's industries.

Copper mining began in 1844 after samples of the ore had been sent to Britain for assessment. It was intended to ship the ores to smelting and casting facilities in Wales. However, this became complicated by the sulphidic nature of the ore, in that, like many

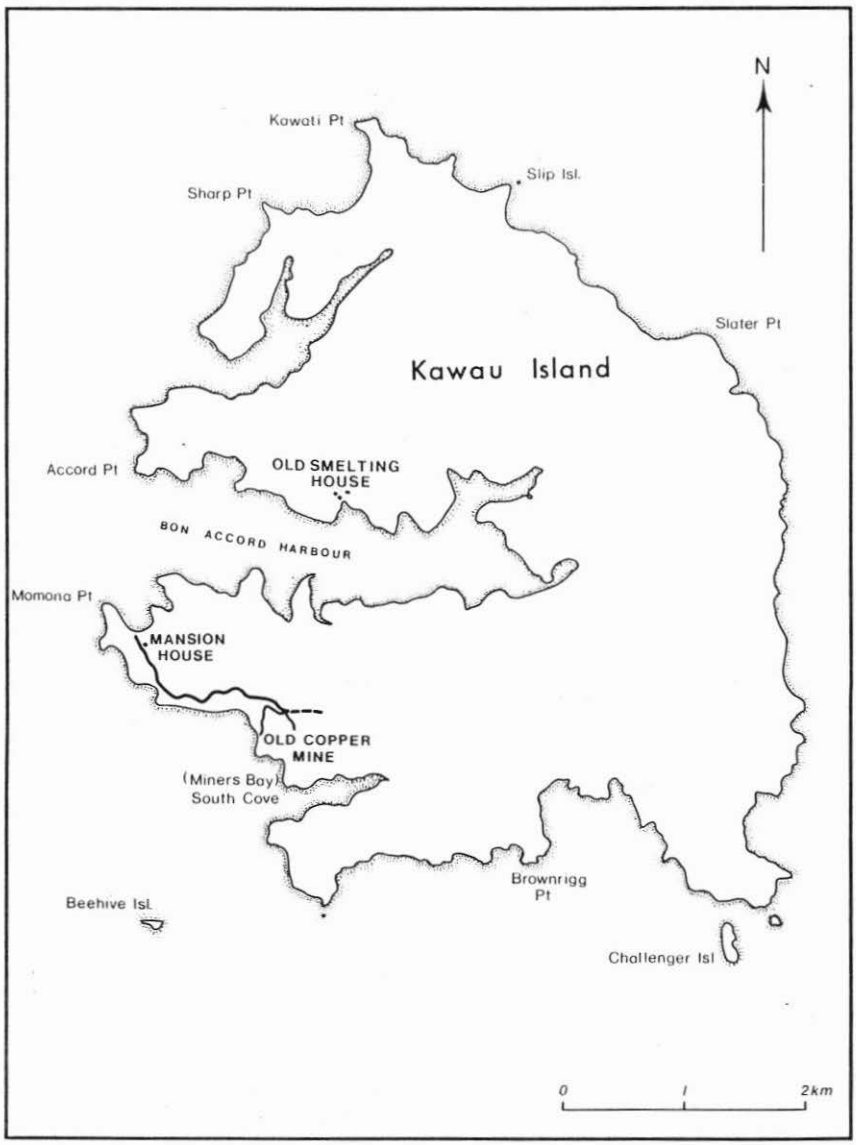

Figure 14: Location map of sites relating to the historic copper industry on Kawau Island.

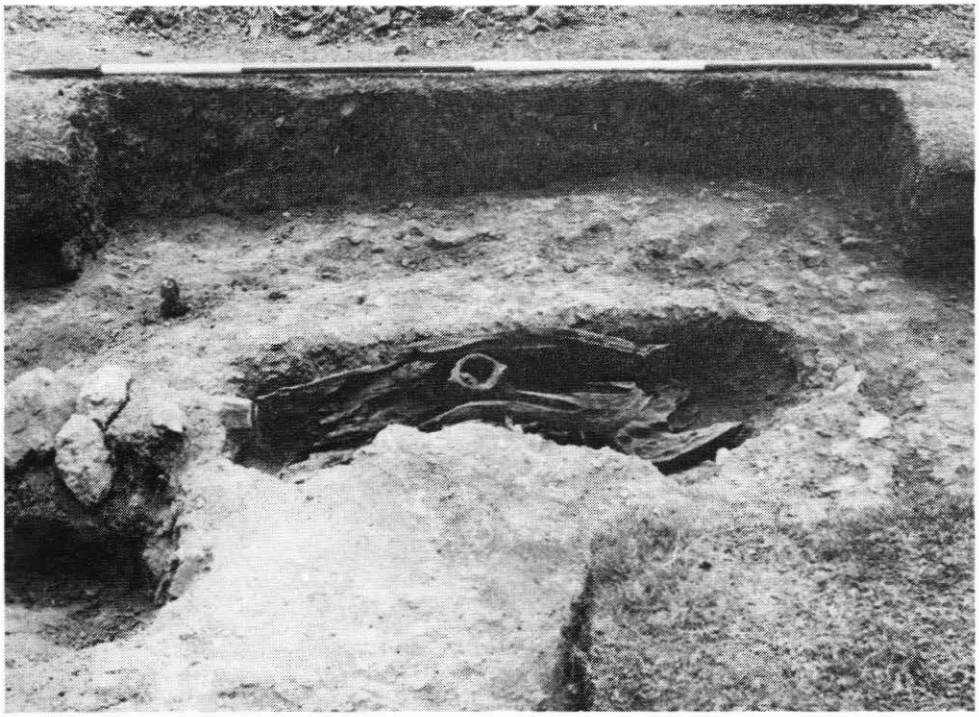

Figure 15: Whim—remains of central winching device, Kawau Island.

sulphides it had a tendency towards spontaneous combustion—a problem in the hold of a ship! This, plus the costs of shipping, influenced the decision to construct a smelter on the island. Initially there was a 'Welsh' system with batteries of roasting furnaces. This proved not to be cost-effective, the Welsh works manager was discharged and a German, Mr Berger, took charge, doing away with many of the existing furnaces and introducing a simpler technique based on a German system. Thus we see an example of the initial use of a system unsuited to its new setting because greatly increased transport costs were not initially taken into account, and its eventual replacement with an alternative system more suited to the economic conditions. Such modification and adaptation were common features in newly established industries in the colonies. By the mid-1850s the mining venture had failed and Berger had returned to Europe, leaving a small team operating the smelter. (There was a later attempt to re-open the mines in the late nineteenth century but this also failed.)

The failure of the copper industry on Kawau cannot be seen only in technical terms of depleted or poor quality raw materials, as both technical and social factors played significant parts in bringing the industry to a halt. Labour was a problem, with losses to the goldfields of Australia and California, and from the early documents pertaining to the copper venture it is evident that shady deals and a bitter struggle for ownership for over a decade between the two main protagonists, Taylor and Whittaker, played a major role in condemning the venture to failure (Wright 1984). Also, in a broader context, part of the problem initially was the attempt to establish an industry in a region devoid of the necessary backup facilities—in this case smelting and casting technology.

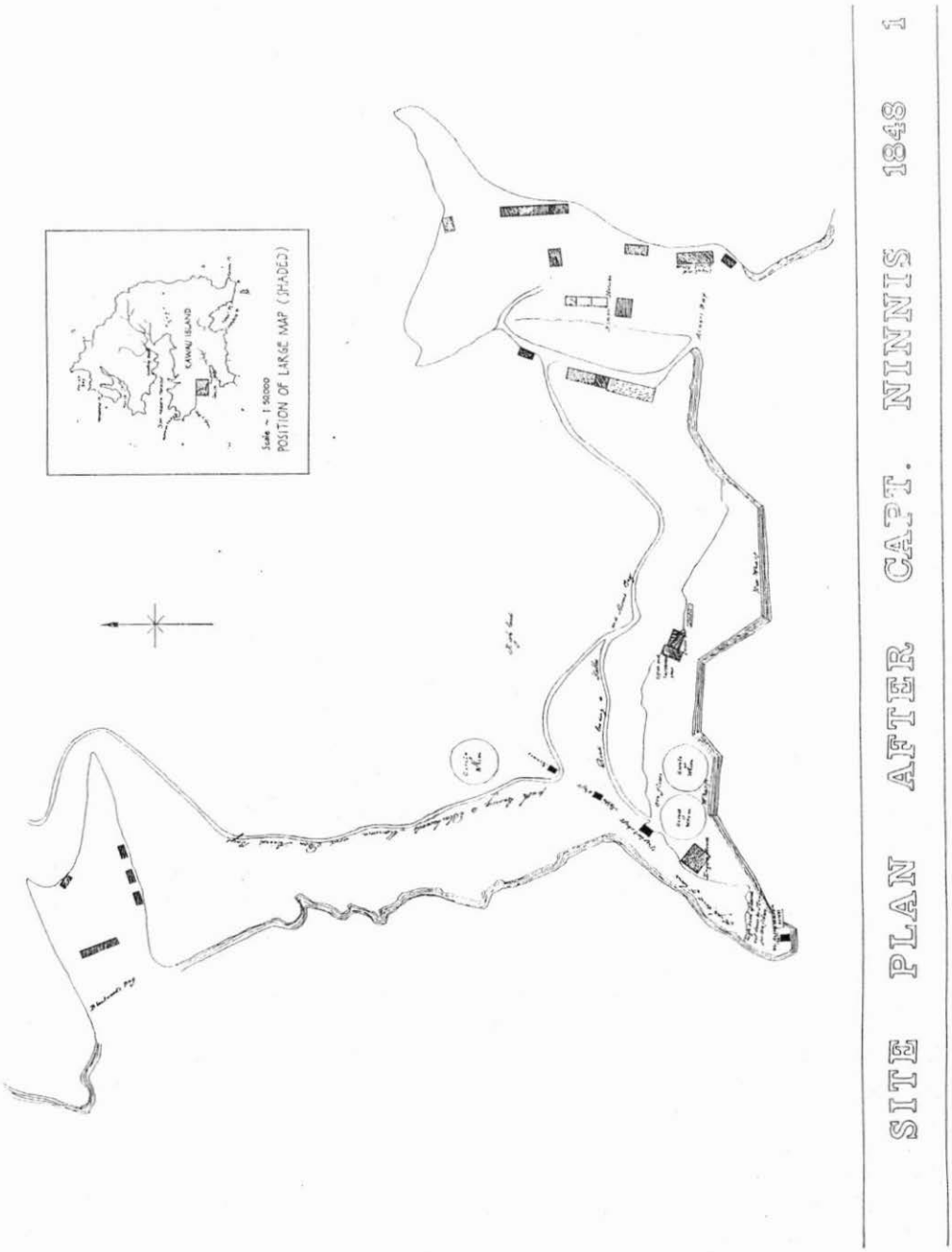

Figure 16: Plan of mine and miners' settlement on Kawau Island in 1848 (based on a plan by Captain Ninnis in National Archives).

Figure 17: Remains of large sandstone and brick hearth, Miners Bay, Kawau Island.

Investigation of the industry was prompted by the deteriorating condition of the smelting installation. It had been constructed of a soft local (Mahurangi) sandstone which had weathered extensively, resulting in partial collapse of the structure and concern about the safety of the remainder. As part of the preservation process it was necessary to excavate the areas which would be affected by the shoring, and in doing so to assess the potential for a more extensive excavation. Even from limited test squares the potential of further excavation was evident. A casting floor of fine sand was revealed, as were large slag blocks and pieces of matte (a sulphidic product of the roasting processes). Analysis of these will enable detailed reconstruction of the process and metallurgical evaluation of its efficacy. In addition, many of the bricks found at the smelter and mine were Australian imports and one of the firebricks, with the stamp of "COWEN", was imported from England, most probably manufactured at Stourbridge (Jack Diamond, pers. comm.), thus providing information about sources of construction materials.

Subsequently, the decision was taken not to limit excavation to the smelting site, but to approach the industry as a whole and investigate all aspects: the smelter, mine (and associated technology), and mining village (about which the information is variable in its quality), and to integrate this information with the documentary evidence for eventual public access.

In February 1990 further test trenches and excavation were carried out in various parts of the industrial complex. It was not possible to continue investigation within the Smelting House itself, as stabilising work on the structure was incomplete and such work would have been dangerous.

Figure 18: Retaining wall from building dating to c. 1900, Miners Bay, Kawau Island.

Three areas were investigated: Miners Bay (R9/500), a whim (remains of a winching device) near one of the main shafts of the mine (R9/632), and the area behind the smelting house (R9/642). Most effort was concentrated in Miners Bay, the primary settlement of the miners a few minutes walk south of the mine entrance and pumphouse (Fig. 14). The whim was partially excavated, revealing remains of machinery and a gravel horse/pony path (Fig. 15), while test trenches were excavated to the rear of the smelting house itself.

Excavation here was influenced by the results of resistivity survey, the 1848 map of Captain Ninnis (one of the mine managers in charge of mid-nineteenth century mining industry on Kawau) (Fig. 16), probing (with a gum spear) and surface morphology. No structures could be detected above the surface.

Probing and subsequent excavation revealed three significant remains of stone and brick structures in Miners Bay. One was the remains of a large hearth constructed of Mahurangi sandstone and brick, with associated iron firebars, hooks and grids (Fig. 17). Also in and surrounding the hearth was a considerable quantity of cultural debris (glass, china and many objects of metal, including coins, silverware, fine pins, clips, etc.) which appeared on preliminary examination to be of mid-nineteenth century date and therefore to relate to the Ninnis period of mining.

The second was a foundation/retaining wall of a large rectangular structure (Fig. 18) with more solid foundations and postholes at the north western end of the building. The latter were interpreted as the base of the entrance and hearth of a small building. A hard burnt area overlay them and contained large chunks of concrete with a coarse, water-rolled, pebble hard core and pieces of ribbed plate window glass of the type normally associated with toilets. It was immediately apparent that this material did not relate to the mid-nineteenth century and that we were dealing with traces of the attempt by Captain Holgate to rework the mine in 1900. Early photographs by Winkelmann capture many aspects of this attempt (Figs 19–21), including one of the bay with a wooden building and tents to the rear (Fig. 19). The retaining walls probably belonged to this building, although it is likely that the miners from the 1900 attempt reused many of the materials left from the earlier venture.

The third structure was a rectangular pit containing a large deposit of mineral water bottles (53 in 9 types) also relating to the last years of the century.

Excavation of another area in Miners Bay marked as stables on the Ninnis map revealed the remains of post-holes and timber structures (timber planking with nails) and structural iron-work (large bolts, nails, and horseshoes), along with some china and glass, although the latter was confined in its distribution. The area also displayed a sequence of construction, burning, subsequent collapse and rebuilding. Many burnt nails were located where the burning planks had collapsed, with the charcoal still attached. The horseshoes indicated that both large (Clydesdale?) and small (pit ponies?) horses were employed in operating in and around the mines.

Further investigation of the smelting installation in Smelting House Bay ('Little Swansea') was limited on this occasion owing to problems of stability, and only limited test trenching on the landward side of the smelter was carried out (Figs 22, 23). Apart from a 20–30 cm thick deposit of broken brick and burnt rubble (a destruction layer), solid brick floors and low walls were revealed. Many of the bricks indicated fire damage which suggests that we are dealing with furnace installations, possibly those known to have gone out of use on the arrival of Mr Berger, who introduced more efficient smelting techniques during the early 1850s. The small area tested indicated that considerable detail of the smelting installation and processes will be recovered in future investigations.

Near the mine itself, the excavation of the whim with part of the winching apparatus remaining is suggestive of the considerable amount of mining (technical) information which is still available in the environs of the mine. Such information is not available through the documentary record, and will enable us to achieve a more detailed reconstruction of the Cornish mining techniques applied on Kawau. It is also essential for interpretation and presentation of the industry.

Figure 19: Winklemann photograph of huts and tents in Milners Bay *c.* 1900. Auckland Institute and Museum photograph, C23046.

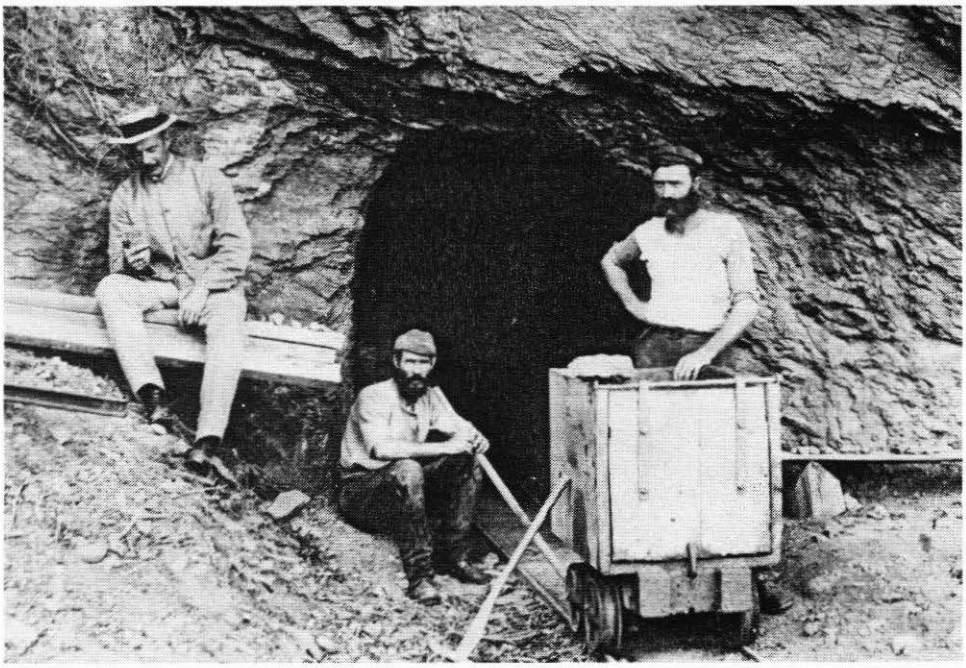

Figure 20: Captain Holgate and two miners during the attempt to re-open the mine, *c.* 1900. Auckland Public Library photograph, A4618.

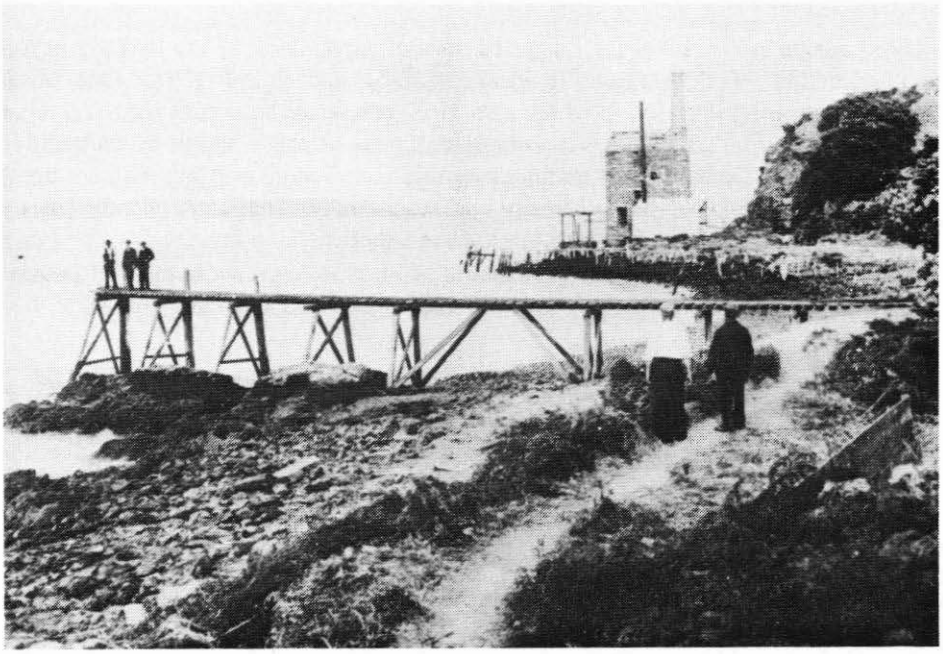

Figure 21: The wharf at Copper Mine Bay, with remains of the 1840s engine house in the background. The small shed in front of the latter houses the engine used to dewater the mine *c.* 1900. Auckland Institute and Museum photograph, C23047.

Figure 22: Ruins of the smelting house at Bon Accord Harbour, Kawau Island in 1926. Auckland Public Library photograph, A4700.

TECHNOLOGICAL ADAPTATION

A study of adaptation is one of the suggested lines of approach if we are to move beyond mere confirmation of documentary evidence (Davies and Egloff 1986). One of the difficulties in studying the ways in which traditional techniques have been modified to suit a new setting and different materials is a question of point of origin and of which traditions are being modified. Technological traditions by their very nature overlap, with a range of techniques being employed synchronically and sequentially. This consequently leads to difficulties in using technological types to establish either contemporaneity or date of sites. For example, Dollar (1978) also observes that in addition to the sheer number of potteries in nineteenth century Staffordshire (above), *c.* 1829 significant improvements were made

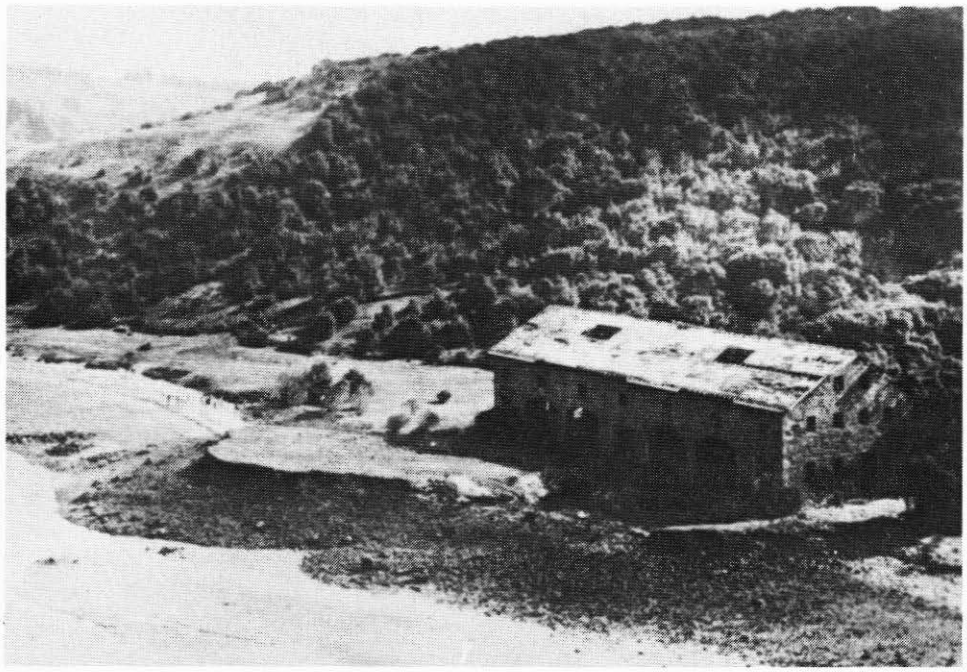

Figure 23: Ruins of the smelting house on Kawau Island in 1986. Photograph, Department of Conservation Regional Archaeology Unit.

in the glazing and firing techniques of certain English wares, but that we have no way (at present) of knowing how many works adopted these new techniques nor how long others continued with the older methods. This is a recurring problem in the study of prehistoric industries (Clough 1986) and perhaps even more so in the vastly more complex historic (industrialisation) period.

Another example can be seen in the historic iron industry at Ironbridge (Shropshire) which played a major role in developing steam power for blowing furnaces. At the same time, the works themselves, partly because of capital investment and ownership of raw materials, retained a complicated and outmoded system based on water power until their demise, well into the age of steam (Clarke 1987).

Such overlap of tradition would certainly have occurred among brickworks, where age, size, location and other factors would have influenced the techniques employed. Dobson (1903), gives examples of the wide variety of current (late nineteenth century) practices resulting from variation in clays and regional traditions such as those observed in Staffordshire, Nottingham, London, and Suffolk.

In Australia, the brick industry reflects a similar pattern with the uptake of innovations erratic, and often linked to rapid growth near urban areas, while the country cousins continued to use simple hand-forming techniques into the middle of the twentieth century (Birmingham 1983).

In New Zealand a similar pattern is emerging, with machine pressed bricks coeval with hand production, Hoffman kilns coeval with Dutch and so on (Eaves 1990). A survey by the author of Carders' brickworks in Hobsonville (Auckland) uncovered a brick stamped: "Clayton and Co. Patented.", while documentary evidence of 1865 referred to a Clayton and Co. patented brickmaking machine capable of producing 350/hr imported by George Boyd's brickworks (Newton, Auckland) and operating during the same period as Carders' (*Weekly News* 14th January 1865, Supplement). Therefore, these two companies producing efficient machine-pressed bricks were contemporary with the hand-moulded and wire-cut techniques in evidence at the Pollen Works.

Thus in any attempt to assess 'adaptation' of technologies to new 'environments' one must be aware of the complexity and range already existing at the point or points of origin.

By studying such adaptation there is also a danger that we might limit ourselves to the evolution of specific species of plant or technology. While we can observe changes in kiln technology at the Pollen site, these can only be understood in relation to other changes on the site, to developments within the industry as a whole and in their wider social and economic contexts. For instance, the observed dynamic nature of the site reflects in part the destructive nature of the industry, involving quarrying of massive amounts of raw material and relocating plant (installations) around the site. But it is also a reflection of a complex web of economic and political considerations, such as changes in building laws and the increasingly competitive nature of the industry (new works established with more efficient machinery).

At the Pollen site kiln modification and the adoption of a new type relate in part to the efficiency of the process and better control over the end product. A similar change in process at the Kawau smelting site had no effect on the end product and was entirely related to cost effectiveness. In neither case did these adaptations represent innovation, but rather selection from a range of existing technological systems as considered appropriate to the scale or economics of the industry.

THE ROLE OF TRANSPORT

Another line of enquiry is the relationship between early industries and transport systems. In Australia we see changes in the location of heavy clay industries as different transport networks develop (Birmingham 1983). The definition of what is an 'economic' source is, needless to say, intimately bound up with the cost of transport. Location of early industries in New Zealand, as elsewhere, was primarily determined by their raw material requirements and the ability to transport the product to the intended market. In the case of industries such as ceramics and metals, both raw materials and the end product are often difficult to transport (especially overland), and an adequate transport system was a necessary

prerequisite for the establishment of industries. Many of the early brickworks, if not located at the site of the construction work, had to be located close to water transport as the unmetalled roads were impassable for much of the year.

The Pollen site and many subsequent brickyards in Auckland were located to utilise the mobility provided by the waters of the Waitemata harbour and the rivers running into it. They succeeded, when others relying on road transport failed owing to difficult passage and the imposition of tolls. In the 1860s complaints were voiced by George Boyd (an Auckland brickmaker) concerning the existence of tolls on the North Road—eventually causing bankruptcy of some brickyards which used the road.

The impact of transport on the copper industry was also significant. The difficulties in shipping the ores influenced the decision to construct a smelter on the island and the cost of shipping the product to Wales played a part in its failure. Communications, along with our dependence on the British legal system, considerably delayed legal decisions over mine ownership, which, by bringing the works to a standstill, resulted in flooding of the mine and consequent increased operating costs.

Excavation of the brickworks and the smelter provided, amongst other material, samples of coal which is ideal for sourcing and thus, when analysed, will provide information on the transport networks encompassing these industries and early Auckland.

DISCUSSION AND CONCLUSIONS

There has been a significant increase in historic archaeology in New Zealand during the past decade, largely resulting from massive urban redevelopment combined with society's growing awareness of conservation issues.

Many of the theoretical problems and self doubts articulated by historical archaeologists abroad have not surfaced in New Zealand, partly because historic archaeology is only now becoming a recognised sub-discipline. However, in recent years with the increase in planned historic archaeology the question of "why dig?" has been voiced a number of times—particularly in the public sector where development funds have been required for archaeology. In many ways we can avoid the recriminations and the need to justify by maintaining what is to all intents and purposes self-evident, that through a multi-evidential approach we are able to throw a unique light on our recent past, providing insights that are not available from archival or excavated material alone. Responses to excavations on Kawau and the Pollen Brickworks have indicated a strong public support and interest in such research which in my mind cancels out the narrow minded 'user pays' attitude of the few.

Rescue archaeology often leaves little time for research design or background documentary research. The problem is exacerbated by sending archaeologists who are untrained in the field of historic sites and are unfamiliar with the material they are excavating. This is currently being rectified in the Auckland central city area in which the early regions of settlement are being evaluated for their archaeological potential and researched as far as possible in anticipation of redevelopment as part of the Regional Archaeology Unit's (Department of Conservation) role. It is to be hoped that other regions will develop a similar strategy.

Confirmation and description are still very much part of historic archaeology in New Zealand, though there have been broader based studies (see above). Although we are moving away from such limited (in scope) studies and attempting more complex approaches, it is evident that the answers to many higher level questions, regarding socio-political and

economic interpretations, await the development of a larger archaeological database. This will necessarily incorporate more particularistic studies: analysis of bottles, ceramics, pipes and metals, etc., all contributing to the grander synthesis.

Apart from the normal criticisms aimed at historic archaeology, industrial archaeology receives additional flak from engineers, metallurgists, and other specialists who ask "what is new?" or question the competence of untrained personnel to interpret industrial remains. Such criticisms can easily be answered for, as Clarke observes, many of those in the forefront of industrial archaeology are engineers, metallurgists and geologists and consequently there has been considerable emphasis on the evaluation of technology (Clarke 1988). On the other hand, this can result in a very limited approach—a 'history of the three-pronged fork' or an excessive concern for 'firsts', thereby disguising, even ignoring, the variety at any one point in time and with little reference to the economic, social and political context of the technology. Certainly in my own field of ancient metallurgy this is a commonly voiced criticism and problem. The historic archaeologist is better trained to answer these questions because he/she will be investigating from a broader base, but must always confer with the appropriate technological specialists.

Analysis of the Pollen data and resultant archival research is still in progress, as is the study of the copper industry. It is hoped that as this progresses, we will be able to approach some of these broader issues.

However, it is unlikely that the imposition of a biological model of adaptation is of value in the field of historic industrial archaeology. Only in a very general sense can we look, for instance, at the heavy clay industries in New Zealand, and assess the ways in which they have been adapted from their homeland or evolved *in situ*. The genes of brickmaking machines are perhaps more elusive than the workers themselves.

The value of an integrated historical/archaeological approach to the industries discussed here is already apparent. Excavation of the Pollen Brickworks and the excavations of the remains of the Kawau copper industry have provided technological and commercial details not available from documentary evidence, while archival material relating to the Pollen Brickworks influenced both archaeological survey and excavation techniques. Title deeds and brief descriptions provided reasonable evidence as to the location and extent of the works, but no fine details as to the site layout, plant or operating procedures. Using probes (gum spears) it was possible to define the outline of many of the features for excavation. Excavation not only provided details of some of the expected plant and equipment but also revealed a range of installations not described in the documents, such as the blunger/washing feature (Figs 7, 8). It also revealed a history of drastic modification to site layout with continuous upgrading of technology to more efficient processes.

The relationship between documentary research and excavation is evidently a dynamic one, for just as documents influenced the methods of excavation, many of the artefacts recovered also gave direction to archival research. For example, a ceramic stamp with the inscription "Onehunga, Storey & Co. New Zealand" referred us to street directories for Onehunga in the 1860s to investigate the nature of the contract. Sadly the search proved unsuccessful but we do know that at least some material was being produced under contract. An English telegraph insulator (Varley) was found in association with those produced on site and had obviously been used as a template for the first local products. The recovery of numerous potters tools and design elements gave direction in the search for nineteenth century English analogues and an understanding of the range of pottery produced by Wright.

For the Kawau industry the documentary evidence is variable. It is informative for the smelting operation and some of the technology of the mine and even more so on the legal

battles. Apart from news coverage in both the *New Zealander* and the *Southern Cross* newspapers there are also volumes of Whittaker's letters (Auckland Institute Library). But it provides very little information regarding the mining settlement and living conditions of the miners. However, even with good documentary evidence, preliminary excavations (test pits) at the copper smelter on Kawau have provided both new technological details and expanded our knowledge of the international nature of the industry. The early copper industry in Kawau had many foreign links: miners from Cornwall, smelters from Wales, refractory bricks from England, along with bricks and coals from Australia. Excavation of parts of the mining installations and settlement have also provided new information regarding the minutiae of everyday life and aspects of the technology in and around the mine. Further analysis of excavated material will undoubtedly add to this.

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