AN ARCHAEOLOGICAL SURVEY OF BRICK MANUFACTURE IN SASKATCHEWAN

A Thesis Submitted to the College of Graduate Studies and Research in Partial Fulfillment of the Requirements for the Degree of Master of Arts in the Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

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Abstract

The province of Saskatchewan's industrial development in its rural prairie region has traditionally been focused on its agricultural capacities which continue to the present day. However, one industry paralleled agriculture in the rural region from the earliest days of agricultural settlement through to the 1990s. This industry was that of brickmaking, which made use of the rich clay deposits that were in association with the rich soils. In its expansion from the first small brickyards to eventual large brickplants, the Saskatchewan brick industry was an integral part of the province's development, advancing and declining in relation to local factors such as settlement and subsequent construction, and more remote factors such as technological innovations and national and international markets.

With the last brickplant having closed in 1996, the active life of this industry has now ceased, but its legacy remains in locations such as Claybank, preserved and dedicated as a National Historic Site in 1997. However, over sixty brickmaking facilities operated in the province, and the study of these as a whole is an important step towards a complete understanding of the industry and its contributions. This research attempts to categorize and link these facilities together, using historical and archaeological methodologies. Relations of the province's industry to those adjacent to it are included in this discussion, so that in addition to an understanding of the provincial industry, a study of the larger industry both in Canada and North America can be advanced.

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Chapter 1 Introduction

1.1 Significance of the Saskatchewan Brick Industry

Coincidental with the opening of the Canadian prairie to European based agriculture in the late 1800s was the development of commercial brickmaking enterprises in suitable locales to support construction of the infrastructure associated with pioneering agriculture. Products of this industry were popularly used in architecture denoting stability and progress as represented by schools, financial institutions, governing agencies, and homes of the wealthier classes, both in emergent cities and the optimistic frontier towns. Brick gave structures a more aesthetic and permanent quality, and was relatively inexpensive if produced locally.

The scale of individual manufacturing agencies varied greatly—in Saskatchewan many communities had at least minimal brickmaking facilities, particularly before large scale manufacturing was established after the turn of the century. At this time several explicitly commercial enterprises were initiated or expanded upon from earlier ventures, such as those at Bruno, Claybank and Estevan (Figure 1.1). Each of these in turn developed special character through variations in technology, clay sources,

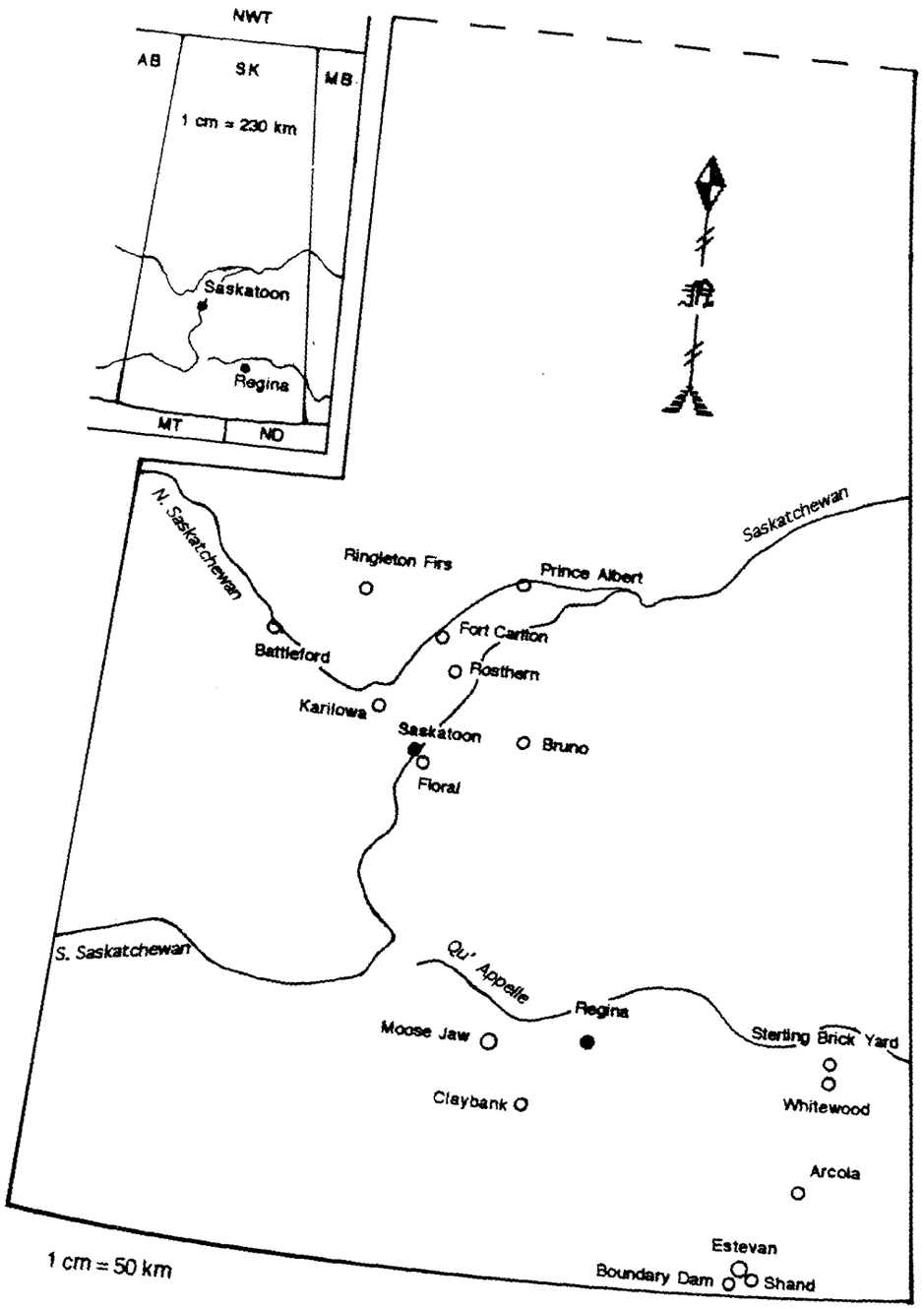


Figure 1.1: Brickmaking locations in Saskatchewan examined during research.

and their ultimate products. Claybank, for instance, used its pure white clay for manufacture of firebrick and also specialized in high-end facebrick used on such grand structures as the Chateau Frontenac Hotel in Quebec City and the Bessborough Hotel in Saskatoon. Bruno, with a redder, less refractory earth, manufactured clay 'tile' in such forms as hollow construction blocks and drain tile. Estevan products tended to be of the more common construction brick which, after WWII, became specialized with various surface textures and special, difficult-to-imitate colours. These, too, were widely distributed up to the plant's closing in 1996, with one of the last recipients being the University of Saskatchewan's 'Innovation Place', an appropriate utilization for the product of the last operational brick plant in Saskatchewan (personal communication, Brian Jennings, 1997).

The significance of the prairie brick industry, particularly in Saskatchewan, is that it complemented and contributed to an economy that was almost entirely agriculturally oriented, from the mid-1870s into the present decade. It was a viable commercial industry that had its roots literally in the same soil as agriculture, and was largely rural based due to the coincidence of rich clay beds often being adjacent to rich farm land (all of Saskatchewan's larger cities had poor clay deposits). Today the legacy of this industry can be found in extant structures of various forms built with Saskatchewan-made brick, as well as in the records and remains of the manufacturing complexes themselves.

1.2 Objectives of Study

The overall objective of this study is to produce a useful, comprehensive overview of the Saskatchewan brick industry by archaeological and historical means. With over sixty locations of manufacture this study will not attempt to detail each one, and there will be some sites, particularly of the earlier brickyards, likely missed at this time due to the minimal information often available. Hopefully, others will find this study a point of departure and continue this research as more information becomes available.

This thesis will endeavor to be more than a compilation of sites (included as Appendix A) by setting the industry into the economic, technological, and social aspects of its time. Topics raised will include identifying those regions in which the manufacturing sites were located, who built them and why, what technologies were used and adapted, and how these sites impacted upon both local and larger scale economies. Available documentary sources can greatly assist the archaeological study of these topics; however, archaeology often provide the sole means of inquiry when documentary sources are scarce or faulty. To this end sixteen sites with archaeological character—where an original manufacturing location exists with some physical evidence of its past use—have been recorded and examined. In two examples no written records existed documenting brickmaking at these locations, while most sites were noted at least in passing in community history compilations.

The majority of attention will focus on the fully industrialized brickmaking operations of Bruno, Claybank, and Estevan which, from 1902 to 1996, formed the core of Saskatchewan's industry. As the most established operations they developed the greatest diversity of products and the largest trade networks to distribute them.

An attempt has also been made to maintain some bounds of what would be included as study material. Initially only firms making burnt or fired clay items were to be considered, excluding concrete and cement-brick or cement-block items which competed with burnt clay items from the early 1900s onward. Burnt clay items include many construction products not specifically termed 'brick', such as the various structural 'tile' categories of hollow clay construction blocks, hollow clay fireproofing blocks, clay drain tile and clay chimney flues. These types of items were essentially modified bricks made by the same extrusion or 'stiff-mud' process that also made conventional stiff-mud bricks. One hybrid turned up, however, which seemed to demand inclusion, that of 'sand-lime' brick. Made of sand fluxed with lime and hardened under pressurized steam, these products imitated regular construction brick closely and were used in similar circumstances—essentially a direct but somewhat inferior replacement. The two Saskatchewan sand-lime manufacturers operated during a period of high demand in the pre-WWI construction market, being located in large urban markets where clay deposits were poor for making conventional brick.

This study will also cover two tightly connected domains:

1) that of the manufacturing of bricks in Saskatchewan

2) a study of the products themselves.

In many cases the latter study is one of the few ways to study the technologies used in manufacturing if an abandoned brickmaking site has been reduced to a purely archaeological state devoid of historical documentation. As well, many brickmaking sites were constructed over time with their own products, interconnecting process and product in a manner uncommon in most industrial situations. The two domains will be separated at this point to demonstrate the potential of each within such a study.

1.3 Value of Brick Manufacturing Study in Saskatchewan within an Archaeological Framework

The study of the manufacturing of bricks in this province mirrors the development of the province—it provides a mechanism to view the various phases of European occupation and settlement with a construction-related industry that rose and fell directly with the economic spirit of any given period, usually with great sensitivity. Themes can be seen in the number and type of brickplants operating at a given time—a few 1870s examples to create the region's first permanent structures as a statement that this early pioneer settlement would endure, more in the 1880s with the arrival of a considerable number of settlers and their desire to recreate the homes they had left in the east, and finally an escalating number of plants during the first decade of the 20th century, culminating in the frenzied boom before WWI when

boosterism demanded construction on a scale never again seen in the province. This phase would end in 1913 with a recession and be finalized by the austerity of the subsequent war period.

Many towns that were sunk into crippling debt by over-ambitious urban improvement programs associated with the pre-WWI boosterism would stay in debt for over forty years (McPherson 1967:177-186). Along with this boom and bust was the end of most of the brickmaking operations that were built in the province, with the exception of a handful that included all of the examples that would survive to become fully industrialized. Each had the economic advantages to rise out of the turbulent second decade, soldier on through the great depression and then benefit from the strong post-WWII economy. Once again, the parallels with the province's general economic health through this time period are direct and obvious.

The human element of this process is the most direct association that can be made in this examination of economic cycles, or jumps, that have been reflected in Saskatchewan's production of bricks. Being labour intensive, brickmaking employed a high number of workers considering its overall small position in the provincial economy. Also, because of its rural locations in most examples, the workers were often farmers or those closely associated with farming. In the depression era, well before there was any Saskatchewan oil or potash industry, brickmaking at Claybank and Bruno provided one of the very few sources of alternative work in the farming region. As one Claybank worker noted in retrospect, "it was honest work and I didn't want to go

from soup kitchen to soup kitchen or ride the rods like so many people did" (*Saskatoon Star Phoenix* [*SSP*] 23 March 1995:A2).

The second world war provided new opportunity for the industrialized brickplants, such as Claybank which produced refractory brick used in many allied naval vessels (Saunders et al. 1992:12). The post-WWII period was one of general economic growth, and the brickplants produced a significant amount of the construction material used. However, by the 1950s, new concrete, metal, and plastic construction materials began to successfully compete with traditional burnt clay products for market share. Themes of national and international takeovers also entered in, along with products increasingly specialized and marketed to more distant locations, union/management tensions, and the effects of the 1988 U.S./Canada free-trade agreement. With the closure of the last Saskatchewan plant in 1996, Estevan Brick Ltd., which was bought and subsequently closed by a long-time interprovincial competitor, the history of this industry had truly mirrored the larger history of the time.

These trends can be observed in the archaeological record in many forms, such as through the remnants of equipment and their installations, the organization of site areas representing different manufacturing phases, trash and disposal features, and the products themselves. Such evidence demonstrates patterns of technology, investment, and daily operation that when compared with other sites suggest and support larger economic and social themes. With continued work in this fashion, a better

understanding of this past industry, and its comments on the larger provincial and national past can be formed.

1.4 Value of Brick Study in Saskatchewan Historical Archaeology

As well as specifically documenting manufacturing sites, the study of the bricks themselves should also be addressed, both for what they can explain of the technologies associated with particular brickmaking entreprises, and also for the information they can contribute when found in historic archaeological sites other than brickyards. For example, two Saskatchewan archaeological studies of the last twenty years noted bricks with the brand "S-H" or "H-S" but could not identify the source (Wilson 1979a:12; Klimko 1981:96). Recent discussion with Hugh Henry, an expert in Manitoba brick, suggested that these likely came from the Manitoba brickyard of H. S. Stephens, operated from c.1892-c.1908 (Henry 1992:23), which both corresponds to dates of the Saskatchewan sites studied and adds new interpretive aspects.

Bricks represent one of the most interesting and researchable artifact categories. They can often be traced to their clay source origins through research into their manufacturing, while distribution cycles can be inferred (via markings, size, colour and other traits) by their intended use in conventional architecture, refractory kilns, engineering structures, brick-paved roads and many other applications. Often they are even traceable from second or third-hand reuse in such adaptations as rustic patios, walkways and fireplace chimneys.

This same attribute of 'traceability' is not as true of other industrial, mineral-based resources, which lose clues to their mining and processing methods, and often their distribution and origin, when finally melted or mixed at some distant point. Bricks furthermore demonstrate longevity and, in terms of construction, have been employed in buildings that are intended to resist fire and decomposition—essentially permanent structures. Thus with the ability to be traced along various routes to their present locations, bricks can be used to reformulate overall patterns of national and international trade, and even help determine flows of supporting capital investment—both in regard to new construction in general and the construction of brick manufacturing sites to facilitate this.

Chapter 2 Literature Review of Bricks and Brick Manufacturing in North American Historical Archaeology

2.1 Introduction

Among the artifact classes of historic archaeology in North America, bricks have been one of the most often neglected and least analysed, despite their common, almost ubiquitous presence at historic sites. Reasons for this neglect are not clear but it seems that between being numerous but seemingly devoid of diagnostic attributes, bricks have long been dismissed as a low-value artifact category much in the same way as non-human faunal remains were long viewed as a low-value artifact category in archaeological excavations. In both cases publications of the last ten years have made it evident that these common artifacts can explain a great deal—the first 1996 issue of *Historical Archaeology* was completely devoted to the study of non-human faunal remains in an urban setting while the first major treatise on North American bricks and their archaeological usefulness was written in 1987 by Karl Gurcke.

In terms of archaeological research into the actual manufacture of bricks in North America, especially through study of the manufacturing sites and the technologies employed, the amount of published material remains scanty. Only in 1994 did the journal *Industrial Archeology* first include an article on a brickmaking

(Garvin 1994), despite this industry having had thousands of manufacturing sites across the continent, important not only to the local economies of states and provinces but national economies as a whole. As it took time for bricks to be noted as a legitimate historic artifact in North America, so it has taken additional time for commercial and industrial brick manufacturing sites to be recognized as useful locations of archaeological inquiry.

An evolution in research has been slowly developing, to the point where graduate work in both the United States and Canada has been undertaken in regard to archaeological examination of brick manufacturing sites. The precedents for this research in North America will be examined in this chapter, beginning with a brief history of the origin of brickmaking, followed by discussion of where bricks first became noted in archaeological research and the consequent developments in this realm—from the study of bricks themselves, then moving to the study of their manufacturing locations and associated technologies. With my personal interest resting with the Canadian prairies and Saskatchewan specifically, the final examination will concentrate on this region.

2.2 Origins of Brickmaking

The manufacture of bricks is many thousands of years old, seeming to appear at various times and places roughly coincident with emergences of agriculture and 'civilization'. This coincidence may have two main reasons—the first being a need for relatively permanent residences while working cultivated plots, when building materials such as wood or stone were not easily available

(Lambert 1987:203). The other reason could be a learned, basic familiarity with clay from working the earth for food production, which would help suggest the use of soil as a building material.

The ancient Middle East has the earliest examples of brick, with sun-dried, hand-formed examples found in Pre-Pottery levels at Jericho dating to about 10,000 B.P. By 5,000 B.P. the use of box-molds is noted both at Jericho and in Peru (Gurcke 1987:40), although molds may originate as early as 7,000 B.P. in Mesopotamia (Oates 1990:388). Brick kilns as controlled environments for brick firing or 'burning' (the brick-trade term for the heat-hardening of bricks) were likely based upon observation of adobe brick-walled towns burning by accident or from warfare, and were in operation by 4,400 B.P. in present-day Iraq. By this time brickmaking is also noted in China (Gurcke 1987:40).

Considerable spirituality was applied to the creation of bricks and the use of them, especially in ancient Mesopotamia where clay was the only abundant building material. A 'brick-god' named Kulla was involved, as "it was held that all aspects of human life (including the material environment) had been ordained in the beginning by the gods, so building with bricks was so considered" (Lambert 1987:203). This included ceremonies where:

> in building operations the first brick of a house or temple was laid...(then) incense was burned and beer was libated to him (Kulla). Prayers were also addressed to him at the appropriate moments to ask for blessings on the building [Lambert 1987: 203-204].

Meanwhile, "The ruler in Mesopotamia, when building for the gods, manufactured the first brick himself" (Heimpel 1987:205),

and bricks were also involved with the concept of child-birth as "the *idea* of the brick was a highly significant symbol of the construction of life and of civilized existence" (Kilmer 1987:213, original emphasis). Bricks were a valued commodity, with the Judeo-Christian Bible noting in Genesis Chapter eleven, verse three: "Then they said to one another, "Come, let us mold bricks, and burn them hard"" (Doubleday & Company Inc. 1964:74).

The Romans were expert builders in fired brick and spread their skills throughout their empire, including Britain (Gurcke 1987:39). Here bricks archaeologically "constitute the most numerous, and certainly the heaviest, single category of artefact from many sites occupied during the Roman period" (Darvill and McWhirr 1984:239). Following the collapse of the Roman empire in the fifth century A.D., European brickmaking outside of Italy appears to have ceased during the approximately five hundred years of the 'Dark Ages' (Gurcke 1987:39-40).

By A.D.1200 brickmaking was again underway across Europe and Britain and by the time of European contact with North America bricks were a common construction material. Locally made bricks were found at the Roanoke Island settlement in Virginia which operated from A.D.1585 to A.D.1586, and by A.D.1621 bricks were being exported from Virginia to the Caribbean (Gurcke 1987:39-40). In Canada brickmaking dates as early as A.D.1604 on the Ile de Sainte Croix (Ritchie 1967:205). C. Pursell observes in regard to the Bermudas that "by 1768 the American colonies were shipping over 1,500,000 bricks a year to this one destination alone" (1968:19).

2.3 The Industrial Context of Brickmaking in North America

Brick manufacture quickly became a common occurrence in North America during European colonization, with the bricks being formed by hand in molds and fired or burnt in simple kilns. Two general categories of bricks were made—regular or 'common' brick which would be used for general building construction or facing of a structure's surface depending on appearance after firing, and 'firebrick' which was used in high-temperature, oven situations requiring a high quality brick-clay resistant to extreme heat (Gurcke 1987:98-99). The procedures involved were rooted in many thousands of years of practice, and did not change substantially until mechanization began to be applied to brickmaking in the early nineteenth century (Gurcke 1983:6). This proceeded rapidly, with Gurcke noting:

> Until the late eighteenth century bricks were predominantly made by hand. By the mid-nineteenth century, however, the main kinds of brick machines in use today had already been invented and were in use, and at the beginning of the twentieth century machines could virtually eliminate hand labor from all aspects of the industry, from mining clay to removing bricks from the kiln [1987:84].

It was from this time of mechanization that brickmaking could become truly industrial, with production rates by 1819 reported as high as 30,000 per twelve-hour day, per brick-forming machine (Pursell 1968:24). This contrasts to traditional hand-forming of bricks where a standard rate was found to be "2,000 bricks in a fourteen-fifteen-hour work day...a really extraordinary molder could produce 3,000" (Pursell 1968:22-23).

Three major forms of brick machines were developed, each utilizing a different moisture range of brick clay. The 'soft-mud' form was closest to that of traditional hand manufacture, with 20% to 30% water content, creating bricks by having a plunger push clay into wooden molds within the machine from which they were subsequently discharged. 'Stiff-mud' bricks, with 12% to 15% water content, were made by a ribbon of brick clay being extruded through a die and then being cut to the appropriate length. The final form, 'dry-press' bricks, with less than 10% water content, were made under pressures of up to 41,000 kPa (6000 psi) in steel molds. This form could be fired with little or no drying, while the previous methods required substantial drying before firing (Gurcke 1983:6,7; 1987:13).

Beyond the actual brick-forming machines there were also improved 'down-draft' and 'continuous' kilns to keep up with the higher output (Gurcke 1987:32-34). This led to true industrial complex layouts at larger manufacturing sites, interconnected with railway systems to both supply input resources and transport the finished products.

These different forms and scales of manufacture had implications for the appearance and structure of the final product, and can be deduced by careful examination of bricks, along with many other formation attributes ranging from deliberate brand markings to the type of cutting device employed with stiff-mud bricks. The diagnostic attributes of bricks are numerous with proper interpretation requiring both knowledge of the attributes and a background of the manufacturing process itself. With such

skills in hand, the ubiquitous brick can be a highly interpretable artifact.

2.4 Bricks and Historic Archaeology in the United States

The study of bricks and their manufacture is a fairly late phenomenon, where even in Britain, with a long tradition of brickmaking, Darvill and McWhirr find as late as 1984 that "brick and tile industries receive only passing mention" (1984:240). However, some of the finest archaeological research on bricks in North America seems to have been some of the earliest, undertaken by J. C. Harrington in Jamestown and Roanoke Island, Virginia, and published in 1950 and 1967, respectively. Harrington used documentary evidence in conjunction with results from the excavations of two brick and tile kilns at Jamestown to prove that early seventeenth century bricks in Virginia were locally manufactured and not imported from England as was commonly believed. His report also looked at the technology of this period of brickmaking and recorded the attributes, with illustrations, of the early Jamestown brick types. He then went on to use laboratory techniques, including X-rays, to determine that early Roanoke Island, Raleigh settlement brick samples were locally produced (Gurcke 1987:129-130).

Stanley South followed in 1964 with a short article, "Some notes on bricks" in *The Florida Anthropologist*, which showed that a long-held notion of simply using brick size in dating buildings was unsound. This tenet held that specific brick sizes were consistent within particular time periods. South looked at bricks

from Virginia and North Carolina, while in 1965 William Lazurus published a similar, brief study of Florida bricks in the same journal, going somewhat further than size to look at brands and the history of the bricks as well (Gurcke 1987:130).

In 1966 Edward Lenik published "Old Bricks: Useful Clues in Historical Archaeology" for the *Maine Archaeological Society Bulletin*, a four-page article that, while brief, did describe the potential of bricks for site interpretation, and noted how brick size could vary dramatically even when regulated by government codes. One potential reason for this was the differing shrinkage rates of early clays upon drying (Gurcke 1987:130-131).

An excellent, purely historical article on early American brickmaking machines was written by Carroll Pursell in 1968. It contains a brief review of American brickmaking since the Roanoke settlers of 1585, including discussion of basic hand-forming processes and of the gradual shift to machine-made bricks as:

> the growing demand for bricks and the rapid mechanization of other sectors of manufacturing led inevitably to the substitution of machine for hand methods in this basic industry [1968:26].

This shift to mechanization is noted as slow and gradual, both due to cost and "the old prejudice against machine-made bricks, probably traceable to inferior products made with inadequately prepared clay" (Pursell 1968:26). Overall it was noted that "the making of bricks was and has remained a conservative and traditional manufacture" (Pursell 1968:26).

Pursell's article gave good background on the shift to mechanization with period drawings of early machines, but it contained little hard, applicable information that archaeologists could use in the course of analysis of excavated materials. This void was partially filled in the mid-1970s by two journal articles on typologies of brick. The first was published in 1974 by L. S. Harley in *The Journal of the British Archaeological Association.* This was a very comprehensive, detailed typology that examined many classes of brick attributes in the interests of identification and analysis. Its British focus had limited specific application for North American studies, however, as Harley was particularly interested in medieval-period and earlier bricks which have no significant presence in the Western Hemisphere.

A North American version was provided three years later in the second article, "Brick Bats for Archaeologists: Values of Pressed Brick Brands" in *Historical Archaeology* by Roger and Marsha Kelly. The Kellys' format was much simpler than Harley's, giving tips on basic research venues to pursue when confronted with bricks, specifically branded examples, with a typology based simply upon the method of molding, position in the kiln, and intended use (Kelly and Kelly 1977:85). Overall, four areas were viewed as relevant to their discussion of bricks:

- The types and sizes of bricks as manufactured
- The 'brands' or identifying marks on bricks
- Historic and other sources useful in research; and
- Potential analytical and interpretive uses of such data (Kelly and Kelly 1977:85).

The archaeology of manufacturing sites was not a part of their focus, and Gurcke notes, "[u]nfortunately, the Kellys do not address the problem of unbranded bricks, a problem archaeologists often have to deal with" (1987:131). They did offer some useful theoretical suggestions, such as an ability of bricks to "illustrate economic networks between urban and rural areas" and imply "the social status of occupants or builders" (Kelly and Kelly 1977:88). They also commented on the interpretive elements of brick reuse and the evolution of brick bonding systems (Kelly and Kelly 1977:88). Overall this was only a brief introduction to what kind of research was possible but it was the first widely circulated article of its kind in a North American archaeological context (Gurcke 1987:131).

Within the same issue of *Historical Archaeology* (1977) as the Kelly and Kelly article was an early brick research article on a specific topic, namely ""Swedish" Colonial Yellow Bricks: Notes on Their Uses and Possible Origins in 17th Century America", by M. J. Becker. Again a relatively brief essay, Becker lamented once more on the dearth of brick research despite the obvious, useful attributes (the following quote is specifically concerned with the Swedish colonial bricks but can be applied to all brick categories):

> Although these bricks frequently are preserved on and received from archaeological sites, a fact which may result from both the durability incurred by firing at high temperatures and their large size relative to other artifactural [sic] remains, almost nothing has been published regarding the origins and use of this kind of brick [1977:112].

Until articles such as the Kelly and Kelly example were written, few people knew how to 'read' bricks for their diagnostic attributes—one of the largest handicaps for interpretation. However, further articles such as the Kelly and Kelly or the Becker examples would remain rare in American historical archaeology journals despite recognition of the research value of bricks. Beads, bottles and tablewares would remain much more popular items of discussion within material culture studies.

It was ten years after the Kelly and Kelly article that the next and currently most important work on bricks and historical archaeology was published, being much more than a brief article. Karl Gurcke's *Bricks and Brickmaking: A Handbook for Historical Archaeology* (1987), was a book that finally covered bricks in North America from their manufacturing technology and industrial history through classification and typologies when found at archaeological sites. Gurcke had been researching bricks for many years—his short 1976 compilation of brick information had been noted by Kelly and Kelly as "an excellent bibliography of such literature" (1977:87). In the interim he became a leading authority on North American brick manufacturing technologies which has been fortunate, as clear, unambiguous descriptions and suggestions were needed for the non-expert to properly sort out and analyse brick artifacts when found at historic sites.

Gurcke's book begins with a step-by-step breakdown of the major stages of manufacture, complete with many excellent photographs and diagrams, then moves on to discussions of industrial history, brick analysis, and pertinent archaeological

literature, including the sites he personally examined. These main chapters comprise only about half of the book, as there follows a bibliography of over 500 entries and an appendix of approximately 3,000 brick brands of the United States and Canada, with respective manufacturers and dates of production. These last two features add a great element of ongoing usefulness to the work, once the main chapters are absorbed.

The book did, however, fall somewhat short of the "dazzlingly comprehensive survey of the brickmaking industry in the United States" accolade on its back cover. In terms of specific sites Gurcke focused most of his attention on the American Pacific Northwest and little on the rest of the United States, or the Canadian Pacific Northwest. His research focus on one region provided a good modelling base although a more explicit inclusion of British Columbia would also have made much sense—for all intents this is very much a continuous region in spite of being in two national realms, which is attested by the amount of British Columbia brick exported to the states immediately south of it (Gurcke 1987:52-57; Adams 1976:32-33).

In addition, Gurcke's book admittedly lacked theoretical or interpretative reasoning in regard to the purpose of studying bricks. He stated at the book's opening that,

> Rather than present a particular theory, I have attempted to bring together information from many sources in the hope that it will stimulate interest in bricks and technology of brickmaking. I may be criticized for this lack of a theoretical perspective, but I believe one must construct a solid foundation before building higher [1987:1].

There is logic to his construction analogy but considering that a decade earlier Kelly and Kelly had suggested the ability of bricks to ascribe economic networks and social status, some mention of such possibilities would have been useful. Otherwise the study of bricks can become an end in itself, as it has been for a growing body of collectors (Kelly and Kelly 1977:88; Anjard 1993).

For someone interested in the archaeology of North American brick manufacturing, Gurcke's work is then both essential and somewhat incomplete. Nothing else of its scope exists but more studies are needed to augment and round out the research begun both by Gurcke and his predecessors.

2.5 Bricks and Historic Archaeology in Canada

The study and analysis of bricks within Canada has largely followed the trends of work done in the United States, with most early research administered by Parks Canada. In 1966 J. L. Swauger conducted a study of Fort St. Joseph, Ontario, where one of his conclusions was that British bricks at this fort were larger and denser than French bricks, based on comparison with one brick from a French fort in New Brunswick, which has been aptly noted as "an admittedly small sample" (Gurcke 1987:132). Later work from 1976 at the same fort was more innovative, with E. R. Lee being "one of the first to give Munsell color designations for the recovered bricks in addition to their dimensions" (Gurcke 1987:132). She also noted the presence of grass impressions, a clue that these bricks were placed directly on the ground to dry,

thus possibly being 'place' bricks as opposed to 'stock' bricks which were dried on pallets (Gurcke 1987:133).

In general, analysis of bricks remained a low priority when excavating historic sites in Canada. A 1970 report on Fort Beausejour in New Brunswick by DiAnn Herst contained a sample of 1,000 bricks but explicitly noted that no data were taken on texture, composition, or firing qualities, and that no historic studies had been undertaken in regard to local brickmaking technology or importation (Gurcke 1987:132). Gurcke noted with some alarm that:

> these or similar attributes would have been recorded without a second thought if the artifacts in question had been plates, bottles, beads, nails, or just about anything else! [1987:132].

Eventually increased attention can be seen in the Parks Canada reports regarding brick, but only over many years. Two studies in Manitoba illustrate this development, the first being by P. J. Preiss and L. J. Sears in Parks Canada Manuscript Report Number 336 (1979). Regarding analysis of excavated materials from Lower Fort Garry, brick is one of sixteen categories in the tabulated artifact distributions and occurs frequently. However, it is the only category not quantified but tabulated as present/absent, whereas nails are quantified and fall within five of the sixteen categories, while glass is similarly quantified into three categories (Preiss and Sears 1979:44-49). Gurcke's previous comment regarding the attention given to traditional artifact classes versus bricks certainly applies here.

By 1985, in Parks Canada Research Bulletin Number 237, J. F. A. Hamilton offered a very different, enlightened attitude toward bricks. She used her research at York Factory, Manitoba as a model for analysis in a manner similar to Gurcke's use of his Pacific Northwest research in 1987 but in a briefer format. Her sentiments reflected many of those already noted:

> All too often, it has been the practice by many archaeologists to neglect analysis of bricks recovered from historic sites. The objective of this report is to provide the basic information required to conduct an analysis of bricks [Hamilton 1985:1].

Hamilton used a sample of 204 bricks and created a typology for them based on her observations and Harley's (1974) typology. She noted shape, size (recognizing the limited usefulness of this attribute from the reports of South and Lazarus), surface treatment, texture, and color with Munsell color charts, where:

> The colour of the brick refers to the fabric (interior), not the surface colour, which may be discoloured due to deposition or by factors related to fabric composition and firing temperature [1985:2].

Indication of manufacturing methods is also a noted attribute, with accompanying short descriptions both of hand molding bricks with or without a stock (to create a recessed 'frog'), and of the mechanical 'extrusion' method, otherwise termed 'stiff-mud' (Hamilton 1985:3). Soft-mud and dry-press mechanical methods are not described, probably because they weren't recognized in the York Factory artifacts.

Hamilton then organized the bricks into seven overall types based on common attributes and Harley's typology. She identified

the manufacturers of the bricks with recognizable markings and presented a short history of each one. She finally considered several additional factors such as:

- reuse: its implications on dating and lack of mention in historical documents
- color and size changes as indicators of construction phases
- adherence of materials to bricks as clues to the original function of the bricks
- general trends of changing standard dimensions (Hamilton 1985:4-8)

Photographs of the branded bricks and a glossary of brick terminology round out this useful report (Hamilton 1985:17-22).

In Saskatchewan at least four notable examples exist of historic archaeology projects with some emphasis on brick analysis. The first dates from 1977 when the Fort Carlton fur-trade site was investigated by the Saskatchewan Museum of Natural History (now the Royal Saskatchewan Museum). Using a road-grader to expose features along a cultivated part of the site, an apparent brick scove kiln was discovered, dating to the post-1850 period of the site (Dyck 1978:7). This is potentially the earliest site of brick manufacture in Saskatchewan but is difficult to date precisely due to a lack of Hudson's Bay Company records for the post from 1838 to the 1870s (Dyck 1978:6).

The analysis of the scove kiln bricks is enlightening as it illustrates how the researchers were at some loss to deal with this task at the time of excavation. By comparing the bricks to a familiar, analogous artifact category in a pre-contact Plains context—tipi-ring stones—the bricks were all collected, numbered,

measured, and weighed individually (along with actual stones from the excavation). The weight attribute could be used to give some indication of density, but attributes more specific to brick analysis such as colour, porosity, inclusions, texture, and impressions made during drying were not recorded (Klimko 1977:36-86). However, one fragment was forwarded to a known authority on brick, John Hudson, Ceramic Engineer at the Saskatchewan Research Council (SRC). Hudson noted the forming method to have been hand-molding ("soft-mud by hand") with subsequent firing at a relatively low temperature, suggesting that "the staff at the Fort had been making brick for themselves" (Hudson 1978:1-2). Overall this excavation seemed to indicate that by 1977 researchers knew the bricks were a valuable artifact and attempted to extract data by the standards of the time, with the assistance of an expert outside of archaeology adding considerably to the interpretation.

In 1979 brick interpretation at another Saskatchewan historical site was aided by a more deductive framework, in the research undertaken by J. S. Wilson, SRC archaeologist, at the Territorial Government Historic Site in Regina (Wilson 1979b). Wilson's objective was to augment the incomplete historical records of this site's demolished buildings by examining the structural foundations, with brick analysis being a major component. John Hudson was once again engaged in this task, and was able to arrive at some preliminary conclusions regarding possible manufacturers and the time periods involved. This helped set time ranges for the construction of building phases at the site, helping close gaps in

the historical records. Wilson recommended further analysis of the bricks, both to benefit this site and "probably a number of other historic buildings" (1979:33).

In a report two years later on the Marr Residence backyard excavation in Saskatoon, another SRC archaeologist, Olga Klimko, who had worked with the Fort Carlton scove kiln feature excavation, examined the bricks found at this later site in a more thorough manner. Klimko enlisted John Hudson to analyse three varieties of bricks recovered, which he did by deducing the type of clay and manufacturing processes used and the likely locations of manufacture with associated dates. He also remarked on the differing colours of the three bricks with possible reasons for the variations, and in addition discussed the differing drying methods used for the bricks, the types of mortar used, and the porosity of each brick with consequent frost implications. Large detailed photographs of each brick followed, which with Hudson's analysis, demonstrated both how much brick analysis could add to a historical investigation, and how far this analysis had developed over four years in one region (Klimko 1981: 96-97).

The fourth Saskatchewan example dates to 1991, during excavations of the North West Mounted Police Sick Horse Stable site at Fort Battleford. Despite the more recent research date the brick analysis performed was something of a throwback to the 1977 Fort Carlton example—the summed weights of bricks recovered in different areas were recorded in the field, but only bricks with distinctive marks were collected. This meant that the older bricks manufactured in Battleford, some of Saskatchewan's

earliest examples but unbranded, were not analysed while one that was recovered, a common S-H/H-S (H. S. Stephens) variety from Portage la Prairie, Manitoba, could be examined in the future. On a positive note the report contains an appendix on brickmaking in the Battleford area covering two possible sources of manufacture for the uncollected bricks (Amundson and Riehl-Fitzsimmons 1991:50, 73, 95, 222).

There has been little equivalent archaeological activity in Alberta to date. In 1983 J. M. Manson wrote a detailed historical volume called *Bricks in Alberta* which concentrated on the brick industry but provided many examples of brick identification of Alberta products which will be useful for future archaeological work in the province and the surrounding brick export region.

In British Columbia several archaeological investigations have encountered bricks, which on the West Coast often include imports from as far away as Britain and Spain, brought over as ship's ballast. Parks Canada investigated several such sites in the 1960s, with the Yuquot site containing probable Spanish brick fragments and the Fort Defiance site containing great numbers of probable New England made brick. Russian bricks made in nearby Alaska can also enter into this very intriguing landscape, made more complex by the eventually emergent native British Columbian brick industry (Adams 1985:7-8). With such ascribable nationality it was probably easier to see the usefulness of brick analysis in British Columbia archaeology than on the prairies where difficulty in transporting pre-railway bricks left out this interesting variable.

John D. Adams, who in 1976 wrote his Master's thesis on the Clayburn brickmaking site (discussed later), has since become the leading scholar of brick analysis in British Columbia, noting that:

> generally bricks are difficult to identify unless they bear a manufacturer's stamp, but physical characteristics such as weight, color, size, and surface marks can help, especially if comparisons can be made to known specimens [Adams 1985:8].

To this end, Adams has been building a public, representative type collection, including spectrographic analyses to aid the process. He finds with bricks that, "their durability and widespread use makes them important features in historical archaeology. As more historic sites are excavated in the province brick research will become increasingly important" (Adams 1985:8).

2.6 Archaeology of Brickmaking Sites and Associated Technologies

As previously noted, some of J. C. Harrington's earliest work involved excavation of two brick and tile kilns at Jamestown, Virginia, the results of which were published in 1950. This was an integral part of his interpretation of seventeenth century brick and tile technology, which he used documentary evidence to corroborate. With his focus towards innovative techniques of analysis, his work set a high standard for future studies (Gurcke 1987:129-130).

In 1960 J. E. Mills published research results from the excavation of a brick kiln at Fort Randall, South Dakota during the

summer of 1952. This work was done in anticipation of damage from nearby dam construction on the Missouri River, and was administered by the Smithsonian Institution. The brick kiln seems to have been contemporary with the use of Fort Randall from 1857 to 1892 and was located just outside the fort walls. A low hummock covered with broken bricks proved to be covering several parallel strips of both brick and masonry, beneath which "the earth showed evidence of baking from fire for about 6 inches [15 cm]" (Mills 1960:35).

Mill's brief report includes a reasonable drawing and good photographs of the excavation, but he doesn't seem to have been knowledgeable of brickmaking or have had access to Harrington's work. He notes "[o]ne puzzling feature of the site...was the absence of a firepit or furnace that functioned as the heating unit for the brick making" (Mills 1960:35). Perhaps this was due to this site being a temporary 'clamp' or scove kiln that had multiple hearth/heating areas.

Bricks were not analysed in Mills' report but one historical document noted that 5,000 bricks from St. Louis had been shipped to this fort before February 1857, at which time no local brickmaking was in progress, thereby dating the kiln later than this time. Some bricks in the fort debris did have a St. Louis trademark (Mills 1960:36).

Background for the Canadian brick industry was soundly provided in the brick chapter of the book *Canada Builds* by Thomas Ritchie in 1967. His discussion of evolving technologies and products in the context of given markets is applicable not just to Canada but

North America in general. Ritchie followed in 1976 with a useful historical essay entitled "The Canadian Brick Industry, 1885 to 1915". In it he noted how the development of the tall office building affected both output and innovation in brick products, along with architectural fashion trends. Included was a study of the Canadian brick industry and the types of brick-forming machines used, covering these topics in a form analogous to that used by Gurcke in his American study in 1987. Interesting points include the production of 899 million bricks in Canada during 1912—the record year of production—and the presence of a continuous, multi-chamber kiln in Toronto which in 1907 could hold 1,300,000 bricks at once, potentially the largest such kiln at the time in North America (Ritchie 1976:98,104).

Reports on actual archaeology concerning brick manufacturing sites are rare in the years following Mills's work, with the next research of note being that of E. F. Heite who excavated several colonial-era 'clamps' in Virginia, being published in 1973. Gurcke observed that Heite showed "quite interesting examples of the amount of information to be gained from a combination of archaeological and documentary research" (Gurcke 1987:131).

British Columbia's largest brickmaking site of the early twentieth century, Clayburn, was profiled in 1976 by John D. Adams, introduced earlier. However, his focus was not strictly archaeological but museological, through which he examined the local company-built village for its architectural merit in the interests of long-term preservation. With this mandate the actual brickmaking site in 1976 was out of his jurisdiction as it

contained no standing structure since the 1930s, but he did include a valuable historical sketch of the Clayburn operation which will be useful for future archaeology in this region (Adams 1976:6, 8-36).

Moving ahead to 1988 is another report of a brick kiln excavation in South Dakota, this time by S. D. Ruple who undertook the work in 1980 and published his results in *South Dakota Archaeology*, volume 12. He believed this kiln to be the second oldest in the state, dating to approximately 1867. The impetus for excavation was the kiln property's nomination to the National Register of Historic Places on behalf of its owners, with architectural details of this collapsed, beehive structure needing to be measured and mapped. Work was limited to removing debris from the inside of the kiln and interpreting the workings of the structure (Ruple 1988:1,14).

Ruple's major technical query was whether the kiln had been built as a regular up-draft kiln (with heated gases exiting through the roof) or as a more sophisticated down-draft kiln (where the gases move down into floor channels to exit in chimneys located outside the kiln). He had noted extant round, beehive kilns appearing to be a combination of both types at other locations, but this attribute could not be determined by immediate examination of this site. As work proceeded it became clear that floor channels did exist and that they originally exited to exterior chimneys in the down-draft manner (1988:5-7).

Considering the relatively small scope of Ruple's project, his report was well researched, with an excellent planview of the kiln

floor and several clear photographs. In his discussion Ruple related the kiln to the two family groups that are known to have operated it and speculated as to how they could have operated a small brick enterprise profitably when large brickmakers were only 30 kms away in Sioux City. His explanation involved a concept of small "sealed markets" where the expense of shipping charges allowed small operations an advantage as long as their buyers were nearby and production remained limited to this small, sealed market (1988:14). Such a microeconomic approach is likely applicable to a great many brickmaking enterprises in North America and illustrates how even a small archaeological project can benefit from a small dose of theory.

Some of the best theory as applied to the archaeological study of brick manufacturing sites is found somewhat further afield than North America, in the journal *Australian Historical Archaeology*. Due to the similarities of colonization and development with North America, the parallels here are very relevant. One article is by R. Clough on the 'heavy-clay' industry in New Zealand, the other by I. Stuart on a notable Australian brickmaking concern. Clough's article examines brickmaking as it fits into the large, macroeconomic realm, finding that:

> 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 [1989:4].

Brickmaking is seen to fit into this system as:

> 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. We would expect such changes to be reflected in the heavy clay industries [Clough 1989:4].

This begs the obvious question:

> To what extent will the excavation of the brick production sites reflect changes in the economy? The answer is complex as it rests in part 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 [Clough 1989:4].

Clough saw the relating of individual production sites together of high importance as, "[e]xcavation of one production site, though informative, will only provide answers to low-level questions as it is only part of an overall development" (1989:4). To this end documentary evidence is viewed as critical in helping to date the modifications and changes that are archaeologically observable, as the time spans involved are often a few years or less, within which conventional archaeological dating methods cannot generally be precise (Clough 1989:4).

The purpose of Clough's model of research is overall much more than the evaluation of technology, on which he charges early industrial archaeologists to have been narrowly focused. He doesn't discredit the value of this pursuit but believes:

> The historical archaeologist can always confer with other specialists on points of technical detail, while better qualified to ask and answer the higher level contextual questions [1989:9].

The site that Clough examined was the Pollen's Brickworks in West Auckland, New Zealand, which he used to illustrate the value of archaeology in noting implementations of new technologies and upgrading/modifications over time. Unfortunately the review of the site is brief, being covered in more depth (presumably) in an earlier, unpublished report (1989:9). An overall lack of written records is noted, as "the archival material gives us no indication of either the range or quality of the goods produced" (Clough 1989:6). This places more emphasis on archaeology in answering the 'higher level' questions about the site and its relationship to other brickmaking sites and the larger economy. Overall, Clough's article introduces theory and interpretative suggestion to brick manufacturing archaeology that was absent in the earlier noted reports—a valuable addition to the technical background of research such as Gurcke's.

Some similar ideas of 'high level questions' surface in the same journal's article by I. Stuart on the Hoffman Brick and Pottery Works in Melbourne, Australia. Like Clough's article, Stuart's essay isn't the definitive, archaeological report of this site but looks at the knowledge gained from documentary and archaeological research and how it can be interpreted, in this case with an emphasis on technology transfer and adaptation. Stuart finds that the Hoffman company began with an attitude of almost obsessive innovation, which helped it become a leader in the field of brickmaking from 1870 through the 1890s. A recession at this point slowed expansion and over many decades innovation was replaced by "the road of monopolistic complacency rather than the

free enterprise ideals" (Stuart 1989:33). The company was taken over in 1960 by one of its earliest competitors and its aged facilities still remain in operation, with Stuart happily noting:

> This complacency reduced a once vigourous company, an innovative leader in its field, to an industrial archaeology treasure house [1989:33].

Stuart's work shows another example of what is possible by study of brick manufacturing sites when related to the economic, political and social histories of a region. In addition, questions relating to such topics can be deductively considered even during the most preliminary of archaeological investigation—theorizing does not have to wait until after major reports are written.

Returning to North America, in 1994 the journal *Industrial Archeology* finally included a study on brickmaking. The article, by J. L. Garvin in volume 20, is a useful overview of brickmaking in New Hampshire but unfortunately is entirely historical without any reference to extant brickmaking sites or archaeology of any form. Garvin does provide a good background for studying brickmaking in a New England context (with excellent period photographs) that remained an essentially non-mechanized industry well into the twentieth century due to its cruder, less regular products enjoying popularity during the colonial revival movement in architecture (1994:30). However, more studies with some of the interpretive ideas as suggested by Clough and Stuart would be a welcome addition to such a journal.

In Ontario there has been discussion of "revamping" one of the most venerable of central Canadian brickplants, the Don Valley

Brickworks which operated from 1890 to 1990. This site is located in Metropolitan Toronto within a heavily urbanized context. The rationale behind dealing with the site may not be amenable to archaeology, however, as an architectural, not archaeological firm was hired in 1995 to examine the site to "secure the buildings of significant historic value and remove the accessory buildings that pose a public liability" (Oleson Worland to Revamp Brickworks 1995). Architecturally this could result in only a few structures being preserved, making archaeological interpretation of the site difficult as the flows of process in an industrial site involve all the structures and features, not just a few historic or 'majestic' structures. In addition, there is seldom any industrial structure, even during operation, that doesn't pose some sort of public liability—industrial landscapes are most often hazardous landscapes.

The most recent work to examine a North American brickmaking site comes once more from South Dakota, in the 1997 Master's thesis of Rose Estep on the Piedmont Brick Plant, Meade County. In it Estep thoroughly chronicles a relatively small, short-lived brickyard from the end of the nineteenth century, which displayed what she terms a "pioneering technology" that was an "old-fashioned technological relic in the overall frontier industrial revolution" (Estep 1997:3). A more appropriate term here would actually be 'persistence technology' (see Newell 1983), as pioneering generally refers to investigating a new subject or method, not continuing with an antiquated one (Oxford University Press 1994:608). However, beyond this problem of definition,

Estep's study of the site and its scove kiln technology is an excellent example of how a brickmaking site can be interpreted by first placing the site within industrial, economic, and social contexts and then use deductive modelling to ask questions of the data. In this manner, three models of possible kiln structure and corresponding site layout were tested, of which one was superior in explaining the data (Estep 1997:98-117).

2.7 Brickmaking study in the Canadian Prairies

Archaeology of brick manufacture in the Canadian prairies has been developing interest in the last two decades, following an industry which began in the mid-nineteenth century and continues to the present at I-XL Industries Ltd. in Medicine Hat, Alberta. Most of the Canadian prairie sites were at least partially mechanized due to the emergence of this industry in this region after the development of brickmaking machinery in the mid to late 1800s.

In terms of the archaeology of brickmaking sites or brickplants, there has not been significant activity to the present in Alberta and Manitoba. A thorough historical cataloguing of the various brickplants of Manitoba was undertaken by Hugh Henry in 1992 for the Museum of Man and Nature in Winnipeg but unfortunately it exists only as an unpublished manuscript. However, for anyone encountering Manitoba-made bricks in an archaeological site, this report will be of great benefit to tracing the manufacturing origins. The potential for such study in Manitoba is noted in a recent (1994) survey of industrial sites by K. D. McLeod, provincial government archaeologist:

> Given the large amount of glacially-deposited lacustrine clays contained within the southern half of Manitoba, it is not surprising that a number of brick, pottery and tile manufacturing industries were developed during the last 150 years...During the Late Historic period, the Selkirk area was one of the major centres for the brick and pottery industry [1994:19].

McLeod goes on to describe excavations undertaken at one ceramics site, the Doidge Pottery Works, but no mention is made of brick production at this location and no other heavy clay industrial sites are noted (1994:19).

Alberta has had several historical studies that will benefit future archaeological study of brickmaking in this province. The previously introduced book by J. M. Manson, *Bricks in Alberta* (1983), chronicles nearly every brickmaking business in Alberta, with approximately one hundred period photographs of the brickyards in operation along with profiles of the people involved and analysis of the various time periods and phases of the industry. It suffers from an eclectic organization of its various sites and themes but contains an overall wealth of information. It is of a style less common in North America than in Britain, where many local historical societies have produced their own, regional brick manufacturing histories.

Another historical study, *Pottery in Alberta—The Long Tradition* (1978) by M. Antonelli and J. Forbes examines the heavy clay industries of the Medicine Hat/Redcliff area, which while producing brick were more involved with the manufacture of culinary ceramics, stoneware crocks, and extruded sewerpipe. A

third study including brickmaking sites is that of a river valley historical site inventory commissioned by the City of Edmonton in 1980. The purpose of this report was to assist future planning of this city area, and it included four sites of past brick manufacture with all information drawn from archival sources (Chan-Marples and Gibson, 1985).

One of these four river valley sites, the Pollard Brickyard, was archaeologically surveyed in 1985, due to potential disturbance from extending Edmonton's Light Rail Transit (LRT) system across the river valley. Most of the work consisted of surface surveys and collections but did include some excavation testing, turning up considerable evidence of brickmaking activity during the years of plant operation from 1898 to 1913. The site was found to be very significant and more thorough mitigation was recommended prior to the LRT development, along with action to have the site designated under the Alberta Historical Resources Act (Minni 1985:37-44). Heinz Pyszczyk, current head of the Archaeological Survey of Alberta, is not aware of any other archaeological research of brick manufacturing sites in Alberta (personal communication, 1996).

Alberta does have the feature of a rebuilt, and relocated, brickmaking site in the example of the J. B. Little Brickyard at Fort Edmonton, Alberta. The original J. B. Little Brickyard was one of Edmonton's longest-running and most significant brick manufacturers (Manson 1983:34-36). However, the present structure with the same name represents only a small portion of the original operation, housing the original brickmaking machine

and related equipment but without the kilns, drying sheds, and storage areas integral to the dispersed landscape of an actual brickmaking venture.

This leads to Saskatchewan, currently the focus of my own research. While significant archaeological research has not previously been done, there is strong interest for such study, stemming largely from the Claybank brickplant in the south-central portion of the province. This site has a history dating back to 1886 when high-quality refractory clay was discovered in the surrounding 'Dirt Hills', with the industrial plant operating from 1914 to 1989. In 1992 the site, still functional and largely in its original configuration, was given to the province by its then current owners, A.P. Green Refractories Ltd. Five years later it was designated a National Historic Site (GRB Project Management 1994:iii).

This form of recognition is probably a first for a brickplant, at least in North America, and has stimulated much interest. A historical society has been set up for the site, and all company records are under the curation of the Heritage Branch of the provincial government which has also set up files for all known brickmaking sites in Saskatchewan. In addition a program of inventorying and storing bricks from demolished buildings in the province has been set up to help in restoration and maintenance of extant brick buildings.

At least six reports have been written in regard to the Claybank Brick Plant, two which are primarily historical (Saunders, Richan & Associates 1992; Fulton 1994) and three dealing with preservation

options (GRB Project Management 1994, Villafranca et al. 1996, Hilderman et al. 1996). Only one is explicitly archaeological, being a comprehensive photographic cataloguing of features at the site (Korvemaker 1997). However, all are useful materials for archaeological endeavors in the future, with planviews, photographs, and specifications of the plant through the years. Preservation of the plant will be expensive but balanced with tourism, the support of the local historical society and provincial and national backing, Claybank should survive as a unique example of past brickmaking technology.

Two other major brickmaking sites exist in Saskatchewan, both of which were contemporaneous with Claybank for most of their productive lives. One is the Estevan Brick Ltd. site, which closed in 1996, the last operating brickplant in Saskatchewan. While its equipment has been removed and sent to its last owner, I-XL Industries Ltd. of Medicine Hat, its structures will be reused in the immediate future by an electrical fabricating company (personal communication with plant superintendent, Brian Jennings, 1997). The other site is that of the Bruno Clay Works, once the largest producer in Saskatchewan but shut down in 1960 and currently in a state of ruin. Neither site has had significant archaeological examination prior to this study, and they will be looked at more closely in future chapters.

At least thirteen smaller sites of brickmaking activity exist archaeologically in Saskatchewan. The Fort Carlton kiln site mentioned earlier is one of these, while in 1990 the site of the brick plant of the Shand Coal and Brick Company was

archaeologically surveyed prior to the construction of the new Shand Coal Mine. It was noted as having high scientific and public significance, with avoidance by development impacts being recommended (Millenium Heritage Resource Consultants Ltd. 1990:11,23). A third site, the Karilowa Doukhobor village, excavated in 1996 by Western Heritage Services Inc. prior to a highway widening impact, contained a strong suggestion of home-made brickmaking during the village's early settlement by the presence of very soft, crumbling light orange bricks in one pit feature (author's opinion). Commercially-made bricks also recovered post-date the earliest years of the village and once available may have replaced the home-made bricks.

Archaeology will be the major method of investigating most of the brickmaking sites in this province, as documentary records are scarce for all sites except Claybank, and oral testimony of former plant workers is only available with the three largest, longest-lived sites. Hopefully, ongoing archaeological work will continue to tie the various sites into a broad picture of the provincial brickmaking industry as it developed during a period of over one hundred years.

2.8 Summary

The legitimacy of bricks within North American historical archaeology as a useful class of artifacts to analyse and interpret has taken many years to become accepted. This is true as well of brick manufacture in terms of becoming a popular topic of scholarly endeavor within the emerging field of industrial

archaeology. The delay of time is unfortunate as many researchers have since proven both the value of bricks as diagnostic tools and the usefulness of studying brickmaking operations to illustrate economic, social and political processes. Some of the earliest work in this area, such as Harrington's, was high in its quality and results, but old assumptions fade slowly, and those heavy, common chunks of historical fill have eventually gained more respect.

Review of available literature shows that the technical background needed to analyse bricks and their manufacturing sites is essentially in place, a lack of which was certainly a problem only a decade ago. It is now time to apply more theoretical models of interpretation to these areas of study, as some authors further afield in Australia and New Zealand suggest.

Meanwhile support is growing for the study of bricks in several ways—popularity with collectors, reuse in new housing or landscaping, and within Saskatchewan, the designation of an industrial manufacturing location, Claybank, as a National Historic Site. Brick has diminished as an overall construction material, but public affection for it has not. Structures made with it have retained permanent, aesthetic qualities reflecting the extra time and funds invested to use this material in place of more mundane, less expensive products. Not to be forgotten are also the skills of brick masonry, becoming increasingly rare and more valued.

Overall, many questions can be asked of bricks and their manufacture, and more answers can be given than with many classes of artifacts, once some background knowledge and patience are applied.

Chapter 3 History of Saskatchewan Brickmaking

3.1 Introduction

This chapter will examine the historical development of brickmaking in Saskatchewan from inauspicious beginnings during the earliest settlement period through to industrialization which ended with the last plant's shutdown in 1996. With the conclusion of over one hundred years of brickmaking activity coinciding with the dedication of the Claybank brickplant as a National Historic Site in June of this year, it is fitting to review the consecutive elements which made up this small but significant portion of the provincial economy.

Discussion will begin with the development of pioneer brickmaking in Saskatchewan, noting the relationship this had to settlement trends up to 1914, when the recession that began in the previous year was reinforced by the beginning of war in Europe, ending this century's early boom years. This was a watershed in the province's brickmaking industry, leaving most of the operations unprofitable because of the considerable downturn in construction that resulted. The latter portion of this chapter will examine how the industry grew out of this period with three large brickplants—Claybank, Estevan, and Bruno—producing specialized product lines that would allow each firm important marketing advantages. This was critical as the brick industry both in Saskatchewan and beyond

became increasingly competitive with the decline of traditional markets after WWII.

3.2 The Development of Brickmaking in Saskatchewan to 1914

European settlement of the Canadian prairies follows several historical phases, dating from the fur-trade period in the north to various waves of immigrant farmers and workers later in the more southern, agricultural regions. Brickmaking accompanied these various phases, which in Saskatchewan includes at least one site connected with the fur-trade, at Fort Carlton. This is possibly the earliest brickmaking site in the province but is difficult to date precisely, falling within an approximate range of 1850 to 1885. It is known entirely because of the archaeological project, noted earlier, which located a brick scove kiln base in 1977 while attempting to find the third of four consecutive fort locations in the vicinity. The fort was operated by the Hudson's Bay Company up to 1884 when it was used for one year as a police outpost prior to the Riel Rebellion and subsequently abandoned. Hudson's Bay Company archives, normally a rich source of information on its many operations, unfortunately possess no documentary records of Fort Carlton when the kiln would likely have operated (Dyck 1978:6). The kiln products were probably used for various utilitarian purposes such as chimneys or ovens—no brick buildings are known from the site (Klimko 1977; Dyck 1978).

The first documented case of both a brick building construction and accompanying brickmaking in Saskatchewan is from the

town of Battleford in 1877. Being the first seat of territorial government in the region it had several structures built simultaneously by a public works crew of which one example, the Registry Office, was of brick:

> The Registry Office...was a brick building, forty-three by twenty-four feet [13.1m x 7.3m], with stone foundations. Presumably it was intended to be burglar-proof, since the room allocated for the storage of deeds was vaulted and fire-proof, the doors were of iron, and the windows protected by iron guard bars and shutters [McPherson 1967:44].

It would seem that the brick used in the construction contributed to an image of security on the prairie frontier. No other brick construction is recorded so the manufacture here was likely a single-purpose, non-commercial enterprise. Meanwhile there is some mention of a more permanent brickmaking enterprise for the North-West Mounted Police stationed nearby, where "[a]n icehouse and dry kiln were constructed for keeping ice during the hot summer months and making bricks respectively" (Hildebrandt 1994:21). As at Fort Carlton, bricks made here were probably used only for utilitarian purposes such as chimneys (Hildebrandt 1978: 132).

The first commercially-minded brickmaking enterprise is noted from 1879 in Prince Albert, operated by Thomas E. Baker. A store constructed in this year was allegedly known for many years as "the first brick building in the Territories, West [sic] of Winnipeg" (Loucks c.1970:1), although the Battleford example seems to have existed for two years by this time. It is interesting that all

the preceding examples were from locations along the North Saskatchewan River, at the northern portion of the future agricultural region (Figure 3.1). European settlement in the 1870s was directed to this transitional prairie area near the southern end of the longer established fur-trade zone, rather than the less-

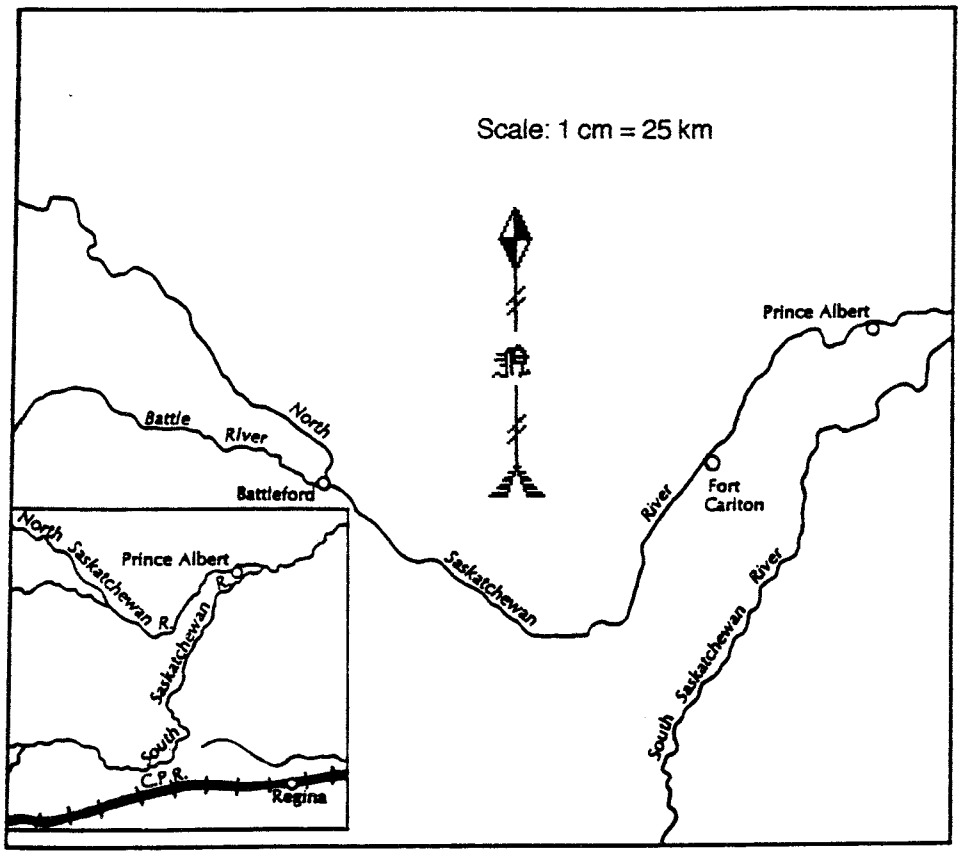


Figure 3.1 Locations of earliest Saskatchewan brickmaking (adapted from Berton 1971:346).

treed, short-grass plains to the south. Saskatchewan's three largest cities, located in this more southerly region, would be founded several years after their northern cousins, with Regina in 1882, Saskatoon in 1883, and Moose Jaw in 1884 (Kitto 1919:95). This followed the arrival of the first railway, the Canadian Pacific,

across the southern rather than northern prairie region in 1882 (Berton 1971:113). It was originally surveyed to pass to the north and have intercepted Battleford, but political and business motivations dictated that the actual route be much further south (Berton 1971:16-19).

Along with the seat of government, moved to Regina from Battleford in 1885, the focus of brickmaking would likewise follow to more southerly areas where new waves of settlers were following the rails from Eastern Canada, a trend which would remain strong up to WWI. Construction became intense in the new prairie towns and many brickplants were set up to meet the demand (Figure 3.2). This came not as much from the average

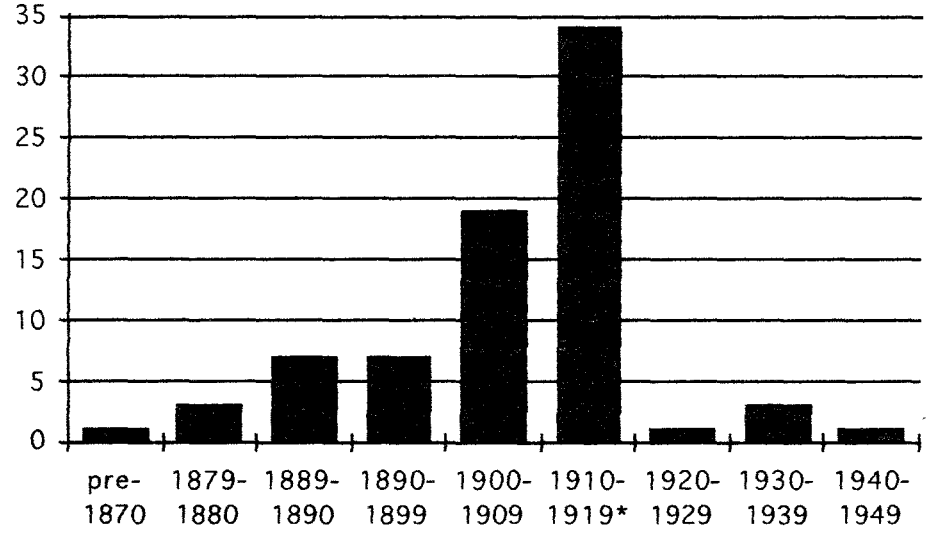


Figure 3.2 Number of new brickmaking operations opened in Saskatchewan to 1949, derived from Appendix A. (*1910-1919 includes 18 1910-1914 endeavors that likely never attained production; as well, no commercial examples were set up from 1915-1919).

householder, who could obtain lumber from British Columbia (via the railway) cheaper than any locally produced brick, but from public agencies such as school boards or town administrations, and the businesses, churches and homes of the optimistic middle classes. There was prestige to building in brick along with a strong symbolism of investing in the long-term future of a given community. Practical aspects were present also, as an 1886 estimate of finishing options on a Regina government building notes:

> The building has either to be painted at a cost of $175.00 or veneered with brick, which is thought to be preferable on account of the annual appenditure which would have to be incurred for repainting besides which the veneering will give the building a more substantial appearance [Public Works of Canada 1886:2].

Fire was also an issue that building with brick addressed—many business districts of the new towns were ravaged by major blazes, sometimes several times within a decade, when the structures were of wooden construction placed close together. This led some communities to enact building codes prohibiting wooden buildings in business districts, such as Saskatoon in 1906 (Lozowchuk et al. 1988:61). Such regulations directly benefited brickmakers in their local markets.

By 1884 the new capital town of Regina had one of the first brickyards in the southern prairie region, Martin and Betteridge, which supplied material for the new government buildings. Canada's first Prime Minister had showed some concern in this

matter, having written to Lieutenant-Governor Edgar Dewdney two years earlier, stating "[b]rickyards will probably be established without delay, from the prospect of Regina becoming a town" (J. A. Macdonald to E. Dewdney, September 1882, copy on file at Saskatchewan Heritage Branch [SHB], Regina). Dewdney replied nine months later that "[b]rick is being made at Indian Head and yards are expected to be started here shortly" (E. Dewdney to J. A. Macdonald, 3 June 1883, Collection R70, Saskatchewan Archives Board, Regina). One government order amounted to 750,000 bricks from Martin and Betteridge in 1885 for the building of a jail and lunatic asylum, a large order for a fledgling prairie company (Martin and Betteridge to D. Ewart, 4 November 1886, copy of letter on file at SHB, Regina). Difficulties ensued when the brick firm became saddled with excessive 'cartage' expenses from the construction location being altered by several kilometres. This was further compounded by the coincidence of the Riel Rebellion occurring that summer:

> And owing to the extra distance and the great demand for teams and the high wages being paid during the rebellion it cost us 62 1/2 cents per thousand to deliver more than it would have cost had the change not been made we delivered at Jail and Asylum 576,000 @ 62 1/2 cents per thousand $360- Yours respectfully, Martin + Betteridge [SHB 1886].

This matter was unsettled as late as 1891 (W. Henderson to A. Martin, 4 February 1891, letter on file at SHB) and illustrates how the expense of transporting bricks even short distances would have encouraged production close to areas of active construction.

Problems with stocking shipment orders were frequent as well. An August 17, 1903 letter from a Lumsden merchant to the Grenfell Brick Company, east of Regina states:

> As you are aware our contract read "Shipment by 6th of July," we are under a heavy expense while building as our carpenter and Bricklayers must be paid whether they work or not. Moreover the season is well advanced. We cannot depend upon September or October weather for building. We do not think you should have sold brick from your Broadview Kiln until our order was completed and await your explanation in the matter. Yours truly, Balfour Bros. [Lumsden Homecoming '71 Book Committee 1971:19].

Part of the problem with such delinquent orders was the length of time it took from the mining of clay to delivering the final product, a process that had to be planned well in advance as the various procedures involved could take most of a year. In addition there were many pitfalls in this process, especially with the contemporary technology of the simple scove kilns and the losses incurred with them, as well as the weather which could be uncooperative in regard to such activities as drying newly formed bricks outdoors before firing (Gurcke 1987:26). In this regard Saskatchewan's short summer season was also reflected in a relatively short season for the early brickyards.

Regardless of difficulty, there was a steady increase of brickmaking across the prairies from the 1880s through the late 1890s. Most operations were labour intensive but employed some mechanization although the single product produced was common brick, molded by hand or machine. Facebrick of a better quality for

building fronts were not produced separately but usually collected together when a given kiln's results were sorted—the best bricks became facebricks while the less attractive examples became common brick for a building's sides, interior structure, or chimneys.

In the first years of the 1900s a sophistication began to develop in the province's brickmaking on several fronts. Newer, more mechanized technologies were entering the brickyards in the form of stiff-mud and dry-press processes which could produce a higher-quality product, and produce it more quickly. At the same time there was increased competition from the adjoining provinces with brick increasingly being shipped greater distances, giving consumers a greater choice than merely their local or closest manufacturer. The standards of product quality were forced higher as a result.

The clay utilized by the newer processes needed to be of high quality as well—a poor glacial-origin clay which could make a passable hand-molded brick would be challenged to make a suitable product in the newer-technology machines (see Appendix C: Geological Examination of Saskatchewan Clay Resources). Therefore, the geological formations in the very southernmost portion of the province began to be tapped: the Whitemud, the Estevan and the Ravenscrag. As most plants opened in the 1880 to 1900 period were to the south of the 1870s locations, now the newest group of enterprises were again located further south. The earliest of these was in 1902 when brickmaking was begun at

Estevan with an operation that would become the longest running brickplant in Saskatchewan, closing in 1996.

This operation took advantage of the Estevan and Ravenscrag formations from which both coal and clay could be extracted. This provided two sources of revenue and a more balanced seasonality—prior to 1900 most Saskatchewan brick manufacturers operated mainly in the spring to fall months when construction demands were highest and the brickmaking process easiest to carry out. However, underground coal mining, the method used in the early decades of this southeastern Saskatchewan industry, was well suited to cold winter activity when demand was highest. One woman born in the area remarked:

> Mining was a seasonal business. If it was a cold winter the mine worked vigorously. The rail cars would be lined up along the spur track to be filled and would be sent to their destination. If it was a mild winter, the mine worked sporadically and wages for miners would be meagre [Pawson 1992:1].

Thus with the marriage of clay and coal extraction, the potential for the first truly industrialized, year-round brick manufacturing was established. Coal miners who formerly looked for other employment in the summer remained to work at brick manufacturing in the summer, ensuring a steady work-force, while the mined lignite made a secure and cheap fuel source for the firing of the brick and heating of the manufacturing portion. Previously most kilns on the prairies had been fired with wood, a relatively scarce fuel commodity on the southern prairie. As well, fuel for firing the brick traditionally has been the largest expense incurred

in brickmaking, a reason why the Medicine Hat clay-product manufacturers of Alberta would soon become such a large manufacturing force on the prairies—they had inexpensive natural gas on the site of their brick and pottery-works.

The layout at Estevan was imitated at another coal and clay mining enterprise 10 km down the railway at Shand. By 1912 this operation made bricks to maintain year-round work for employees, and was run by J. G. Peterson, who had earlier managed the Estevan outfit. Peterson seems to have had his original focus on brickmaking; however, his coal mining business would prove more lucrative and outlast the brick manufacturing, while the Estevan operation would see the reverse occurring (Pawson 1992:1). At least three other companies in the southeast region claimed to be coal and brick producers by their name (see the Roche Percee and Pinto entries in Appendix A), but it is more likely that they mined and sold both lignite coal and brick clay but did not actually produce brick on their premises.

The third major brickmaking enterprise to utilize the higher-grade clay deposits of the south was set up at Claybank, constructed from 1912 to 1914. This plant was located at the base of the Dirt Hills, southeast of Moose Jaw, in the vicinity of Saskatchewan's best clay source, the Whitemud formation. This very pure Kaolin-type clay possesses great refractory (high-temperature) properties which, when formed into products such as firebricks used in steam locomotives and brick-kilns, was in very high demand before WWI. This demand had led to large amounts of American imports, and since the province possessed the raw

resource it was logical to set up a plant to utilize it (Davis 1918:2).

The white clay deposits near Claybank had been noted as early as 1886 and by 1904 a company named the Moose Jaw Fire Brick and Pottery Co. Ltd. was mining and shipping the clay to Moose Jaw where an established manufacturer, Wellington White, made a moderate production of firebrick. They also shipped the raw fire clay to the eastern United States and Canada but had plans to build a large industrial plant of their own to utilize their product, to be placed at the source location. After a reorganizational name change to Saskatchewan Clay Products Ltd. in 1912, construction began and by 1914 a large, modern facility was completed. Unfortunately, this was just as the market for all types of brick collapsed (Saunders et al. 1992:1-5).

The decade previous to 1914 had seen increasing growth in the Saskatchewan economy, with expanding settlement and construction that by 1911 was resulting in a true 'boom' environment of real estate speculation and community boosterism. The height of this boom was 1912, but it continued into 1913 until a recession that year slowed it down, with the start of war in 1914 ending it completely. Not only did construction stop in almost every region of the province but young men left the work force by the thousands for the battlefields, many never to return.

The rise and abrupt fall of the economy changed the entire nature of the brick industry. Of approximately 40 brickmaking operations established by the end of 1913, a process which had taken four decades to develop, only four were operating a decade

later (Saunders et al. 1992:7) Three of these continued to operate through the oncoming Great Depression into the better economy of the post-WWII era. Two of these were the previously mentioned Estevan and Claybank located operations. A third was developed during the boom period, like Claybank, but was located north of the prime clay belt. This was the Bruno Clayworks Ltd., 100 km northeast of Saskatoon. Railway construction which passed this location in 1905 had uncovered high-quality glacial lake clay which was subsequently used to make bricks for the nearby Humboldt railway roundhouse (Hargarten 1955:89-90). With its clay resources proven and of significant quantity, an initiative to industrialize the original brickyard site began in the midst of the pre-war boom, with the intention to make extruded structural tile—then a very popular new product not yet produced in the province—as well as extruded, or stiff-mud brick. The operation had enough momentum to outlast the WWI-era depression and establish itself in the structural tile market.

Many more industrialized plants for manufacturing brick and structural tile were planned in the boom years of 1911 to 1914, with most never getting past their stock-issue promotions and even fewer manufacturing any product. One example is the Northern Brick and Tile Co. in the industrial development of Saskatoon called "Factoria" by its promoters (Figure 3.3). Photographs show the brickplant being constructed in the summer of 1913 even as the recession was mounting (Saskatoon Public Library, Local History Room, Saskatoon, PH 87-112, PH 87-114). It never had a chance to prove itself, disappearing within a few years

along with "Factoria" which would eventually be developed under a different name as a housing development in the 1970s. Meanwhile, just outside of Saskatoon, a large stiff-mud plant was set up at Floral. This plant may have been intended, like Bruno, to produce lucrative structural tile products. Unfortunately its clay was not tested rigourously enough, with the result that there was difficulty making any marketable product regardless of the economy (Keele 1915b:14-15).

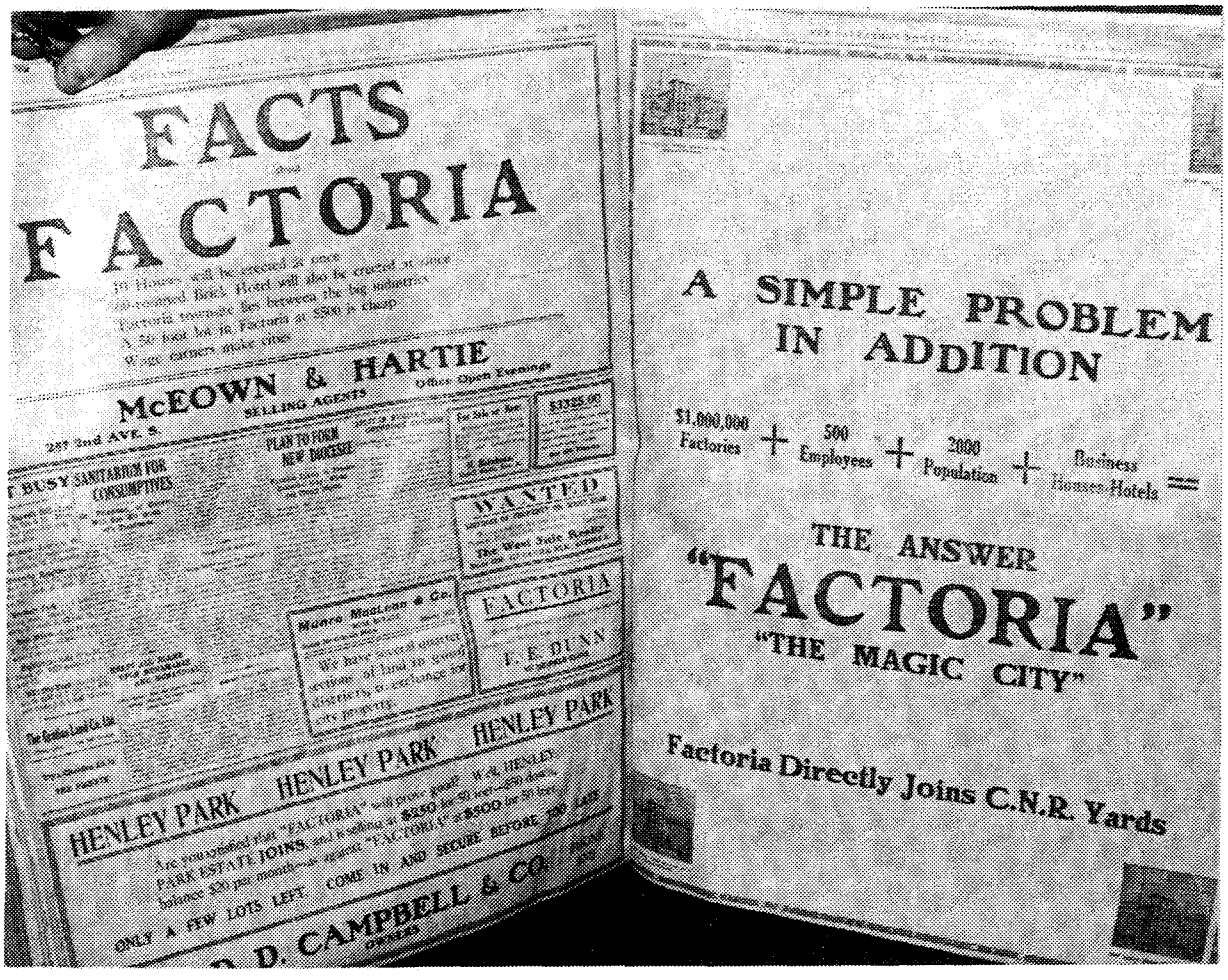


Figure 3.3 Advertisements for "Factoria" in 1912, Saskatoon Public Library, Local History Room, Saskatoon, LH 4946.

The provincial Bureau of Labour noted in its 1915 report that "[n]early all brick and tile plants were closed down the entire year" (Province of Saskatchewan 1916a:5), a condition lasting until large inventory stocks were sold off in the depressed construction materials market (Province of Saskatchewan 1915:5-6, 1916a:5). The boom was over and a new phase of a few, large industrialized brickplants operating over the next half century was to begin.

3.3 A Non-commercial Operation During the War Years

The first site to be examined in the post-1914 period is not industrial in nature; however, it is the only known site of brick-making to have been initiated in the immediate post-1914 years. This was the site of Ringleton Firs, a mixed farm and ranch in the boreal forest transition zone of north-central Saskatchewan, 80 km northeast of Battleford. This property had been homesteaded in 1905 by English-born Christopher Castle who came from an above-average economic background and had a university education from Middlesex. He set out to create a country home in the English style, which was assisted by the discovery in 1914 that some of the sandy clay deposits on his property could be made into brick.

Expertise in this realm was provided by two neighbours of Ukrainian and Italian origin, respectively, who had been trained in brick-related skills before emigrating to Canada. They proceeded to hand-mold their bricks with an unbranded frog, then fired them hot enough to create some 'clinkers' (distorted, over-fired bricks), which were used in the fireplace chimney to reflect the style of the day (Meeting Lake Regional Park Committee 1976:177-178;

Manson 1983:15-16). The house was a large two-and-a-half story dwelling, surrounded by landscaped gardens and equipped with electric wiring and running water, items uncommon in rural Saskatchewan until the 1950s—Castle ran a generator to power his utilities. It stood until the 1970s, last being used as a convalescent home (Muriel Sherman [daughter of Christopher Castle], personal communication 1996).

The significance of Ringleton Firs lies in its pioneer spirit of building a structure with the resources at hand, which on the prairies included using the original prairie sod, as cut into large brick-like units, to build homestead-era sod houses. Other examples included using sun-dried mud-brick, 'rammed-earth', lime-gravel cement, many forms of log construction, and probably on more than one occasion in Saskatchewan, manufacturing one's own fired bricks from one's own clay. For example, the author worked at the 1996 archaeological excavations of the Karilowa Doukhobor village site, introduced in Chapter 2, which produced evidence of low-fired, hand-molded bricks. These were probably made on-site, c.1900, for use in communal ovens before local, commercially-made bricks from Rosthern (also recovered) were available.

Certainly the Ringleton Firs dwelling example has an Albertan analogue, the Strecker family home of Rosedale, Alberta. In 1921-1923 Frank Strecker, a miner, built a two-storey house and two-room cottage from bricks made on his premises, with help only from his family (Manson 1983:121-123).

3.4 Saskatchewan Brickmaking from WWI to the end of WWII

Some economic recovery followed the end of WWI on the prairies, although not enough to be termed 'roaring twenties' as the earlier boom period of 1910 to 1912 would only be paralleled in the two peak years of 1920 and 1929 (Worcester 1950:45,48,49). For instance, the value of annual construction from the six largest Saskatchewan centres was $25,461,531 in 1912, bottomed out at $729,463 in 1915 and only returned to $4,136,501 by 1920 (Province of Saskatchewan 1914b:8, 1917:162, 1920:374). Regardless, this did create enough demand for the larger plants to sell off inventories and resume production. Meanwhile, a few smaller operations survived for a time, depending on their specific situations. The Shand plant turned out bricks until at least 1935, boosted by its winter coal mining activity (Pawson 1992:30; Worcester 1950:46), while Yorkton's Doukhobor communally-run brickyard, a large operation when set up in 1907, ran on occasion until at least 1932. At this time it supplied material for six Doukhobor-built rental houses in Yorkton, a rare Depression-era development (Facade 1992:6-8). W. G. Worcester consequently notes a "Malloff and Son" of Yorkton making bricks at a summer yard in 1935, 1946, and 1947—this may have been a continuation of the Doukhobor operation when demand was sufficient (Worcester 1950:46, 51).

By this time the three large plants supplied the overwhelming majority of product. The oldest of these, the Estevan operation, lost the coal portion of its name when it was purchased and

renamed "International Clay Products Ltd." in 1925. It was joined by a branch plant at Prince Albert under the same name, probably the purchase of an older existing firm although the emphasis on production remained at Estevan. Here many additions and upgrades were made, including a pottery plant in 1927 which made perhaps the only such items in the history of the Saskatchewan industry, even though Alberta plants such as Medalta Potteries made such products in great quantity from Saskatchewan clay (King 1967:37). Examples included wine jugs and terracotta, but the pottery component probably didn't last long (Estevan Brick c.1979:11). Despite factory improvements and an expanded range of products that now included structural tile and in-vogue rough-textured facebrick, a few good years at the end of the 1920s were followed by the depression years of the 1930s (Worcester 1950:45-47).

A c.1979 promotional pamphlet for Estevan Brick states that "[t]he depression hit the building industry, and the brick plant, and operations ceased in 1932. For 12 years the plant sat idle, because money wasn't available to put it back into operation with the necessary modernization to make the products competitive" (Estevan Brick c.1979:11). According to W. G. Worcester (1950), head of ceramic engineering at the University of Saskatchewan from 1921 to 1947 and general industry consultant, the plant was probably operated a few times in that period, including 1933 (along with the Prince Albert branch) and 1937 (Estevan branch only). He alludes to some production between 1937 and 1944, but probably not at full capacity (Worcester 1950:46,51). In late 1944 the plant entered a very different phase as it was bought by the provincial

government to become a state-owned or 'crown' corporation, with a name change to "Saskatchewan Clay Products" (Worcester 1950:51). This would give the somewhat derelict plant a new life, although with more investment and less return than the new socialist government of the day likely expected.

The Claybank plant had a delayed beginning because of WWI, sitting complete but idle for two years. In 1916 it was re-opened, and in 1917 a company reorganization dubbed it Dominion Fire Brick and Clay Ltd., a name it would hold until 1970 (Saunders et al. 1992:7). It was fortunate to have additional capital to bring it through to actual operation, as many other prairie factories were left insolvent by lack of funds. However, the markets for the company's refractory wares had been re-established by the later years of the decade, which would lend future production stability to augment the more volatile market for general construction wares (Saunders et al. 1992:21). Claybank's non-refractory products did have an advantage in being high-end facebrick varieties previously unavailable in Saskatchewan except by import. For instance, Minnesota and North Dakota examples were advertised in a 1912 Regina business directory (Henderson Directories Ltd. 1912: 90,93). Claybank's facebricks were noted as "a fine range of dry-pressed face brick and mantel brick...equal in colour and quality to any brick hitherto imported in the Province" (Kitto 1919:125). Such product would be used, as earlier noted, in upscale hotels such as the Bessborough in Saskatoon, the Saskatchewan in Regina, and the Chateau Frontenac in Quebec City (Saunders et al. 1992:18).

Although such large orders for facebrick benefited the plant, it was the firebrick production that proved critical to Claybank's growth and survival. This was greatly assisted by the development and manufacture of special-shape firebrick for locomotives, beginning in 1923. Like the high-end facebrick, these special firebrick had previously been mostly imported from the United States (Saunders et al. 1992:8,9). Saunders, Richan and Associates (1992:8) note in their report on the history of the Claybank site that "[m]uch of the economic basis of the steady progress experienced by Dominion Fire Brick and Clay Products over the quarter century after 1930 resulted from its entry into the manufacture of specialized refractory products in the mid-1920s." In addition, they found that the plant benefited from "careful ownership and stable management through the difficult decades of the 1930s and 1940s" (Saunders et al. 1992:19). This was demonstrated by almost continuous full-capacity operation from 1936 through WWII, with Claybank firebrick being used in most of Canada's railway locomotives west of the Great Lakes, as well as in war-era marine ships and a variety of smelting and manufacturing industries (Saunders et al. 1992:11-12).

The Bruno brickplant seems to have survived the WWI depression much like Claybank—completed at the end of 1914 it had to wait for better markets, although it seems to have operated at some capacity throughout the war (Hargarten 1955:94). By 1919 it is noted that "[t]here is a great demand for hollow clay building blocks, as these are easily laid up in walls, but the plant of the Bruno Clay Works is the only place in the province where they are

made at present" (Kitto 1919:125). Joined by the Estevan brickplant in this pursuit by 1925, Bruno seems to have stayed dominant in this field until the end of the hollow clay block or 'tile' era, probably due to such factors as its more central location in the Saskatchewan market and a complete focus on extruded fired clay products. For this end it possessed the most advanced and efficient kiln in Saskatchewan: a nine-chamber, top direct-fired affair that could utilize the less expensive, finer sizes of coal. Such a kiln was well-suited to the high production of large-sized clay tile products at Bruno, although it was limited from firing higher grade wares such as pressed facebrick because of ash dust settling on the finished goods (Worcester 1950:52). For Bruno this wasn't a problem as they were limited by their clay from making higher grade products while competitor Estevan produced both lower and higher grade products, making it possibly uneconomical to build and operate such a structure at the Estevan location.

Worcester (1950:46) notes that in 1922 "[t]he plant at Bruno in addition to common brick produced a line of structural building tile and some drain tile", while in 1934 it was closed from lack of demand but probably operated at some level from 1935 on, through to the end of WWII (1950:46,51).

3.5 Saskatchewan Brickmaking from WWII to 1996

The last five decades of the Saskatchewan brickmaking industry was a period of increased competition and specialization to counter the declining popularity of burnt clay products as structural materials. New construction materials of metal and

plastic appeared while light concrete aggregate was developed to become what earlier, excessively heavy cement blocks had not succeeded in being—a direct structural substitute for burnt clay products of brick and structural tile (Figure 3.4). Many attributes of brick would not be improved upon or equalled, particularly in aesthetics and overall longevity, but in the post-WWII climate of North America these traditional qualities were less valued. New buildings possessed built-in obsolescence with estimated life-spans of less than a century and depreciation calculated annually.

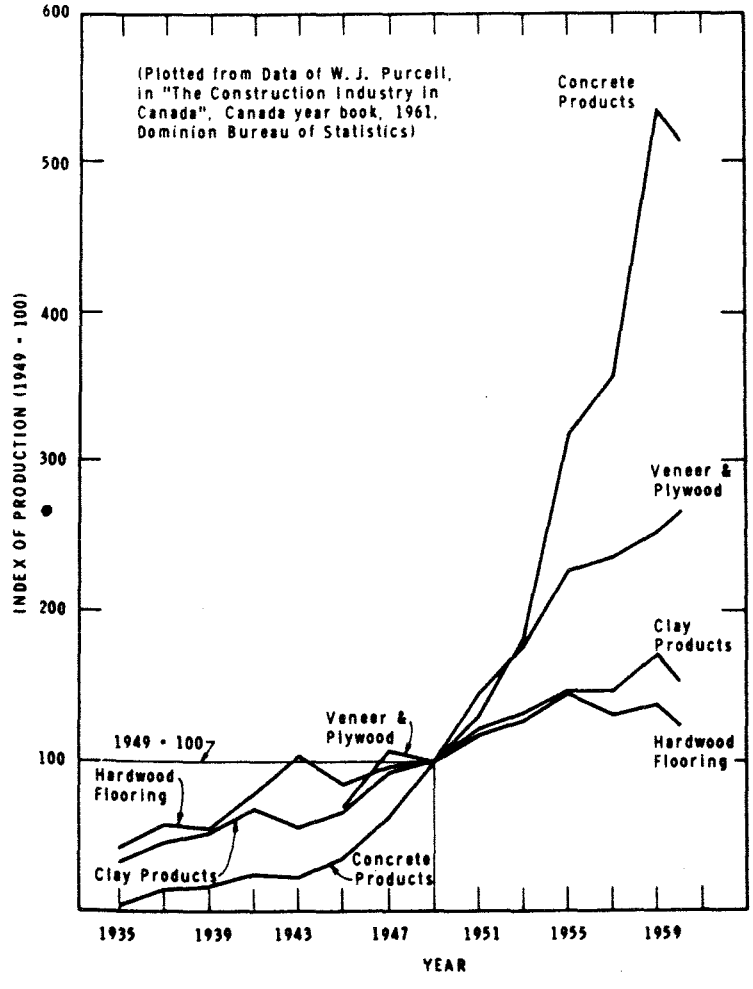


Figure 3.4 Comparison of building material production in Canada from 1935 to 1961 (from Ritchie 1967:246).

The most important aspect of this change was the general relegation of structural clay products to a non-load-bearing veneering or façade purpose. While such veneering was an old concept, being mentioned in Saskatchewan as early as 1886 (Public Works of Canada 1886:2), it had previously been complemented by a much larger number of constructions with walls of solid brick or the later burnt clay structural tile. However, by the mid-1950s the light-aggregate concrete 'cinder-blocks' began displacing brick and structural tile as the popular masonry structural unit for smaller buildings (Saskatchewan Minerals 1956:1; Manson 1983:26). Larger structures were often built of steel and aluminum products entirely, or of poured and pre-cast concrete reinforced with steel framing. Brick veneering became popular as an option on any of these newer construction types leading to high-grade facebrick becoming more developed in terms of colour, texture and overall quality, even as total production of structural burnt clay products diminished.

Estevan was the leading innovator in this period, thanks to the direct involvement of the provincial government following the purchase of the International Clay Products holdings in late 1944. The government-owned crown corporation, Saskatchewan Clay Products (the name earlier used for the Claybank brickplant) was then set up, with production focused at the established Estevan brickplant. At this time the Bruno establishment probably possessed a more modern plant with higher production levels; however, the Estevan plant had the advantages of higher grade clay, including some Whitemud quarries in south-central Saskatchewan,

and better access to fuel, with holdings of coal included in the sale (Saskatchewan Department of Natural Resources and Industrial Development 1947:150).

The socialist government of the day, led by Premier Tommy Douglas, established the crown corporation through its new Industrial Development Branch. Douglas's government was concerned that Saskatchewan's economy was over-dependent on agriculture and its companion industries, leaving the province vulnerable if the agriculture sector did poorly, as shown dramatically in the 'dustbowl' 1930s. It therefore tried to stimulate growth in non-agricultural resource sectors such as lumber, furs, oil, coal, sodium sulphate, and clay products. In particular, with the scarcity of building materials in the early post-WWII recovery period, clay resources seemed to be a reasonable investment (Saskatchewan Department of Natural Resources and Industrial Development 1945:108,113). Beyond actual manufacture of clay products the government was also concerned with the marketing of raw clay, much of which had gone to Alberta-based manufacturers in previous decades with almost no return to Saskatchewan (Saskatchewan Minerals 1947: 5-6).

Initially, the Estevan brickplant benefited from the first major capital investment since the 1920s, with rebuilding of all major components and construction of proper water and electricity hookups to the nearby town. This occupied the entire working year of 1945 with no actual brickmaking taking place, suggesting that the plant was not in proper serviceable condition when purchased

(Saskatchewan Clay Products 1946:2). The next year saw a substantial production of brick, although probably not up to expectations. Output was better in 1947 but there was difficulty in keeping the plant operating through winter, as much of the process still took place outdoors (Saskatchewan Minerals 1947:4).

Meanwhile in 1946 the Estevan brickplant had officially become the Clay Products Division of the newly formed Saskatchewan Minerals crown corporation, losing its independent status as such an entity although it continued to use the name Saskatchewan Clay Products in regular business. Its sister member was the Sodium Sulphate Division, a relatively new industry which would prove to be very profitable in the years ahead as the Clay Products Division consumed massive amounts of capital to become fully modernized and competitive (Saskatchewan Minerals 1947:1).

Despite the improvements to the original Estevan brickplant, profits could not be realized even in the post-war economy, so plans were undertaken in 1950 to build a new plant at the same location, complete with a modern tunnel kiln, that could be operated efficiently year-round (Saskatchewan Minerals 1951:1-3). This had large implications on several fronts. First, the Estevan brickplant would be essentially brand-new with the latest technology, ensuring a long-term industrial presence with its considerable history ensuring its reputation in the marketplace. Second, the Bruno facility (owned by Alsip Brick and Tile Co. Ltd. of Winnipeg, Manitoba since 1947) was doomed by this move, for even though it had been a more modern plant up to 1950, its semi-continuous kiln of 1914 could not compete for efficiency or

productivity with a tunnel kiln, the standard of the post-WWII brickmaking trade to the present, and it did not have the capital or resources to completely rebuild as Estevan did. Third, the provincial government became much more involved than it had originally intended and probably should have, both in terms of monetary investment which would not be recoverable due to the future downturn in the burnt clay industry and in ultimately choosing which brickplant would carry on and which one would fold.

Five years earlier the situation had appeared much different—the burnt clay industry had an apparently bright future, with a possible undercapacity if the Estevan facility remained closed (Saskatchewan Department of Natural Resources and Industrial Development 1945:112-113). The provincial government's interest to assist this situation was in "priming the industrial pump" (Saskatchewan Department of Natural Resources and Industrial Development 1947:150) by reviving the Estevan plant which had been "closed down completely prior to its operation by the Corporation" (Saskatchewan Minerals 1949:2). Bruno didn't need any such 'priming' in 1945, having survived the Great Depression in serviceable condition for the large post-war demands. However, the government's choice of choosing Estevan had broader motives than the plant itself:

> The operation of the plant is only an initial step in a broader programme to develop the coal and clay resources of the Province, by establishing in Estevan area a series of inter-dependent industries based on utilisation of our extensive coal and clay resources [Saskatchewan Department of Natural Resources and Industrial Development 1947:150].

With this rationale, the events unfolded so that by the end of 1951 the new plant at Estevan was in operation. However, its 'tender-drying' clay (difficult to dry without cracking prior to firing), which was always a concern from the earliest days (Ries and Keele 1913:79-81), created problems with the new machinery and layout (Saskatchewan Minerals 1952:1).

Claybank was little affected by the Estevan rebuilding and government involvement, having limited product overlap except for high-end facebrick which Estevan began developing more seriously in the early 1950s. However, Claybank's facebrick production had long been ancillary to its refractory products, with facebrick production ending altogether in the 1960s (Saunders et al. 1992:17). More important was the decline of steam locomotives in favour of diesel through the 1950s, eliminating Claybank's most important market for firebrick in the previous decades. This coincided with a staged transfer of ownership in 1954 and 1955 during which control of the plant was first assumed by an out-of-province concern in Alberta, Redcliff Pressed Brick Co. Ltd., then with share transfers was assumed by the large American firm, A. P. Green Fire Brick Co. Ltd. Countering opposition to American interests acquiring the firm was the rationale behind the staged transfer, with A. P. Green Fire Brick Co. Ltd. operating the plant until its close in 1989. The name Dominion Fire Brick and Clay Products (1954) Ltd. was kept until 1970 when the company was dissolved and became a direct division of A.P. Green Refractories (Canada) Ltd. (Saunders et al. 1992:13,14).

The Bruno brickplant began experiencing serious problems in the later 1950s as the market for its structural tile products declined in the face of the newer concrete products, and competition from the government-run Estevan brickplant became stronger. For instance, by 1955 "two (Estevan) full-time salesmen promoted sales in Saskatchewan, Alberta and the United States" (Saskatchewan Minerals 1955:1) with the intention that "the aggressive sales programme being undertaken will result in increased sales in 1956 and increased returns for the province" (Saskatchewan Minerals 1955:3). This would have affected Bruno's sales purely on its own, but it also was alleged that the provincial government was specifying Estevan product in all of its construction contracts as part of a policy of supporting Saskatchewan manufacturers, which ironically may have left Bruno excluded despite its own Saskatchewan location (*Sun-Times* [*ST*], 24 February 1961a:1, 24 February 1961b:1).

However severely Bruno was being squeezed by its single Saskatchewan competitor, the burnt clay materials market seemed relatively buoyant through the 1950s (Saskatchewan Minerals 1957, 1958, 1959), but in 1960 experienced a serious downturn that would become a trend (Saskatchewan Minerals 1960:2). This placed the Bruno brickplant in a tight fiscal situation that was compounded when a union demand to seek wage parity with Estevan was forwarded, with the result that the plant was shut down and never reopened (John Hudson, personal communication 1996). The local community blamed Saskatchewan Clay Products for the closure but in 1961 the community also circulated a petition for

the Bruno brickplant to be purchased by the same government agency (*ST* 24 February 1961a:1), which was unsuccessful.

The annual reports for Saskatchewan Minerals in this period illustrate why the government probably had no interest in acquiring another brickplant. In 1960 the Saskatchewan Minerals Corporation, comprised of the clay and sodium sulphate divisions, had finally accumulated a net surplus greater than the government capital advances, thereby becoming a viable economic entity (Saskatchewan Minerals 1960:1). This was accomplished largely on the strength of the Sodium Sulphate Division, however, for while the Clay Products Division achieved net profits from 1953-1960, there had been the large cost of the new plant to cover. When the clay products market dipped in 1960 and became severe enough in 1961 to have the Clay Products Division end with a net deficit, thoughts likely began to circulate not of purchasing another plant, as the Bruno petition requested, but of detaching the Clay Products Division from Saskatchewan Minerals so that the Sodium Sulphate Division could continue its remarkable success, as 1961 was the second record-profit year in a row for this agency (Saskatchewan Minerals 1961:1, 4-5).

The provincial clay products market continued to decline despite innovative new brick colours (such as Winter White) in 1962 that became a mainstay of the Estevan brickplant's production through its final three decades. The official plant name was also changed at the end of that year to Estevan Clay Products, reflecting the focus on this location from what earlier had been a wider-range of scope, involving raw clay sales from the south-central and

southwest areas of the province (Saskatchewan Minerals 1948:2, 1962:1, 4-5). After finally achieving a modest profit in 1965, the Clay Products Division was removed from the Saskatchewan Minerals crown corporation and set on its own as a limited liability company named Estevan Brick Ltd., commencing January 1, 1966 (Saskatchewan Minerals 1965:3; King 1967:38). For three years the government held the majority of shares, with reports on its progress being included with other crown corporations as was done previously. A strike in 1967 tempered the relative success of the first year, but 1968 found the brickplant with a record profit (Estevan Brick Ltd. 1966, 1967, 1968). Perhaps on this strength the brickplant was finally sold outright to PeBen Industries of Edmonton, Alberta in 1969, signalling the end of Saskatchewan ownership in this industry (Estevan Brick Ltd. c.1979:11). Items of note in the last year under Saskatchewan ownership include the majority of sales now being from outside of Saskatchewan, and the last chairman of the board being the non-socialist (Liberal) premier of that time, W. R. Thatcher (Estevan Brick Ltd. 1968:i, 2).

Less information is available on the Estevan brickplant following its privatization, but it seems to have mostly operated in its final 18 years with the facilities and products which were in place by the end of the 1960s. As this represented a wide assortment of colours and textures of facebrick, it is easy to assume that production followed the demand for whichever product variation was currently requested, although some new products were designed and automation increased (Estevan Brick Ltd. c.1979:11). Ownership shifted from Alberta to Ontario when

Thunderbrick Limited of Thunder Bay took ownership in 1977, continued with a transfer to Jannock Ltd. of Toronto, then shifted back to Alberta in 1995 when the brickplant was purchased by its long-time rival, and only other operational brickplant on the prairies, I-XL Industries of Medicine Hat, Alberta (Estevan Brick Ltd. c.1979:11; Brian Jennings [last Plant Superintendent, Estevan Brick Ltd.], personal communication 1997). This was a subsidiary of Redcliff Pressed Brick Co. Ltd., the same operation that briefly owned the Claybank brickplant in the 1950s (Dun & Bradstreet 1997:405).

Renamed Estevan Brick (1995) Ltd., the plant operated for its last year in 1996 and was then closed down, its equipment being shipped to Medicine Hat while the site was sold to a local electrical fabricating firm (Brian Jennings, personal communication 1997). The site had existed as a brickmaking factory for 94 years, one of the longest-lived industrial sites in the entire Canadian prairie region.

Claybank's final years as a division of A. P. Green Refractories were spent producing exclusively refractory products with the steel industry being one of its main customers. Factors such as the decline of the North American steel industry and rising freight rates (a concern of brickmaking in the province throughout its entire history), led to the plant operating at well below capacity (Saunders et al 1992:18-19). Together with the trend of corporate downsizing in the late 1980s and political events such as the Canada and U.S.A. Free Trade Agreement in 1988, which allowed the parent American company easier access to Canadian markets, it

was finally shut down in 1989 (Ken Oakley [former plant employee at Claybank], personal communication 1997).

The active history of Claybank can be viewed as over 100 years in length, from the time of its clay first being noted and tested in 1886 until its final commercial closure. The brickplant itself operated from 1914 (not including its initial inactive phase), for a total of 75 years, comparable to the slightly longer life of its Estevan counterpart. However, unlike Estevan which was dismantled, Claybank endures as an intact brickplant by its presence as a National Historic Site since June 29, 1997. In terms of the overall history of the brickmaking industry in Saskatchewan this is significant as it possesses nearly all of its original WWI-era equipment, complemented by later additions and modifications but not replaced, as occurred at Estevan in 1951. In addition it is possibly the only North American commercial brickmaking site to be preserved in this manner.

3.6 Summary

The history of the brickmaking industry in Saskatchewan parallels the entire period of the province's agricultural settlement, providing a valuable companion medium for viewing the development of this region. Brickmaking study is particularly useful in its sensitivity to economic and social patterns through its direct relation to construction—one of the main indicators of the development or decline of a given area.

This role as an economic indicator is evident in reviewing the various phases of brickmaking, beginning with the steady growth

of facilities and production from the arrival of settlers in the late 1870s up to 1910. At this time there was a boom in settlement and subsequent construction, with brickmaking at its all-time peak in Saskatchewan during 1912. A recession in 1913 ended the boom, followed by WWI and subsequent austerity in 1914 which left most brickmakers inoperative or bankrupt. A reorientation of the brickmaking industry towards fewer, larger operations followed, with the 1920s demand sufficient to allow some product and site development. Subsequently the 1930s and the Great Depression became a period of simple economic survival for the remaining brickmakers.

WWII lifted the economy into a new boom era, which benefited brickmaking well into the 1950s. In 1960 a new recession triggered a drop of production that coincided with new post-war construction practices which largely excluded brick products. This led to a major decline of the brickmaking industry that would not be reversed with future upsurges in the general economy. However, through product development and adjustment, brickmaking continued into the 1990s when continued consolidation of the overall North American industry led to the closure of the last Saskatchewan plant.

Succeeding chapters will expand on the themes introduced by this historical review, beginning with the archaeological examination of the technologies used at the various brickmaking sites in Saskatchewan.

Chapter 4 Introduction to Brickmaking Technology and the Saskatchewan Sites Examined

4.1 Introduction

From comparison with other studies across North America as reviewed in Chapter 2, Saskatchewan's brickmaking seems to have thoroughly covered the range of forming and firing processes that were available in the last two centuries, including some of the more obscure examples. This is especially apparent in its archaeological record, of which 16 sites were visited by the author in the course of this research. From such examination much can be learned when historical documents are either unavailable, inaccurate, or indicative of a particular site phase which was subsequently modified. Many contradictions were found in various documents, ranging from recent community-history compilations often written over half-a-century after a respective brickmaking site had ceased operations, to authorities on a given site during that site's operation. Archaeological inquiry not only helps fill in such historical gaps and discrepancies, it can often utilize historical sources as a point of departure for a much different perspective of what occurred in the past.

Research at two sites involved significant excavation by agencies other than the author, while the other 14 sites received surface examination by the author with collection of product

samples on location when possible. From observations gained so far, it appears that these sites represent a reasonable cross-section of the more than sixty brickmaking sites established in the province. Wide variations of age, scale, and technology are present within the sample, along with patterns following social and economic trends, such as the pioneer settlement before 1914.

A brief primer on brickmaking process will begin this chapter, to assist in the understanding of the technological features of the sites examined. The archaeological sites will then be presented within three economic/technological groupings.

4.2 Technical Aspects of Brick Manufacture

The specific process of brick manufacture is introduced here to provide some background for the subsequent review of the archaeological sites and their products. A more extensive discussion of firing appears in Appendix D, while the glossary, Appendix E, should help explain specific terms. For additional information one should refer to the publications by Gurcke (1987), Estep (1997), Ritchie (1967), and Hammond (1981).

Gurcke (1987) cites five major sequential components to brickmaking that applies to all types of burnt clay brickmaking:

1. Mining or extracting the raw clay, also known as 'winning'
2. Clay preparation
3. Forming or molding the product
4. Drying
5. Firing or burning

Extracting the clay usually entails open-pit or underground mining methods similar to other soft-mineral mining techniques

such as coal-mining. Raw clay is seldom usable for brickmaking without a significant amount of preparation, initially involving some amount of weathering for the clay to develop good working characteristics. This usually consists of spreading the clay over a large surface to a depth of approximately 1 m, then allowing precipitation, frost, and other climatic elements to break down the clay into smaller fractions and leach off salts and other impurities. This process involves a time-frame varying from several months to several years for some of the higher-grade product lines. Once the clay has a good working character it is often screened and ground into a powder, at which point other clays, colouring agents, and tempering agents are added. Tempering agents lessen the shrinkage of the formed bricks, and consist of such substances as sand or grog—ground fired brick or other clay products. Finally water is added in prescribed amounts (Gurcke 1987:4-13).

Forming the brick product can take a number of avenues, especially after the mid-1800s when several new methods were developed. Harley lists several ancient methods which may have been duplicated occasionally in non-commercial North America applications, such as the 'butter-pat' and 'pastry' methods which involve paddling lumps of clay into brick-like shapes and cutting brick-like shapes out of a large sheet of clay (Harley 1974:64). However, for the most part there are three main classes of brick forming relevant to North American, and Saskatchewan, brickmaking as introduced in Chapter 1. These methods are soft-mud molding, by hand or by machine, with 20% to 30% water

content; stiff-mud extrusion (also known as wire-cut) with 12% to 15% water content, and dry-pressing with less than 10% water content (Gurcke 1987:13). Variations exist within these classes but the majority of products fall directly within one of these three categories. In addition, with a 'repress' machine, brick from the soft-mud or stiff-mud methods can be repressed for sharper edges and dimensions, and have brands placed on stiff-mud bricks. Many varieties advertised as 'pressed facebrick' are actually repressed soft-mud brick (Gurcke 1987:109).

Once formed, most 'green' (unfired) bricks need some time to dry, often accomplished in heated drying chambers to accelerate the process. Soft-mud bricks take longer by virtue of their higher moisture content whereas some British dry-press bricks called 'Flettons' can be directly fired (Hammond 1981:17). Less required drying also leads to less shrinkage and misshaping of the brick.

As with brick forming, firing of the brick has had a number of innovations since the mid-1800s. Most of these revolve around varying designs of kilns, the ovens used to harden the brick. The simplest form of kiln is a scove, also known with some minor differences as a clamp. This form of kiln is made of the green, unfired bricks themselves, being stacked in such a fashion that firing gases can pass through all the brick from openings formed in the bottom of the kiln along the sides. The gases exit at the top of the mass of bricks in an 'up-draft' manner, with the sides and ends of the brick mass being covered and plastered with previously fired brick. This type of kiln is inexpensive to construct but it suffers from considerable variation in the amount of firing that different

bricks receive. Bricks at the top and sides are often underfired while bricks at the bottom tend to be overfired and deformed from the weight of the brick mass above them (Gurcke 1987:29-32).

A partially permanent form of the scove kiln was often used, being alternatively called 'Dutch' or 'case' as in Canada (Keele 1915a:194, Ries 1915:60, Davis 1918:21), or 'Scotch' as in Britain (Hammond 1981:22). Gurcke notes this type simply as a "slightly more advanced version (of the scove)...(with) two permanent side walls...(and) both ends open until the kiln is loaded (1987:29). For this research 'Dutch' will be used as all known Saskatchewan references to this kiln type use this name.

As the scove-type kilns are wasteful of heat and routinely have product losses of over 25% (Gurcke 1987:32), permanent down-draft kilns were designed, in which the firing gases pass up along the interior sides of the kiln, separated from the green brick by partial 'bag' walls, then move over and down through the mass of brick, exiting through a perforated floor that leads to an exterior chimney. The heat can be reused before reaching the chimney by rerouting it to drying areas or other kilns to preheat newly-loaded green brick. A substantial fuel cost saving is realized along with good control of firing and little wastage of product. Down-draft kilns are often of the round 'beehive' shape, although they can also be rectangular (Davis 1918:21; Gurcke 1987: 32).

The previously noted kilns are all 'periodic' in terms of the firing beginning and ending with each load of bricks. Several kinds of more efficient 'continuous' kilns exist, where the firing of a kiln can continue indefinitely. One of these is the circular or ovoid

'racetrack' kiln of multiple chambers, usually 12 to 16. In this type the chambers are fired in a sequential fashion, with the heat from a chamber being fired (or cooled) moving to preheat one or more recently loaded chambers further ahead, while behind the firing zone the previously fired bricks are unloaded. Some examples have continuously operated in this fashion for over fifty years (Gurcke 1981:32, 34). Linear semi-continuous, multiple-chamber kilns also exist, where the firing zone advances from one end of the kiln to the other, then either restarts at the chamber originally fired or reverses in direction towards this chamber.

The most modern form of continuous kiln is the tunnel kiln where the product to be fired moves slowly through a long corridor on a track, with the temperature increasing gradually until the zone of full firing in the middle, then decreasing towards the cooling zone at the tunnel's end. Multiple cars of brick follow each other through the tunnel while the firing portion remains stationary (Gurcke 1987:34; Davis 1918:21).

Once fired and subsequently cooled, bricks are sorted and either placed in storage or shipped to their market destination.

4.3 Archaeological Sites of Saskatchewan Brickmaking

As noted, 16 sites of past brickmaking were examined in the course of this research. Most sites exhibited surface evidence of their past workings while several were notable only by the presence of bricks produced at that location. A brief alphabetical listing of the sites follows in Table 4.1, along with the relative archaeological condition of each example. In this table,

disturbance refers to the below-ground portion of the original brickworking operation, often altered by agricultural or industrial reuse as well as environmental factors. A full listing of all known Saskatchewan brickmaking sites is provided in Appendix A.

Table 4.1 Archaeological sites of Saskatchewan brickmaking examined in research

Brickmaking site location	Condition of site
Arcola	Minimal disturbance: no structure, some foundations present.
Bruno	Minimal disturbance: kiln structure mostly intact, other structures vary.
Claybank	Undisturbed: all facilities intact as last used in 1989, including most equipment.
Estevan (Estevan Brick Ltd.)	Undisturbed: all structure intact as last used in 1996, most equipment removed.
Estevan (Boundary Dam location)	Minimal disturbance: two beehive kilns present, one with collapsed roof, also some foundations of the workings present.
Floral	Partial disturbance: no structure intact, most foundations remain. Areas within foundations undisturbed, cultivation outside of this area.

Fort Carlton	Significant disturbance: base of kiln completely underneath cultivated layer, no other known evidence of brickmaking at site.
Karilowa	Complete disturbance: bricks from site collected prior to highway construction impact in 1996, no other evidence of brickmaking at site.
Moose Jaw (Wellington White)	Significant disturbance: only noted evidence of site in 1997 was brick-laden strata in cutbanks near river, site heavily disturbed by electric transmission tower mountings and natural water erosion.
Ringleton Firs	Minimal disturbance: no intact structure, clay pit and brickmaking area obvious.
Rosthern	Minimal disturbance: no intact structure, some concrete foundations.
Saskatoon (Saskatoon Brick & Supply Co. Ltd.)	Minimal disturbance: main structure intact but modified.
Saskatoon (Elliott's Brickyard)	Significant disturbance: cemetery now covers site area.
Shand	Minimal disturbance: no intact structure, bases of four scove kilns remain along with the foundations of other structures associated with the coal-mining aspect of operation.
Whitewood (Whitewood Brickyard)	Minimal disturbance: no intact structure or foundations.

Whitewood (Sterling's Brickyard)	Some disturbance from natural water erosion in ravine location: no intact structure or foundations.

In Table 4.2 these 16 sites are grouped into three divisions to facilitate discussion of their technologies, namely: non-commercial operations, seasonal brickyards, and year-round brickplants. This division of brickyard and brickplant is not explicitly found in other references but seems reasonable from reviewing most historical sources on brickmaking, such as Ries and Keele (1912:18-43), Davis (1918:2-3), and Adams (1976:10-11). The full level of industrialization integral to year-round operations, which included technological elements of structural layout and machinery, dependable transportation links in the winter, and a perpetual labour pool, is almost always applied to locations termed brickplants. One exception is the 'Moose Jaw Brick Yard' of Wellington White, which continued to use the term 'Brick Yard' in its name at least up to 1906, several years after its original status was changed from seasonal to year-round operation.

Discussion of the three groups will begin with the Non-Commercial category, as the technologies here were among the simplest and likely represent the earliest Saskatchewan brickmaking. The brickyard category will follow, with the brickplant category forming the final and longest enduring

grouping. Within each grouping the order will follow alphabetically as in Tables 4.1 and 4.2.

Table 4.2 Designation of sample brickmaking sites by site type

Brickmaking site location	Designation
Arcola	Brickyard
Bruno	Brickplant
Claybank	Brickplant
Estevan (Estevan Brick Ltd.)	Brickplant
Estevan (Boundary Dam location)	Brickplant
Floral	Brickplant
Fort Carlton	Non-commercial
Karilowa	Non-commercial
Moose Jaw (Wellington White)	Brickplant
Ringleton Firs	Non-commercial
Rosthern	Brickyard
Saskatoon (Elliott's Brickyard)	Brickyard
Saskatoon (Saskatoon Brick & Supply Co. Ltd.)	Brickplant (sand-lime)
Shand	Brickyard (with winter coal-mining component)
Whitewood (Whitewood Brickyard)	Brickyard
Whitewood (Sterling's Brickyard)	Brickyard

Chapter 5 Non-commercial and Brickyard Saskatchewan Brickmaking Sites Examined

5.1 Introduction

This chapter will review the Saskatchewan brickmaking sites examined archaeologically which fall into the non-commercial and brickyard (seasonal operation) categories. These categories comprise the earliest period of brickmaking in the province, dominating such activity up to the turn of this century, when the first representations of the year-round-operated brickplant category appeared.

5.2 Non-commercial Saskatchewan Brickmaking Sites Examined

This category includes sites that were set up to assist the owners in building their own respective infrastructure and not to generate revenue from the sale of brick product. Three sites were examined under this classification.

5.2.1 Fort Carlton

The Fort Carlton site (Figure 5.1), a past Hudson's Bay Company trading post earlier discussed in Chapter 3, is possibly the earliest site of brick manufacture in Saskatchewan, dating between 1850 and 1885. There are no available records to help date the

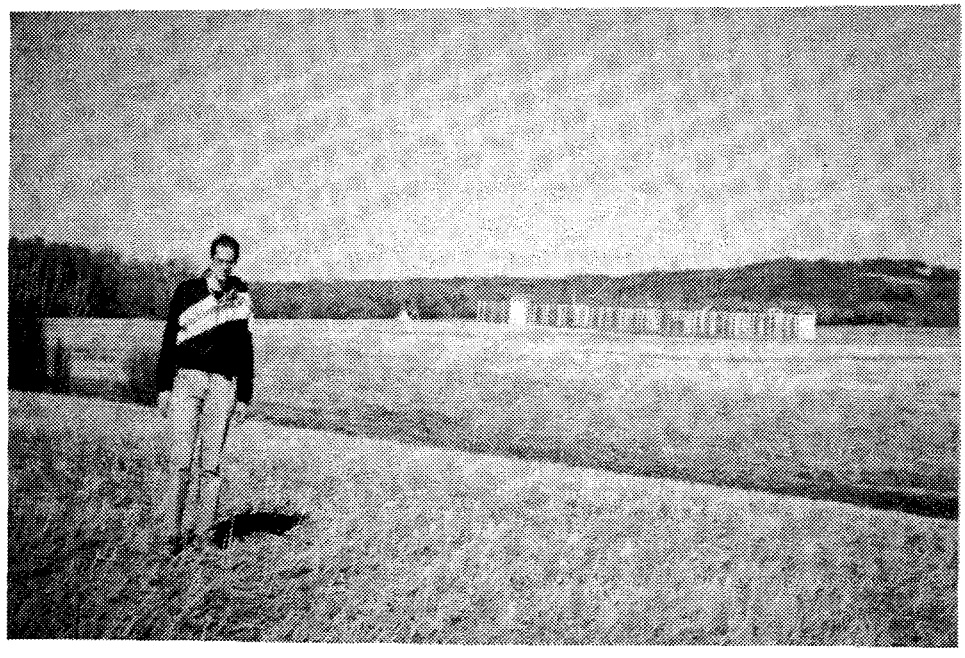


Figure 5.1 Fort Carlton brickmaking site (foreground) in 1997. Reconstructed fort in background.

brickmaking area more specifically (Dyck 1978:6). It is known entirely from archaeological excavations undertaken in 1977 by the Saskatchewan Museum of Natural History, when the base of a scove kiln was located in a grader pass which had removed the plough zone An approximate sketch of the kiln's outline is illustrated in Figure 5.2. It has a rectangular shape, approximately 1 x 2 m, with two apparent firebox tunnels at one end. Later scove kilns in Saskatchewan had numerous fireboxes along the side; however, this early example may have been modelled after the English 'Newcastle Kiln', of which smaller versions used two fireboxes at one end opposite the chimney (Hammond 1981:23). As a scove kiln it would

have been built from the green bricks that were being fired without any permanent structure, as none was noted in the excavations. The outline of the base was formed by the discolouration of the subsoil during the firing of the kiln.

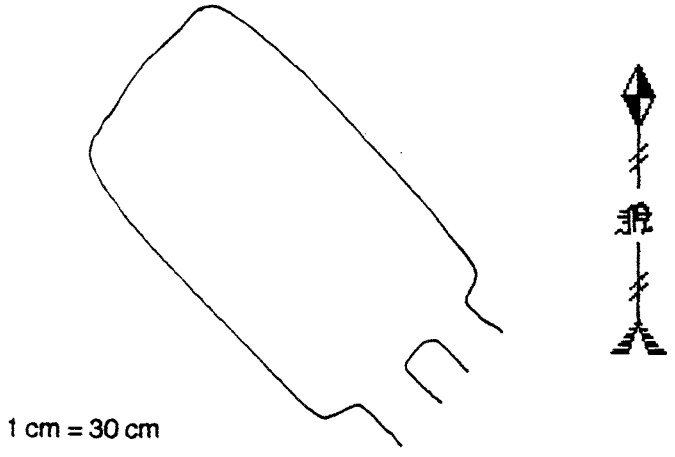


Figure 5.2 Outline of Fort Carlton scove-kiln base.

The bricks in this small kiln seem to have been low-fired, as suggested by tests of one sample by John Hudson of the Saskatchewan Research Council. He used X-ray Diffraction and acetic acid testing to arrive at this conclusion (Hudson 1978:1-2). The low-firing may correspond to the less rigourous demands of the intended utilitarian nature of the bricks in chimneys or ovens. Dwelling structures would have required a better-fired, higher tensile-strength product but no dwellings are known to have been built of brick at Fort Carlton. However, at least one baking oven of brick was apparently noted during excavations at the site in 1965, possibly with bricks made in the small scove kiln (Royal Saskatchewan Museum, Regina 1965: Saskatchewan Department of

Natural Resources, Historic Sites Branch, photo index cards #90 and #C.T. 107 for site FfNo-1, Fort Carlton, Saskatchewan).

The technology at the site appears to have been very simple, with the hand-molded bricks bearing no frogs or branding, and their colour being a pale buff consistent with the premise of a low temperature of firing.

5.2.2 Karilowa Doukhobor Village

Analogous in many ways to the Fort Carlton site is the later site of the Karilowa Doukhobor Village, 60 km west of Saskatoon introduced earlier (Figure 5.3). Established in 1899, the village was one of four in the area, and was occupied until about 1920. In 1996 highway construction impacted the centre of the village site

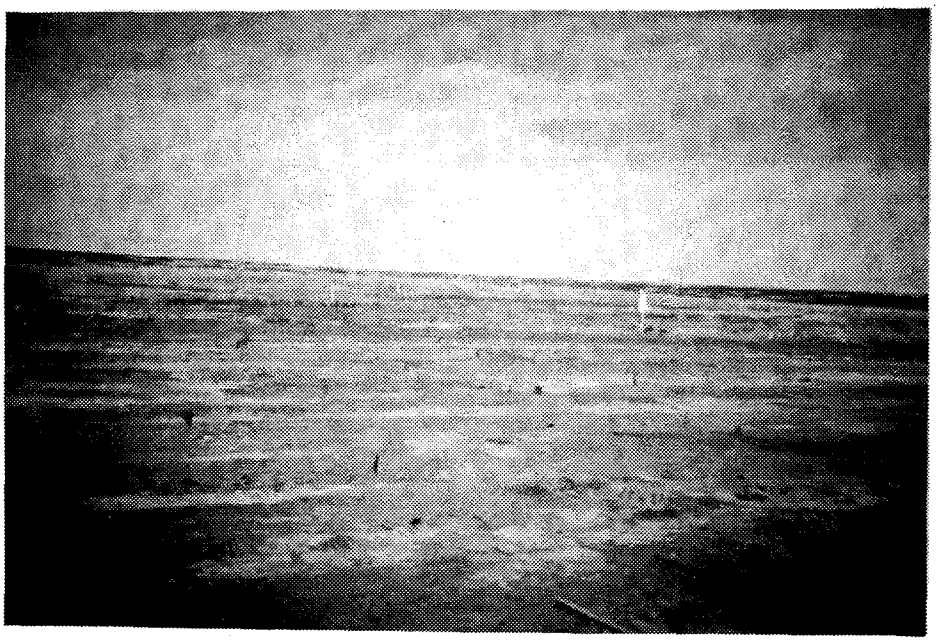


Figure 5.3 Karilowa Doukhobor Village site in 1996.

which led to mitigation by Western Heritage Services Inc. of Saskatoon, with the author engaged as a field crew excavator. Brickmaking at the site was suggested solely by the presence of a large assemblage of orange, low-fired bricks of varying sizes (Figure 5.4). These specimens were fragile with no complete examples extracted; however, they display an unmistakable parallelogram shape. In addition, some examples exhibit carbon residues on the exterior surfaces. Since these bricks, as at Fort Carlton, would have been too soft either for structural building purposes or commercial resale, it would seem that they were made locally for a utilitarian function, probably baking ovens. The Doukhobor villages generally had large communal ovens in the

Figure 5.4 Bricks from Karilowa Doukhobor Village site.

village centres, which is approximately where the excavations were conducted at Karilowa. As well, photographs of the village during its occupation do not indicate that brick was used either in dwelling construction or chimney construction.

The Doukhobors have a strong tradition of brickmaking in western Canada, with a significant Saskatchewan operation having been located in Yorkton, and several located in British Columbia (City of Yorkton Municipal Heritage Advisory Committee 1992:6-8; Adams 1976:25). It is not clear, however, if this utopian religious group from Russia had prior knowledge of brickmaking before arrival in Canada, as an account from Winnipeg in 1904 describes recent Doukhobor immigrants making "brick in the crudest and simplest way possible, without recourse to machinery of any kind whatever" during a period of high brick demand, which the author found "speaks well for the adaptability of these settlers, who have probably never made a brick in their life" (The Brick of Winnipeg 1904).

The examples from Karilowa seem to relate to this pioneer attitude of developing skills on location. As with the early Winnipeg example, molds may not have been utilized at Karilowa for forming the bricks as the sizes are not uniform. Instead they were likely shaped by cutting the clay with an implement such as a trowel or spade, or paddled into the proper shape. Ultimately, the need for this home-made brick may have been temporary, as nearby commercially-made brick from Rosthern was also found at the site. As the Rosthern Brick Co. began production in 1904, there would have been a period of at least five years when local commercial

bricks were unavailable, leaving home-made brickmaking as a solution to obtaining this product.

5.2.3 Ringleton Firs

Ringleton Firs, introduced earlier, differs from the other two sites in the non-commercial category in that its products were used for a structural purpose, to build a large English-manor-style dwelling on a northern Saskatchewan homestead (Figure 5.5). Presently, the site is an abandoned yard surrounded by a mix of coniferous and deciduous trees (Figure 5.6). Little can be seen on the surface of the brickmaking area indicating a kiln structure, although excavation, as at Fort Carlton, would likely delimit some sort of scove kiln boundary (Figures 5.7, 5.8). The clay source pit, along with debris representing the manufacturing area, is obvious, however. From examination of brick samples, it appears that hand-filled molds were used, complete with well-formed, unbranded frogs (Figures 5.9, 5.10). Horizontal laminations appear on the samples, suggesting that clay was added in multiple amounts to each mold, not ideal and a strong sign of hand-molding versus machine-molding in which amounts of clay in excess of each mold's capacity are uniformly dispensed before being struck off.

The potential friability of the resulting bricks was probably negated by the temperature of firing which was sufficiently high to create some clinkers, as noted earlier. This allowed the bricks to become sufficiently hardened to possess the proper tensile-strength and crushing-strength necessary for the walls of a multi-

Figure 5.5 Photograph of home at Ringleton Firs.

Figure 5.6 Ringleton Firs site in 1996.

Figure 5.7 Brickmaking area at Ringleton Firs.

Figure 5.8 Kiln/brick forming location.

Figure 5.9 Complete Ringleton Firs brick from house.

Figure 5.10 Ringleton Firs clinker (left) and bat (right).

storey structure. Fuel for firing would have been plentiful in this range of transitional boreal forest, while the significant natural sand content of the clay would have lowered the point of vitrification, where the clay starts melting (creating clinkers), allowing less firing to achieve good hardness of product. The sand

would have also minimized shrinkage upon drying, acting as a natural tempering agent.

The technology used at this site was likely part trial and error, but was derived largely from Peter Saccucci and Mike Ewanchuk—the Italian and Ukrainian immigrant neighbours of the owner, Christopher Castle, who had previous experience in the brick trade from their countries of origin (Meeting Lake Regional Park Committee 1976:178). This is illustrated by the overall commercial quality of the Ringleton Firs product in comparison to the two other non-commercial examples where direct previous experience with brickmaking may not have been involved.

5.3 Saskatchewan Brickyard Sites Examined

The seasonal brickyard category accounts for most of Saskatchewan's brickmaking sites, producing the majority of product in Saskatchewan before the pre-WWI boom. Six sites were examined under this classification.

5.3.1 Arcola

The Arcola Brick Co. Ltd. operated from 1903 to 1915 in the southeast corner of the province, north-east of Estevan, and represents one of the larger seasonal brickyards (Figures 5.11, 5.12). The brick manufactured here is evident throughout the small town itself, particularly in such edifices as the combined Arcola Town Hall and Opera House. The site of the brickmaking exists in a large tract on the south side of the town, it has had little redevelopment except on the north and east edges. Debris brick can

be found here and some remnants of concrete foundations. More study would require excavation (Figures 5.13, 5.14).

The bricks from the site are distinctive in having a shallow frog running across one or both faces (Figures 5.15, 5.16). This is a result of the stiff-mud, or extrusion, process used at Arcola which precluded the inclusion of conventional frogs and branding. Within the stiff-mud genre, there are two main ways for the brick ribbon to exit the forming die: sideways and endways. Both were used at various brickmaking firms in Saskatchewan, with Arcola bricks appearing to have been made only by the endways method, with the product then being an 'end-cut' brick. With this method the described shallow frog ran parallel to the direction of the extruded brick ribbon. As is typical of glacial brickclays in southeastern Saskatchewan and into Manitoba, the brick colour is predominantly a yellowish buff, with some bricks exhibiting reddish patches that can be called a 'blush'.

The stiff-mud process was relatively sophisticated for a seasonal brickyard and may explain why the plant was able to operate for two years after the end of the pre-war boom in 1913. For instance, Estevan used this process to 1996, while Bruno used it until its closing in 1960. In addition, both of these longer-running plants used the process to make structural tile which possessed a lucrative market from WWI until the mid-1950s. However, there is no indication that the Arcola plant experimented in this way, perhaps because they shut down just before this product became popular in Saskatchewan following WWI.

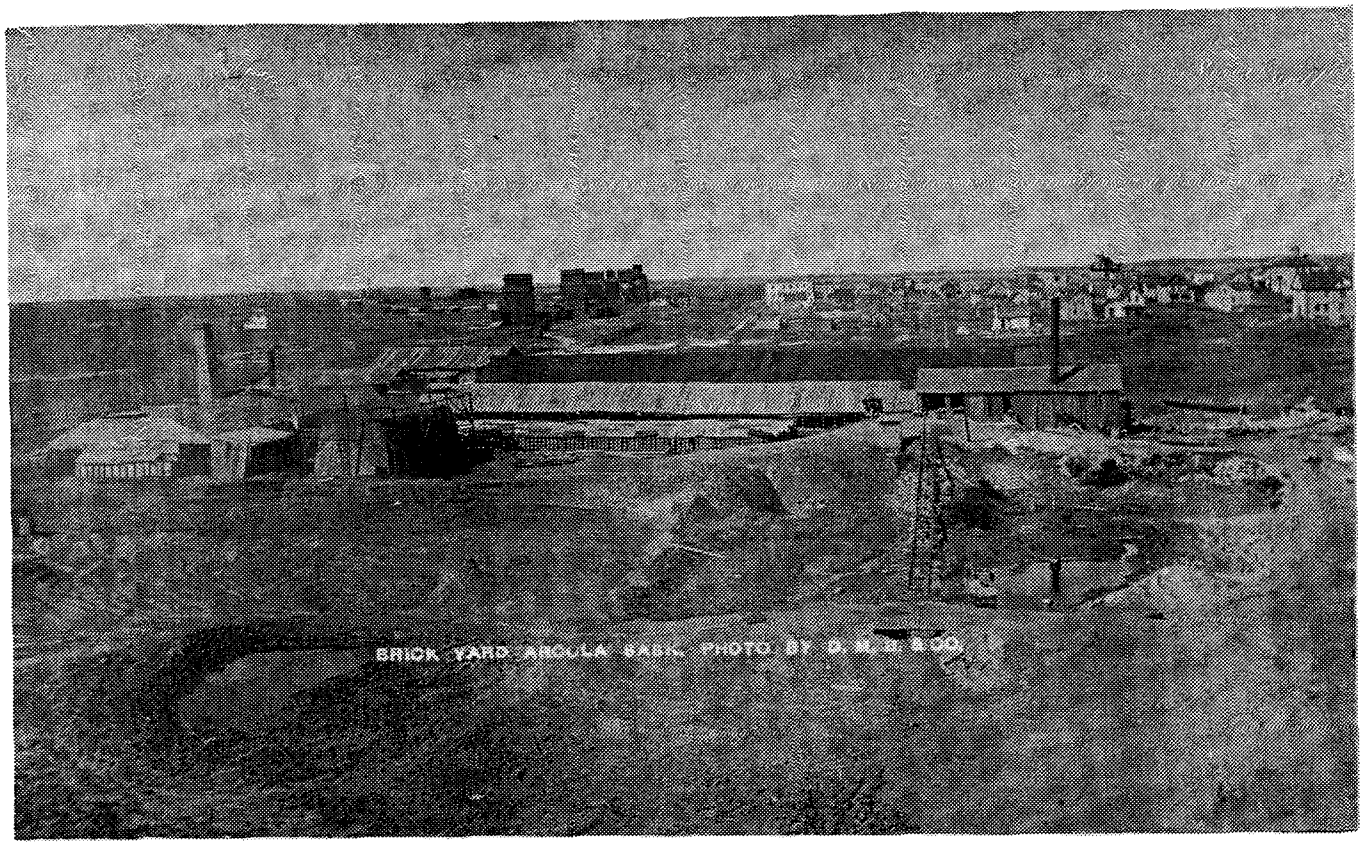


Figure 5.11 Arcola brickyard from c.1906. Courtesy A. Paton collection.

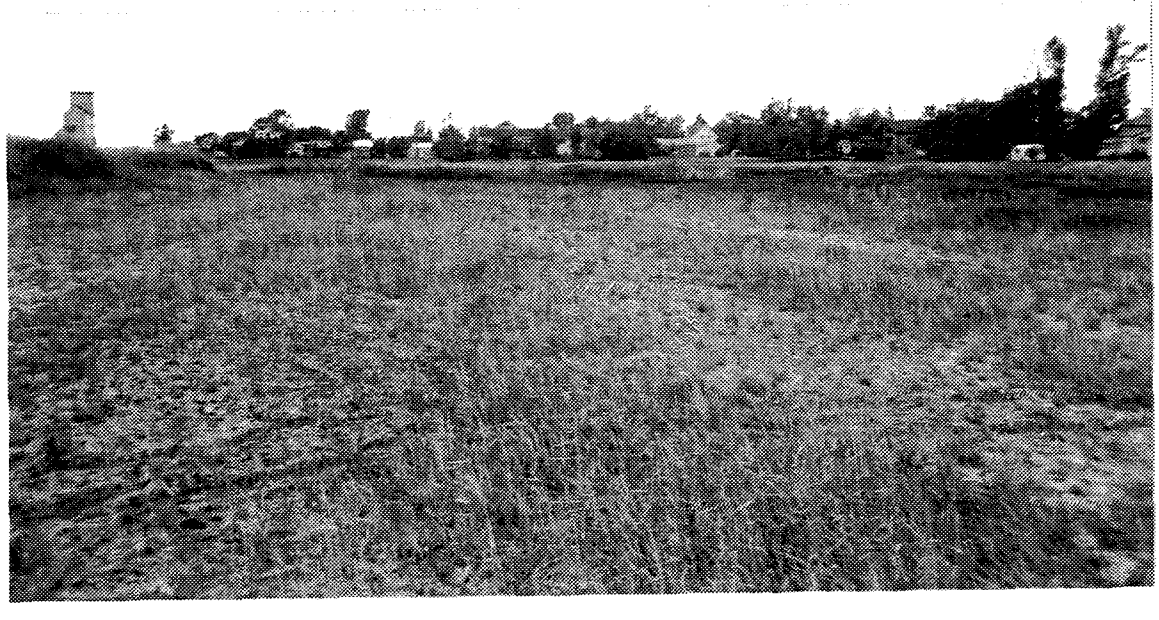


Figure 5.12 Arcola brickyard site in 1997.

Figure 5.13 Debris at Arcola brickyard site in 1997.

Figure 5.14 In situ bat at Arcola brickyard site.

Figure 5.15 Complete Arcola brick.

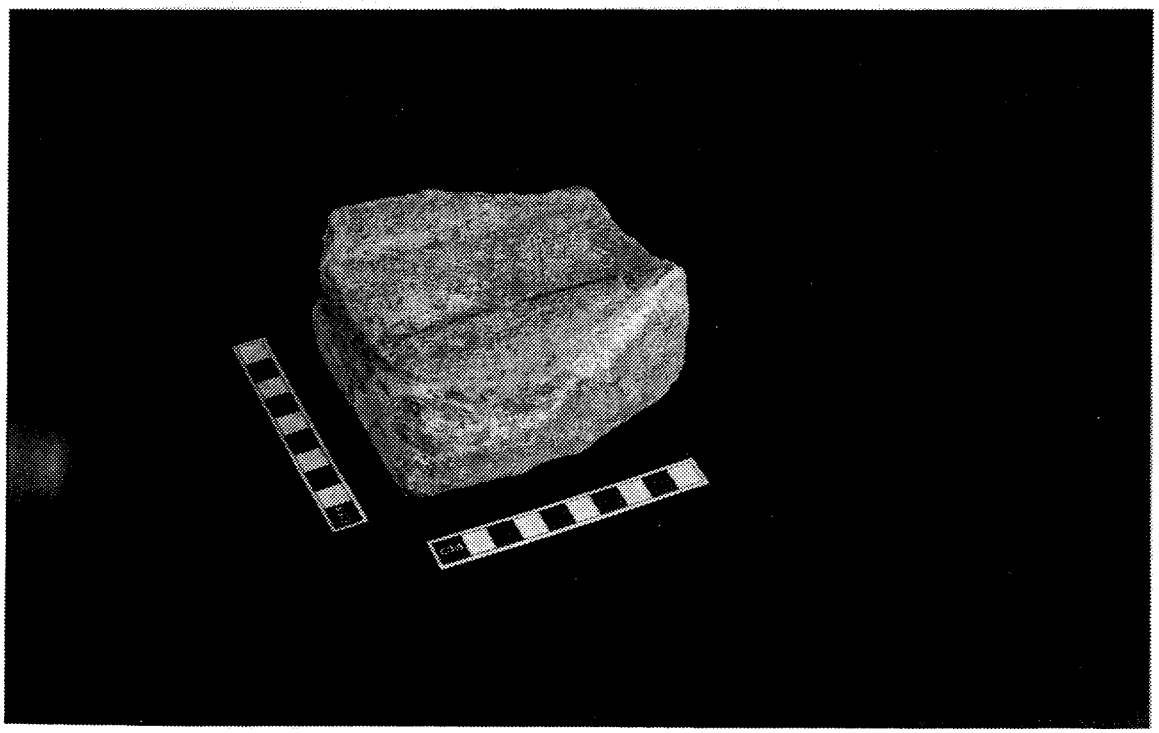


Figure 5.16 Bat from Arcola brickyard site.

While Arcola's brick-forming process was sophisticated, its kilns were of the standard permanent-scove or 'Dutch' variety, of which it apparently possessed at least five examples at one point (Hislop and McLellan 1965:61). A picture dating from after 1905, as the Town Hall is visible, shows one kiln being fired—the other kilns may have been later additions.

Overall, the Arcola brickyard is a good example of an early twentieth-century enterprise that utilized some technological innovation with an overall traditional layout. Its product is archaeologically useful in demonstrating that unbranded brick varieties can often be very distinguishable once some research is undertaken.

5.3.2 Rosthern

The Rosthern Brick Co. operated in nearly the same time frame as Arcola (beginning in 1904 and ending about 1914) but was located significantly further north. Its originators were apparently a pioneer of Mennonite extraction in the area, David Welk, and, in a rare instance of a woman being involved with the start of a brickmaking operation, "an Italian girl by the name of Ezilla" (Rosthern Historical Society 1977:41).

The site of the brickyard today is also similar to Arcola, being situated on the edge of town (north in this case), with some concrete foundations and brick debris present. The nearby clay extraction pits are now shallow ponds where later off-site debris appears to have been deposited alongside debris of the actual brickyard. Scrape-marks on exposed reinforcing bars in some of

the extant concrete floors suggest that this was done by a bladed tractor (Figures 5.17, 5.18, 5.19, 5.20).

The Rosthern brickyard appears to have had a healthy production in its lifetime, with many buildings in the town such as the Rosthern German-English Academy (presently the Rosthern Junior College Museum) and its own town-hall/opera-house (since torn down) having been built of this product. Its technology seems to have been quite rudimentary throughout, utilizing a hand-molded soft-mud process and scove kilns for firing (Ries and Keele 1912:33). The resulting product was of moderate quality, being relatively soft after firing and displaying a high amount of fine lime inclusions. Colour was a reddish-orange, with a frog and prominent brand 'ROSTHERN'. In this regard it is one of the easiest Saskatchewan brick types to identify (Figure 5.21).

Figure 5.17 Rosthern brickyard site in 1997, clay source pits.

Figure 5.18 Rosthern brickyard site, concrete debris.

Figure 5.19 Rosthern brickyard site, concrete floor. with imbedded steel bar, bent and scraped.

Figure 5.20 Rosthern brickyard site, brick debris.

Figure 5.21 Rosthern brick.

In summary this brickyard is a good example of a pioneer-era operation which produced a moderate quality product in the pre-WWI years when demand was high for all building materials, but which was outmoded by the following decade when markets tightened and customers were more demanding.

5.3.3 Elliott's Brickyard/Saskatoon Clay Products

William 'Harry' Elliott began Elliott's Brickyard in Saskatoon about 1911, at the height of the pre-war boom. From city directory listings Elliott's appears to have closed down by 1915, like most smaller Saskatchewan operations. However, unlike most small brick manufacturers, this example reopened after the war, as 'W. H. Elliott & Sons'. This name was used from 1921-1926, when 'Saskatoon Clay Products' was used into the closing year of 1928 (Henderson Directories Ltd. 1913, 1914, 1915, 1921, 1928; Ries and Keele 1913:13-14).

The location of the site presently falls within the large Woodlawn Cemetery north of Saskatoon's downtown. It is possible that most of the cemetery may lie on reclaimed portions of the previous clay source pits with the actual manufacturing portion significantly impacted by landscaping and burial excavations. Despite this, a surface search near the railway boundary yielded a number of distinctive brick fragments that likely originate from this operation (Figures 5.22, 5.23, 5.24).

The fragments are all of a reddish-brown colour which corresponds with tests done on a sample of this site's clay in 1912 (Ries and Keele 1913:14) (Figure 5.25). They are also heavily

eroded which is indicative of both their softness and a high porosity or ability to absorb water, which leads to freeze-thaw deterioration. A soft-mud, molded process was used, with a prominent unmarked frog. Large grog inclusions of the same colour are an obvious tempering agent. One brick fragment shows pallet impressions (narrower than brick impressions when stacked on their sides) on the bottom surface that occurred during drying. All samples appear to have been low-fired (accomplished in scove kilns), with a resultant moderate-quality product. This level of quality was also due to the glacial, silty surface clays being used (Ries and Keele 1913:13).

Figure 5.22 Elliott's brickyard site (Woodlawn Cemetery) in 1997.

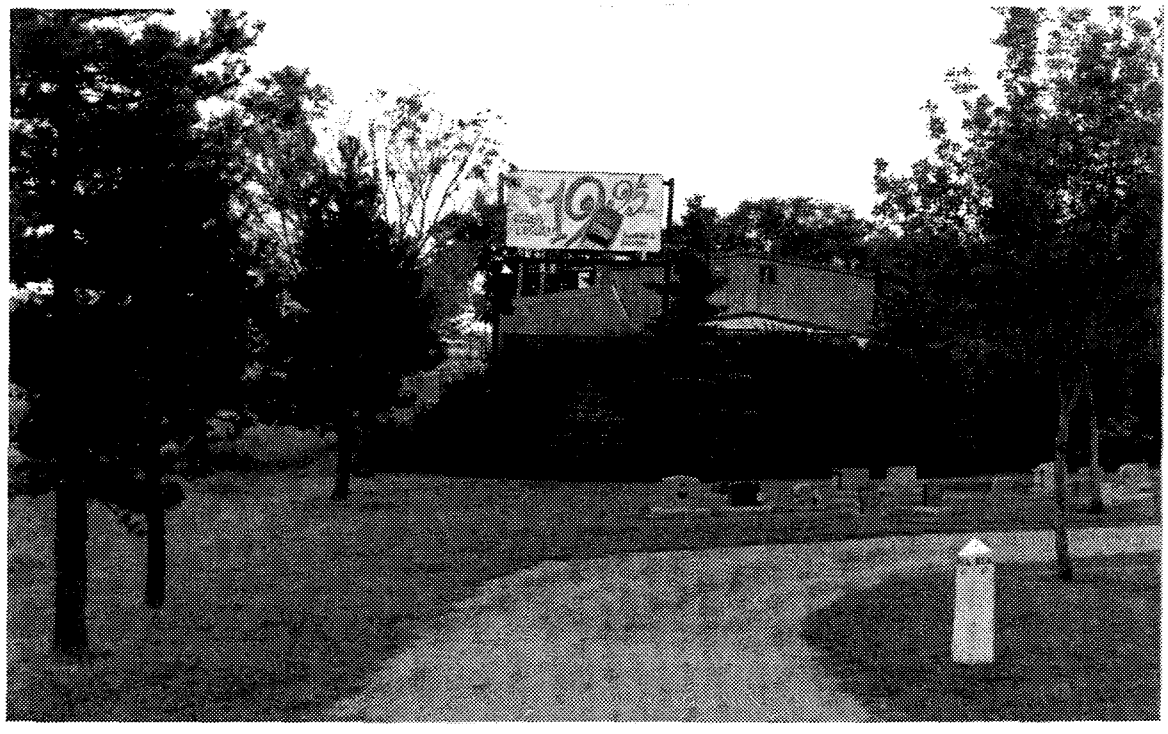


Figure 5.23 Area (to the left) where brick fragments found, Elliott's brickyard site.

Figure 5.24 Brick fragments near find-spot of largest specimen, Elliott's brickyard site.

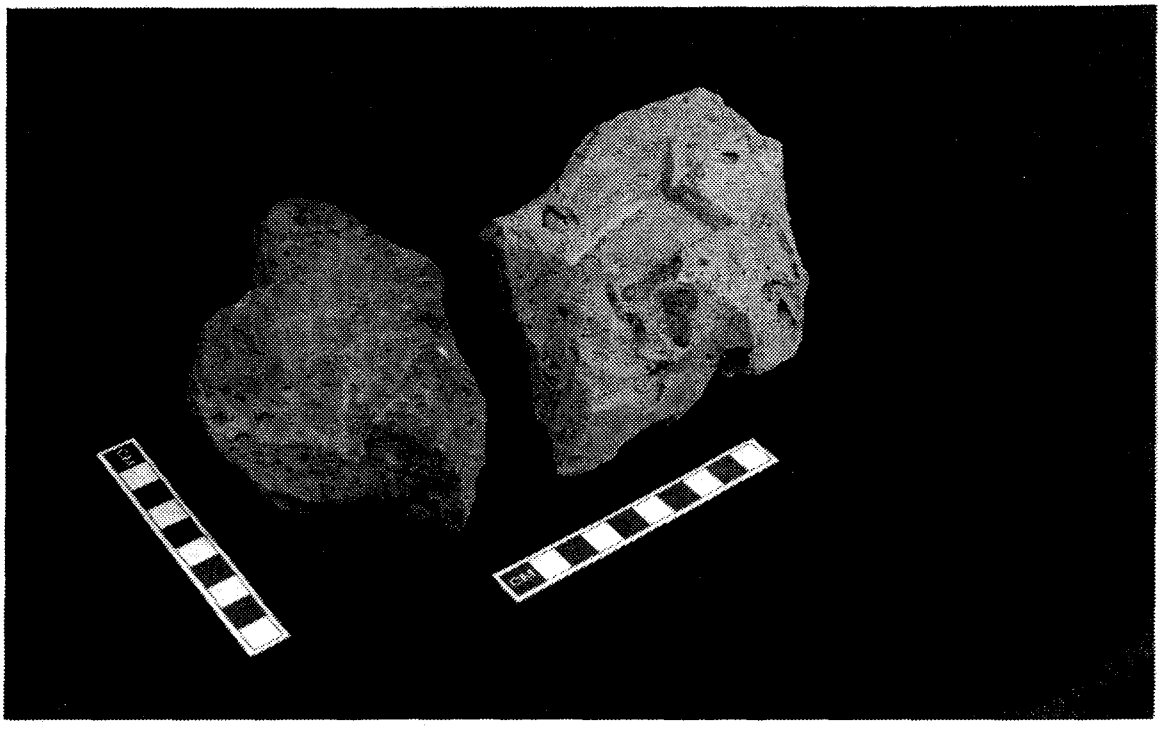


Figure 5.25 Brick fragments, Elliott's brickyard site.

If these samples are representative of Elliott's Brickyard, then it would appear that this operation was set up with a minimum of infrastructure to produce a moderate-quality product in the pre-WWI period of high demand, much like the Rosthern operation. It is interesting that unlike Rosthern, this operation resumed brickmaking for most of the 1920s, having the advantage of a much larger local market in Saskatoon. Elliott's also may have maintained a small infrastructure that could run on minimal capital and inputs, allowing considerable managerial flexibility.

5.3.4 Shand

Introduced in Chapter 3, the brickyard at Shand operated from approximately 1912 to 1926 in conjunction with a coal-mining

enterprise that allowed workers to spend the winter mining when coal was in demand, and the summer brickmaking when construction was active. The original name was Maple Leaf Mines Ltd., followed by Shand Coal, Brick & Power Co., and finally Shand Coal and Brick Co. J. G. Peterson was the owner and operator throughout the brickmaking at this site which included a company village set up by Peterson and occupied into the 1940s (Millenium Heritage Resource Consultants Ltd. 1990:41-44) (Figure 5.26).

The complete site of brickyard, colliery, and residential quarters was examined in 1990 by Millenium Heritage Resource Consultants Ltd. of Saskatoon, prior to the construction of a new coal mine at Shand. They found that the site's resources possessed "high scientific and public significance." In addition they felt that "[t]he site, when considered a part of an integrated Shand Village Complex is unique in Saskatchewan" (Millenium Heritage Resource Consultants Ltd. 1990:23).

Since the 1990 study the site has not been impacted by reuse development and is the best surviving example of a Saskatchewan seasonal brickyard site. In particular, the bases of four Dutch kilns remain in place, complete with multiple arched fire boxes on the sides and a ditch or below-ground flue that runs behind all four kilns (Figures 5.27, 5.28, 5.29). Brick samples taken from the partially collapsed walls were likely made on-site, as they are side-cut stiff-mud varieties that can be compared to bricks in the extant two-storey farmhouse that Peterson built north of the brickyard in 1925 (Pawson 1992:i, 28) (Figure 5.30). The bricks from the kilns are not of high quality although they may illustrate

a problem associated with collecting bricks at an abandoned brickmaking site: while this is often the best way to obtain a sample which truly corresponds to that site's past product (especially with non-branded varieties), the bricks found at a given site are often discarded culls or clinkers (Figures 5.31, 5.32). At Shand it is likely that culls, not suitable for commercial sale but structurally sound, were used in the Dutch kiln walls, while numerous clinker brick were tossed short distances from the last kiln firings. Some of these clinkers were melted together in large bunches, illustrating the relative lack of control with the scove technology used at Shand (Figure 5.33).

Despite the problem of collecting less than pristine bricks at a given site, the Shand bricks seem to have been made with less rigour than at the other stiff-mud brickyard examined, Arcola. Broken Shand examples show a rough, heterogeneous mixture of clays and inclusions versus Arcola's finely mixed composition. In addition the Shand bricks were side-cut with no attempt of incorporating a frog as with Arcola's end-cut variety (which also produced fewer bricks per hour than the side-cut method, as less clay was passing the die). Colour of the Shand bricks is an orange-red with occasional patches of yellow, the opposite of the Arcola product 60 km to the north.

The Shand site represents an interesting combination of combined industries alongside the element of residential paternalism in the company village site. The scale of the entire enterprise was not large, however, but with a manageable size

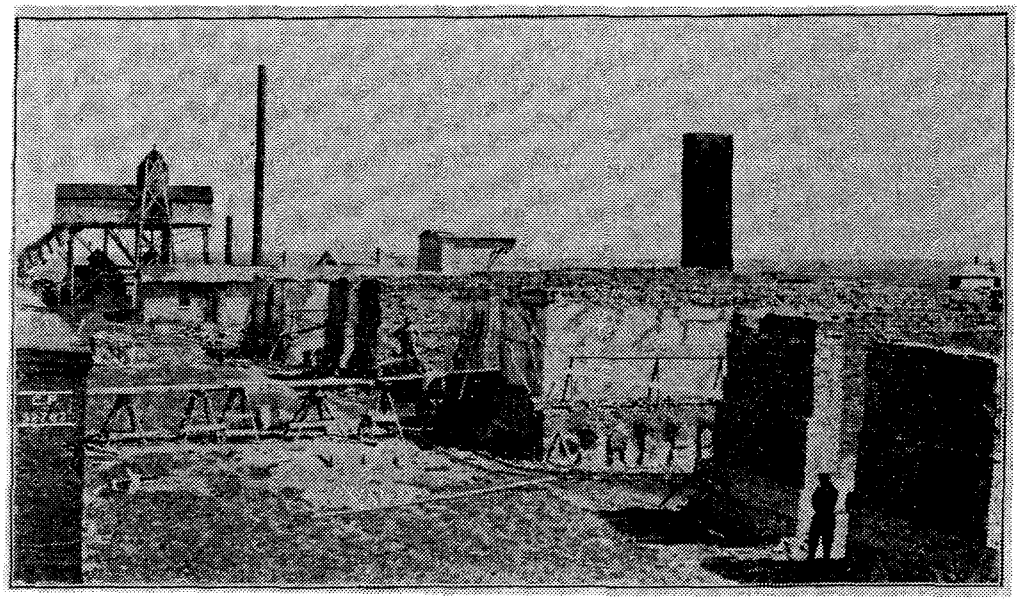


Figure 5.26 Shand brickyard c.1916. All four Dutch kilns visible, coal tipple in background. From Davis 1918:76.

Figure 5.27 Shand brickyard site in 1997: bases of four Dutch kilns, facing east. Remains of coal tipple at upper left, new Shand coal mine structure at upper right.

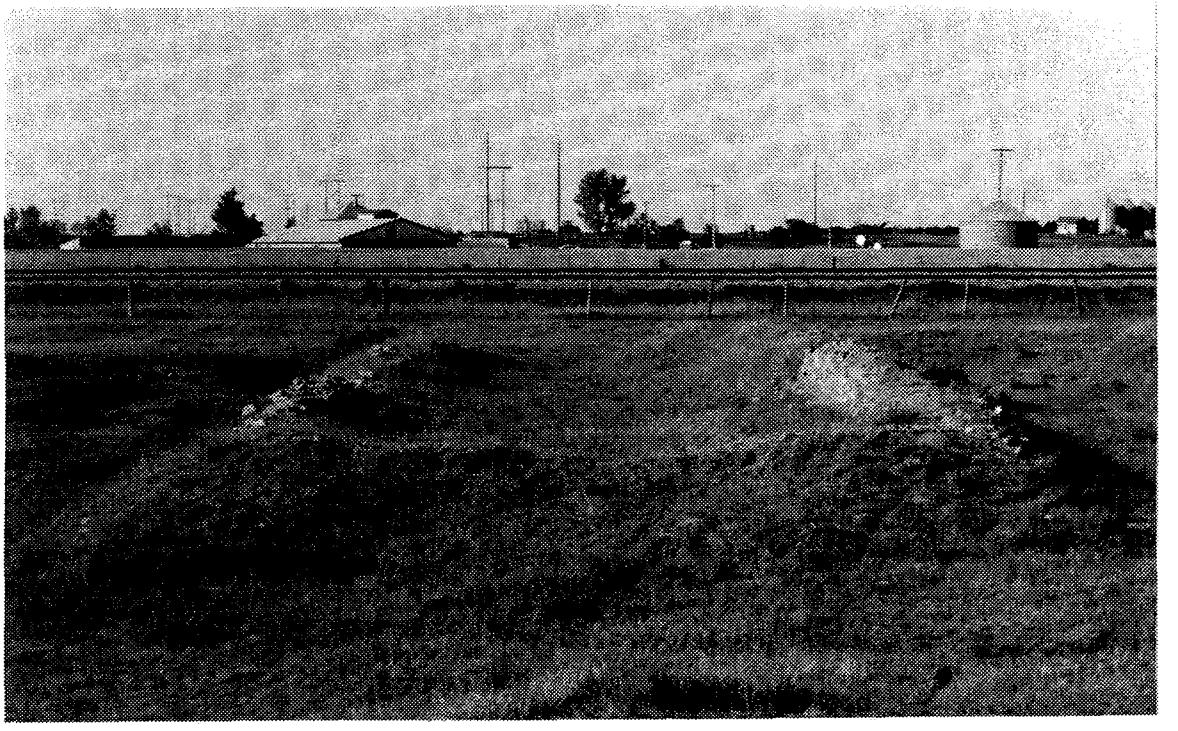


Figure 5.28 Shand brickyard site in 1997: westernmost kiln base.

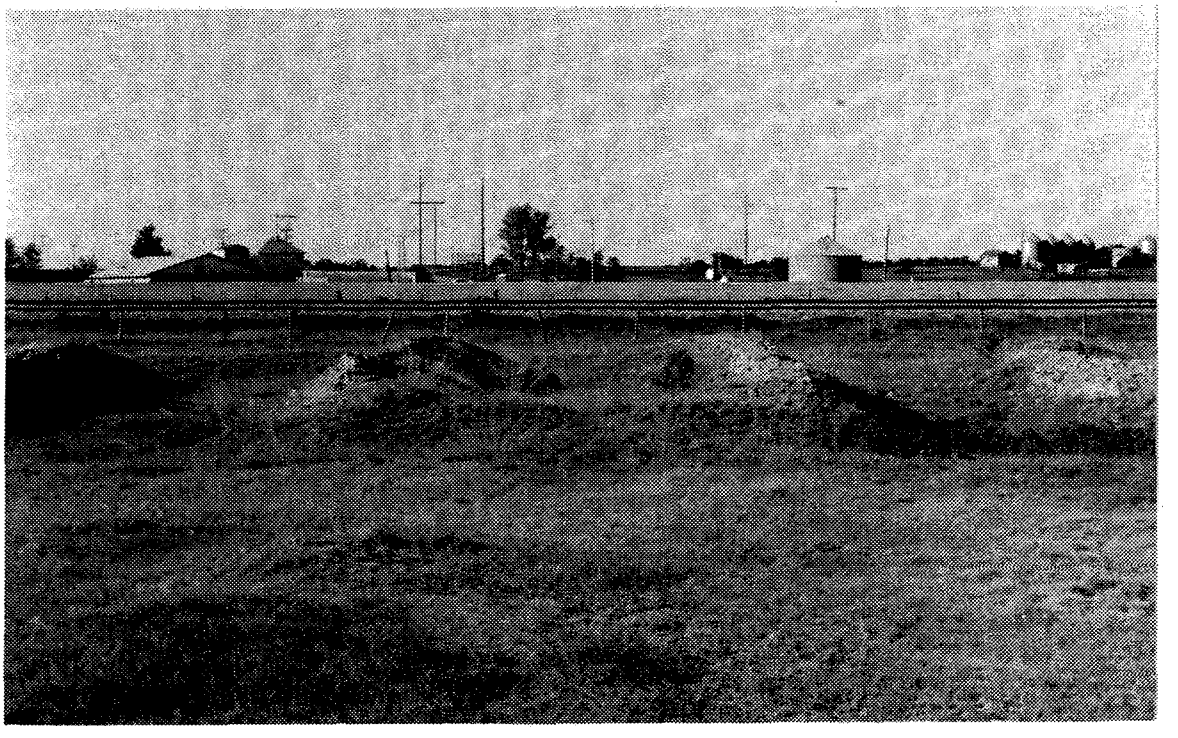


Figure 5.29 Shand brickyard site in 1997: west-middle kiln base.

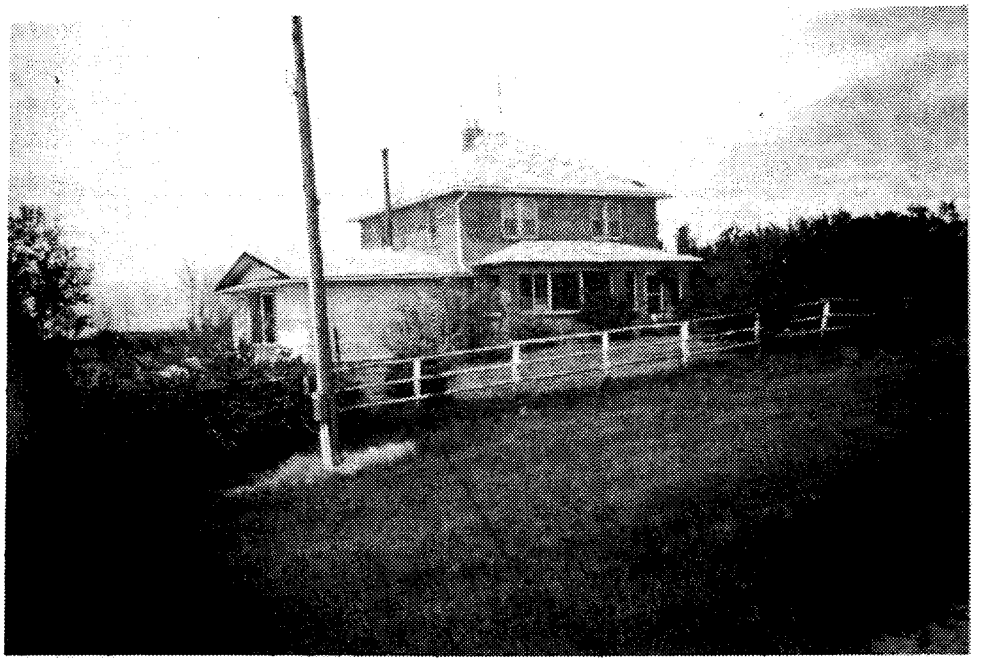


Figure 5.30 Peterson house at Shand in 1990. Courtesy F. Korvemaker, photographer.

Figure 5.31 Clinker clump of five brick, from Shand.

Figure 5.32 Conventional thickness Shand brick.

Figure 5.33 Two-thirds thickness Shand brick.

was able to survive several decades in the limited Saskatchewan economy. This smaller scale also lends itself to future research of the site, which could be formulated in a variety of ways without great logistical expense.

5.3.5 Whitewood Brickyard

The Whitewood Brickyard was operated by John Street from approximately 1884 to 1895, during the arrival of the first railway and subsequent new settlers (Whitewood History Book Committee 1992:54, 251, 1121, 1249). The site is currently occupied by an autobody shop as a compound for vehicles and exhibits little surface evidence of its brickmaking past (Figure 5.34). However, brick samples (Figure 5.35) were obtained from a dismantled house chimney in Whitewood, whose construction dates to 1889—within the time of Street's brickyard operation (Blaine Coleman, personal communication 1997).

The bricks are pale buff, hand-molded soft-mud without a frog, being the only known Saskatchewan commercial example of such a variety. As such they are the opposite of the Arcola bricks which are the only known stiff-mud Saskatchewan bricks with a frog. The Whitewood bricks appear to have been well-fired with a homogeneous texture, having a good 'ring' or high-pitched sound when tapped, indicative of good hardness and low porosity (Ries and Keele 1912:32; Gurcke 1987:35).

This site is notable for its early commercial beginning and austere but suitable product, reflecting the simple brickmaking technology popular in the later 1800s.

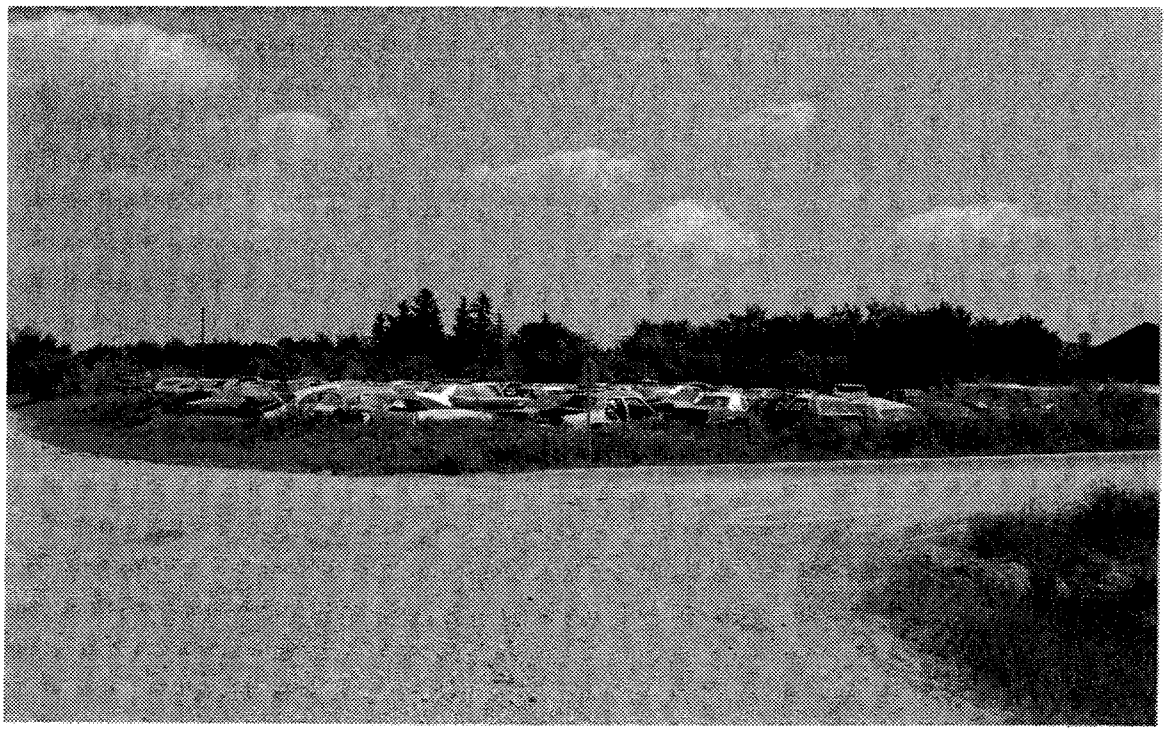


Figure 5.34 Whitewood/Street brickyard site in 1997.

Figure 5.35 Brick likely made at Whitewood brickyard.

5.3.6 Sterling Brickyard

A second brickmaking site was set up in the Whitewood area at about the time that the first brickyard closed, this example being the Sterling Brickyard 12 km north of Whitewood. It operated from 1893 to about 1904, being set up by C. Angus Campbell (*Whitewood Herald* 29 June 1893). Numerous buildings in the community used its brick, such as the Knox Presbyterian Church, built in 1895 (Knox Presbyterian Church, Whitewood, Saskatchewan 1995:16).

The site is situated in a ravine valley, where a hillside that was quarried for clay can easily be seen (Figure 5.36). No remnants of equipment or foundations are visible, but fragments of brick dot the site location, particularly where runoff channels have cut into the low-lying ground. This form of water disturbance, combined with occasional spring flooding, may have disturbed the site considerably.

The approximately 60% complete sample brick collected from the site is a hand-molded soft-mud specimen with an unbranded, shallow frog (Figures 5.37, 5.38, 5.39). The colour is orange salmon, which suggests less than rigourous firing, while the composition is homogenous, with some obvious grog inclusions of the same colour. The width is 11.1 cm at its widest, considerably more than the average of 9.5 cm for common brick and facebrick. However, firebrick made later at Claybank often has this width. As the brick was incomplete it was not possible to determine the length although this could be studied on the buildings which used this product in Whitewood. Thickness is a conventional 5.8 cm for the maximum measurement.

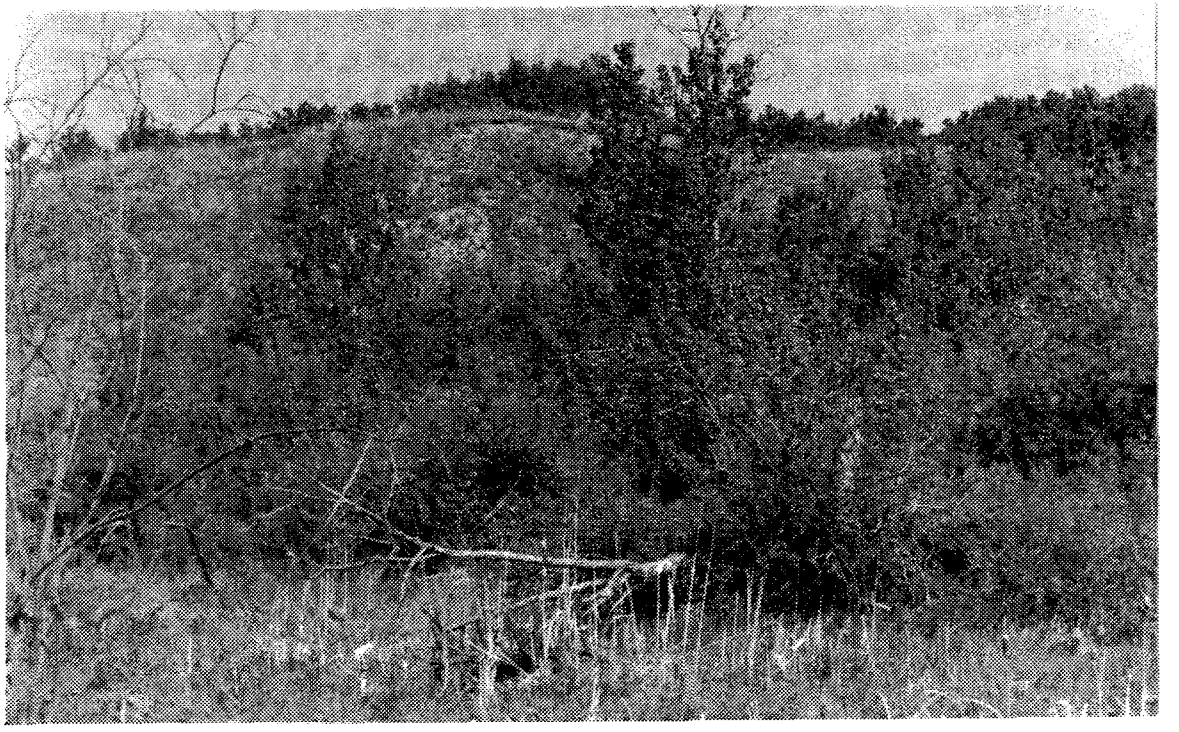


Figure 5.36 Sterling brickyard site in 1997. Clay source hill visible in background.

Figure 5.37 In situ brick at Sterling brickyard site.

Figure 5.38 Brick from Sterling brickyard site, frog up.

Figure 5.39 Brick from Sterling brickyard site, frog down.

Of the six brickyard sites examined, the Sterling Brickyard is notable for being the most rural, as the other examples were located in or adjacent to towns or cities. Transporting the brick 12 km by horse and wagon to Whitewood would have been a significant expense, as Whitewood was both the closest significant market and the nearest railway terminus. The other brickyard sites were either located directly on railway sidings or within one km of a railway, making more distant product shipment much less expensive. Despite this handicap, the Sterling Brickyard appears to have operated for at least a decade, with a simple technology of forming and firing in its rural ravine location.

Chapter 6 Saskatchewan Brickplant Sites Examined

6.1 Introduction

This last category of examined brickmaking sites in Saskatchewan includes the three long-enduring sites of Bruno, Claybank, and Estevan, as well as several that began in the same era but failed to survive beyond the difficult WWI period. All were either originally set up to operate year-round or were set up in this fashion for the majority of their operating lives. Seven sites were examined under this classification.

6.2 Bruno

The site of the Bruno Clayworks Ltd. was used initially as a single-purpose operation in 1905, then ran from 1908 to 1960 as a full commercial enterprise, as reviewed in Chapter 3. After the conversion to year-round brickplant status in 1913 to 1914, the Bruno site became recognized as Saskatchewan's major producer of structural tile products: hollow clay construction blocks otherwise known as partition and interlocking tile, clay weeping tile, steel-beam fire-proofing tile, and flat arch floor tile blocks. As these products were all modified brick forms made with the stiff-mud process, conventional stiff-mud bricks were made as well. Except for the regular bricks, all these products were part of an industrial trend in construction that developed in the late 1800s and ended by the late 1950s, which coincided with the shutdown of the plant.

Structural clay tile was replaced by improved concrete aggregate and cement products, while clay weeping or drainage tile was replaced with plastic varieties. For many decades, however, the tile market made Bruno Clay Products Ltd. a viable operation.

The site of Bruno is large, representing most of the actual clay extraction, clay preparation, and manufacturing area of the site as it was last used in 1960. Ancillary components such as possible company housing that was located adjacent to these areas, as seen in aerial photos from 1949, have been removed and returned to cultivation (Central Survey and Mapping Agency, Regina, A12026-129). For the most part the site has been undisturbed by later reuse, although the majority of standing structures have either been torn down or vandalized. A map of the site is shown in Figure 6.1, with photographs of the site and kiln in Figures 6.2 and 6.3.

The kiln, as earlier discussed in Chapter 3, was for many years the most efficient example in Saskatchewan, being a rectangular semi-continuous, multiple-chamber design which used the heat from a chamber or chambers being fired (or cooled) to preheat other, newly loaded chambers through a series of dampers and flues. With a tall stack at either end, the direction of the draft could potentially be shifted 180° so that the firing zone could move back and forth rather than beginning at the original end (Gurcke 1987:32). In this way the kiln was very close to a continuous design, in which the firing zone moves in the same circular direction indefinitely. The top-firing method with coal did limit it from firing high-grade wares which would have been marred by ash,

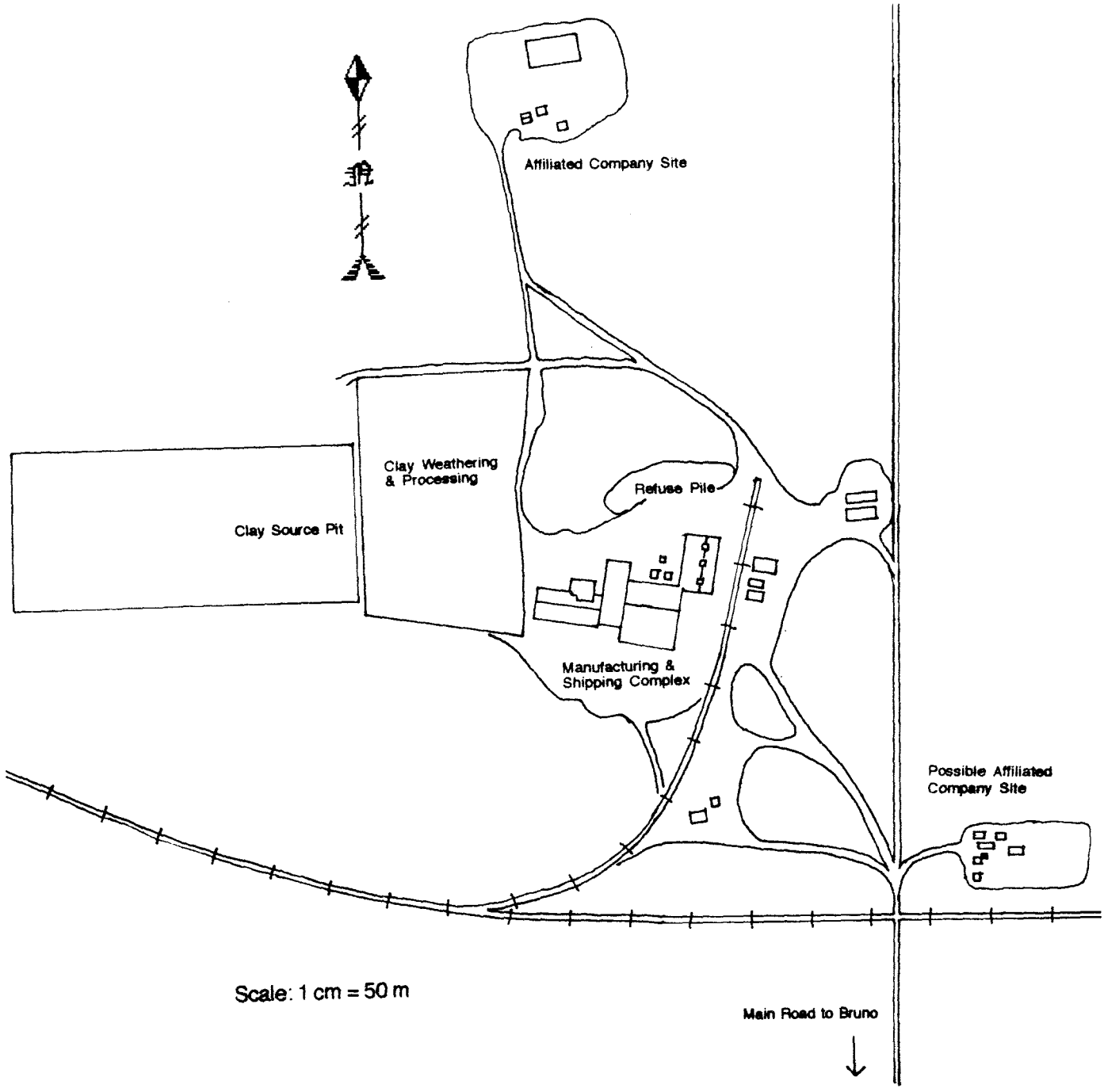


Figure 6.1 Map of Bruno site as operated in 1949. Derived from Photograph A1 026-129, Central Survey and Mapping Agency, Regina.

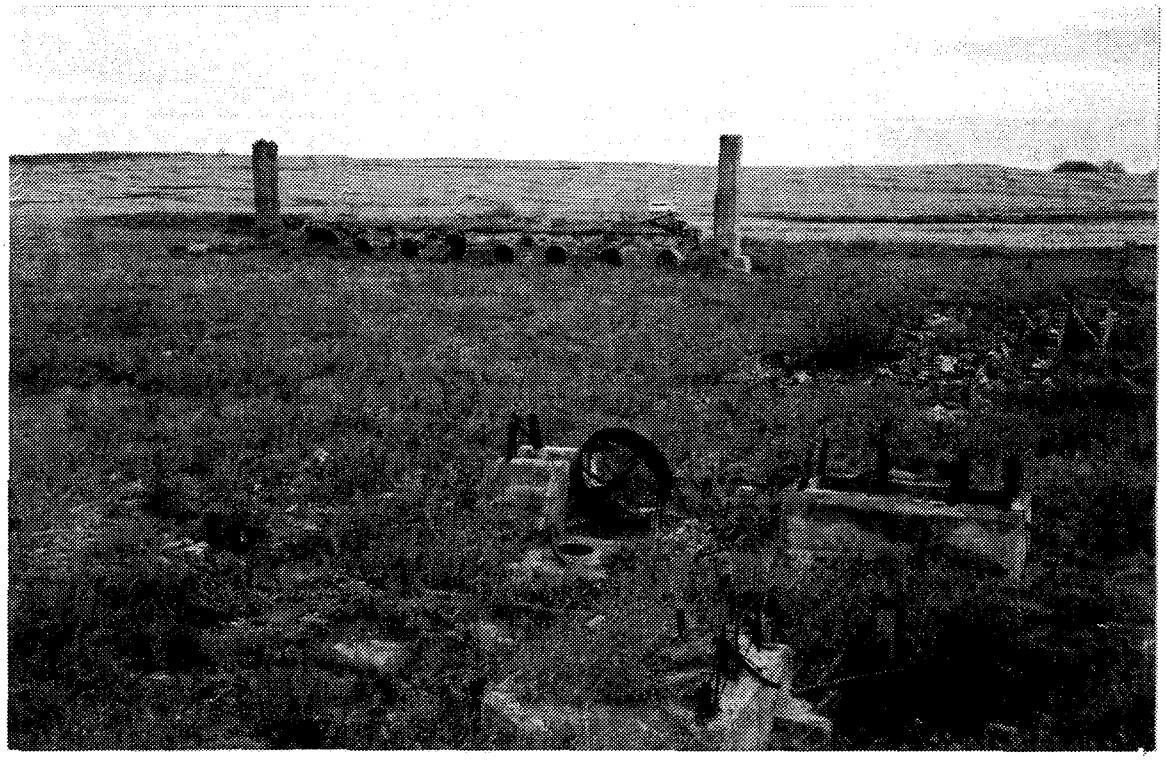


Figure 6.2 Main manufacturing area of Bruno site in 1995. Forming area in foreground, drying area at centre right, kiln at upper left.

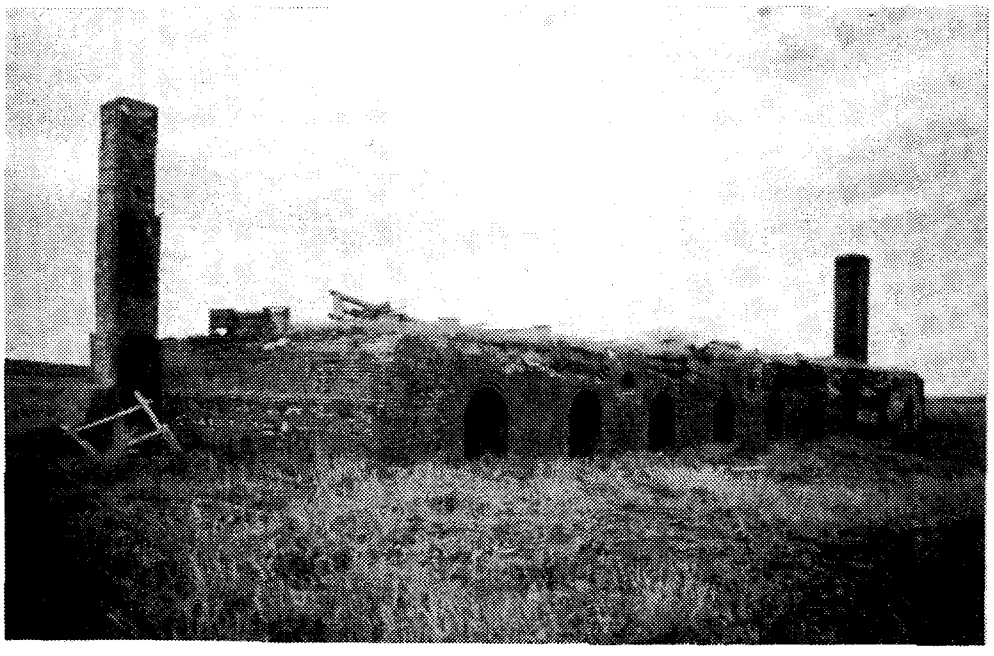


Figure 6.3 Bruno kiln in 1985, facing south-east corner. Courtesy F. Korvemaker, photographer.

as noted earlier (Worcester 1950:52). Overall, the Bruno kiln is perhaps the most significant brick kiln example within Saskatchewan, both for its unique technology within the region and its central role in this particular operation's success. Presently the kiln has been partially dismantled and its stacks are in danger of toppling, but with prompt action it could be stabilized and eventually restored.

Besides the kiln, the Bruno site possesses the remains of an elaborate drying facility consisting of tunnels made from its own structural tile which were heated by a large double-burner oil furnace, also built of its own tile product (Figures 6.4, 6.5, 6.6). Foundations of the stiff-mud machinery are present, along with the large flywheel of the steam engine which powered the process (Figure 6.7). Some distance away are the remains of a gas-powered generator that was used to supply electricity for lighting. As with Claybank, Bruno had its own electrical generation decades before the rural electrification arrived in the mid-1950s. A large pile of clay, left over from 1960, remains near the forming area, which, together with the drying tunnels and kilns, were all enclosed within buildings during the site's operation. West of the clay pile is a large area of land where the raw clay was unloaded and weathered until it was of usable condition, while west of this is the clay source pit itself. Currently it contains a large amount of water attesting to its depth—when it was last used for quarrying there were pumps to keep the water table low (William Lemke, former Bruno Clayworks Ltd. employee, personal communication 1996).

Figure 6.4 Remains of drying tunnels at the Bruno site in 1995, made from Bruno structural tile. Facing west with last clay pile in background.

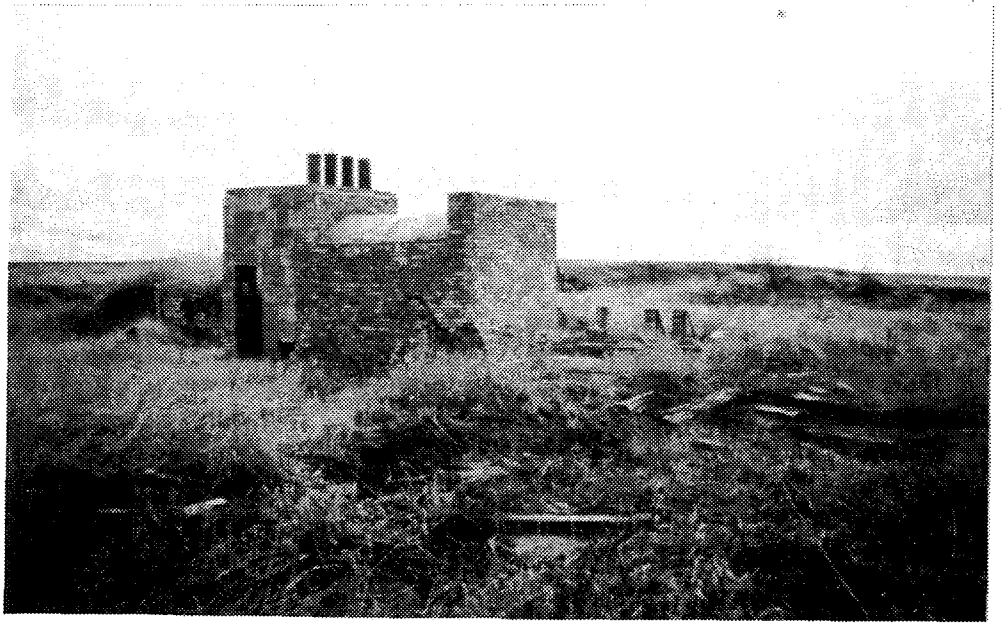


Figure 6.5 Furnace for heating the drying tunnels in 1985. Tile product in left part of structure. Courtesy F. Korvemaker, photographer.

Figure 6.6 Bruno site in 1995: cradle for holding fuel oil tank for drying furnace.

Figure 6.7 Bruno site in 1996: steam-engine flywheel.

Product from the site includes the many varieties of tile previously noted and the regular brick. Colour of all products varies from an orange to a red-orange, and the clay texture and composition appears very similar between the varieties of tile and the regular brick. As with most of the longer-lived sites, there is a very large brick refuse pile which, while not producing necessarily pristine specimens as noted earlier, does afford some reliability of containing unbranded specimens which have actually been made at the site being reviewed. At Bruno this is evident when one can see literally several thousand examples of nearly identical product on the refuse pile, while below, near the disintegrating kiln, a jumble of common brick and firebrick of many textures, varieties, and origins (including Missouri and Illinois), create an initially confusing scene.

Until a full cataloguing of Bruno product varieties is done, only a cross-section of its product line will be known, particularly of its many tile varieties (Figures 6.8, 6.9, 6.10, 6.11, 6.12, 6.13, 6.14, 6.15). The bricks themselves have considerable variation, with side-cut examples of three-hole perforated and unperforated types (with or without nail-scratch-texturing), and end-cut varieties with longitudinal grooving on one or two sides (Figures 6.16, 6.17, 6.18, 6.19). One side-cut specimen had the number '3349' scratched on one end before firing, possibly a batch number (Estep 1997:83) (Figure 6.20). No branding is noted on any Bruno bricks, as this would have required a repress machine which Bruno likely did not have—this procedure had little

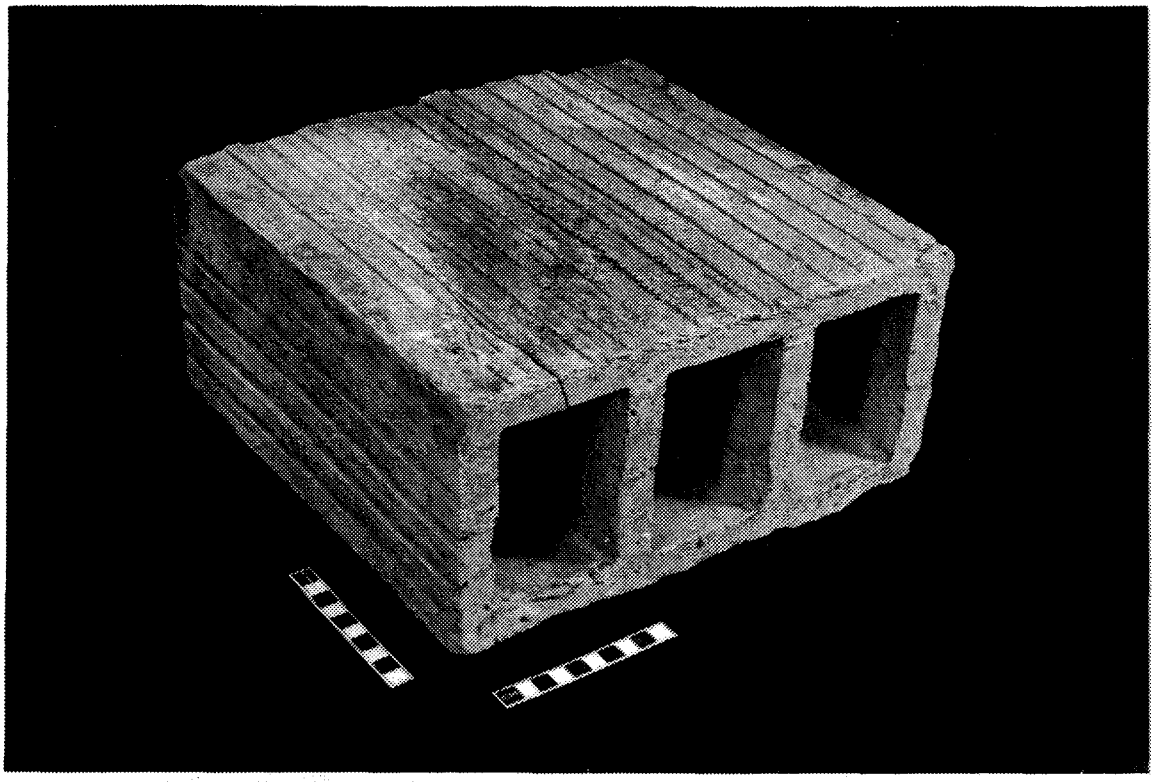


Figure 6.8 Bruno large three-cell tile block.

Figure 6.9 Bruno 'split furring' tile.

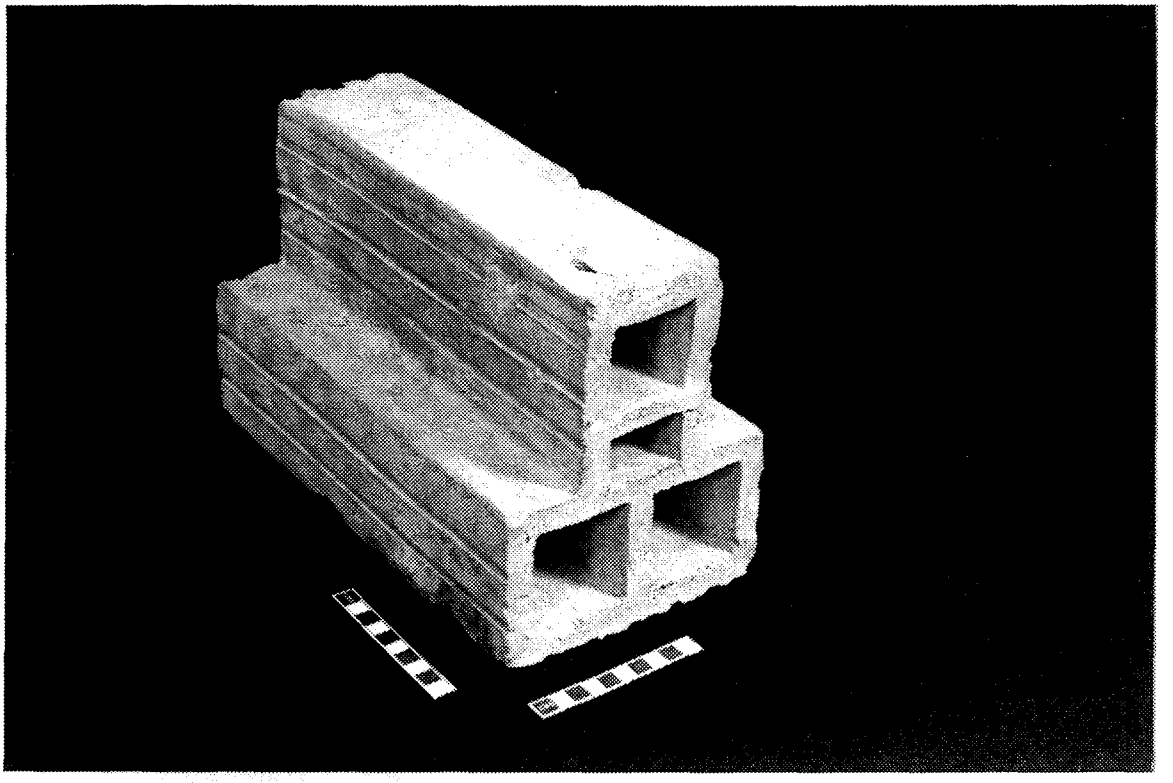


Figure 6.10 Bruno interlocking tile: narrow side up.

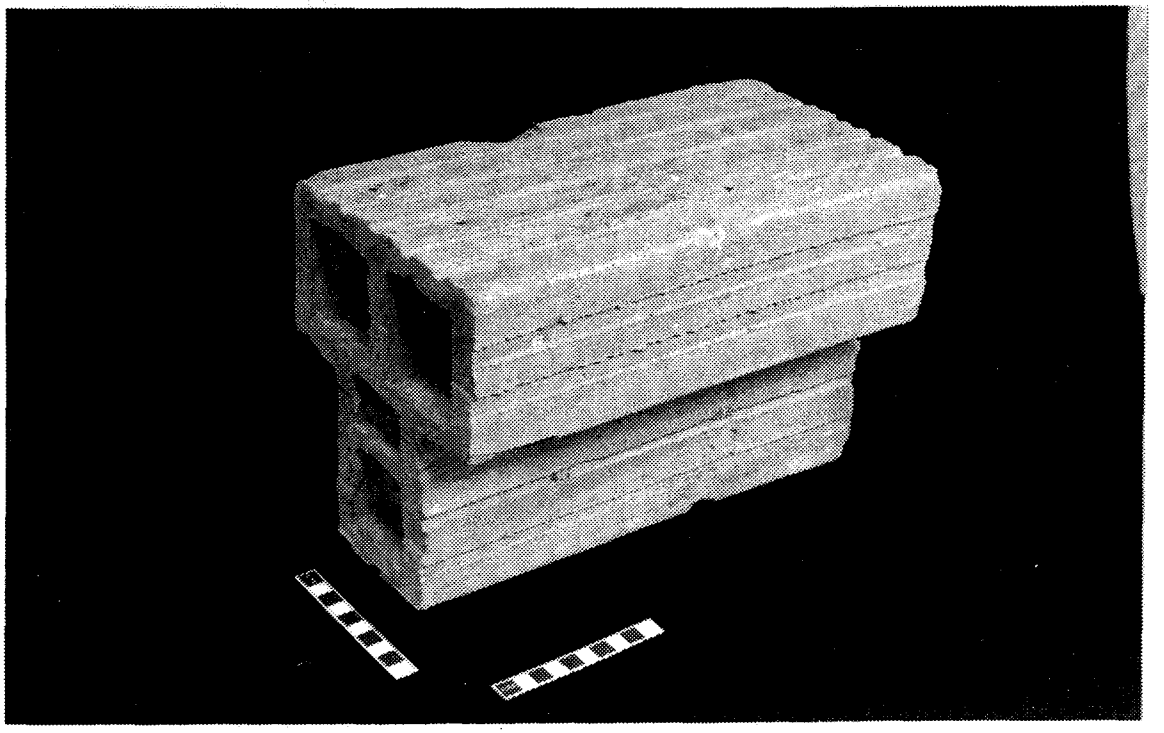


Figure 6.11 Bruno interlocking tile: narrow side down.

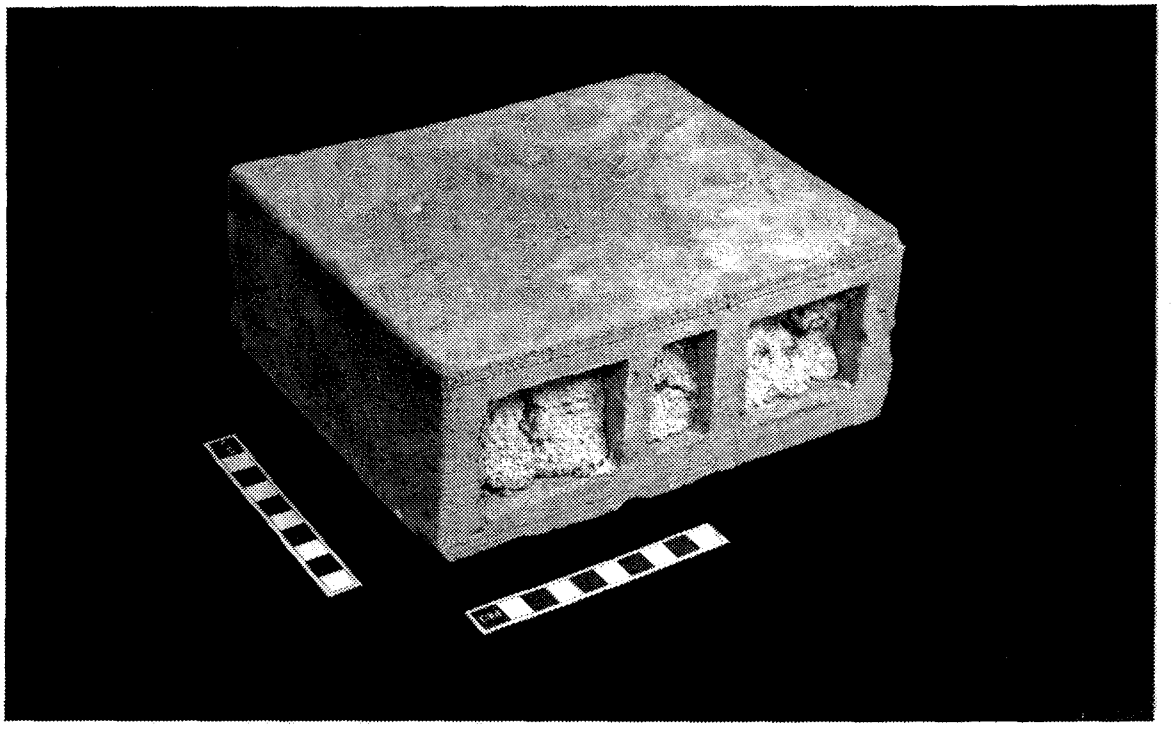


Figure 6.12 Bruno small three-cell tile block.

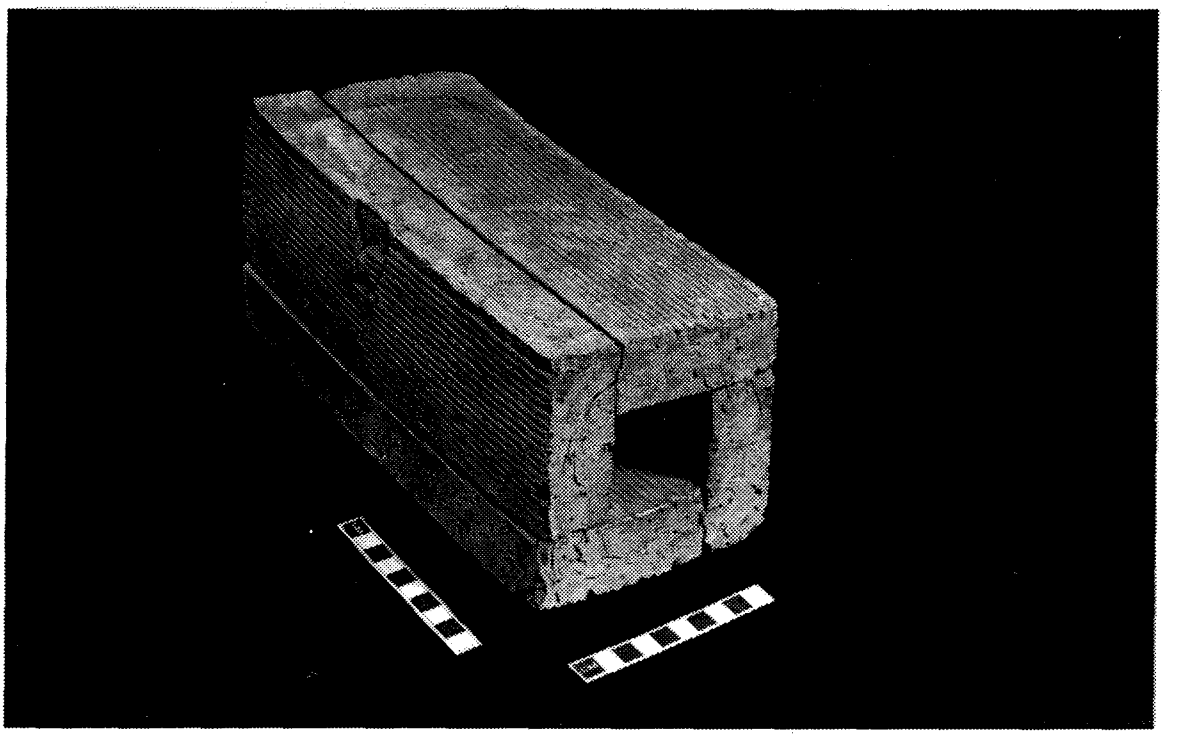


Figure 6.13 Bruno four-piece, multi-component drain-tile.

Figure 6.14 Bruno hexagonal drain tile.

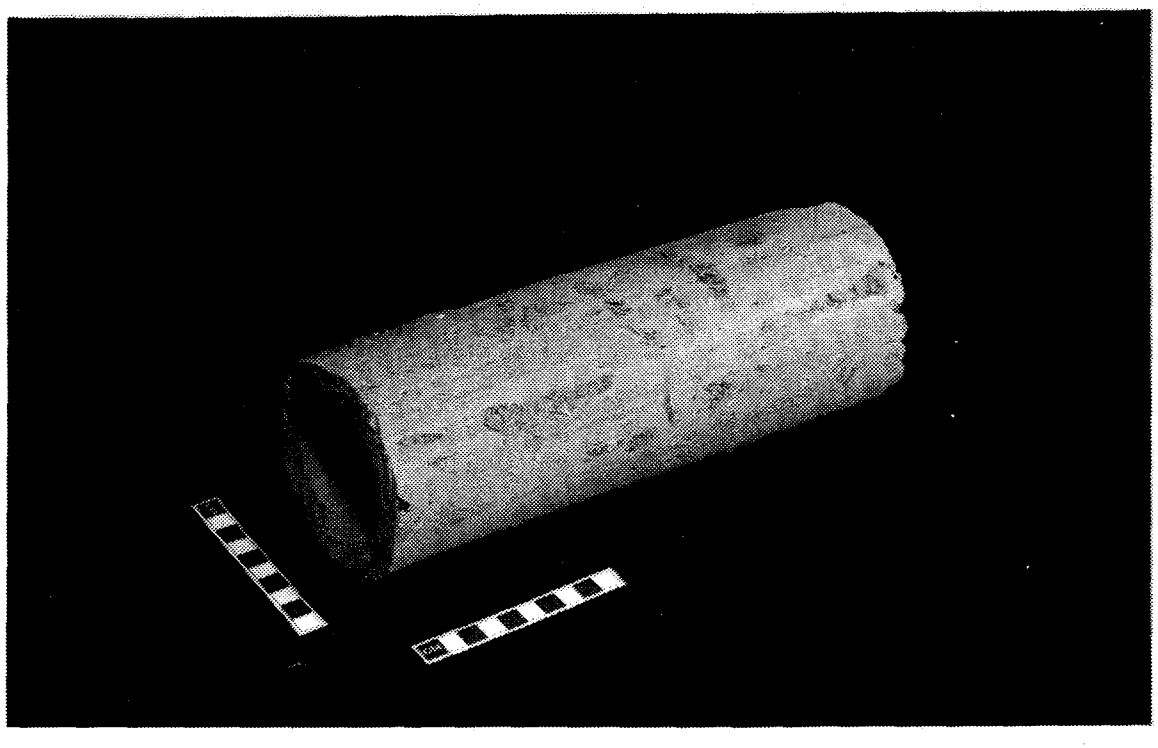


Figure 6.15 Bruno round drain tile.

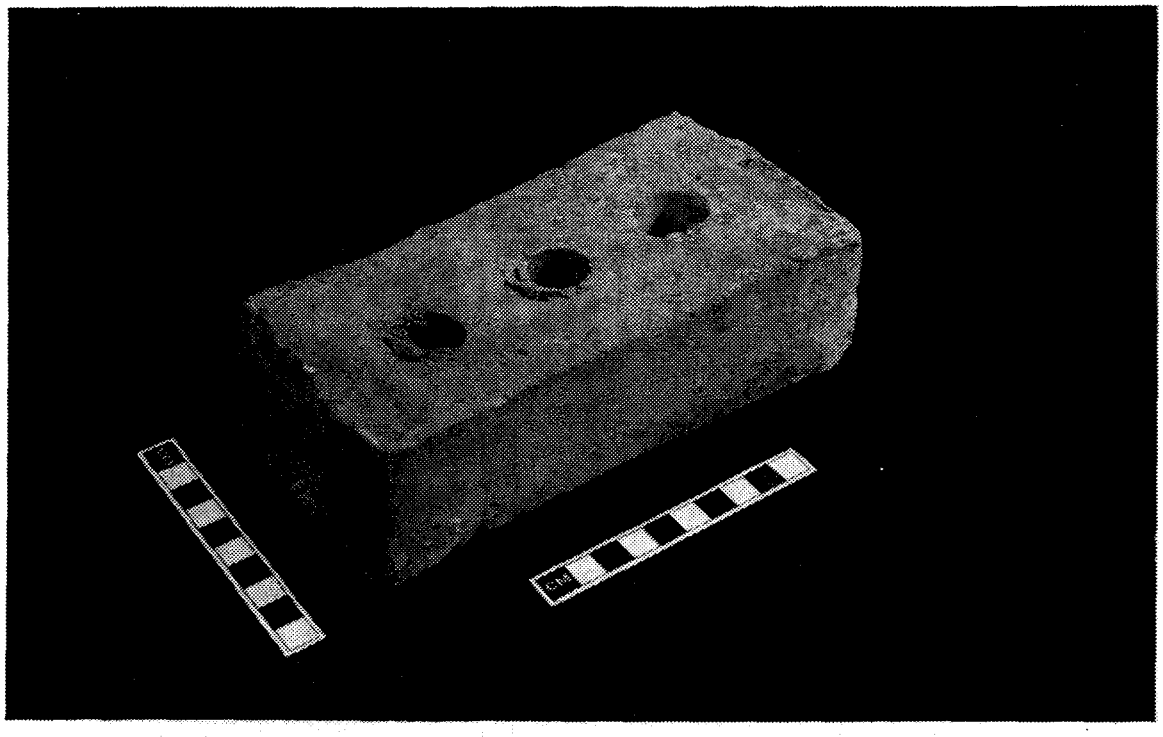


Figure 6.16 Bruno side-cut, three-hole perforated, non-textured brick.

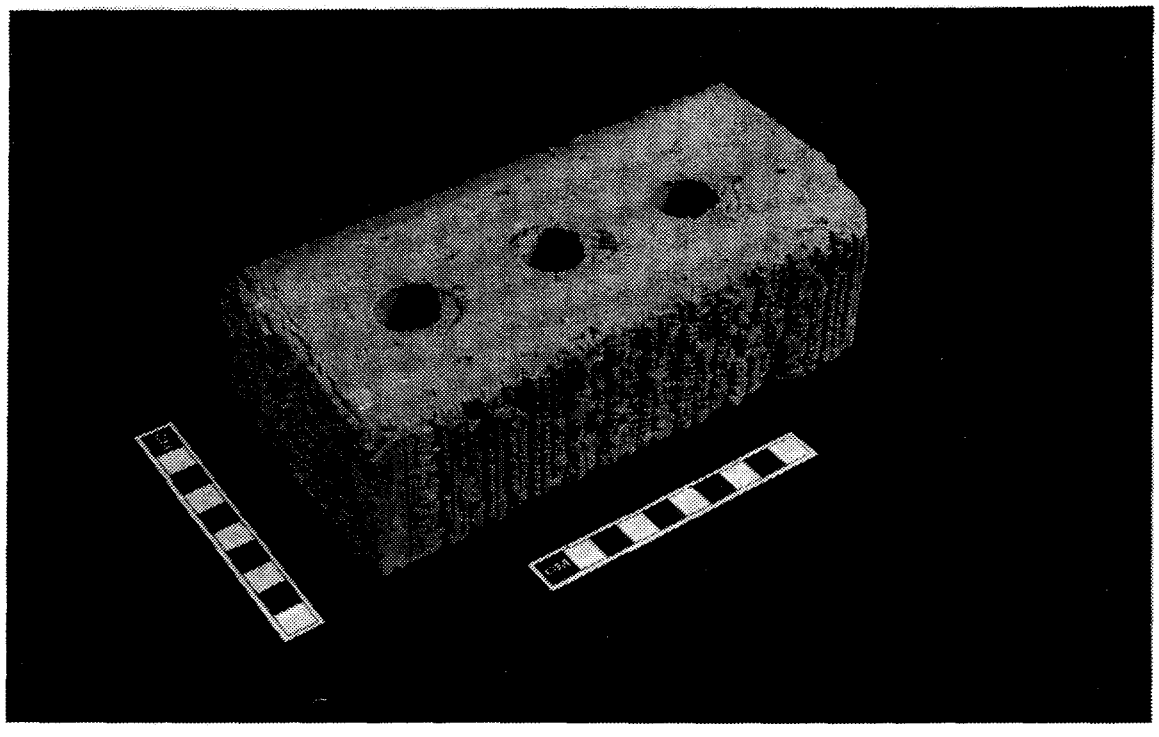


Figure 6.17 Bruno side-cut, three-hole perforated, textured brick.

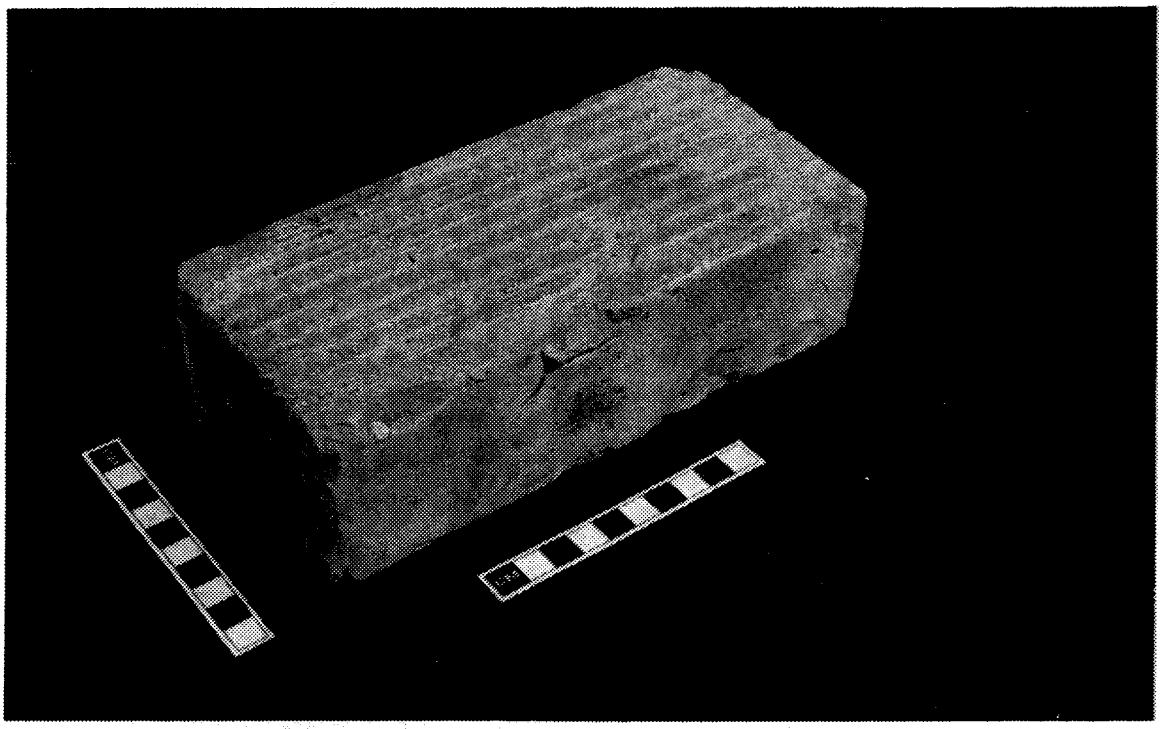


Figure 6.18 Bruno end-cut, ten-rib (one side) brick.

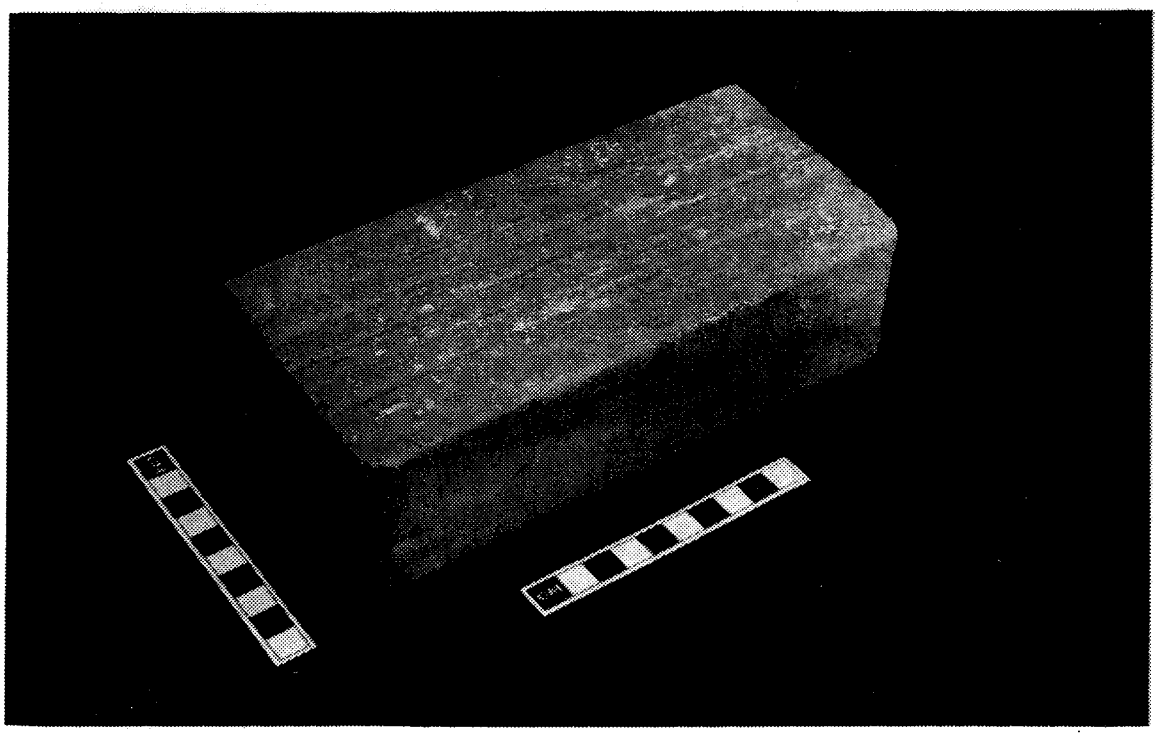


Figure 6.19 Bruno end-cut, five-rib (both sides) brick.

Figure 6.20 Bruno side-cut, non-textured brick with '3349' inscribed on end, before firing.

if any application for the general tile product line. Excavation testing of Bruno's brick refuse pile in the future could prove useful in identifying earlier products and variations, along with the accompanying technological inferences.

The Bruno site is very significant within Saskatchewan brickmaking for its role in tile production and its technology, particularly its kiln. It is an excellent comparative site to Claybank and Estevan, as all began in the same time period, were approximately of the same scale, and operated simultaneously for over five decades.

6.3 Claybank

Claybank, whose history was discussed in Chapter 3, was perhaps Saskatchewan's premier brickmaking site in terms of its high-quality product line of both facebrick and firebrick. From the time of its clay sources first being noted in 1886 to its shutdown in 1989, the site also had the longest history of the Saskatchewan brickmaking sites. Today it exists as a National Historic Site, intact with all structures and nearly all equipment as last used, much of which was original to the plant's construction from 1912 to 1914 (Figures 6.21, 6.22, 6.23).

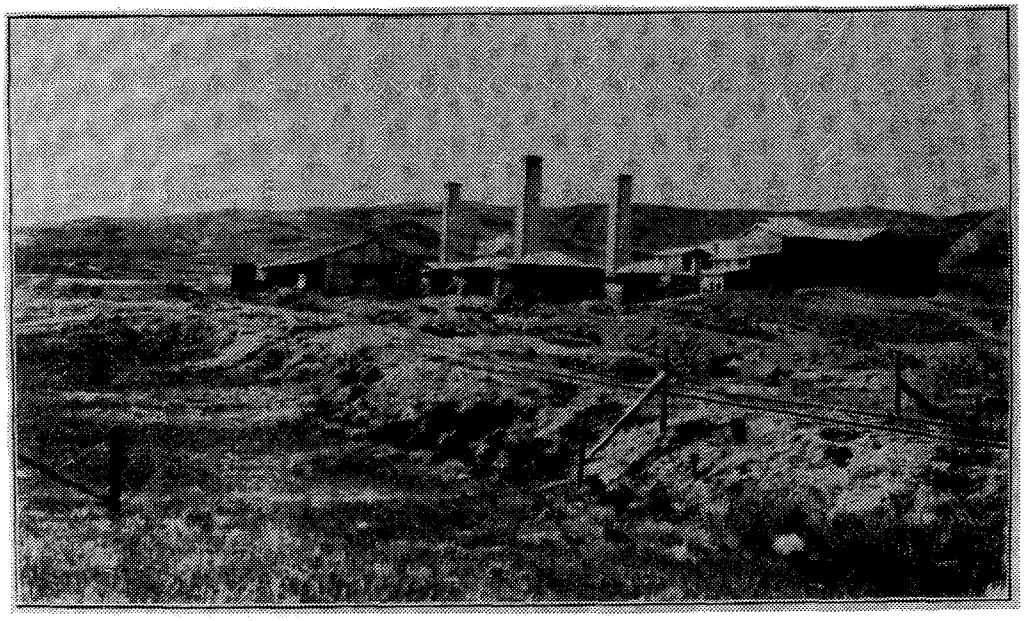
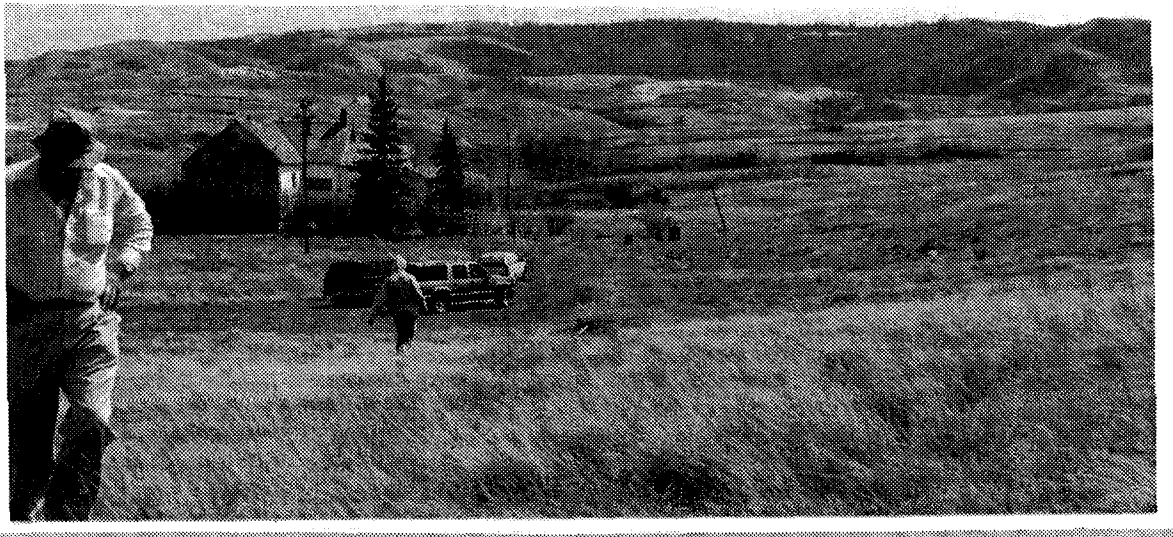
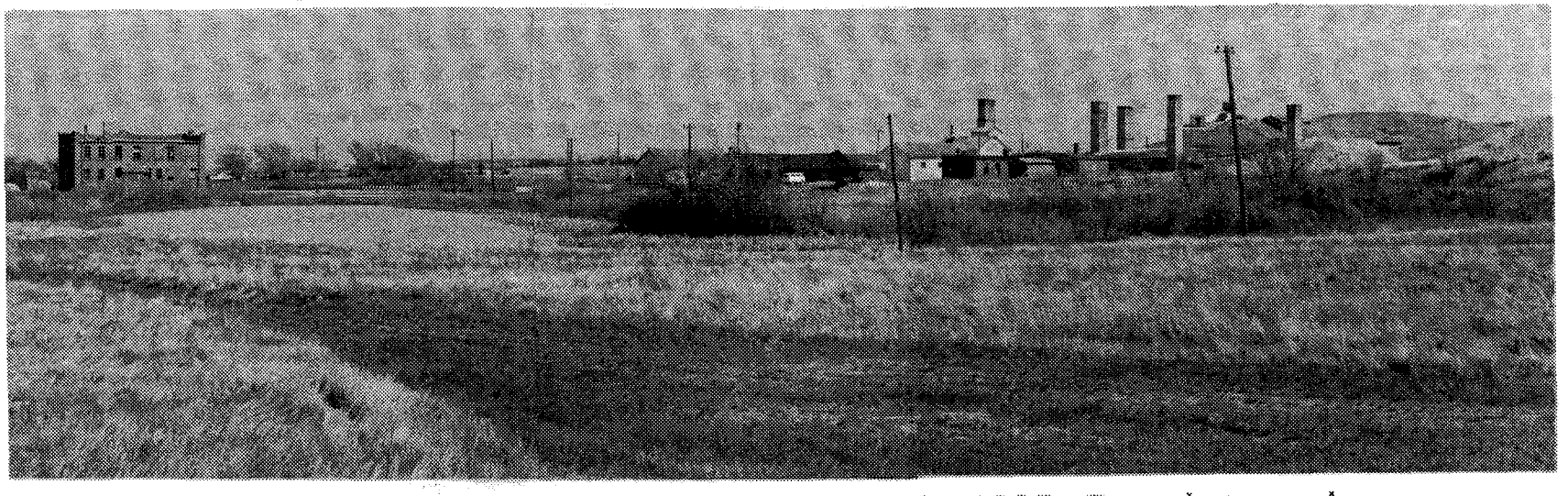


Figure 6.21 The Claybank brickplant c.1916. From Davis 1918:70.

The scale of Claybank is enormous in terms of its study potential, especially in comparison to many of the disturbed brickmaking sites previously noted. For example, Frank





Figures 6.22 and 6.23 The Claybank site in 1997. Top photograph shows the remaining married-men's company home in the foreground, with the Dirt Hills/ Whitemud formation in the background.

Korvemaker, senior historian at the provincial government's Heritage Branch, has already assembled the earlier mentioned four volume set of Claybank's myriad of site features with photographs and accompanying descriptions written with the assistance of former plant employees. For the purposes of this discussion brevity will be attempted in relation to this site so as to allow reasonable archaeological comparison with other sites.

A major feature of Claybank is that it retains a layout and technology which is the same as when construction was completed in 1914. There has been some expansion but even this was only extensions of the original scheme, such as four beehive kilns later joining the original six, all of similar size and form. Modifications such as converting six kilns to natural gas firing from coal in 1960 left little major alteration, and often the remnants of previous systems are obvious. For instance a narrow gauge rail system powered by a modified Fordson tractor was used to transport clay from the local pits to the storage shed into the 1950s. While trucks finally replaced this system, stretches of the rail-line, along with the raised grade approaching the shed, still exist. Combined with old film footage showing the rail system in operation, reconstructing this particular technology is straightforward.

Claybank was also similar to its analogous British Columbia firebrick producing plant, Clayburn, which John Adams notes "bypassed...more primitive, unmechanized stages almost entirely and very soon was producing bricks all year round, using the most advanced machinery available" (1976:11). Although clay had been

extracted for some time in the nearby hills and shipped elsewhere, no other brickmaking existed in the area before 1912, leaving the present site essentially the end of the "first phase" of its brickmaking technology. This affords the type of research that usually is available in only very short-lived operations, where multiple-site use is not a confusing issue in assigning certain technologies to specific time periods. Claybank's brickmaking operation did evolve over the years, but always within the technological model from which it began.

A map of the general arrangement of Claybank's operation is shown in Figure 6.24. The various stages of brickmaking as set out in section 4.2 are evident here. While the kiln technology never advanced to a continuous design, the down-draft beehive system was efficient in rerouting kiln heat to the drying tunnels as well as providing heat for the entire main structure during the winters. There may have also been a management advantage to numerous smaller kilns instead of one high-investment tunnel kiln, in terms of the fluctuating demand that the Saskatchewan brick market exhibited. Only a few of the multiple kilns would need to operate if production was low; however, operating a large tunnel kiln would have demanded high production at all times in order to remain cost-effective.

In terms of product, Claybank produced dry-press firebrick and facebrick, stiff-mud firebrick and facebrick, and hand-molded special-shape firebrick (Figures 6.25, 6.26, 6.27, 6.28, 6.29, 6.30). Special refractory mortar was an important product to

correspond with fire brick construction, while raw fireclay continued to be sold as had been done before the plant's construction (Dominion Fire Brick & Clay Products Ltd. c.1940).

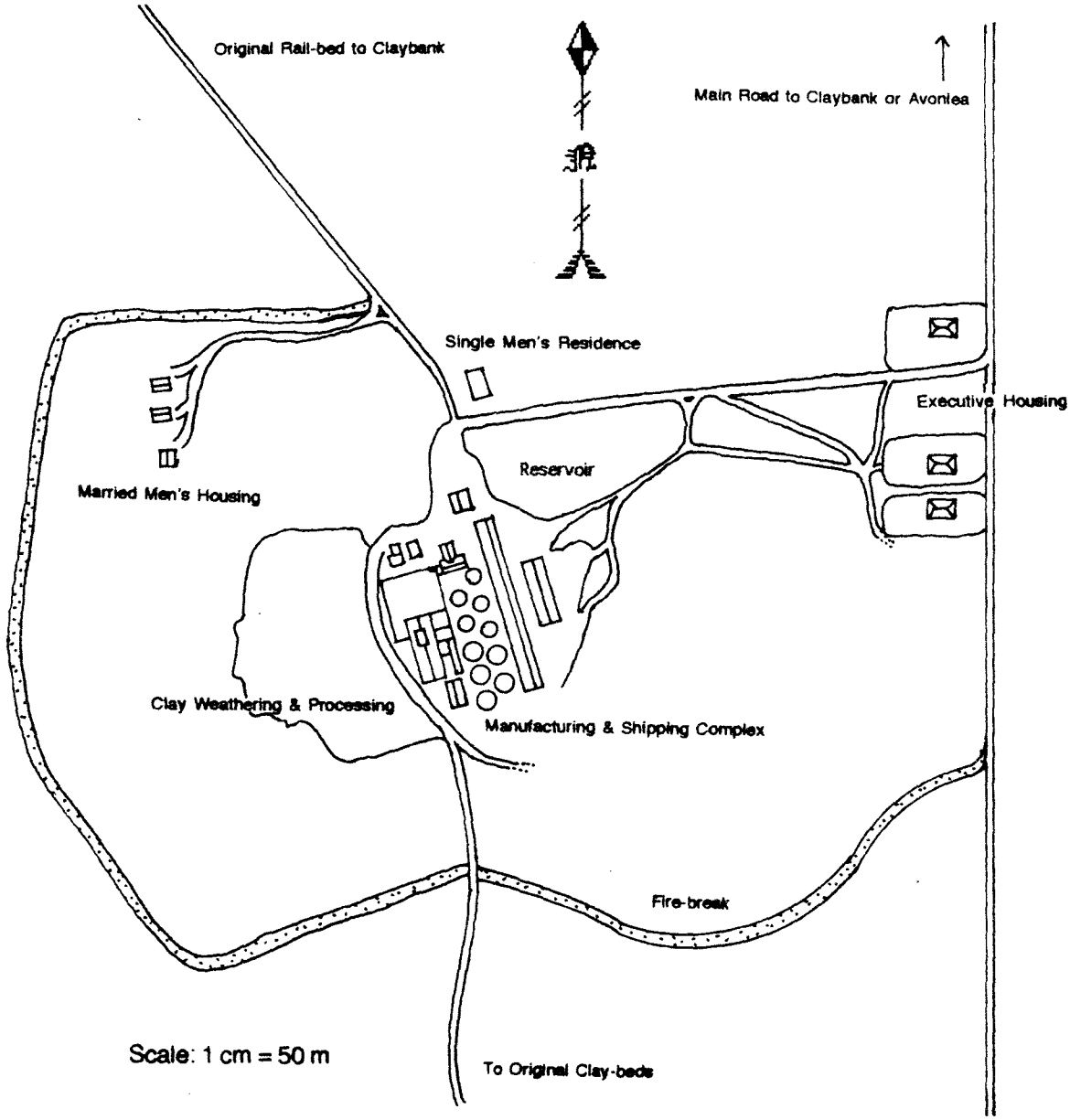


Figure 6.24 Map of Claybank site as operated in 1968. Derived from Photograph A 20685-30, Central Survey and Mapping Agency, Regina.

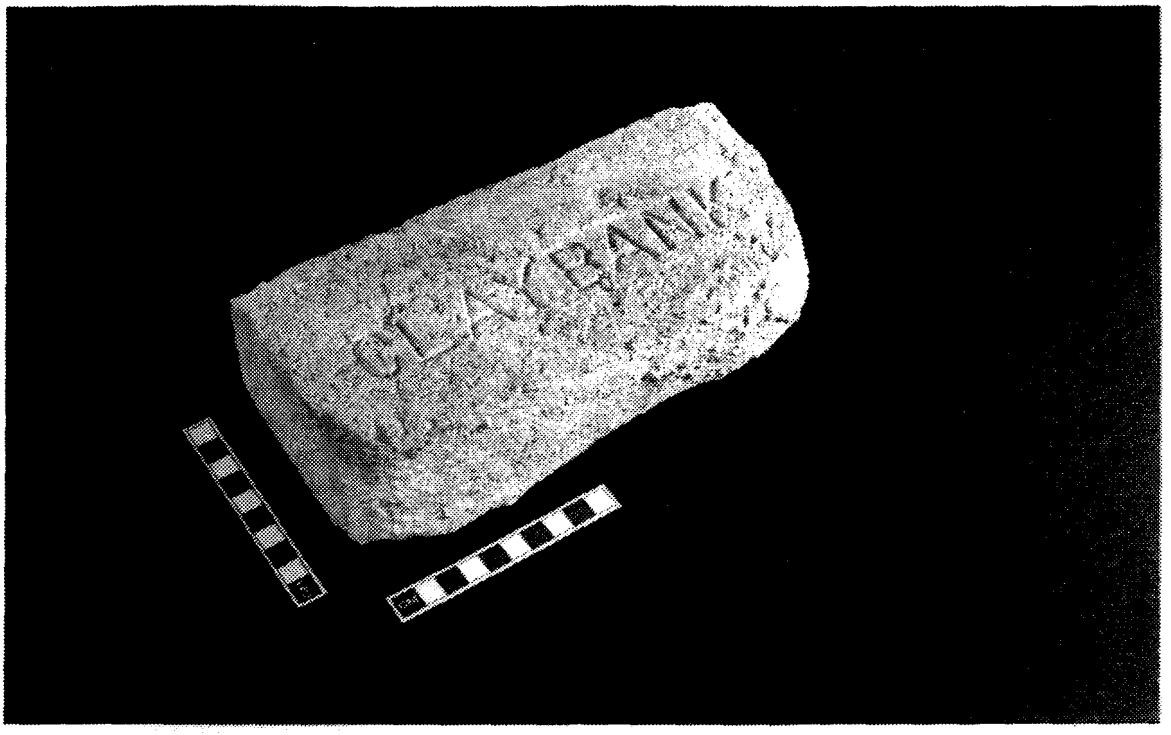


Figure 6.25 Claybank 'CLAYBANK' firebrick, c.1930.

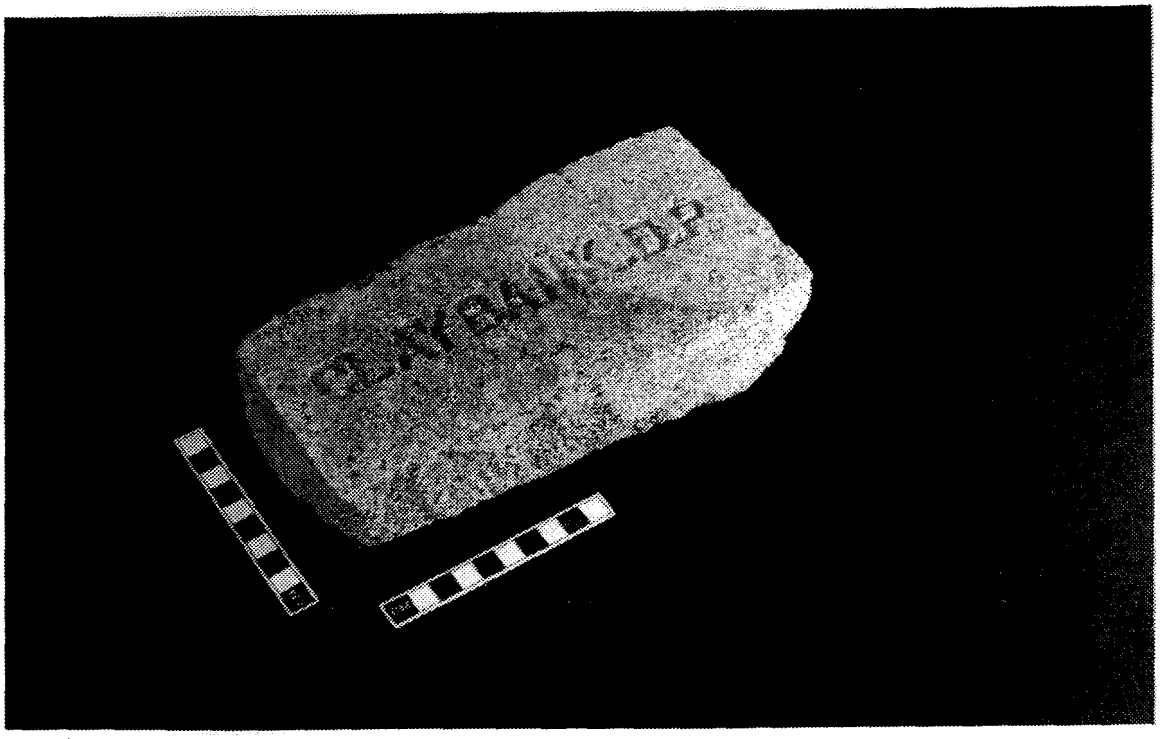


Figure 6.26 Claybank 'CLAYBANK D P' (or 'B P') firebrick, c.1930.

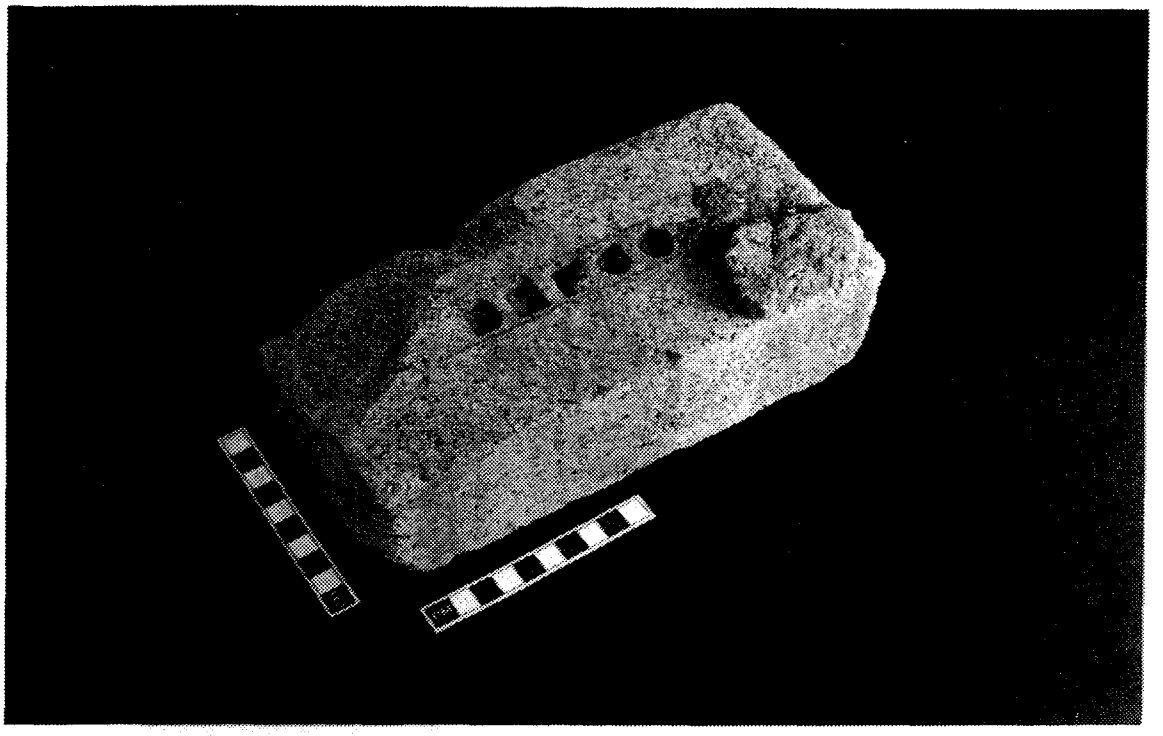


Figure 6.27 Claybank 'DEFCO' firebrick, c.1940.

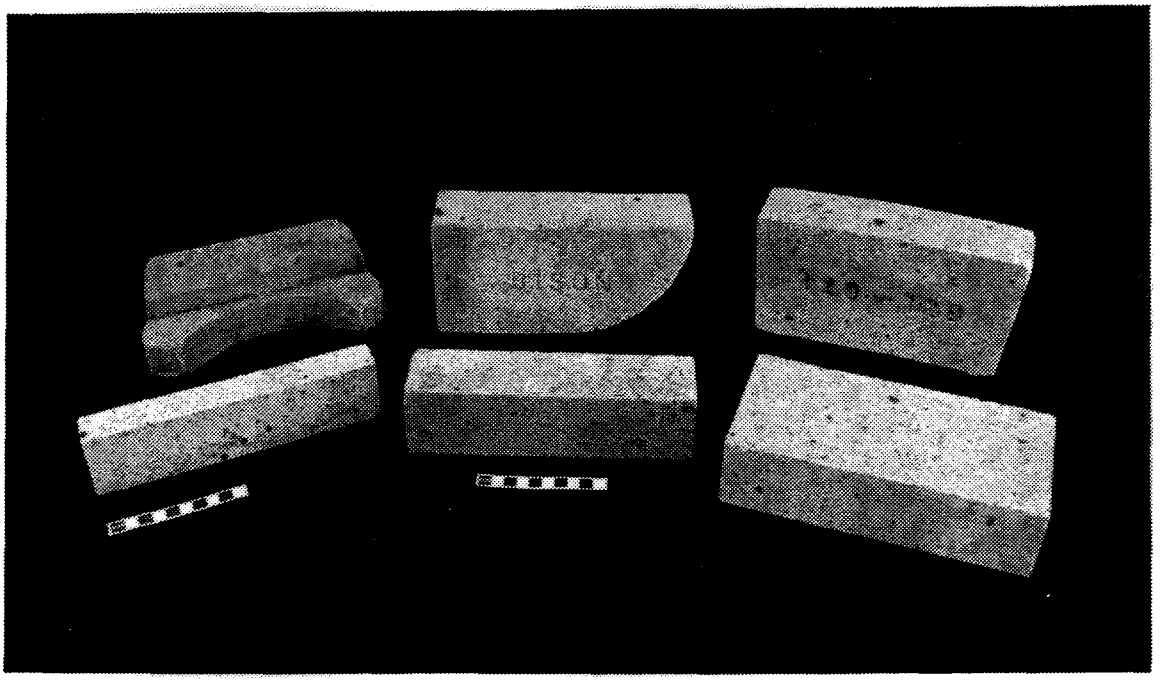


Figure 6.28 Claybank firebrick products, c.1989. Back: hand-moulded 'N43', 'BISON' jamb, '120-129' circle. Front: half-soap, soap, 'K-3' straight.

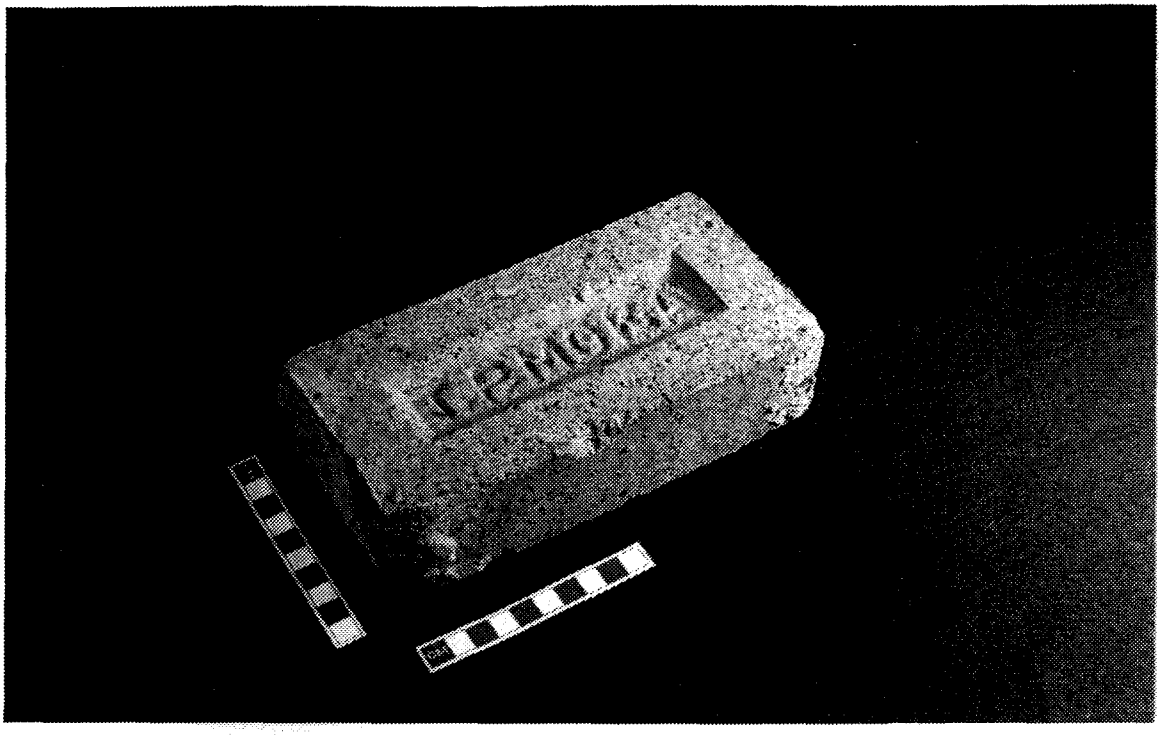


Figure 6.29 Claybank 'T P MOKA' facebrick.

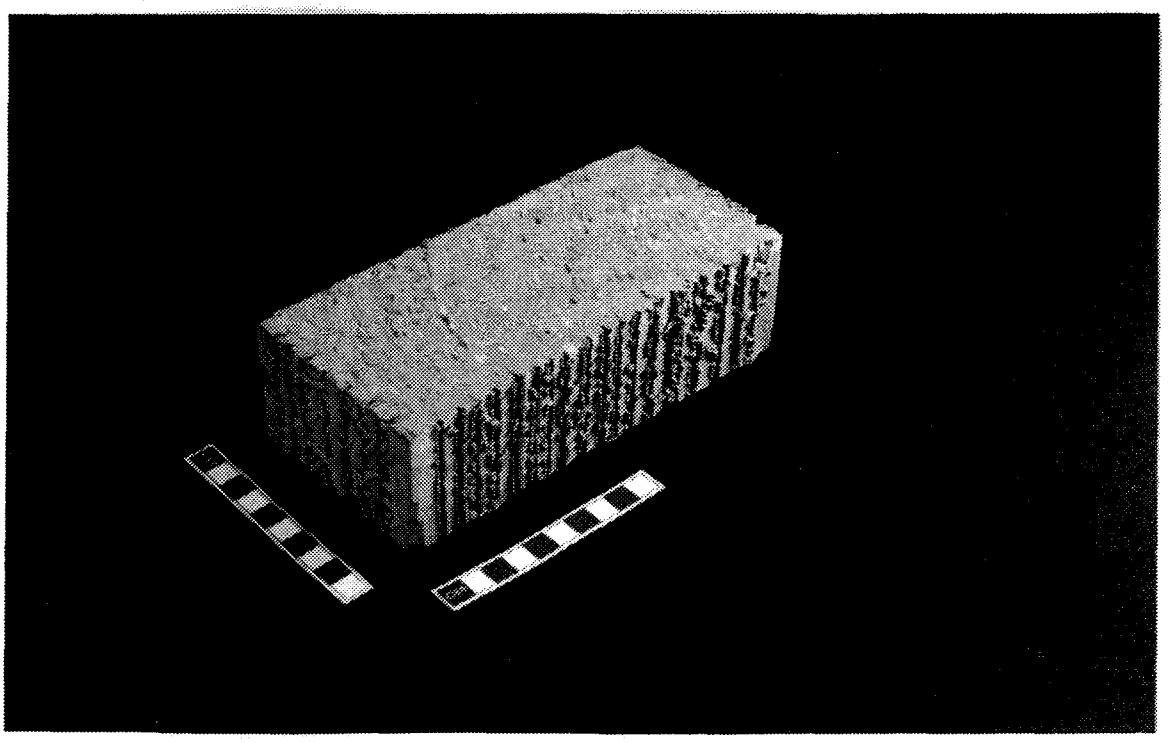


Figure 6.30 Claybank 'RUFF-TEX' facebrick.

The dry-press method was the most commonly used method at Claybank, likely because of the exact dimensions and true surfaces that could be achieved both from the pressing operation and the subsequent low shrinkage upon full drying and firing. In conventional bricklaying, mortar is often 1 cm or more thick, making up for small differences in brick dimensions and shape. The rigourous demands of refractory situations dictate that the bricks be laid much closer together, with only a thin layer of refractory mortar when mortar is used (Dominion Fire Brick & Clay Products Ltd. c.1940:6). In applications such as domed beehive kiln roofs, which must be able to expand and contract during firing periods, no mortar is used (Ken Oakley, personal communication 1997).

The disadvantage of dry-press firebrick is that it possesses a granular structure of high porosity that is vulnerable to moisture and abrasion, despite good load-bearing qualities when heated to high temperatures (Gurcke 1987:111). For applications where abrasion was a concern, Claybank made stiff-mud firebrick of low porosity, important in situations such as molten metal containment (Dominion Fire Brick & Clay Products Ltd. c.1940:7).

Claybank's facebrick, both dry-press and stiff-mud types, seem to have been made with the same general processes and clay as the firebrick, with high resultant quality. One popular dry-press facebrick type was called 'Tipi-Moka', branded with a shallow frog as 'T P MOKA' on earlier versions while later examples are devoid of brand or frog. A speckled finish was a characteristic of this brick, which varied in colour from off-white to an orange-brown. A popular stiff-mud facebrick was called 'Ruff-Tex', a very

dense side-cut, non-perforated type with rough grooves on three surfaces. Ruff-Tex came in at least two distinctive colours, orange and a dark purple which appears to have been accomplished by firing the brick to the point of vitrification or melting. This would also result in the darker variety having close to zero absorption of water, making it a good paving brick. Such an application would also have benefited from the Ruff-Tex brick's absence of perforated holes, a common practice elsewhere with stiff-mud brick manufacture which reduced weight and improved mortar attachment.

The Claybank site is in summary a location of great significance to the province's brickmaking industry which will provide, through the preservation of the site, many opportunities for future archaeological examination and study.

6.4 Estevan Brick Ltd.

The brickmaking site on the southeast edge of Estevan, Estevan Brick Ltd., had the longest operating history of any such enterprise in Saskatchewan, accompanied by a great deal of change and evolution over its operation from 1902 to 1996. Its history was reviewed in Chapter 3, where several major temporal phases were noted. The first of these was the original coal and clay mining with brickmaking arrangement from 1902 to about 1925, when the brickmaking plant was largely rebuilt to include pottery making with less emphasis on coal mining (Figures 6.31, 6.32). New ownership in 1944 by the provincial government led it to become the centre-piece of a much wider Saskatchewan clay industry

development agenda, with a completely new plant replacing the older example in 1951. While this provided the physical arrangement up to 1996, ownership had changed back to the private sector by 1970, with four different subsequent owners up to its closing.

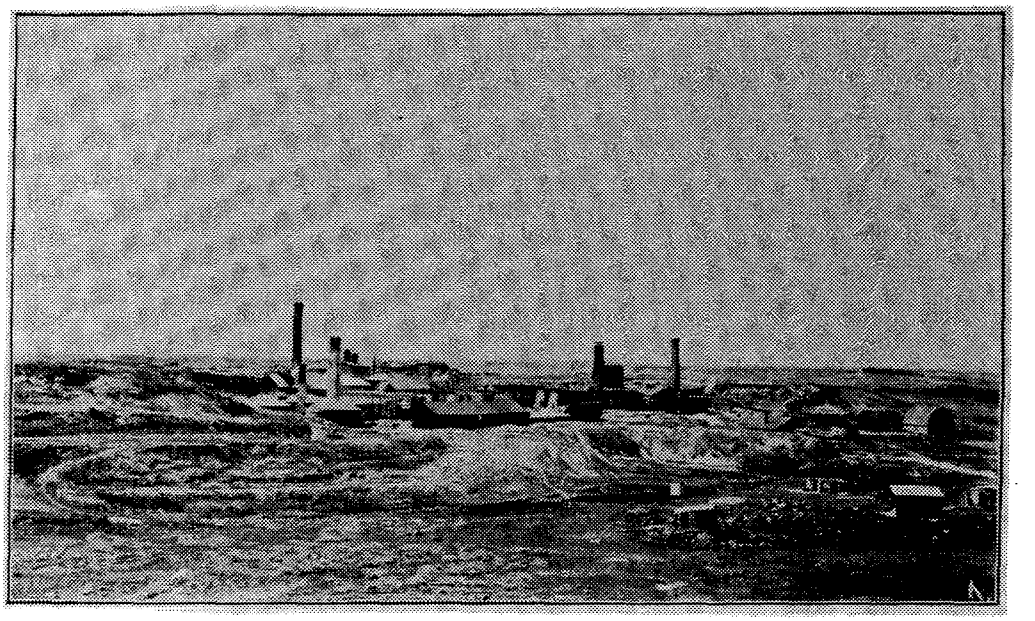


Figure 6.31 Estevan brickplant site, c.1916. From Davis 1918:74.

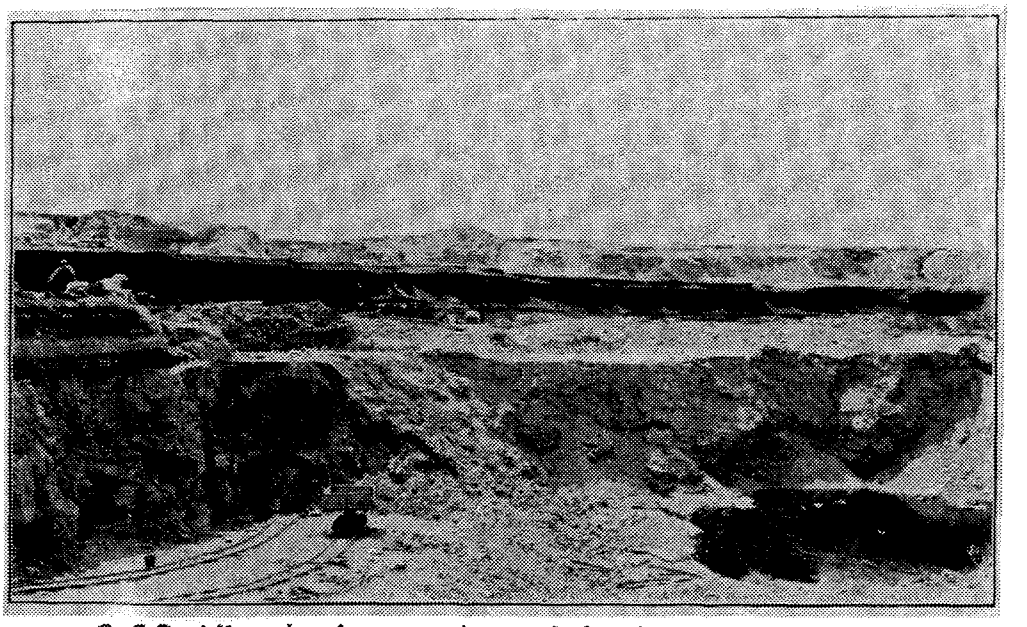


Figure 6.32 Mixed clay and coal beds at Estevan, c.1916. From Davis 1918:74.

The complete rebuilding in 1951 mostly removed earlier traces of the plant, although John Hudson (personal communication 1997) remembers seeing some remnant of the earlier Dutch kilns a decade later. While some below-ground evidence may still exist, for the most part activity in the 45 years after the final rebuilding has left little but the last stage discernible (see Figure 6.33 for map of the last plant layout). This contrasts with Claybank which was

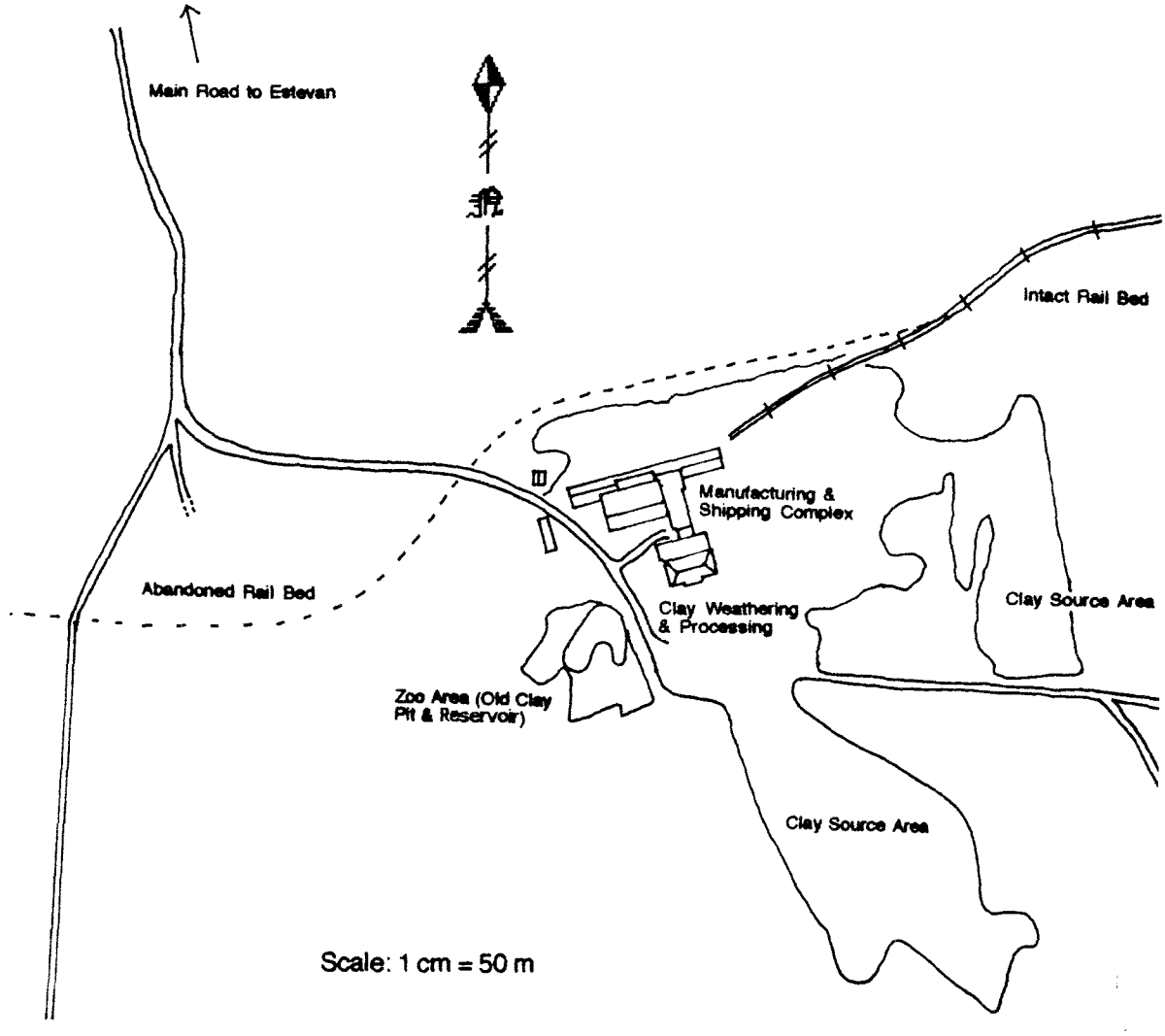


Figure 6.33 Map of Estevan site as operated in 1962. Derived from Photograph A17907-23, Central Survey and Mapping Agency, Regina.

never significantly altered from its 1912-1914 construction, and Bruno where the overall layout was retained from its major upgrade in the same pre-WWI time period.

The implications archaeologically from this is that the Estevan Brick Ltd. site is best examined with a focus on the last phase of the site only, which is, however, the most significant phase of the site both in regard to its own history and that of the Saskatchewan brick industry in general. It is unlikely that in 1951 a private concern would have invested the capital required to build a fully modern brick factory in Saskatchewan as at Estevan, but without such a facility the Saskatchewan brickmaking industry would have had a much briefer and less significant history.

As most of the equipment has been removed in the last year, specific technological examination is now difficult. However, the removed technology was largely contemporary, so that a study of a functioning company's machinery, such as I-XL in Medicine Hat, Alberta, could provide analogous information. The overall landscape and arrangement of the site remains, with the clay quarrying pits, the grinding and storage areas, the large main building, the loading area, and the refuse piles remaining in 1997 (Figures 6.34, 6.35, 6.36, 6.37). As well the office, built of Estevan brick in 1957, remains, along with a very unique component—an employee-built zoo and wildlife compound on the west end of the site (Figure 6.38). From examination of old photographs this appears to have been created from land that was earlier part of the coal-mining component of the site. Presently it functions

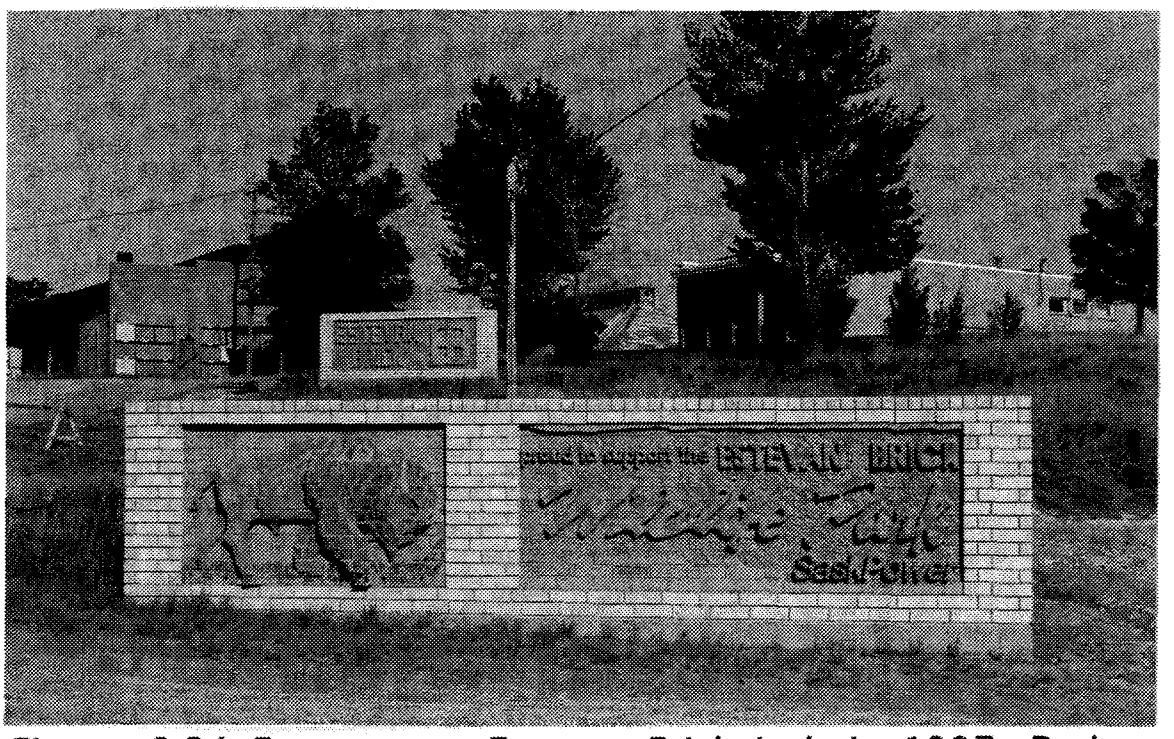


Figure 6.34 Entrance to Estevan Brick Ltd. in 1997. Drying and firing building at upper left, top of clay storage shed in centre, office at upper right.

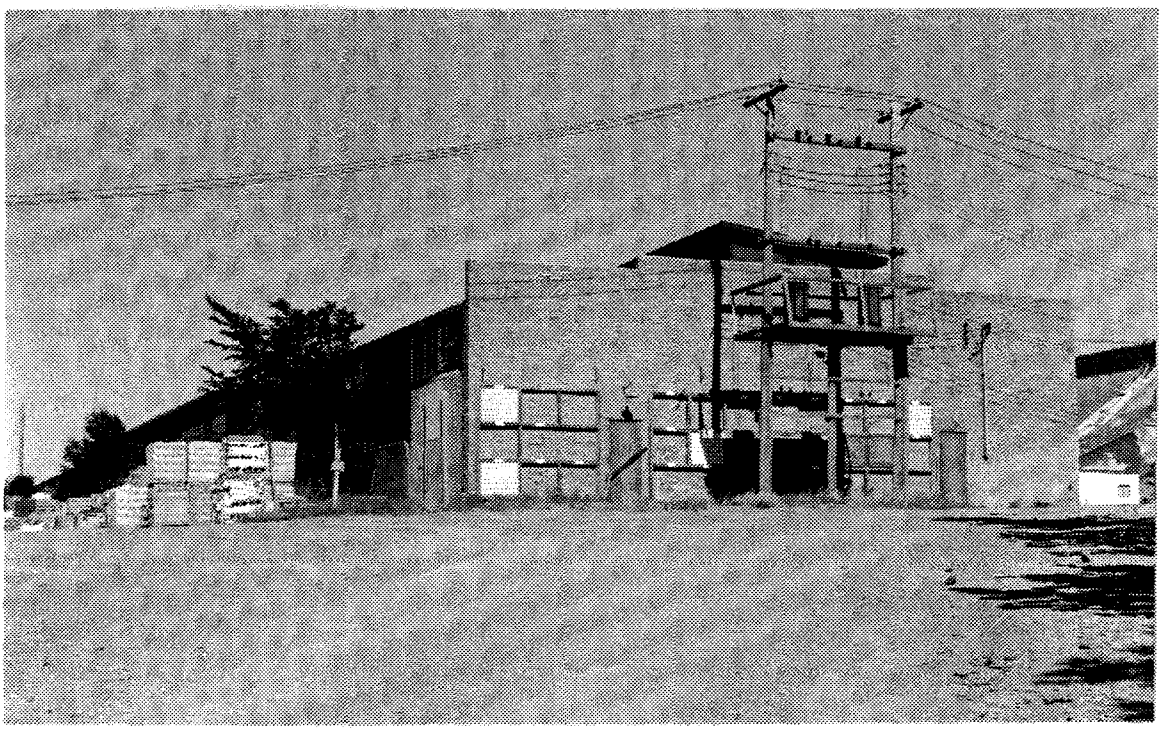


Figure 6.35 West end of drying and firing (tunnel kiln) building.

Figure 6.36 View of Estevan site, facing west, in 1997.

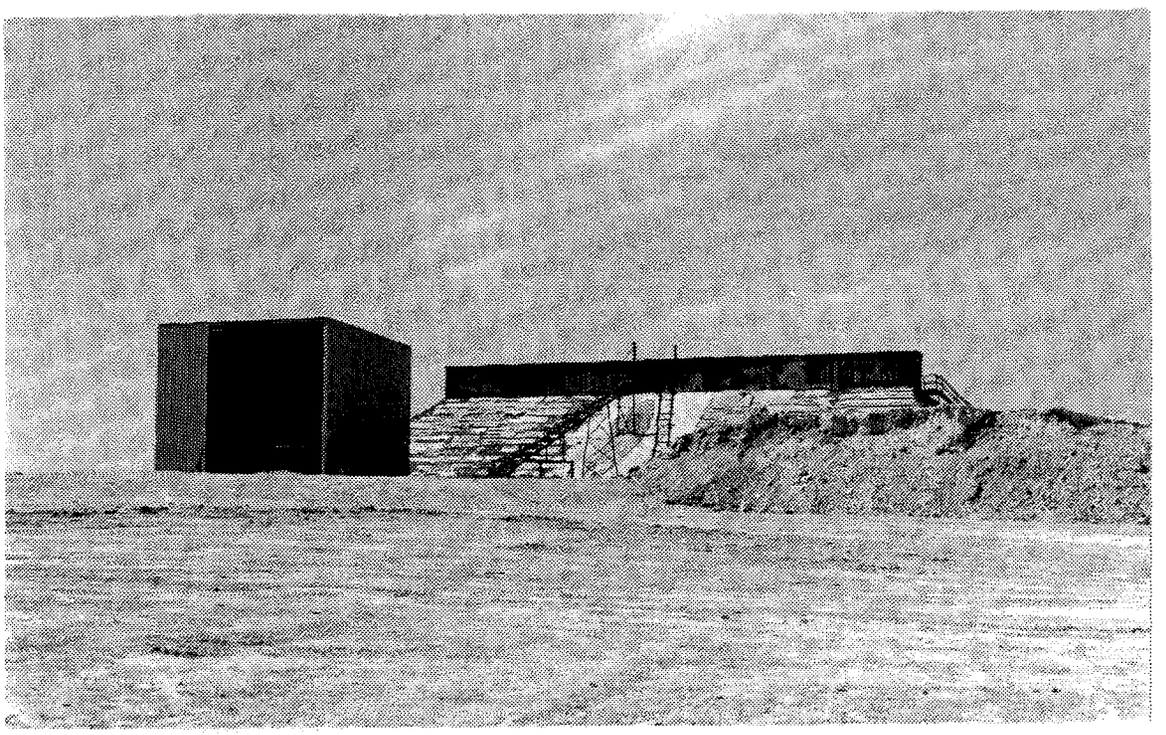


Figure 6.37 Estevan site: primary clay grinding structure at left, with conveyor leading to top of main clay storage shed, in centre.

Figure 6.38 Estevan Brick Ltd. Wildlife Preserve/Zoo.

as the only zoo in Estevan and will likely be maintained (Brian Jennings, personal communication 1997).

In terms of product, all samples the author has examined post-date the 1944 purchase of the plant by the provincial government (Figures 6.39 to 6.45). Some particularly bright yellow, side-cut, three-hole-perforated examples have 'S.C.P. ESTEVAN CANADA' branded on one side, which were probably made in the old plant between 1946 and 1951. In Saskatoon, two buildings on the University of Saskatchewan campus built in 1947, Kirk Hall and the John Mitchell Building, utilize this era product with a significant amount of red grog giving the yellow brick a distinctive speckled appearance. After the new Estevan plant was built the bricks seem to have lost the yellow colour in place of a tan to tan-orange as the standard hue. The branding on these examples into the 1960s appears not to have been done by repress but by a hand stamping, and was applied to the side opposite the intended exterior facing side. By the later 1960s there was a shift to applying only a four digit date code and 'CANADA' on most Canadian brick product, including Estevan's, making sourcing of later examples much more challenging (Figure 6.43).

The later examples of Estevan's bricks became more sophisticated in colouring and texturing, such as the innovative winter-white colour of 1961 which inspired a succession of 'buff' varieties both on its own and from competitors (Saskatchewan Minerals 1961:6, 1962:1; Estevan History Book Committee 1981:92), and the rock-textured facebrick made possible by the

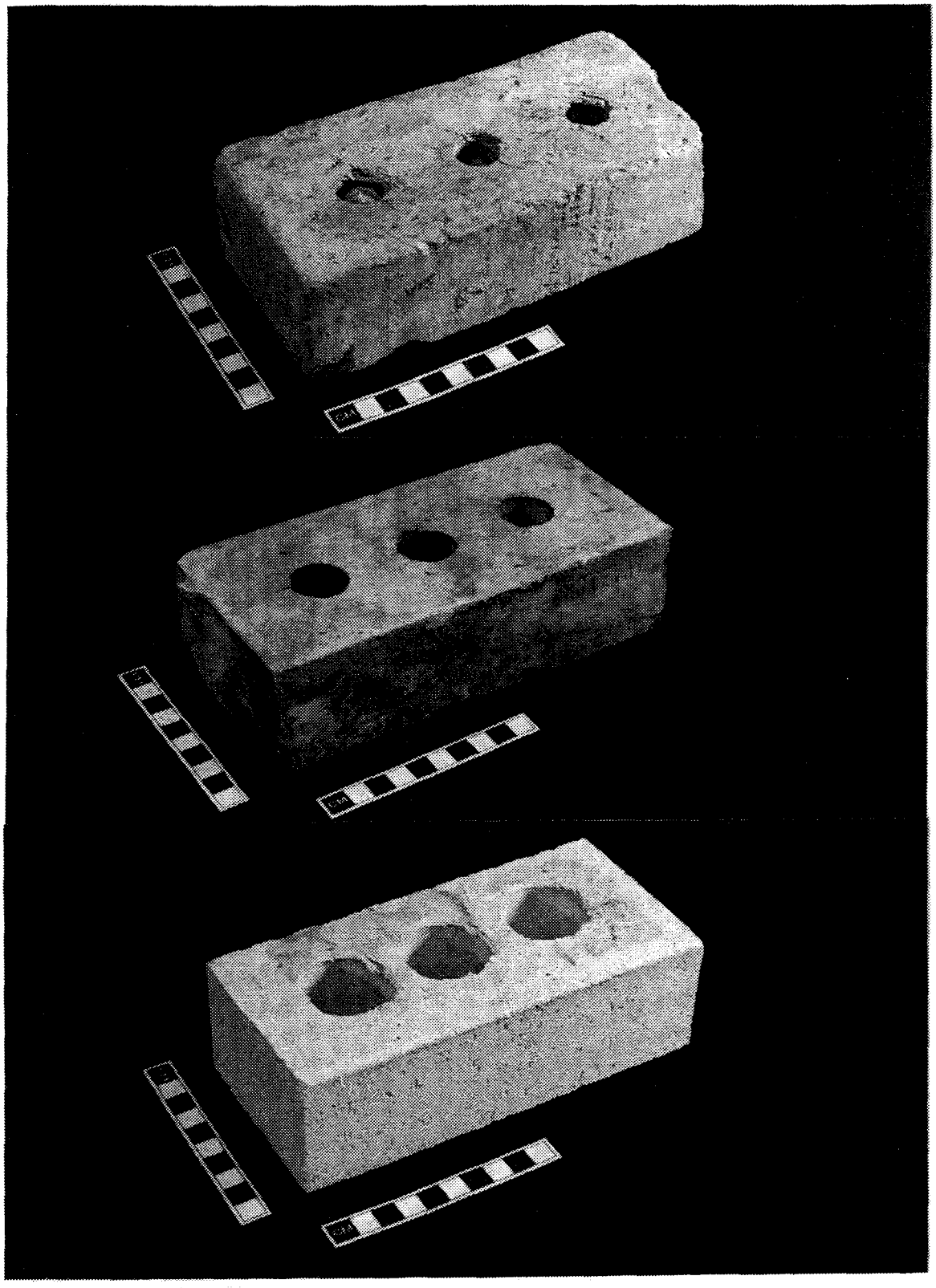


Figure 6.39 Evolution of quality in Estevan bricks. All examples side-cut, three-hole perforated, non-textured. Top: 1946-1951, middle: mid-1950s, bottom: post-1962 'Winter White'.

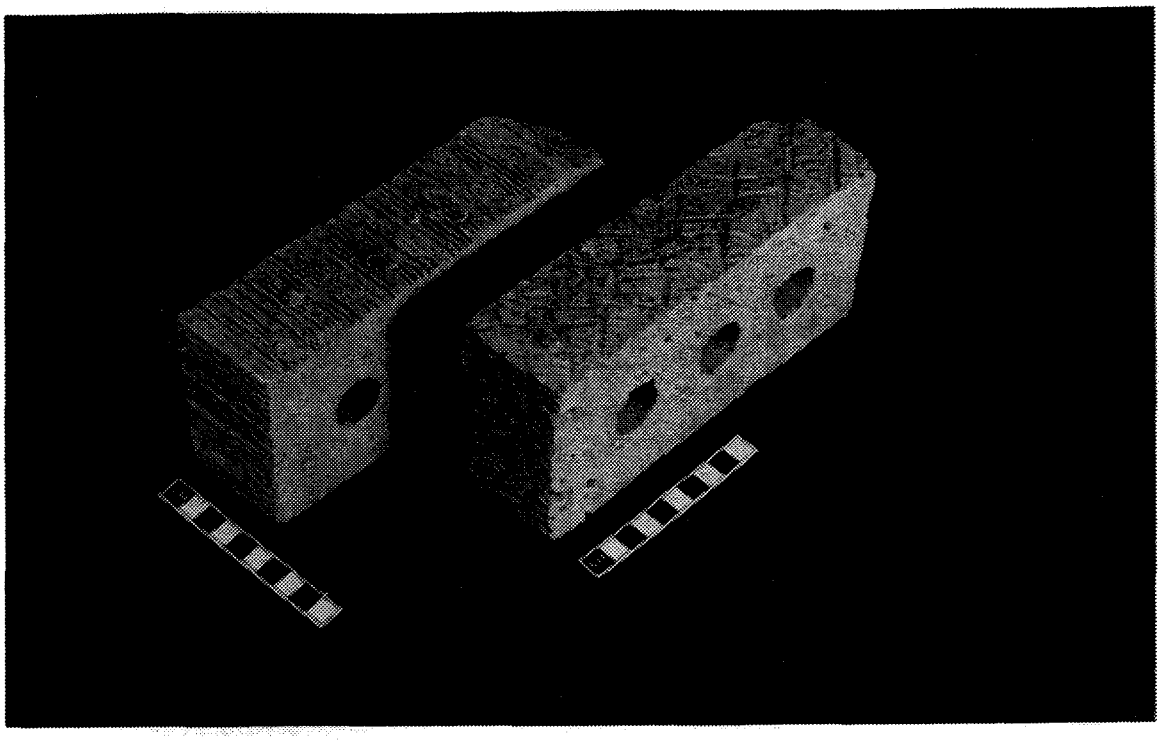


Figure 6.40 Estevan textured facebrick of the 1950s. Facing sides up.

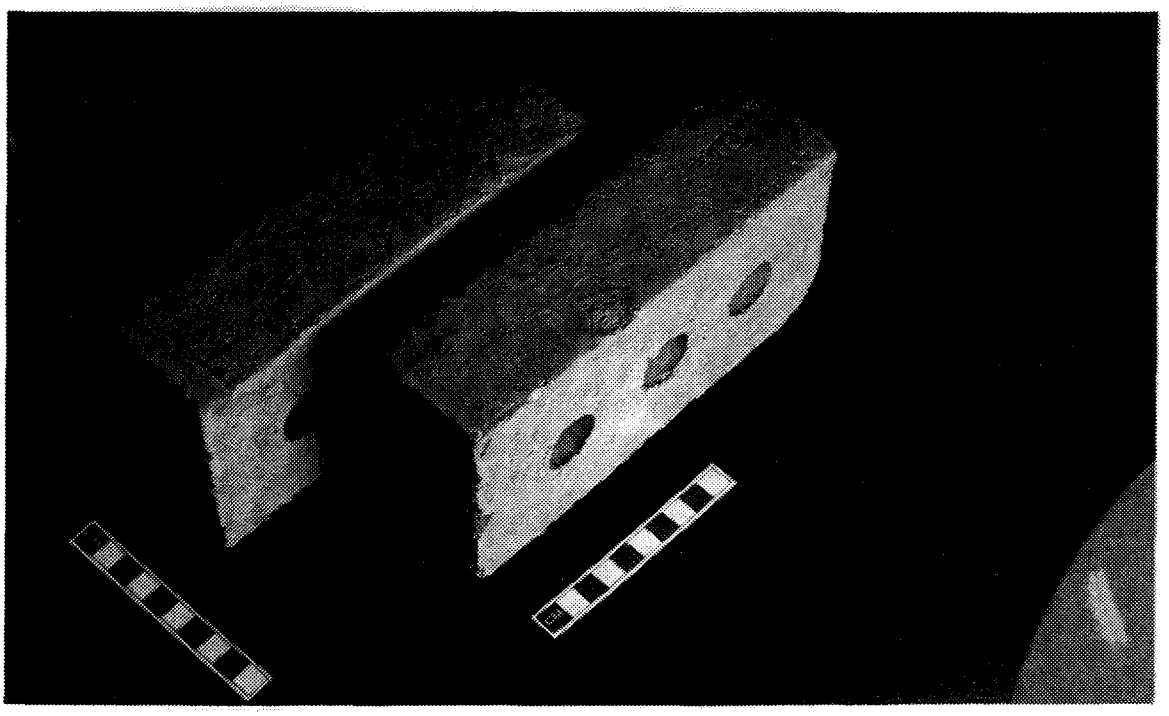


Figure 6.41 Estevan textured facebrick of the 1950s. Facing sides down (with branding visible).

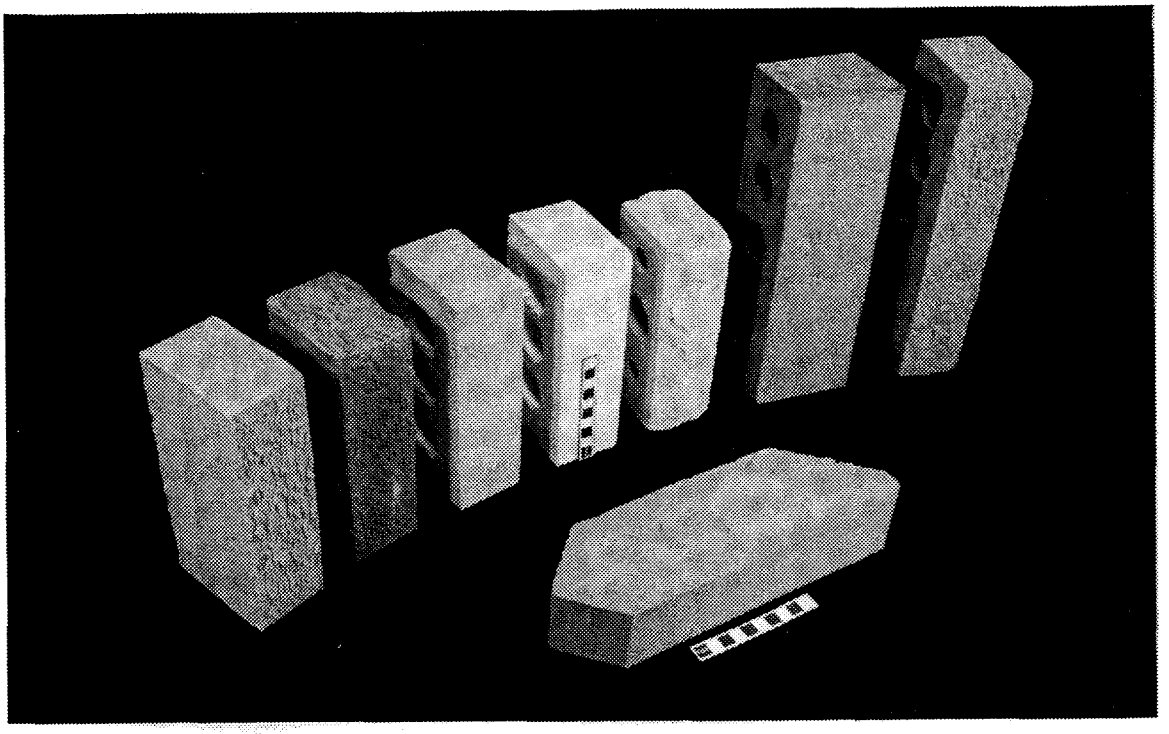


Figure 6.42 Estevan facebrick products c.1996. Winter White in middle at back, next right is rock-textured. Foreground example is window-sill brick, designed to sit at 45° angle.

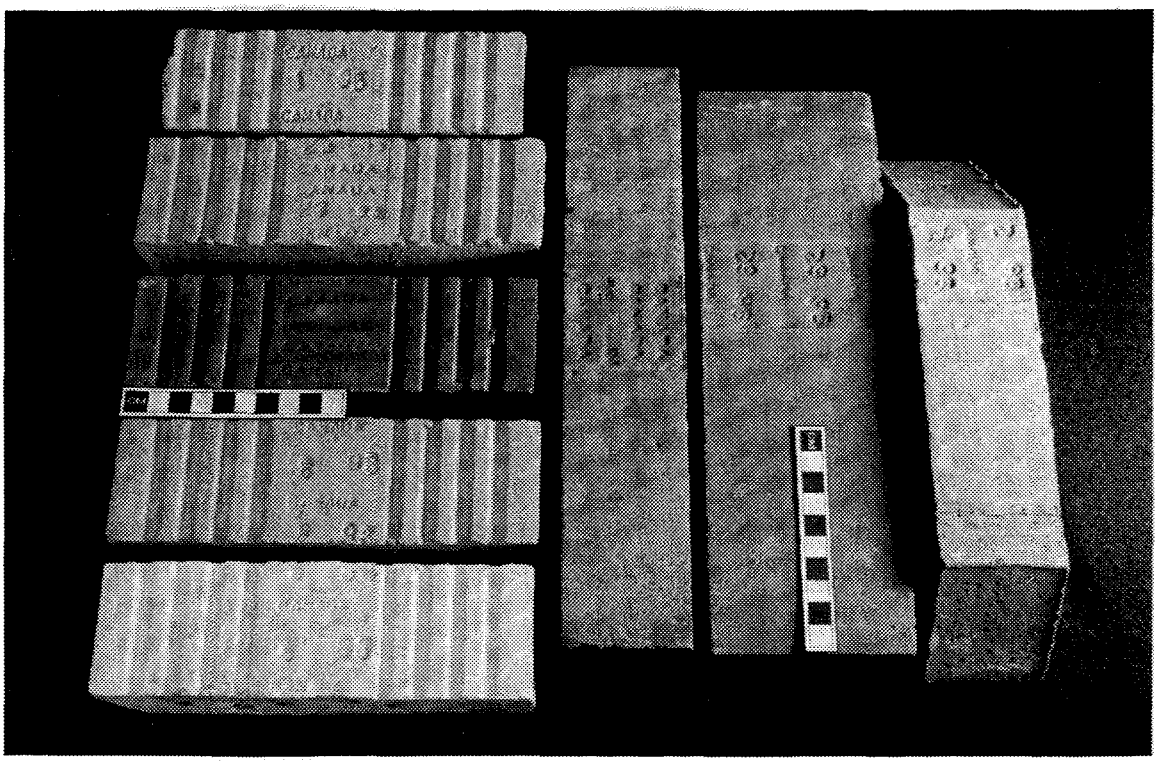


Figure 6.43 Later date-coding on Estevan bricks.

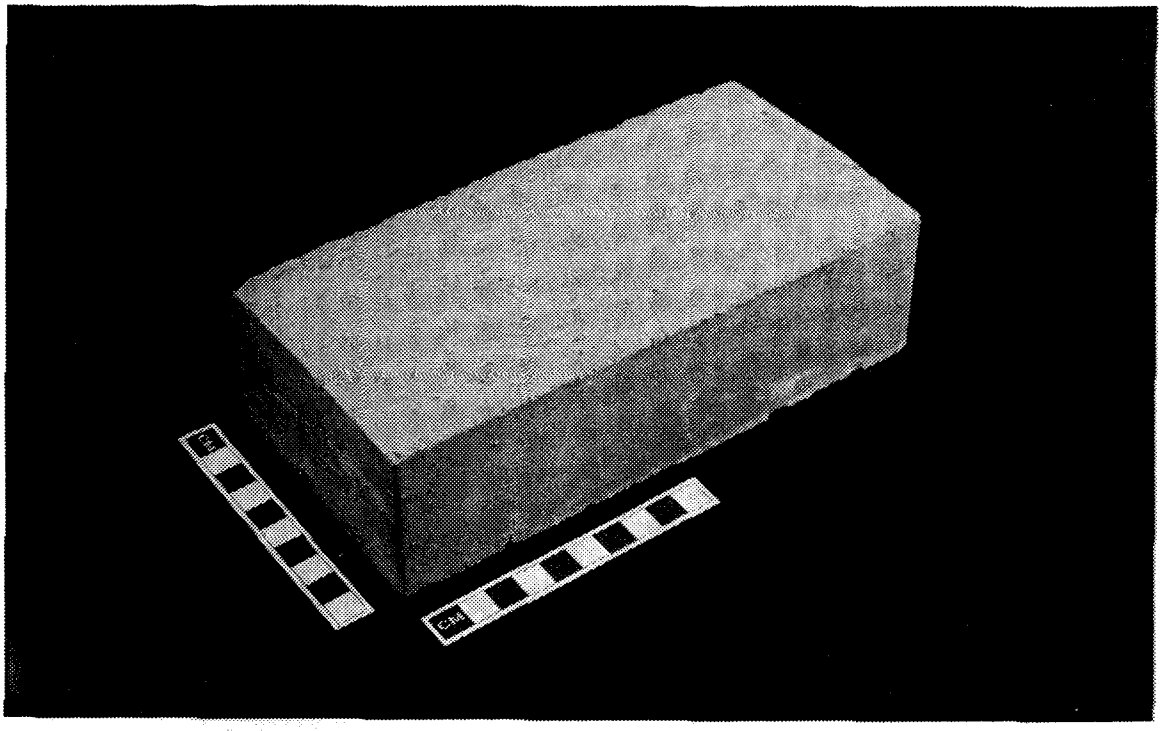


Figure 6.44 Late Estevan paving brick.

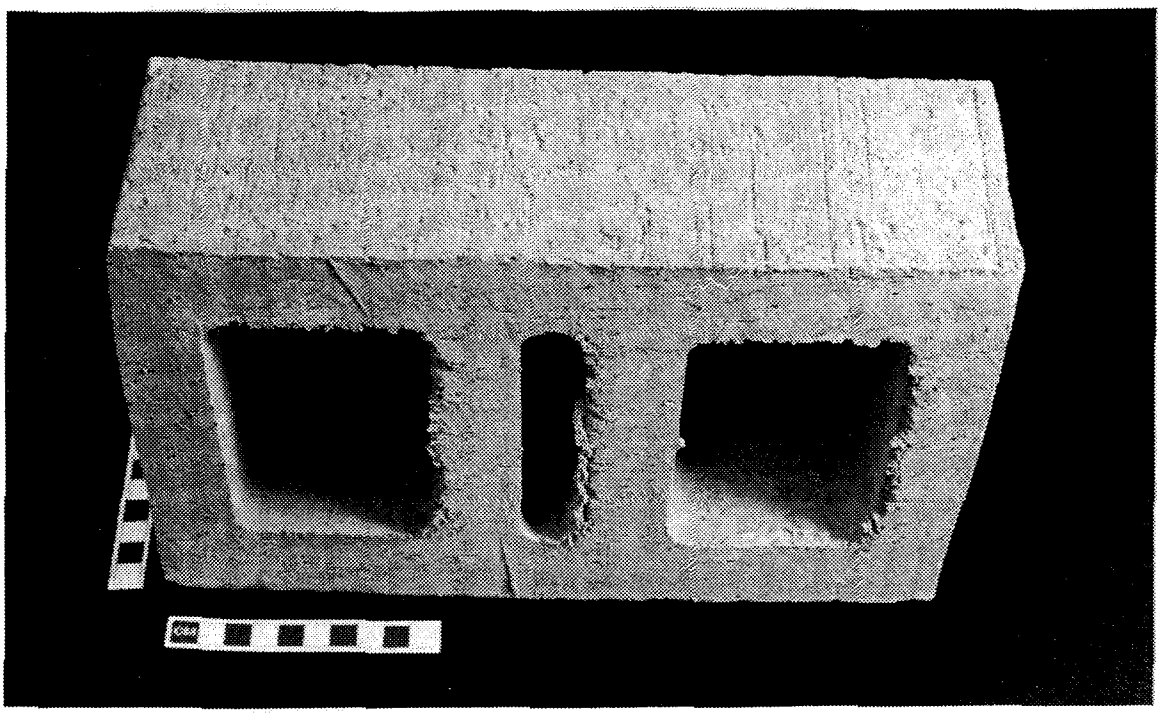


Figure 6.45 Late Estevan three-cell tile block.

first brick chipping-machine in Western Canada (Saskatchewan Minerals 1958:3). All brick continued to be side-cut stiff-mud in terms of basic process, along with some tile product which seems to have been of minimal production by the 1960s in comparison to brick.

The kilns at Estevan had originally been a mix of Dutch, beehive down-draft and possibly a rectangular down-draft, although the 1944 to 1951 period seems to have mostly relied upon the coal-fired Dutch versions. When the tunnel was built in 1951, being originally heated with oil and then switched to natural gas in the later 1950s, the ability to produce a great deal more product more efficiently was created (Saskatchewan Minerals 1958:2). This also signalled the final separation of coal and clay that had been a part of the plant's heritage since its inception.

In summary, the Estevan Brick Ltd. site is one of great significance in the history of the Saskatchewan brick industry, although archaeologically it appears limited to its later, modern phase. However, as this later phase was its most significant both in an individual and provincial sense, the value of further study here is considerable.

6.5 Boundary Dam

A second brickmaking site exists in the Estevan area, two km south and slightly west of the city near the present Boundary Dam. Two beehive kilns, one intact and one with a collapsed roof, are the most noticeable aspects of the site, along with a large clay pile and brick, stone, and concrete foundations for mounting a

substantial amount of machinery (Figures 6.46, 6.47). Despite its distinctive appearance, there has long been mystery as to the site's original usage and company affiliation. Andrew King, who wrote a history of Estevan in 1967, believed it to be the original site of the later Estevan Brick Ltd., and that the operation moved in the mid-1920s to the present site when International Clay Products was formed (King 1967:37). This is partially understandable as the older Estevan Coal and Brick Co. Ltd. site was rebuilt substantially in 1925 when it became International Clay Products. However, photographs from the Eureka Coal and Brick Co. (1902-1911) and Estevan Coal and Brick Co. (1911-1925) periods clearly show that the site location was unchanged from 1902 through to 1996, despite the two plant rebuildings. In addition, inspection of the Boundary Dam site in 1995 did not indicate the expected degree of disturbance from the coal-mining activity which occurred during the operation of the Eureka Coal and Brick and Estevan Coal and Brick companies.

One of four companies listed under the incorporation section of the *Saskatchewan Gazette* from 1910 to 1914 may be the original company affiliated with the site. These companies were:

- Estevan Sewer Pipe & Clay Products Co. Ltd., incorporated in 1910 (Province of Saskatchewan 1910a:13)
- Saskatchewan Sewer Pipe and Brick Co. Ltd., incorporated in 1912 (Province of Saskatchewan 1912a:25)
- Great West Brick and Coal Co. Ltd., incorporated in 1912 (Province of Saskatchewan 1912c:13)
- Estevan Clay and Pottery Co. Ltd., incorporated in 1914 (Province of Saskatchewan 1914a:18)

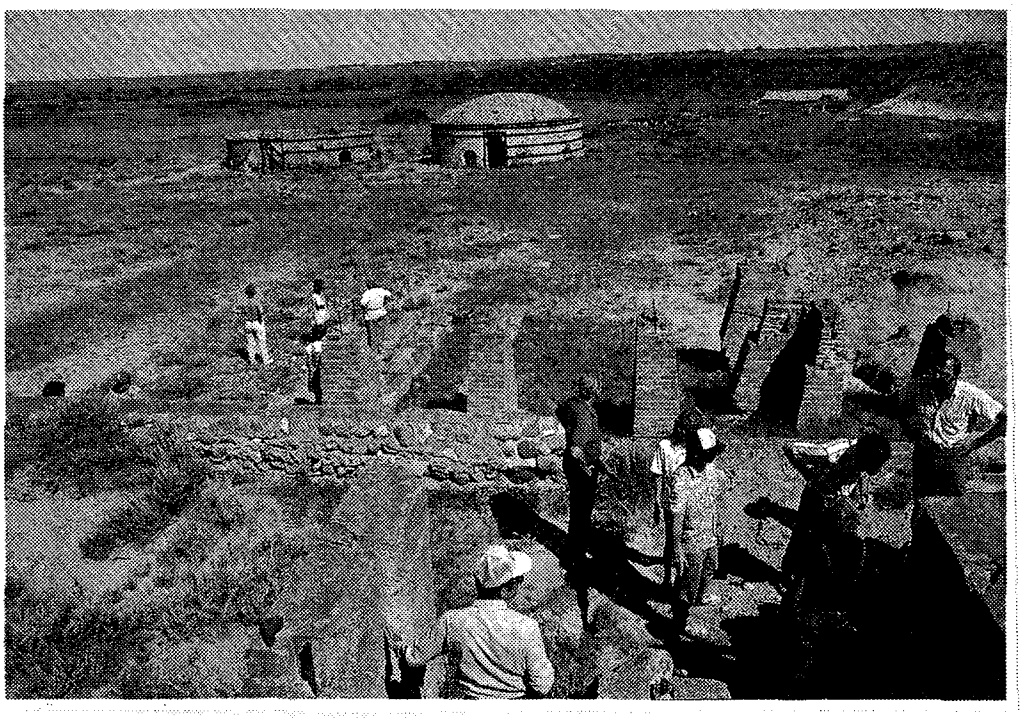


Figure 6.46 Boundary Dam brickmaking site in 1992. Courtesy T. Jones, photographer.

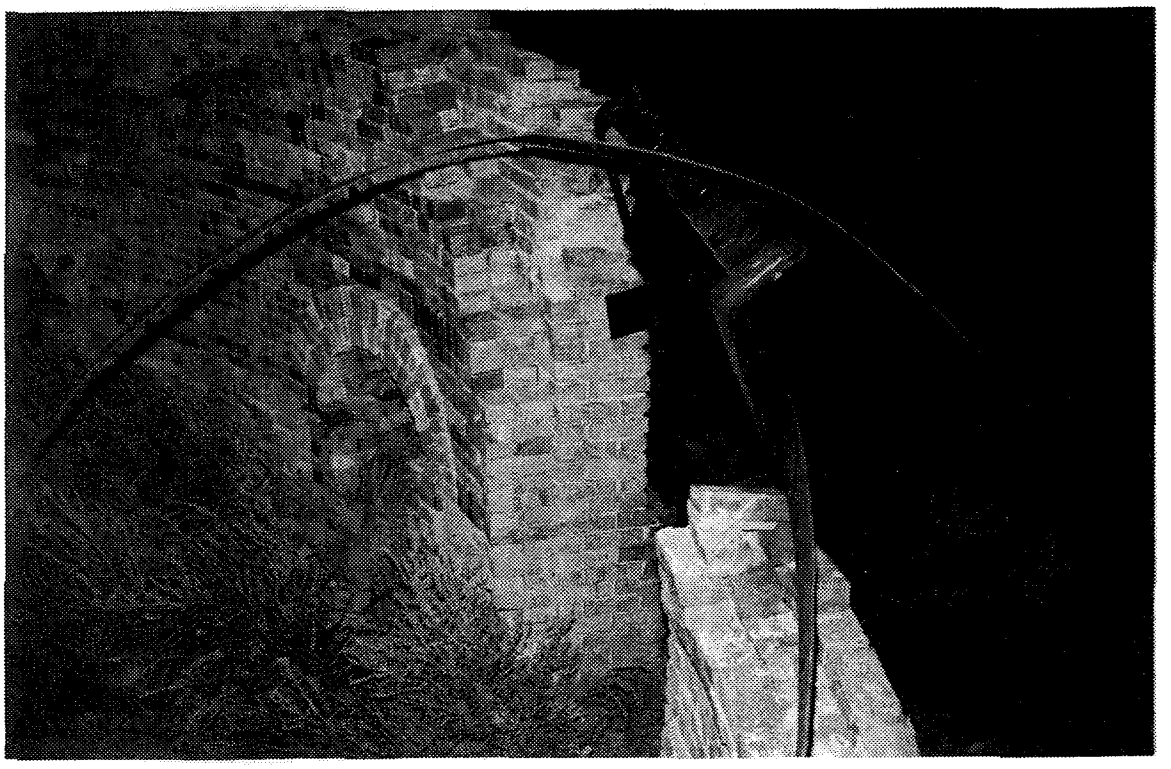


Figure 6.47 Boundary Dam site, detail of collapsed kiln in 1995.

All companies had head offices in Estevan but there is no known documentation of any constructing a manufacturing facility. A letter written on behalf of the Estevan Board of Trade in 1911 noted that "[i]t is quite likely that a sewer pipes works will be erected this summer" (Peel 1973:microfilm #1982), while an earlier 1908 booklet from the same agency found that "a pottery and sewer pipe plant should prosper under experienced and capable management" (Estevan Board of Trade 1908:23, 25). A further variation of brickmaking was announced in a 1912 newspaper article which stated, "the coming spring will see a new and much needed departure in the brick industry—the manufacture of hollow brick or fireproofing (structural tile)" (*Estevan Mercury* [*EM*]26 December 1912:9). It is probable that the site in question was the result of pursuing such opportunity during the pre-WWI boom period, with brief production preceding a permanent closure.

One sample brick collected near the kilns may have been made on this site, being an orange to yellowish-orange, side-cut stiff-mud specimen similar to Shand bricks (Figures 6.48, 6.49) However, it has an extremely heterogeneous texture of varying clays that appear to have been poorly mixed prior to forming, leading to a present state of surface exfoliation. Keele (1924:136) calls this defect 'lamination', a particular problem with auger-driven stiff-mud machines, the most-common of that era.

Further examination of the site will be necessary to confirm what, if any products, were manufactured, and who was responsible. It constitutes an intriguing 'mystery' brickmaking

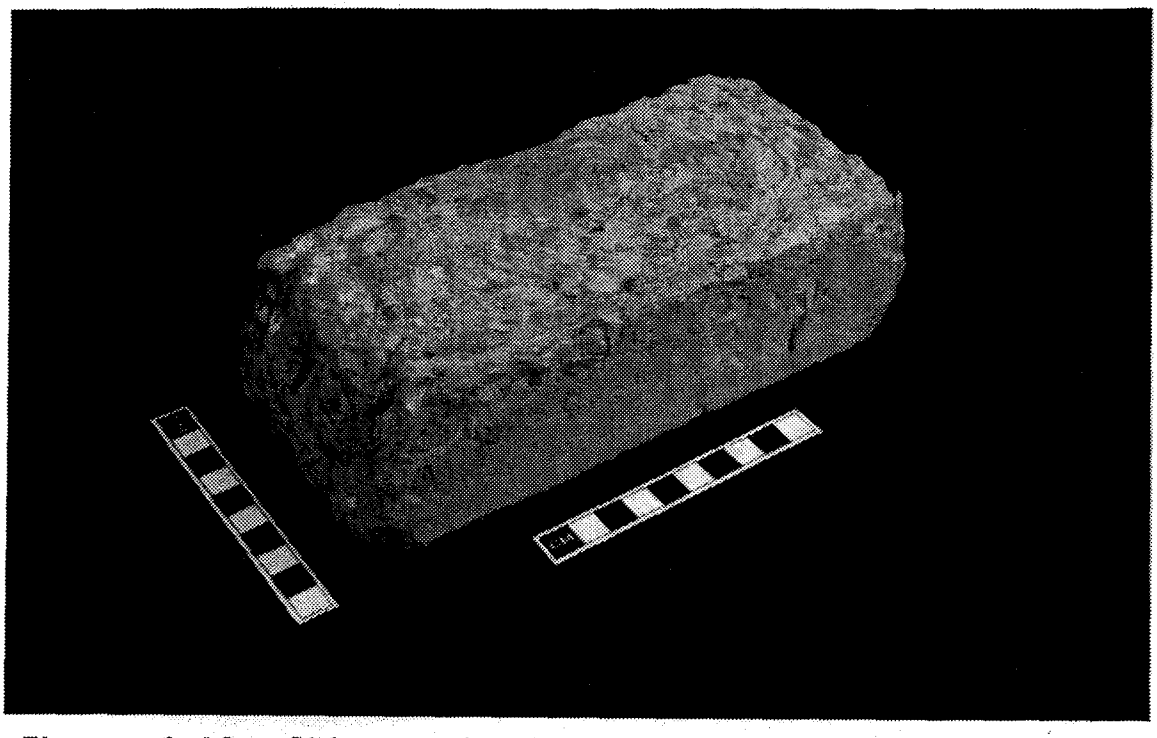


Figure 6.48 Side-cut brick possibly attributable to the Boundary Dam site, fragmented side up.

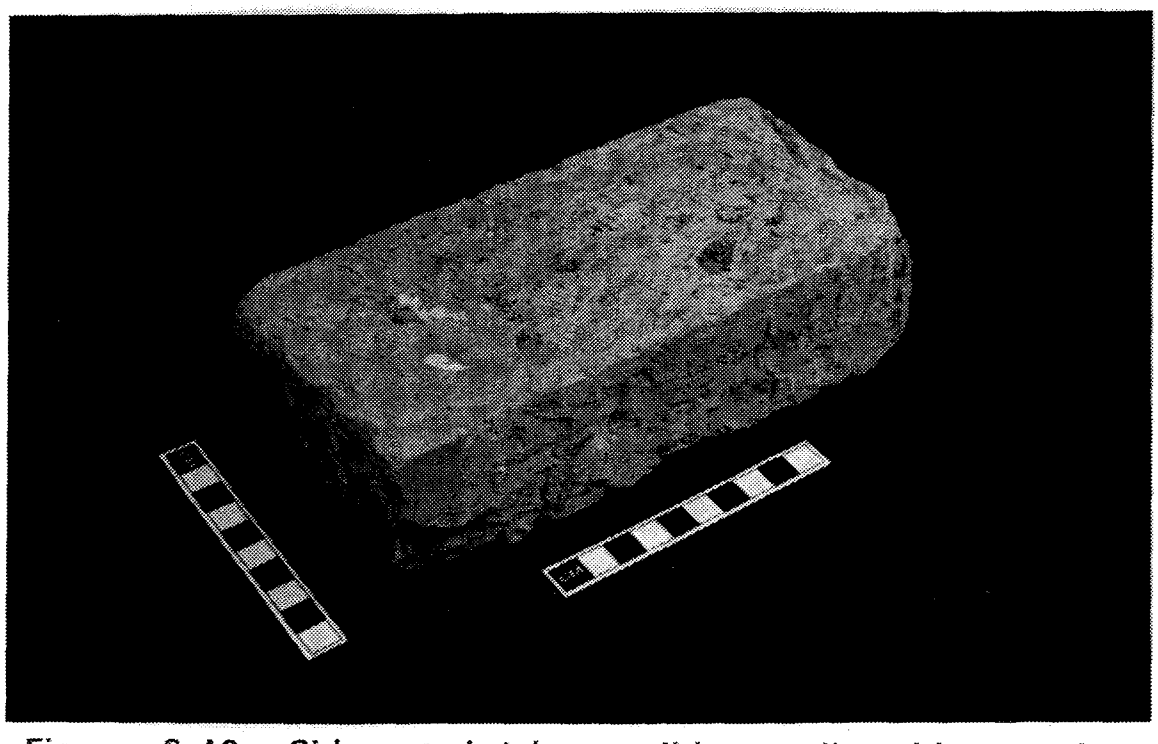


Figure 6.49 Side-cut brick possibly attributable to the Boundary Dam site, fragmented side down.

site representing considerable investment, likely in the pre-WWI boom period.

6.6 Floral

The Floral site represents the brief operation, or attempted operation, of the Canadian Clay Products Ltd. at a location four km southeast of Saskatoon (Figure 6.50). It was incorporated in 1912 and constructed a year later as a stiff-mud operation, possibly with an intent to produce tile products in addition to brick (Province of Saskatchewan 1912b:14; *Daily Star* 8 May). Joseph Keele (1915b:14) notes from his 1913 visit to the site that drying of the clay without cracking was a major challenge at Floral, with pre-heating of the clay being the only possible, although uneconomic, method of alleviating this problem (Figure 6.51). Keele (1915b:15) adds that some preliminary tests of the site's clay had been undertaken by "a firm of clayworking machinery makers in the United States" with good results, but that this did not guarantee the ability to make satisfactory brick under actual working conditions. The boom-era rush to supply building materials likely influenced the company's quick formation and insufficient on-site testing. Despite Keele's report, a much later local history states that the Floral operation made "[s]everal batches of first class bricks" before the general economic conditions deteriorated (Floral History Book Committee 1985:21).

Examination of the site itself suggests that the operation suffered many problems and may not have produced any saleable

Figure 6.50 Floral brickmaking site in 1996.

Figure 6.51 Clay source pit at Floral in 1913. From Keele 1915b:Plate III.

product (see Figure 6.52 for map of site). Although the brick samples recovered are from a brick refuse pile on the site, with the attendant problems of judging a given firm by such product, substantial cracking is seen on all examples along with large

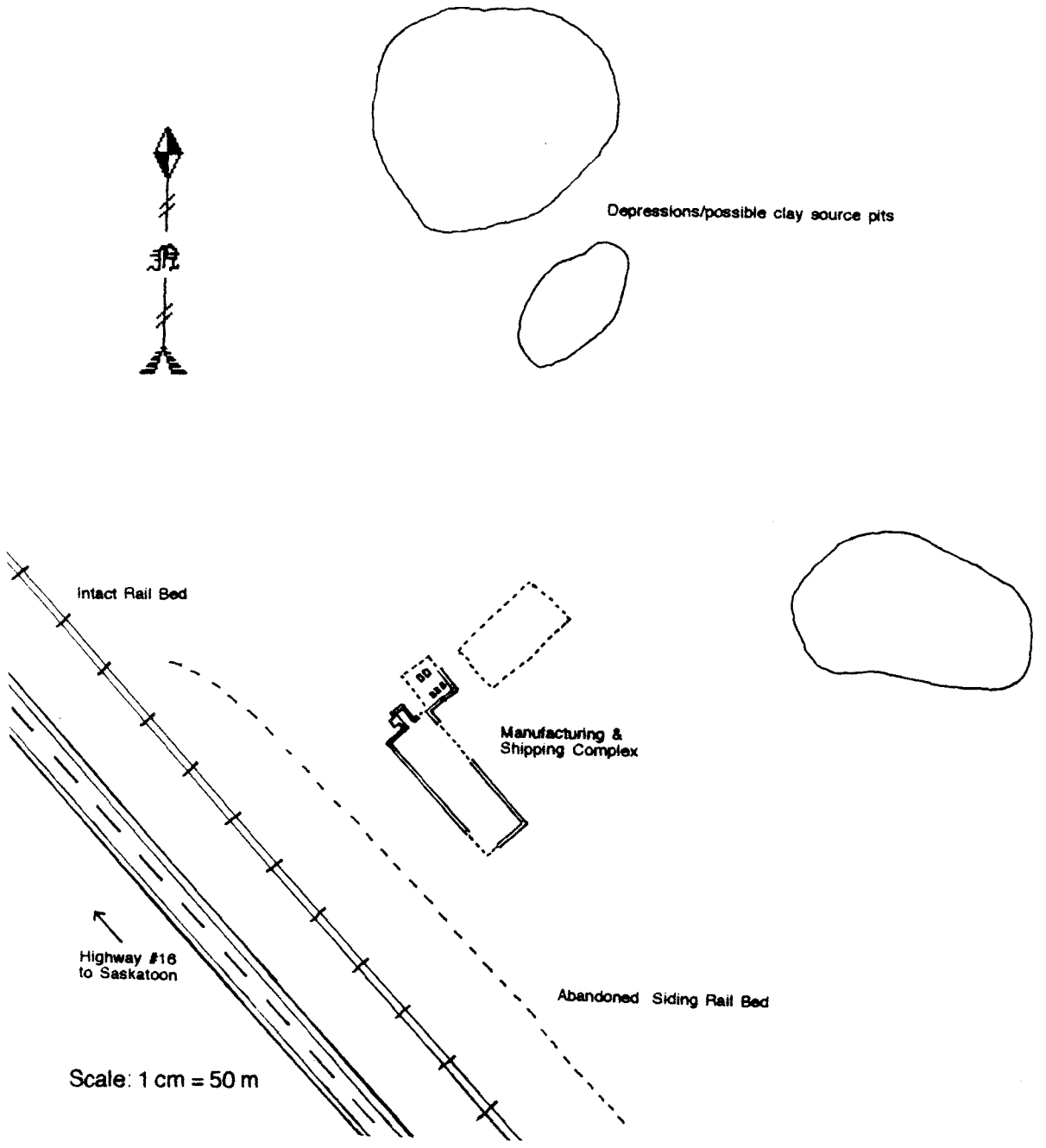


Figure 6.52 Map of Floral site as examined in 1996.

limestone inclusions and an overall soft, underfired character with a pale orange or salmon colour (Figures 6.53, 6.54, 6.55, 6.56, 6.57). In terms of process, both end-cut and side-cut variations were undertaken. One of the end-cut types is unique in having two square, longitudinal holes or perforations, along with fine raised lines on two of the outer surfaces. Other types found were an end-cut without the longitudinal perforations but with sunken, nail-dragged lines on two of the outer surfaces; a plain end-cut with a smooth exterior; and a side-cut with three round perforations and a smooth exterior. Such a variety suggests a large measure of innovation was occurring at the brickplant, perhaps in an attempt to create a marketable product despite the operational problems.

A large number of concrete foundations and machinery-mounting pedestals cover the manufacturing site, with the size of the main structure being approximately 16 x 50 m (Figures 6.58, 6.59, 6.60). This suggests an enterprise involving considerable investment which correlates with the $150,000 of capital that the company possessed at the time of incorporation (Province of Saskatchewan 1912b:14). Construction of such a large-scale operation without full testing of the resource to be exploited is analogous to many failed hard-rock mining ventures where large amounts of capital were raised and quickly used for site construction without proper testing of the ore-bodies. Within Saskatchewan brickmaking this site is then valuable for representing the failures which could occur within a volatile economic period such as the pre-WWI boom.

Figure 6.53 Floral end-cut, two-longitudinal-hole perforated, (faintly) textured brick.

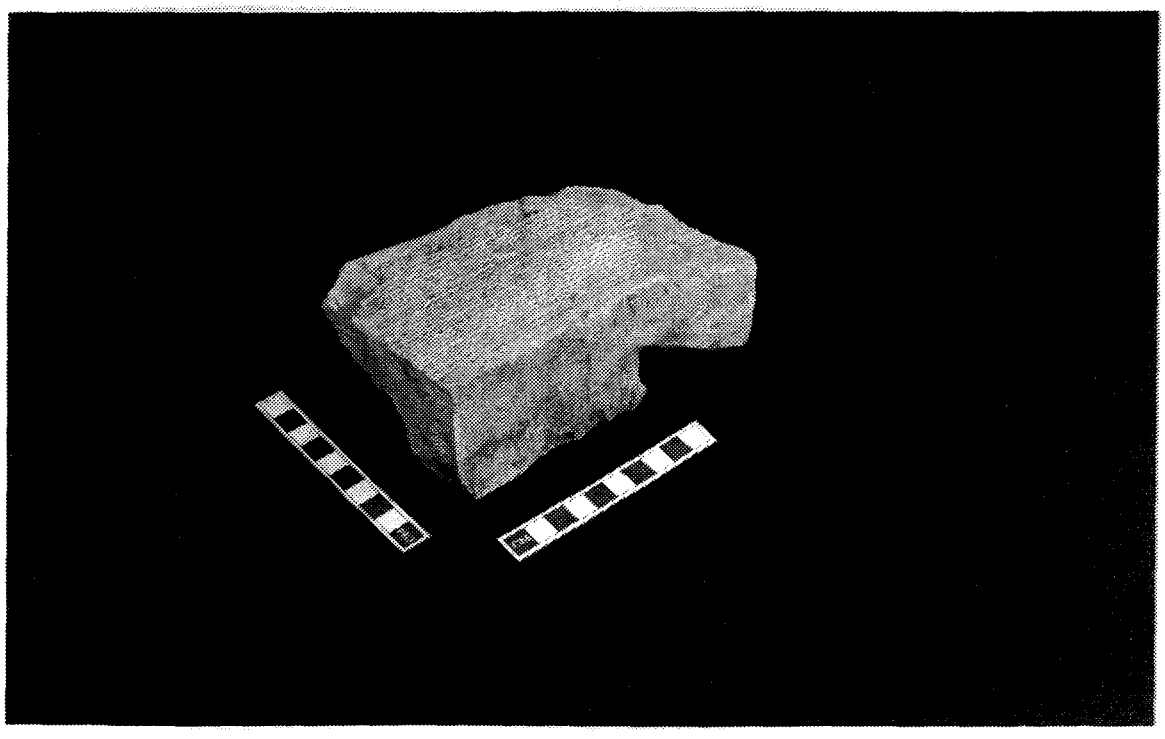


Figure 6.54 Floral end-cut, non-perforated, textured brick.

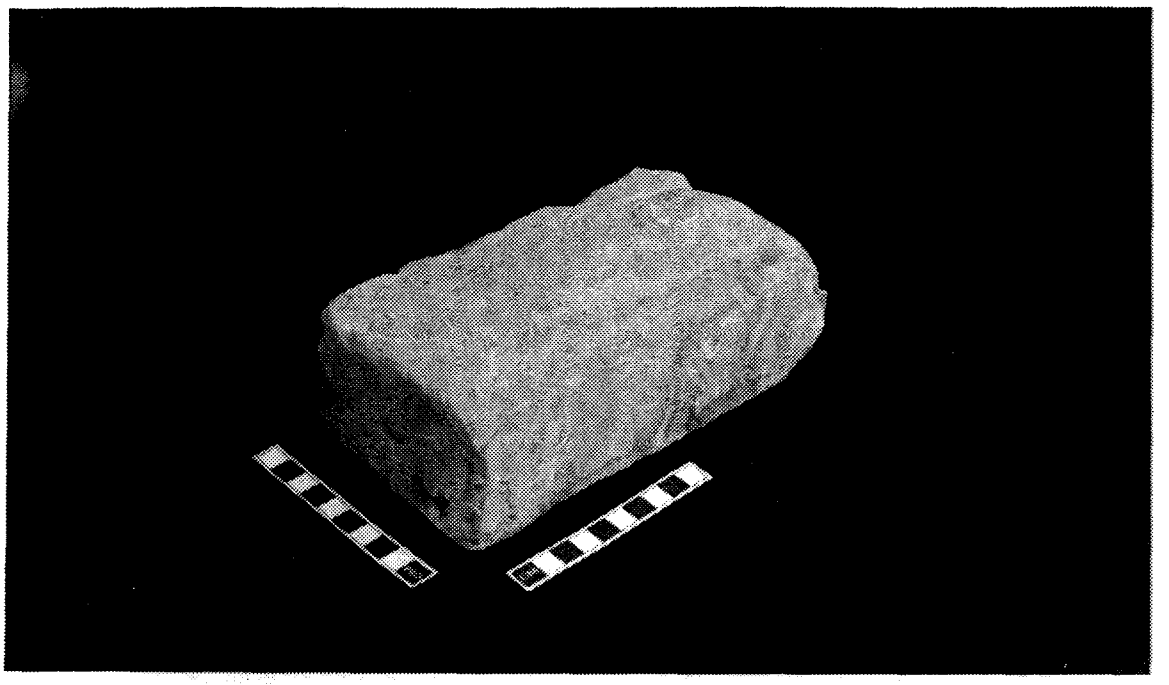


Figure 6.55 Floral end-cut, plain brick.

Figure 6.56 Floral side-cut, three-hole-perforated, non-textured brick.

Figure 6.57 Floral clinker brick.

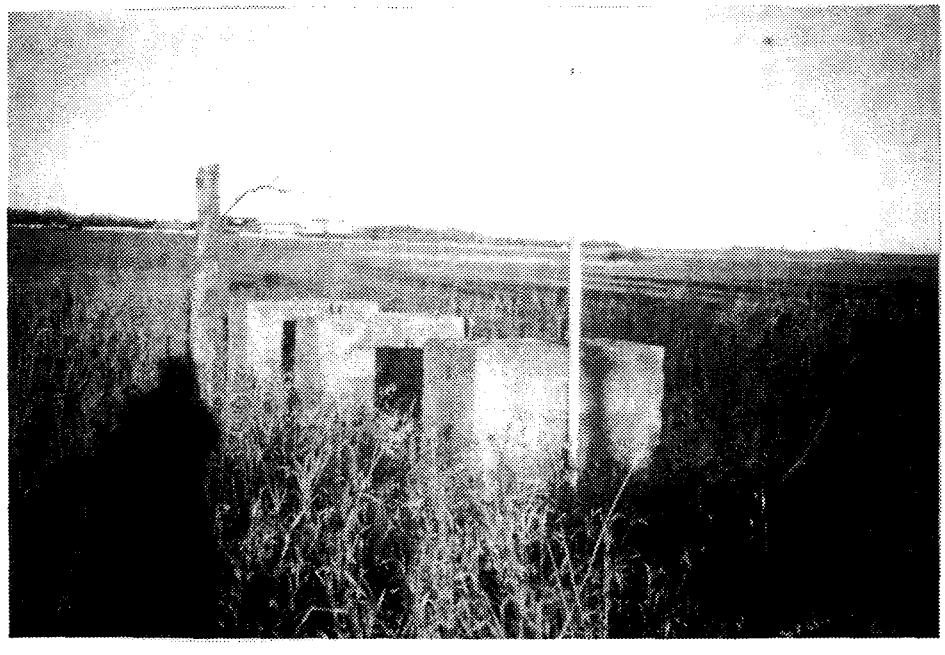


Figure 6.58 Floral site in 1996, three concrete machinery-mounting pedestals, about 80 cm in height.

Figure 6.59 Floral site, foundations uncovered in 1996. K. Gadd, photographer.

Figure 6.60 Floral site, machinery-mounting pad uncovered in 1996.

6.7 Wellington White, Moose Jaw

Wellington White was a prominent early Saskatchewan business man who first established a brickyard in Prince Albert in 1893, then began a brickyard in Moose Jaw in 1898, where he also moved (Black 1913:417; Knight 1982:28). Strong local demand for brick prompted an expansion to year-round brickplant status in 1902, with two down-draft kilns being installed. In the years following, White's brickplant was the first to produce firebrick in the province, with clays from the Dirt Hills areas to the southeast of Moose Jaw (Saunders et al. 1992:4-5, 28). White ceased operations by 1914 (Knight 1982:28).

The site of Wellington White's brickmaking is well-known in Moose Jaw but exhibits little evidence of its past (Figure 6.61). Significant disturbance has occurred from the later construction of electrical-transmission towers on the site as well as from water erosion due in part to the site's unstable river-bank location. Examination in 1997 showed no surface evidence of any foundations, but a recently exposed cutbank displayed a stratum of fragmented brick about 30 cm below the grade surface. From this layer a clinker brick had fallen, with the distinctive brand 'W.W.M.J.' in the frog representing 'Wellington White, Moose Jaw' (Figures 6.62, 6.63, 6.64). Presently the only sample, this brick's colour is a light brown to grey on all sides but the bottom, which is a deep red likely more indicative of the actual hue of White's product. The soft-mud process was used, with this specimen appearing to be a regular facebrick variety (Figure 6.65). Distinctive marks show where adjoining bricks pressed into the

specimen during the excessive phase of firing, on the sides perpendicular to the frog.

The Moose Jaw site of Wellington White appears to have limited archaeological potential in comparison to other brickplant sites but still merits further examination due to its significance as a combined facebrick and firebrick manufacturer in the province prior to Claybank. In terms of firebrick production it also possibly predates the Vancouver Fireclay Company of Clayburn, British Columbia, which began operations in 1905 (Adams 1976:4), making this potentially the earliest firebrick manufacturing location in Western Canada, and perhaps nation-wide. Quebec is the only other province to have early firebrick manufacturing, which was occurring by 1913. However, the clay for this use did not originate in the province but was imported from New Jersey (Keele 1915a: 138).

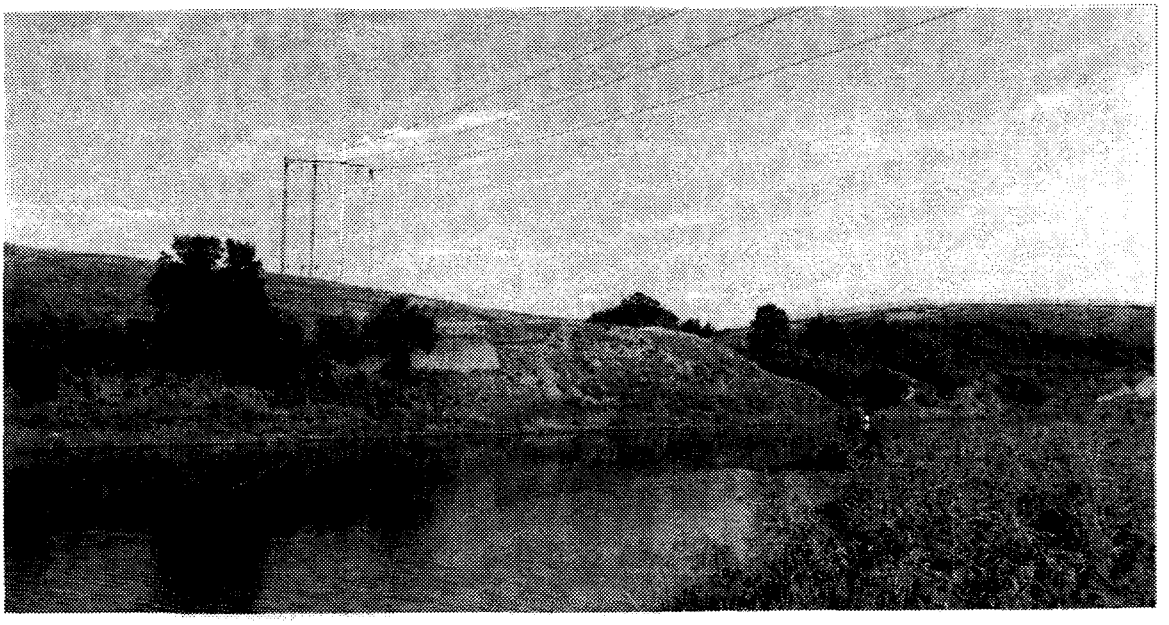


Figure 6.61 Moose Jaw brickmaking site of W. White in 1997.

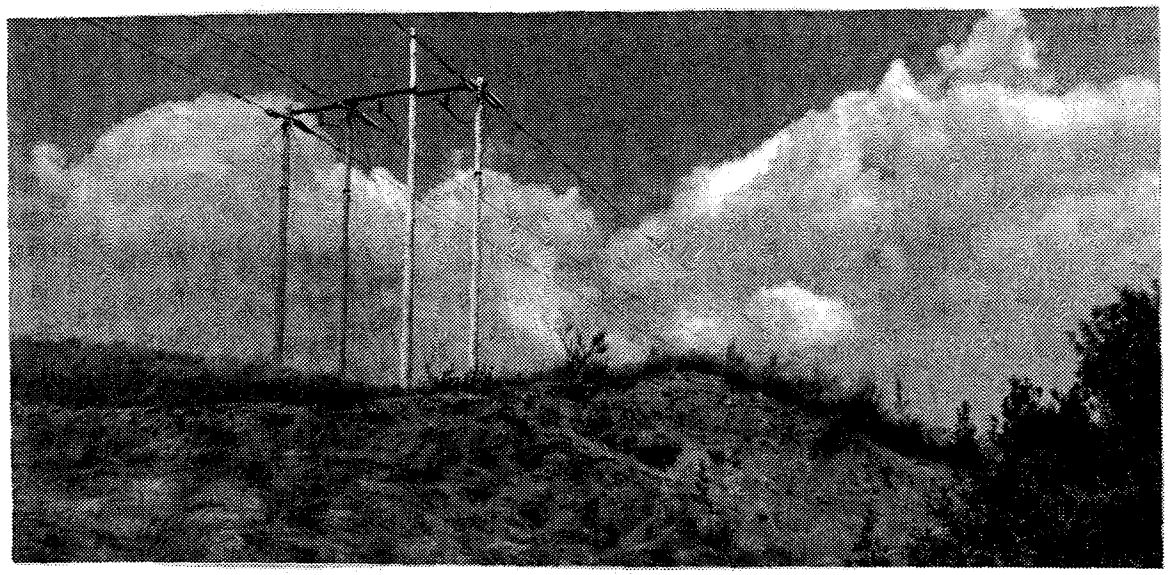


Figure 6.62 Moose Jaw site showing cutbank.

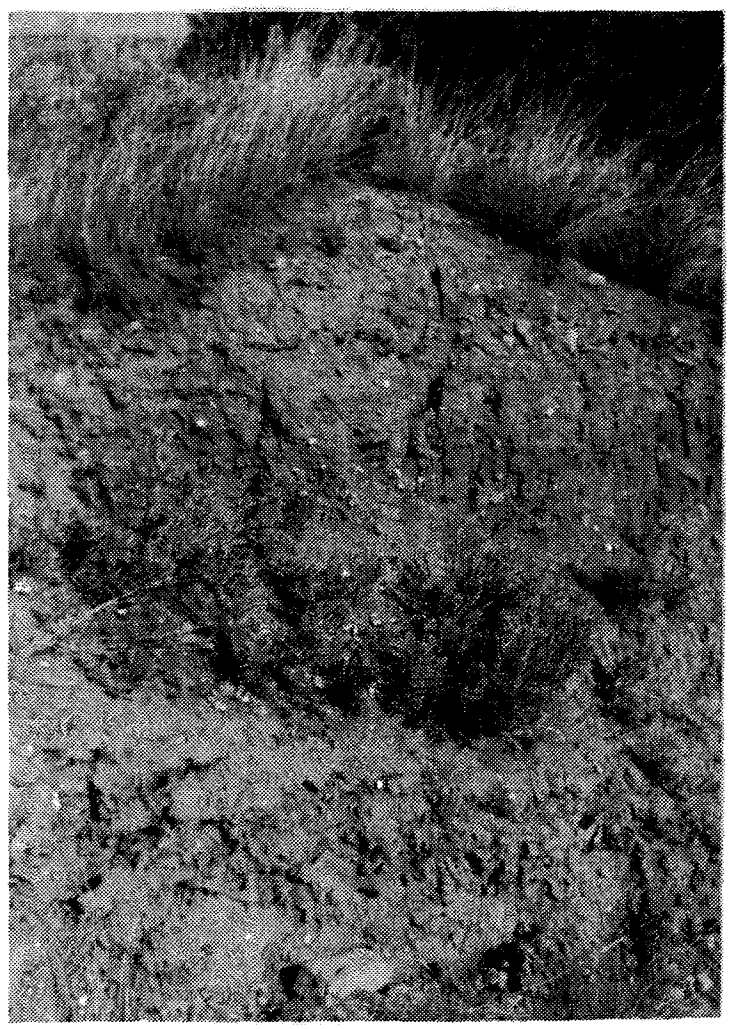


Figure 6.63 Close-up of cutbank at Moose Jaw, brick lies at bottom.

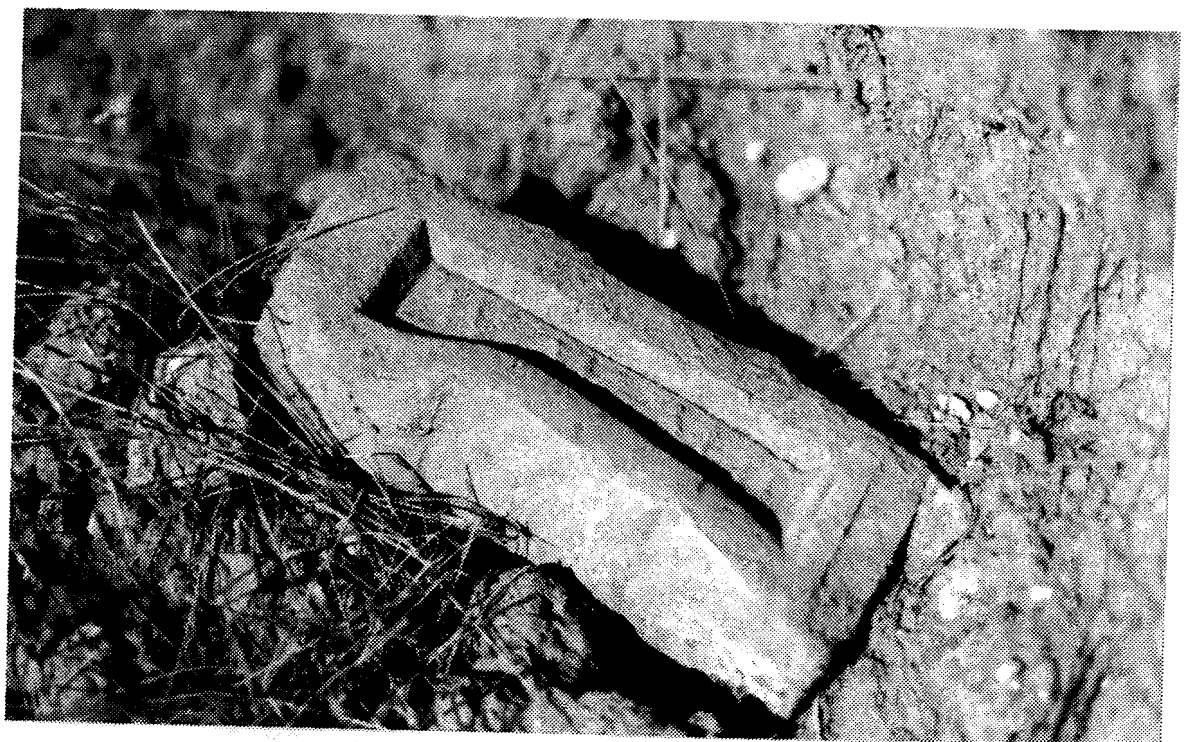


Figure 6.64 Moose Jaw brick in situ.

Figure 6.65 'W.W.M.J.' clinker brick.

An affiliated feature of the Moose Jaw site is the large house that Wellington White built from his product in about 1908, on the location where he had previously built a smaller brick house. (Knight 1982:29) (Figure 6.66).

Figure 6.66 Later house of W. White, Moose Jaw in 1997. House built c.1908.

6.8 Saskatoon Brick & Supply Co. Ltd.

The final site to be considered is an example much different than any of the sites previously examined. This difference lies in the fact that the brick product from this operation was not made from burnt clay, or in fact any form of clay, but instead of sand and lime. While this could be excluded from a strict discussion of burnt clay items, the sand-lime category both imitated

conventional bricks closely and competed in the same markets to such a degree that it warrants inclusion in this research, having been included in several other reports predominantly focused on burnt clay products (Keele 1915a; Hammond 1981; Manson 1983).

Sand-lime bricks are made from sand mixed with lime and water, which after the addition of any metallic oxides to yield colours other than a neutral grey, are dry-pressed much like dry-press burnt clay bricks. However, they are not fired or burnt in kilns but are cured under steam pressure in autoclaves for several hours. Properly manufactured, the resulting product resembles a good quality dry-press clay brick, with similar qualities of size uniformity and a tendency for the well-defined edges to crumble during rough handling (Keele 1915a:140-141). Sand-lime brick is sometimes classified as a calcium-silicate brick (Hammond 1981:29), although Keele cautions against such description as true calcium-silicate or silica bricks are made from pure crushed quartzite in place of sand, resulting in a product used in demanding refractory applications (Keele 1915a:145).

The sand-lime process was developed in Germany in the later 1800s and was used in North America by the early 1900s (Keele 1915a:140). Due to the expense of the lime and the machinery needed to make a good product, sand-lime manufacturing facilities were generally set up where good clay was not present but demand for brick product was strong (Manson 1983:25). In Saskatchewan this was true in both of its major urban centres, Saskatoon and Regina, leading to two brickplants of sand-lime product being constructed. The first plant was set up at Pilot Butte, just outside

Regina, by 1908 and was called Inter-Ocean Pressed Brick Co. (Black 1913:314). The second plant, located in Saskatoon at 17th Street and Avenue P, was set up in 1910 and called Saskatoon Brick & Supply Co. Ltd. (*Saskatoon Phoenix* [*SP*] August 1914).

The developer of Saskatoon Brick & Supply was James W. Wilson, who managed the operation through the difficult WWI years until approximately 1926 (Henderson Directories Limited 1926, 1927). During this time, particularly in the pre-WWI boom period, this plant supplied product for most of Saskatoon's brick construction, including all public schools and many business blocks, warehouses, apartment blocks, and churches (*SP* 1914 August; Saskatoon Writer's Club 1981:67). In many of these examples other facings such as stone or burnt clay facebrick were used on the exteriors or façades while the sand-lime product was used either as interior structural brick or along the sides and backs. One current example, the Tees & Persse warehouse at 331 First Avenue North (*SP* 1914), has uncoloured grey sand-lime brick on the sides and back while being faced with red-coloured sand-lime brick on the front. Because of the metallic oxides used for colouring, the coloured sand-lime brick would have been more expensive than plain, which had a dull, cement-like appearance (Keele 1915a:141).

The Saskatoon Brick & Supply enterprise was sold, probably in the late 1920s, to the Quaker Oats Company which operated a large milling operation directly to the east of the brickplant site (Saskatoon Writer's Club 1981:67). Only one, central structure had existed on the site, and this was reused by Quaker Oats for many decades. The structure survives today in essentially the same

condition as when it was last used for brickmaking but without the actual machinery. On the rear (north side) of the building, the name 'Saskatoon Brick & Supply Co. Ltd.' can still be seen (Figures 6.67, 6.68).

Being a reused industrial site, there is no sign of a brick refuse pile as at most other brickplant sites in the province. However, there is likely significant below-ground evidence of the brickmaking in the yard surrounding the main structure where brick product was stored before shipment. In terms of product sample, it is likely that several sand-lime bricks collected from the demolished Thornton School in Saskatoon were made at Saskatoon Brick & Supply (Figure 6.69). In this instance, red 'pressed' (repressed soft-mud) brick was imported from Alberta and used on the front on the school, while plain grey sand-lime brick was used for structural purposes. They have a chalky surface texture (due to the lime) with sand-grains being easily visible. The corners and edges are significantly eroded with no markings on any surfaces from either branding or cutting, suggesting the dry-press forming method. A plain, grey sand-lime specimen collected at the Floral brickmaking site near Saskatoon matches the specimens from the school. Dimensions in all examples are very similar.

The Saskatoon Brick & Supply site is significant in regard to the degree to which its product was used in the boom-era city of Saskatoon, fulfilling a strong demand for locally available brick product even if an alternative technology was required. The Floral

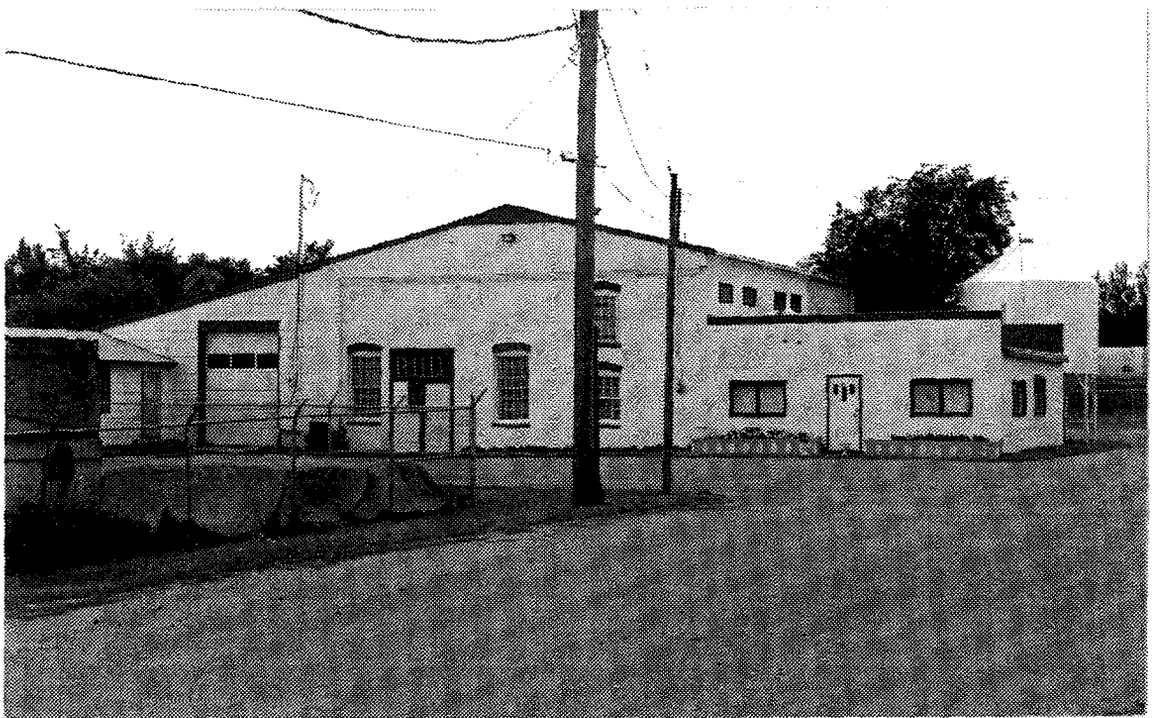


Figure 6.67 Front of former Saskatoon Brick & Supply Co. Ltd. in 1997.

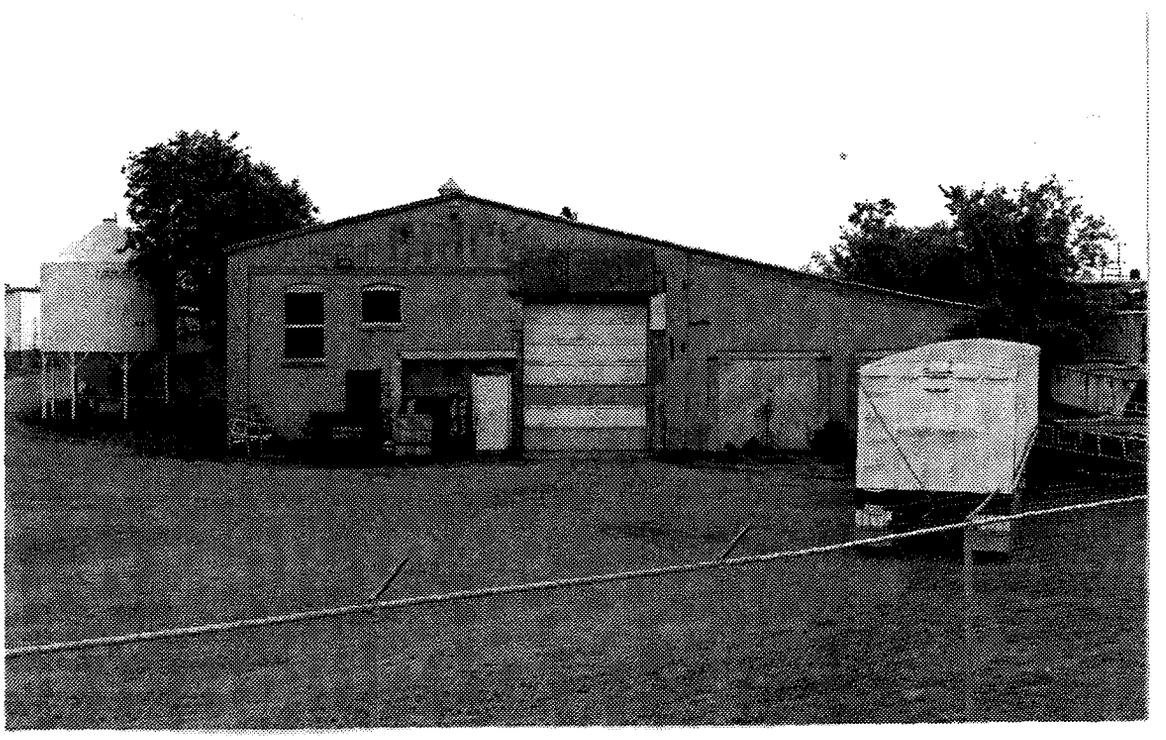


Figure 6.68 Back of former Saskatoon Brick & Supply Co. Ltd. in 1997.

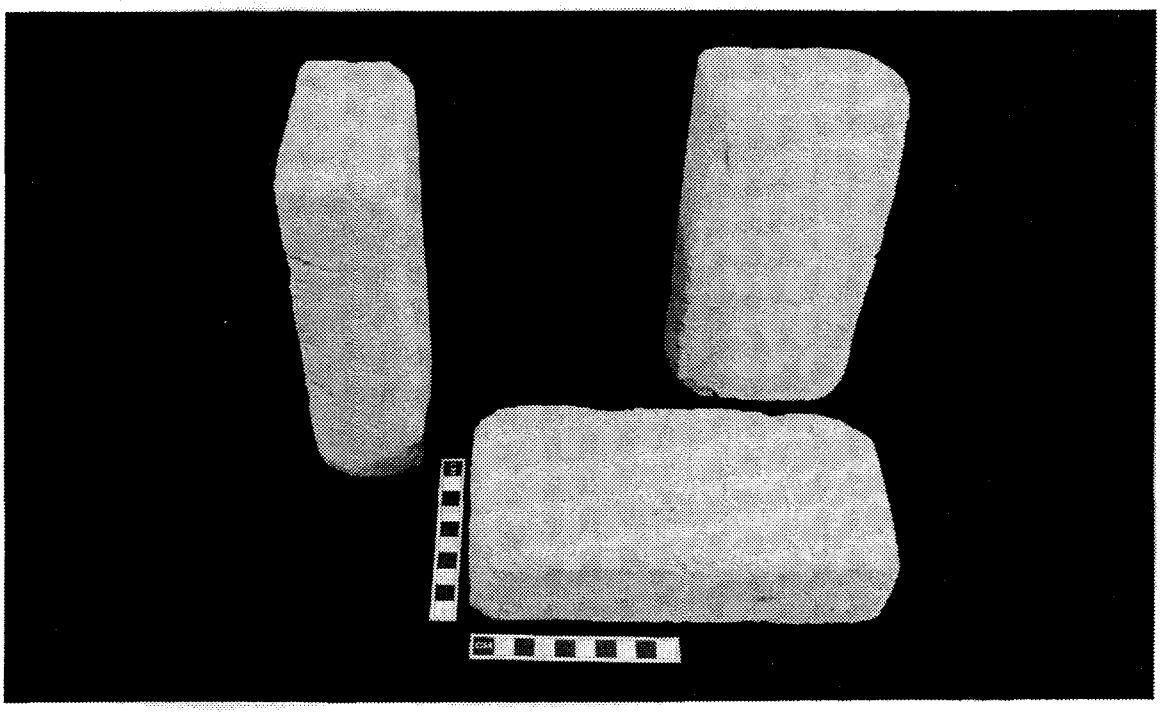


Figure 6.69 Sand-lime bricks likely made at Saskatoon Brick & Supply Co. Ltd.

site reviewed earlier attempted to tap this same urban market with conventional technology and failed when its clay source proved unusable.

Beyond the important role that Saskatoon Brick & Supply played in the building of modern Saskatoon, its technology foreshadowed an important product development three decades away—light concrete aggregate. This had its roots in a variation of the sand-lime process called the 'ante-fired process' where clay with poor drying characteristics was used instead of sand. The clay would first be fired or burnt in its raw state, then reground and mixed with lime and steam-hardened in the same manner as sand-lime brickmaking (Keele 1915a:121-122). A company which planned to make brick by this method was established at Davidson in 1913, but it seems to have quickly folded (Province of Saskatchewan

1913a:16; Keele 1915b:15). However, by the 1950s the burnt and ground clay was being combined with actual cement to produce light-weight concrete-aggregate 'cinder' blocks and bricks. These had a significant competitive effect on the burnt clay industry as previously noted, especially in the realm of structural tile. Previously the burnt clay products had possessed great weight advantage over the pure cement blocks, but ironically it was the inclusion of the ground burnt clay with the cement that made the new concrete blocks a competitive, viable product in the brick market.

6.9 Summary

The brickmaking industry in Saskatchewan became well developed in its over 100 years of activity, with various archaeological sites presently known representing both the many social and economic phases of the province, and the various technological innovations and evolutions that are typical across North America. Sites vary in age from the fur-trade era to the present generation and represent a scale from small single-purpose efforts to large, fully industrialized operations. Such variation allows a comprehensive research of this field, particularly with one of the longest-running and most significant locations, Claybank, preserved intact as a National Historic Site.

Overall, the usefulness of archaeological research involving brickmaking sites and their material culture within historical study is evident from the information which can be derived. In several cases such as Karilowa and Fort Carlton, no historical

documentation existed, and often when information was available there was considerable contradiction. A recent local history extolled the virtues of Floral's brickmaking while onsite investigation suggested that this was far from true, supporting an early geological opinion of the site. Even the large, established site of Estevan Brick Ltd. had its original location in substantial doubt judging from documentary sources, with archaeological investigation again helping to sort out this issue.

Hopefully, archaeological research will continue in this domain, both at well-preserved sites such as Claybank and at the lesser known and more disturbed examples, recognizing that all contributed to the development of this provincial industry.

Chapter 7 Conclusions

7.1 Economic Summary of the Saskatchewan Brickmaking Industry

Many economic issues were raised in the course of this research, of which some of the more significant examples will be reviewed here. Some of these issues relate to the level of demand present, or not present, in the home market of the province, and how this affected the level of the industry's development. Also, during its operating period, Saskatchewan's brickmaking industry was affected by import competition from outside the provincial borders while being a significant export competitor itself. Hopefully this discussion will assist in providing a more balanced view of the industry than simply discussion of technology alone would permit.

Of the four western Canadian provinces, Saskatchewan had the lowest production up to WWI, and was never able to surpass that of its western neighbour, Alberta, despite having the advantage of the largest and highest quality clay resources of the prairie provinces. This proved to be a lesser advantage than inexpensive firing. For instance, in 1934, A. H. A. Anderson found that "[t]he plants at Redcliff and Medicine Hat, Alberta,...although having to contend with a type of [local] clay which is difficult to process, are able to meet competition on account of the cheap natural gas at

their disposal" (Robinson 1934:22). Manitoba meanwhile had the largest brick market with Western Canada's first major city, Winnipeg, possessing insatiable demand before 1910, despite both poor clay and fuel attributes locally. It therefore held the position of largest brick producer of the prairie provinces in this time, which would drop to smallest by 1930 (Keele 1911:182; Ries and Keele 1912:152; Hutt 1932:19,20).

Beyond Western Canada, the production and usage of brick products was much larger. The 1965 *Encyclopedia Canadiana* noted that,

> The industry is heavily concentrated in Ontario and Quebec where bricks are used relatively much more for building purposes than in other parts of the country. The census shows that the main material used in the construction of dwellings in Ontario has been brick in 46 p.c. [percent] of cases, as compared with 6 p.c. in the Western Provinces and 2 p.c. in the Maritime Provinces [Brick and Tile Industry 1965:59].

These findings are reinforced by examining the total number of establishments making products from Canadian clay versus the number of Saskatchewan establishments in the same period. For example, in 1921, 220 Canadian manufacturers are noted, with a gross product value of $8,857,818 (Dominion Bureau of Statistics 1962:3). This compares with Saskatchewan in 1921 having seven manufacturers with a gross value of $152,243 (Worcester 1950:48). This amounts to only 3.2 percent of the national total of manufacturing establishments, and 1.7 percent of the national gross product value. Later values, such as in 1946, show these percentages little changed, being at 3.1 percent of the national

total of manufacturing establishments, and 3.4 percent of the national gross product value (Worcester 1950:50; Dominion Bureau of Statistics 1962:3). These last values do show that despite the small number of Saskatchewan brickmaking firms, the production per plant in gross value was close to the national average by the post-WWII period.

The question may be posed of why brick never became more widely popular in Western Canada, particularly in Saskatchewan with its considerable wealth of clay resources. In 1927 Malcolm and Robinson noted, from a federal government position, that "Saskatchewan has probably a greater variety of clays, in larger quantities and inclusive of the higher grades, than any other Canadian province" (1927:141). Saskatchewan had the potential of being able to supply virtually all its own construction needs by its own clay resources and products, contemporaneous with a much larger, more developed industry that could have had more significant export potential to the neighbouring regions. If it had developed on this scale, the economic well-being of the province would have benefited handsomely, while in addition its overall building inventory would be in better condition today. However, while the industry did relatively well in its more than 100 years of operation, it never significantly tapped into the mainstream residential market, as had been done in Ontario and Quebec.

Such a scenario appeared likely at the turn of the century. The neighbouring prairie city of Winnipeg was undergoing construction with brick at rates comparable to Central Canada, and the optimism of that city was also being felt in the much newer cities and

emerging towns of Saskatchewan. Before the beginning of WWI, the boosterism spirit of the prairies seemed to dictate that all homes and buildings would eventually be made from masonry—either brick or stone—in permanent structures that would unequivocally display the prosperity and stability of the newly settled western frontier. Up to 1914, many homes and buildings were built with such materials, leading the Saskatchewan brickmaking industry to be viewed with great promise. A 1912 Estevan newspaper stated that "for what the lumber trade is to British Columbia so the brick and tile trade will become to southern Saskatchewan" (*EM* 26 December 1912:9). A year later the provincial government's Bureau of Labour reflected this sentiment when it noted that "The Bureau has made an exhaustive inquiry into four of the principal industries of the province, namely, brick and tile manufacturing, flour and feed mills, lumber manufacturers and planing mills" (Province of Saskatchewan 1913b:6).

The decade after 1913 seemed, however, to quash the dream of Saskatchewan brickmaking as a major industry. By 1924 brickmaking failed to make the top 10 leading industries list (Saskatchewan Department of Railways, Labour and Industries 1928:4), and by 1953 was not included among the top 33 leading industries (Province of Saskatchewan 1956:13). Despite this diminishment of provincial stature, the industry soldiered on for another 43 years, but remained a relatively small player in the provincial economy. Despite this, from 1944 to the mid-1960s there was a final attempt to have the industry regain its former ranking, when the provincial government took a direct role through

the purchase and operation of the Estevan brickplant, as well as the management of exported raw clay resources.

The failure of the government effort to bring the industry back to a prominent place among the province's industries can be attributed to many previously discussed factors, such as improved concrete substitutes for brick products and evolving construction design. However, it remained undeniable that building with brick in Western Canada continued to be much less popular than the traditional alternative, wood. The 1963 report on the Estevan brickplant's operations recognized this by stating "[t]he house-building market has been strong in 1963, but this corporation, along with other western brick producers, has been unable as yet to convert what is conventionally a lumber market, to brick" (Saskatchewan Minerals 1963:6).

Reasons for this lack of a break-through to replace lumber rests significantly with the vast presence of lumber resources that were utilized across Western Canada from as far back as clays were, although on the prairies the lumber industry was generally north of the clay-based industry. Regardless, lumber was relatively inexpensive and plentiful in Western Canada when compared with Ontario and Quebec. This also corresponded with the development in North America of 'balloon frame' (versus traditional timber frame) houses in the mid-1800s which could be assembled quickly with a minimum of skilled workers (Hamilton 1958:467-468). This became the standard construction in the early settlement days on the Canadian prairie, and after the collapse of the pre-WWI boom and its loftier construction ideals in masonry, lumber construction

prevailed. Fire was a larger problem with wood, particularly in urban downtown areas where wood construction was often outlawed as earlier noted, but for most residential areas and smaller towns no such legislation existed. The Great Depression and accompanying agricultural disaster of the 1930s precluded any significant amount of upscale construction, and by the time prosperity re-emerged in the late 1940s, lumber construction in Western Canada was firmly entrenched for the majority of small construction efforts.

Saskatchewan's brickmaking therefore supplied a market that was mostly non-residential, being public and commercial structures of many varieties, as well as the specialized refractory market of Claybank's product. Except for this last category, most Saskatchewan brick product seems to have be used within the province at least up to 1950. After this, export of Saskatchewan brick product increased until by 1968 Estevan Brick Ltd. was exporting the majority of its product beyond the province's borders, including to the United States (Estevan Brick Ltd. 1968:2). The Canadian-American Free Trade Agreement of 1988, although partially responsible for Claybank's shut-down a year later, likely extended the range of Estevan's products in its last decade of operation. Some of the last brick shipments were reaching customers in Las Vegas, Nevada (Brian Jennings, personal communication 1997).

American products themselves do not seem to have been greatly represented in Saskatchewan imports except for firebrick. This was largely due not only to the high cost of brick transport but

early tariffs placed on American brick product of which comparable domestic varieties existed. Firebrick, however, was exempt before Claybank's firebrick production was underway in the 1920s (Ries and Keele 1912:153-154). This explains the many American, usually Missouri-derived, varieties found at brickmaking sites begun before 1920 such as Bruno, Shand, and the Boundary Dam site at Estevan (see Appendix B). Although Canadian firebrick was being made closer than Missouri at Clayburn, British Columbia by 1906, the transport costs were high due to traversing the mountains (Adams 1976:11, 33). From 1905 to 1906, Wellington White was also making firebrick at Moose Jaw, Saskatchewan but it is unknown if he continued this production up to the brickplant's closure around 1913 (Henderson Directories Ltd. 1905:754, 1906:798; Knight 1982:28).

Other American product sold in the province included high-grade pressed facebrick, which again was not produced in Saskatchewan until Claybank was in full operation after WWI. Most American imports of both firebrick and high-grade facebrick were therefore from the pre-WWI boom era, being commonly advertised at this time in publications such as city directories (e.g. Henderson Directories Ltd. 1912:90, 93), but were rarely seen by the 1920s. Two American dry-press brickplants were located just south of Saskatchewan's border, in the North Dakota towns of Hebron and Dickinson. Both made firebrick and facebrick from the same Whitemud clay formation as Claybank used, with some export north to Saskatchewan (Ries and Keele 1912:91-92).

Brick imports into Saskatchewan from the adjoining provinces of Manitoba and Alberta were much greater than from the United States. Manitoba was the first province to export considerably into Saskatchewan, due to its earlier brick industry development. This led early Saskatchewan edifices such as the Legislature Building of 1905-1906 to use a considerable amount of Manitoba brick when local plants could not supply the demand (Ries and Keele 1912:25). Manitoba product was not generally of the highest quality, however, which along with its buff rather than red colour led it to be supplanted by Alberta imports by the 1930s. While not a good indicator of quality, red was both associated with a high quality brick and was architecturally fashionable in the early 1900s (Keele 1915a:134). Once the Medicine Hat/Redcliff area of southern Alberta began producing its red, hard-burned 'pressed' (re-pressed soft-mud) bricks in large quantity, they became very popular in Saskatchewan. Today the most common brick to be found in this province is the red 'I-XL', a trade mark for the Redcliff Pressed Brick Co. Ltd. from 1920 onward. In 1971 the manufacturing portion of Redcliff Pressed Brick Co. Ltd. became simply known as I-XL Industries Ltd., today the last operating brickmaking operation on the Canadian prairies (Manson 1983:75-81; Dun & Bradstreet 1997:405, 651).

In summary, the Saskatchewan brickmaking industry had a significant life-span that had the resource potential to be much larger, but which for various reasons was restrained from this attainment after 1914. However, it produced a variety of brick product of sufficient quality that allowed it to compete for

markets both within and without its borders, leaving an indelible imprint upon the province's past.

7.2 Consideration of the Heritage of Saskatchewan's Brickmaking Industry

The Saskatchewan brickmaking industry was a significant component of the province's development, paralleling agricultural settlement from the mid-1800s onward. In its own development Saskatchewan brickmaking paralleled the North American industrial era, growing from fur-trade based origins to modern, large-scale manufacturing facilities. Both aspects benefit from archaeological and historical research, which in this region is considerably blessed with such resources. As the topic of brickmaking continues to become more widely studied, a research realm such as this, encompassing wide ranges of technologies, products, and involved people, will prove to be increasingly valuable.

The overall scale of the provincial industry, while considerable, is also of manageable size for such research, with a core of three major sites being augmented by a much larger number of smaller, mostly earlier sites. As previously discussed, the brickmaking industry in this province had the potential to be larger, but retained an overall smaller scale for various reasons. Saskatchewan's brickmaking heritage is, therefore, relatively compact in its entirety, yet displays the variety of product and manufacture of a well-matured industry. In addition, because most of the sites were located in rural settings to be proximate to the

clay sources, subsequent reuse of site areas has been rare, leaving a greater amount of heritage resource inventory than in a more urbanized area such as southern Ontario.

The recent designation of the Claybank site as a National Historic Site is presently the greatest single feature of Saskatchewan's brickmaking heritage. Besides retaining its original layout and technology from the WWI era, Claybank was arguably the most significant of the three large operations in terms of volume and manner of production. The national recognition that it has now received mirrors the attention that it enjoyed during its operation, and it hopefully will be the focus of considerable research.

7.3 Future Research Considerations

Many avenues of research are possible in the study of Saskatchewan's brickmaking industry. First, in continuing the survey aspect of this thesis, more of the operations that existed could be examined for archaeological evidence and subsequently recorded. Among the early, small sites that are presently known, archaeological excavations could provide a wealth of new information in regard to firing technologies, site layout, and product development. Archaeological examination of underground technology at the later, fully industrialized sites such as Claybank and Bruno could also be very informative. Meanwhile, elements such as clay extraction and preparation, not tackled in this thesis, could be focused upon in a comparative fashion. This could be combined with continuing a raw-clay type collection, begun during

this research, including making and firing test 'bricklets' to attempt duplication of original manufacturing problems and variables. Matching of clay sources to unmarked bricks would then become much easier as well. The type collection of bricks begun with this research could also be further extended and analysed with methods such as mineralogical analysis via x-ray diffraction. It is planned that this brick collection will be housed at the Claybank Brickplant National Historic Site for suitable access to future researchers.

Creating better catalogues of individual brickmaking sites would also be extended by excavation, such as at Bruno where simple testing into the extensive refuse pile would help recover earlier product variations.

One particularly intriguing research path involves at least three sites, Claybank, Shand, and Bruno, which all had some degree of company housing with its attendant paternalistic character. This is reflective of a management style where nearly all aspects of an employee's life were provided for by the company. At Claybank there were three levels in a hierarchy of paternalistic housing, being a residence for single men, houses for married men, and houses for the executives, all of which are represented in surviving examples. While Shand and Bruno company housing examples are represented purely archaeologically, a study of these together with the preserved examples at Claybank would help explain the domestic sphere involved with brickmaking.

More emphasis could also be placed upon the economic aspects of the industry, in such terms as capital used for setup and

expansion, markets within the province as well as the export market outside, the suppliers of inputs to the industry such as fuel and machinery, and the relationships between the brick manufacturers and the dealers who often acted as middlemen in the retail marketing of the brick product.

These are only a few ideas of what is possible in this field, but hopefully it demonstrates the wide array of research possibilities open to future study of the Saskatchewan brickmaking heritage.

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Appendix A Database of Brickmaking Endeavors in Saskatchewan

The following database lists 90 presently-known brickmaking endeavors in Saskatchewan. As many of these were stock issues in the pre-WWI boom period which never produced brick product (or even built facilities) the true number of actual Saskatchewan brickmakers is probably closer to 65. This is a significant number for a region of relatively low population, and is mostly indicative of the early years of agricultural settlement. In the post-WWI period, only a few brick manufacturers would remain for the longest portion of the province's brickmaking.

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	COMMUNITY AFFILIATION	COMPANY/OWNER'S NAME	LOCATION	WHEN OPERATED
1	Arcola	Arcola Brickyard Co. Ltd., Arcola Brick Co. Ltd.	north of railway, SE corner of Arcola	1903-1915
2	Balcarres	?		pre1918
3	Battleford	Territorial gov't public works, single purpose	onsite of Registry Office location	1877
4		Fort Battleford, NWMP (non-commmercial)	1 km east of Battleford	c.1877
5		Thomas Dewan	north side of Battle River	1886-1890
6		C. J. Johnson		c.1905
7		Battleford Brick & Cement Block Co.		c.1909
8		Lobb and Clark Brick, Tile & Sewer Pipe		c.1912
9	Beauval (affil.: Ile a la Crosse)	Roman Catholic church of the area		early 1930s
10	Broadview	Broadview Brick Co.		1906-c.1916
11	Bruno	Joseph and Charles Bonas	2 km northwest of Bruno	1905
12		Bruno Brickyard; Bruno Clay Works Ltd.	2 km northwest of Bruno	1908-1960
13	Carlyle	?		c.1910
14	Claybank (other affiliation:Avonlea)	Saskatchewan Clay Products Co. Ltd., Dominion Fire Brick & C. Prod.s Ltd.; A.P. Green Refract.s	1 km south of Claybank	1912-1989
15	Davidson	Davidson Clay Products Co. Ltd.*		c.1913
16	Estevan	Eureka Coal & Brick Co.; Estevan Coal & Brick Co. International Clay Products Ltd.; Saskatchewan Clay Products (crown corp.), Estevan Brick Ltd.	southeast edge of Estevan	1902-1996
17		Estevan Sewer Pipe & Clay Products Co. Ltd.	brickmaking site 2 km SW of Estevan may be from any of these four companies	c.1910
18		Great West Brick & Coal Co. Ltd.		c.1912
19		Saskatchewan Sewer Pipe & Brick Co. Ltd.		c.1912
20		Estevan Clay & Pottery Co. Ltd.		c.1914
21	Floral (other affil.s: Engen, S'toon)	Canadian Clay Products Ltd.	4 km southeast of Saskatoon	1912-1915
22	Foam Lake	Foam Lake Cement Block, Brick & Tile Co. Ltd.		c.1920
23	Fort Carlton	Hudson Bay Co.; NWMP (non-commercial)	≈200 m SW of reconstructed 1875 fort	c.1850-c.1884
24	Fort Qu 'Appelle/Lebret	A. J. Osment		c.1898
25	Grenfell	Grenfell Brick Co., T. S. Campbell		c.1900-c.1905
26	Halbrite	Halbrite Coal & Brick Co. Ltd.		1910-1912
27	Indian Head/Lake Katepwa	A. J. Osment, later C. Peltier	east edge of Lake Katepwa	1883-c.1904
28	Karilowa	Karilowa Doukhobor Colony (non-commercial)	6 km west of Langham	c.1899-c.1904
29	Kamsack	Kamsack Brick and Tile Co. Ltd.		c.1913
30	Lloydminster	Gee Brickyard, James Gee & Co., Sidney Gee	north edge of city, Alberta-Sask. border	1905-c.1908

*—likely never made brick or tile

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	COMMUNITY AFFILIATION	COMPANY/OWNER'S NAME	LOCATION	WHEN OPERATED
31	Lumsden	?	NW corner, LSD 2-33-19-21-W2 (Hudson '57)	c.1910
32	Maple Creek	William R. Lawrence		c.1905
33	Meota	?		pre1921
34	Meyronne	Meyronne Brick and Cement Co. Ltd.*		c.1914
35	Moose Jaw	James Brass	adj. to river, Manitoba St., Moose Jaw	1890-c.1898
36		Moose Jaw Brick Yard/Works, Wellington White	present-day tourist campground site by river	1899-c.1913
37		Moose Jaw Fire Brick and Pottery Co. Ltd.*		1904-1912
38		Moose Jaw Pressed Brick Co. Ltd.*		c.1910
39		Canadian Faced Brick Process & Mach. Co. Ltd.*		c.1913
40		Faced Bricks Ltd.*		c.1913
41	Moosomin	Moosomin Brick Yards, T. A. Scroggie	10 km SW of Moosomin	c.1890-c.1904
42	North Battleford	North Battleford Brick and Concrete Co.	north of Exhibition Grounds	c.1912
43		North Battleford Brick Manufacturing Co. Ltd.		1912-c.1913
44	Outlook	Outlook Brick and Investment Co. Ltd.*		c.1912
	Pilot Butte—see Regina			
45	Pinto	Pinto Coal and Brick Co.*	Pinto station, 20km SE of Estevan	c.1910
46		Excelsior Co.*	Pinto station, 20km SE of Estevan	c.1912
47	Prince Albert	Thomas E. Baker	400 block (?), 8th St. E., Prince Albert	1879-c.1890
48		Thompson's Steam Brick Yard	east end of Prince Albert	c.1888
49		Prince Albert Brick Manufacturing Co. Ltd.		c.1908
50		Red Rock Brick & Pottery Co. Ltd., R. Deacon	10 km NE of Prince Albert	c.1908-1914
51		Wellington White's P.A. brickyard		1893-c.1905
52		W. Fawcett		c.1895
53		Northern Brick Co. Ltd.*	206 K of C Building, Prince Albert	c.1911-c.1914
54		Sandstone Brick Co. Ltd.*	Union Bank Bldg., Prince Albert	c.1914
55		P.A. Brick Co.?/Intl. Clay Products (P.A. division)		pre1921-c.1944
56		Celtic Brick Co.	south edge of Prince Albert	1909-1913
57		Penitentiary brickyard	Prince Albert Federal Penitentiary	1912-1927
58		Ittner's Brickyard	1st Ave. W & 28th St., Prince Albert	c.1900-1914
59		Excelsior Brick Co. Ltd.	117 8th St. E., Prince Albert	c.1923-c.1933
60	Qu 'Appelle	Samuel Henry farm	10 km south of Qu 'Appelle	1887-?
61	Regina (including Pilot Butte)	Martin & Betteridge; Kerr & Bett.;P. Butte Brick Co.	Pilot Butte: NW1/4-33-17-18-W2 (Hudson '57)	1884-c.1916
62		Queen City Brick Yard		c.1889

*—likely never made brick or tile

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	COMMUNITY AFFILIATION	COMPANY/OWNER'S NAME	LOCATION	WHEN OPERATED
63		John A. Williamson		c.1900
64		Inter-ocean Pressed Brick Co., H. W. Laird	Pilot Butte: NE1/4-33-17-18-W2 (Hudson '57)	c.1907-c.1922
65		Western Fire Brick Co. Ltd.*		c.1913
66		Western Fireclay/Brick & Clay Products Co. Ltd.*	clay & coal mine at Willows	c.1914-c.1920
67		Western Paint & Tile Co.		1936-c.1940
68		Regina Brick & Tile Co.	826 Dewdney Ave., Regina	c.1946-c.1954
69	Ringleton Firs (near Mullingar)	Christopher Castle (non-commercial)	13 km east of Mullingar, 2 km north	1915-1916
70	Roche Percee	Roche Percee Brick and Lignite Co. Ltd.*		c.1912
71		Anglo Canadian Coal and Brick Co. Ltd.*		c.1912
72	Rosthern	Rosthern Brick Co.	north edge of town by ravine	1904-1914
73	Saskatoon	Saskatoon Brick Works/Saskatoon Brick Yard	office: 229 2nd Ave., Saskatoon	1909-1910
74		Saskatoon Pressed Brick Co. Ltd.*		c.1909
75		Saskatoon Brick & Supply Co. Ltd.	1502 17th St. W	1910-c.1926
76		Elliott's B. Yard; Elliott & Son; S'toon Clay Prod.s	1320 3rd Ave. N	1911-c.1928
77		Northern Brick & Tile/N. Brick & Supply Co. Ltd.	north of Saskatoon city center—'Factoria'	1913-1914
78	Shand:	Maple Leaf Mines Ltd.; Sask. Coal, Brick & Power Co., Shand Coal and Brick Co.	10 km SE of Estevan	c.1912-c.1926
79	St. Walburg	?		pre1921
80	Weyburn	Western Fire Clay Products Co. Ltd.		c.1908
81		Weyburn Brick Co. Ltd.; Hunt, Bunting & West		1910-c.1914
82	Whitewood	Whitewood Brickyard	west edge of town	1884-c.1890
83		Sterling Brickyard, C. A. Campbell	10 km north of Whitewood	1894-1904
84	Willowbunch		6 km north of Willowbunch	c.1912
85	Wolseley	Wolseley Brick Co., Magee & Thompson		c.1898-c.1905
86	Yorkton	John Smith		c.1896-
87		A. F. Reusch		c.1900
88		Yorkton Brick Co.		1907-c.1914
89		Doukhobor Community Brickyard	Darlington St. & 7th Ave., Yorkton	1907-c.1935
90		Malloff & Son		c.1935-c.1946

*—likely never made brick or tile

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	PRODUCTS	PROCESSES	KILN TYPE	SITE KNOWN?
1	buff common brick	stiff mud (end cut)	scove, Dutch	yes
2	salmon common brick	soft mud		
3	common brick	likely hand molded	scove	
4	common brick	likely hand molded	scove	
5	buff common brick	soft mud	likely scove or Dutch	
6				
7				
8				
9	red common brick	soft mud		
10	buff common brick	likely hand m., later soft mud	Dutch	
11	common brick	soft mud	scove	superseded by later plant
12	red/salmon common brick; hollow structural tile, drain tile	soft mud to c.1913, then stiff mud (end & side cut)	scove to c.1914, then rectangular semi-continuous with nine firing chambers	yes
13	common brick	likely hand molded	small scove set but not burnt	
14	speckled white, salmon refractory, special shape & face brick	dry press, stiff mud (side cut), hand molding	ten downdraft beehive	yes (National Historic Site)
15	common brick production attempted	dry-press ante-fired	autoclave: steam hardened	
16	buff, red & special colour brick, structural tile	stiff mud (side cut), dry press	Dutch, bee-hive, rectangular down-draft to 1951, tunnel kiln after	yes
17				
18				
19	common brick, sewer pipe, tile	stiff-mud	two beehive	yes
20				
21	salmon common brick	stiff mud (end & side cut)		yes
22				
23	common brick	likely hand molded	scove	yes
24	common brick			
25	buff common brick			
26				
27	buff common brick	hand molded	scove	
28	salmon common brick	hand molded	likely small scove	yes
29	common brick	soft mud		
30	common brick	soft mud	likely scove or Dutch	noted in 1977, N. Proctor

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	PRODUCTS	PROCESSES	KILN TYPE	SITE KNOWN?
31	buff common brick	soft mud	scove	noted in 1957, J. Hudson
32				
33	common brick			
34				
35	red common brick	likely hand molded	likely scove or Dutch	
36	red common, refractory brick	soft mud	scove, two downdraft (type unknown)	
37				
38				
39				
40				
41	common brick		scove	
42	common brick			
43				
44				
45	common brick	dry press		
46	common brick			
47	common brick	hand molded	likely scove or Dutch	
48	'pressed' common brick (sand-lime?)	dry press sand-lime?		
49				
50	red common brick			poss. noted '81, D. Meyer
51	common brick			
52				
53				
54				
55	red sand-faced brick	soft mud		
56	dark red common brick	dry press	three Dutch kilns	
57	common brick			
58	red common brick	soft mud	scove	
59				
60	common brick	likely hand molded		
61	red common brick	likely hand m., later soft mud	scove	noted in 1957, J. Hudson
62				

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	PRODUCTS	PROCESSES	KILN TYPE	SITE KNOWN?
63				
64	sand-lime common brick	sand-lime	autoclave: steam-hardened	noted in 1957, J. Hudson
65				
66				
67	clay tile products	stiff mud		
68				
69	dark buff common brick	hand molded	likely small scove	yes
70				
71				
72	red common brick	hand molded	scove	yes
73	common brick			
74				
75	sand-lime common brick	dry press sand-lime	autoclave: steam-hardened	yes
76	common brick	soft mud	scove	yes
77		stiff mud and/or sand lime		
78	buff to red common brick	stiff mud (side cut)	Dutch	yes
79	common brick			
80				
81	red common brick	dry press, stiff mud	two beehive, several Dutch	
82	salmon common brick	soft mud	likely scove or Dutch	yes
83	salmon common brick	hand molded	likely scove or Dutch	yes
84				
85	buff, white common brick	soft mud	scove	
86				
87				
88	common brick			
89	common brick			
90	common brick			

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	REFERENCES (see Bibliography for full information, except for items in parentheses)
1	Henderson Directories Ltd. 1905, Davis 1918, Worcester 1950
2	Davis 1918, Worcester 1950
3	McPherson 1967
4	Hildebrandt 1978, 1994
5	McPherson 1967
6	Henderson Directories 1905
7	McPherson 1967
8	McPherson 1967
9	Beck and Macdonald 1974
10	Davis 1918, Worcester 1950
11	Hargarten 1955
12	Keele 1915b, Wrigley's Directories Ltd. 1921, Worcester 1950
13	Henderson Directories Ltd. 1905, Worcester 1950
14	Davis 1918, Wrigley's Directories Ltd. 1921, Worcester 1950
15	Keele 1915b, Wrigley's Directories Ltd. 1921
16	Henderson Directories Ltd. 1905, Ries and Keele 1912, Davis 1918, Worcester 1950
17	Province of Saskatchewan 1910
18	Province of Saskatchewan 1912c
19	Province of Saskatchewan 1912a
20	Province of Saskatchewan 1914a
21	Keele 1915b, Worcester 1950
22	Wrigley's Directories Ltd. 1921
23	Dyck 1978
24	History of Indian Head and District Inc. 1984
25	John Lovell & Son 1900, Henderson Directories Ltd. 1905
26	Province of Saskatchewan 1911b
27	Henderson Directories Ltd. 1905, Davis 1918, Worcester 1950
28	(previously unpublished)
29	Keele 1915b, Worcester 1950
30	Henderson Directories Ltd. 1908, Worcester 1950, Manson 1983

BRICK AND STRUCTURAL TILE MANUFACTURERS IN SASKATCHEWAN

#	REFERENCES (see Bibliography for full information, except for items in parentheses)
31	Worcester 1950
32	Henderson Directories Ltd. 1905
33	Worcester 1950
34	Saunders et al. 1992
35	Knight 1982
36	Henderson Directories Ltd. 1899, Ries and Keele 1912, Davis 1918, Worcester 1950
37	Saunders et al. 1992
38	Province of Saskatchewan 1910b
39	Saunders et al. 1992
40	Province of Saskatchewan 1916b
41	Henderson Directories Ltd. 1905
42	Worcester 1950, McPherson 1967
43	Worcester 1950, Saunders et al. 1992
44	Saunders et al. 1992
45	Worcester 1950
46	Ries and Keele 1912, Worcester 1950
47	Loucks c.1970
48	(notes from B. Burke's research of an 1888 newspaper advertisement)
49	Henderson Directories Ltd. 1908
50	Henderson Directories Ltd. 1908
51	Henderson Directories Ltd. 1905
52	Henderson Directories Ltd. 1895
53	Province of Saskatchewan 1911a
54	Saunders et al. 1992
55	Worcester 1950
56	Henderson Directories Ltd. 1908, Ries and Keele 1912
57	(notes from H. Henry's research of Canadian Dept. of Justice Warden's Reports)
58	Henderson Directories Ltd. 1908, Ries and Keele 1912
59	Wrigley's Directories Ltd. 1921
60	(copy of local history book of Qu'Appelle , c.1980, without full bibliography)
61	Davis 1918, Worcester 1950
62	Henderson Directories Ltd. 1894, 1895, 1896, 1897, 1898

#	REFERENCES (see Bibliography for full information, except for items in parentheses)
63	Henderson Directories Ltd. 1900
64	Wrigley's Directories Ltd. 1921, Worcester 1950
65	Saunders et al. 1992
66	Saunders et al. 1992
67	Worcester 1950
68	Henderson Directories Ltd. 1947
69	Meeting Lake Regional Park Committee 1976
70	Saunders et al. 1992
71	Saunders et al. 1992
72	Henderson Directories Ltd. 1905, Ries and Keele 1912, Worcester 1950
73	Ries and Keele 1912
74	Province of Saskatchewan 1909
75	Ries and Keele 1912
76	Ries and Keele 1912, 1913; Keele 1915b
77	Saunders et al. 1992
78	Davis 1918, Wrigley's Directories Ltd. 1921, Worcester 1950
79	Worcester 1950
80	Worcester 1950
81	Ries and Keele 1913, Davis 1918, Worcester 1950
82	Whitewood History Book Committee 1992
83	Whitewood Herald 1893, Henderson Directories Ltd. 1900
84	(Willowbunch Museum exhibit)
85	Henderson Directories Ltd. 1905, Davis 1918, Worcester 1950
86	Henderson Directories Ltd. 1896, 1897, 1898, 1899, 1900
87	Henderson Directories Ltd. 1900
88	Worcester 1950, City of Yorkton Municipal Heritage Advisory Committee 1992
89	Worcester 1950, City of Yorkton Municipal Heritage Advisory Committee 1992
90	Worcester 1950

Appendix B Brick Brands and Identification in Saskatchewan

B.1 Introduction

Of the many bricks and brick products used in Saskatchewan, many were branded, making identification relatively simple if a compilation of the brands has been undertaken. This will be started here, realizing that the listing is incomplete and will hopefully be enlarged in future publications as more brick brands are found and matched to their respective manufacturers. The brands are grouped into domestic (Saskatchewan-made), and imported varieties. Bricks are arranged by site and relative age within that site's production. For reference to unbranded product, such as that made at Bruno, please refer to the photographs in previous chapters.

Analysis of the brick specimens beyond the photographs in this section is certainly possible; however for the purposes of simple identification within the bounds of this thesis, attributes such as colour recording by Munsell values was not undertaken. However, a general 'rule of thumb' regarding pre-1960 regional colouring of brick on the Canadian prairies can be applied to initial analysis:

- Manitoba-made bricks are usually of a buff (off-white) or salmon (pinkish-orange) hue
- Alberta-made bricks are generally solid red in hue

- Saskatchewan bricks are split between buff and red:
  - -Southeastern Saskatchewan examples tend to be buff, or a mottled pattern of buff and red that can termed blush
  - -the rest of the province's bricks tend to be red or brownish in hue

Because intentional colouring of bricks by metal oxides became popular in the 1960s, this basic colouring guide is less useful for recent examples. In the earlier years colouring was largely limited by the amounts of primary colouring agents present in the raw clay sources, such as iron oxides which produce red hues, and lime which tends to produce paler hues.

More specific recording of colour, along with mineralogical analysis of several forms, and testing of other attributes such as porosity, will greatly aid specific research of bricks in the future. To this end it is planned that all specimens used in this research will be archived for future examination as part of a type collection at the Claybank Brickplant National Historic Site. An Alberta brick type collection presently exists at the Glenbow-Alberta Institute in Calgary (Manson 1983:inside front cover), while hopefully a Manitoba version will soon be started, allowing comparative research from across the Canadian prairies.

B.2 Brick and brick product made within Saskatchewan

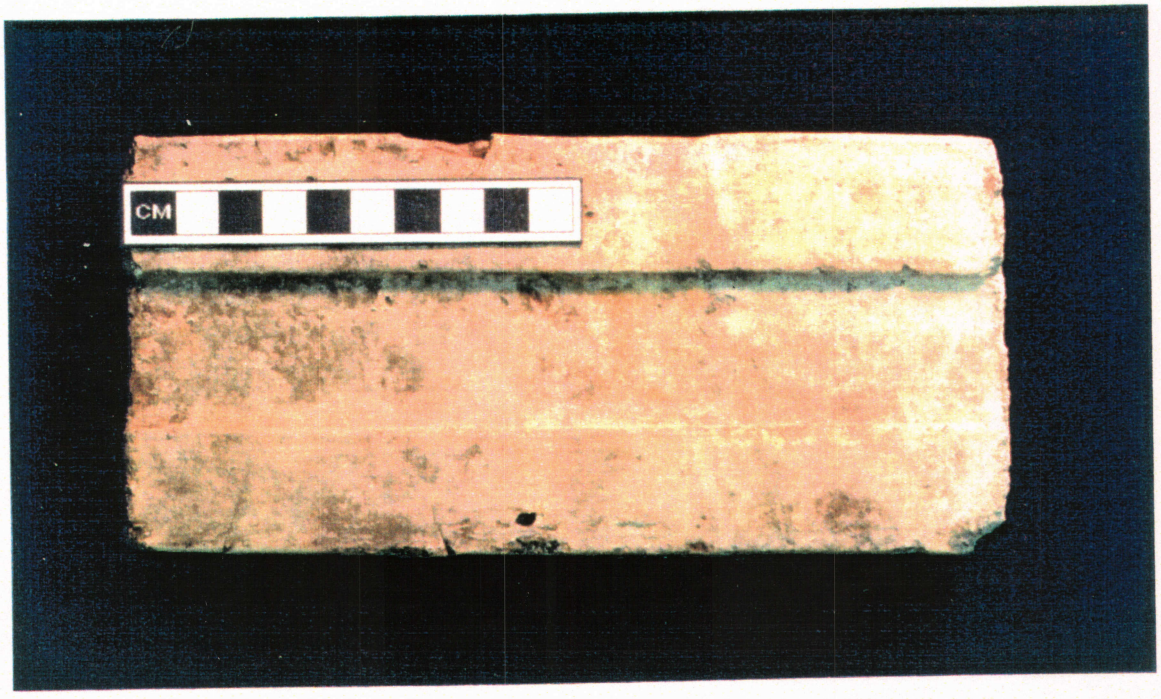


Figure B.1 Arcola, 1903-1915. (while not technically branded, Arcola bricks are distinctive due to their full, shallow frog).

Figure B.2 Broadview Brick Company, 1906-c.1916.

Figure B.3 Claybank firebrick c.1930.

Figure B.4 Claybank firebrick c.1930.

Figure B.5 Claybank firebrick c.1940.

Figure B.6 Claybank facebrick c.1930 (later 'T P MOKA' are not branded).

Figure B.7 Claybank jamb firebrick, c.1980.

Figure B.8 Claybank wedge firebrick, c.1980.

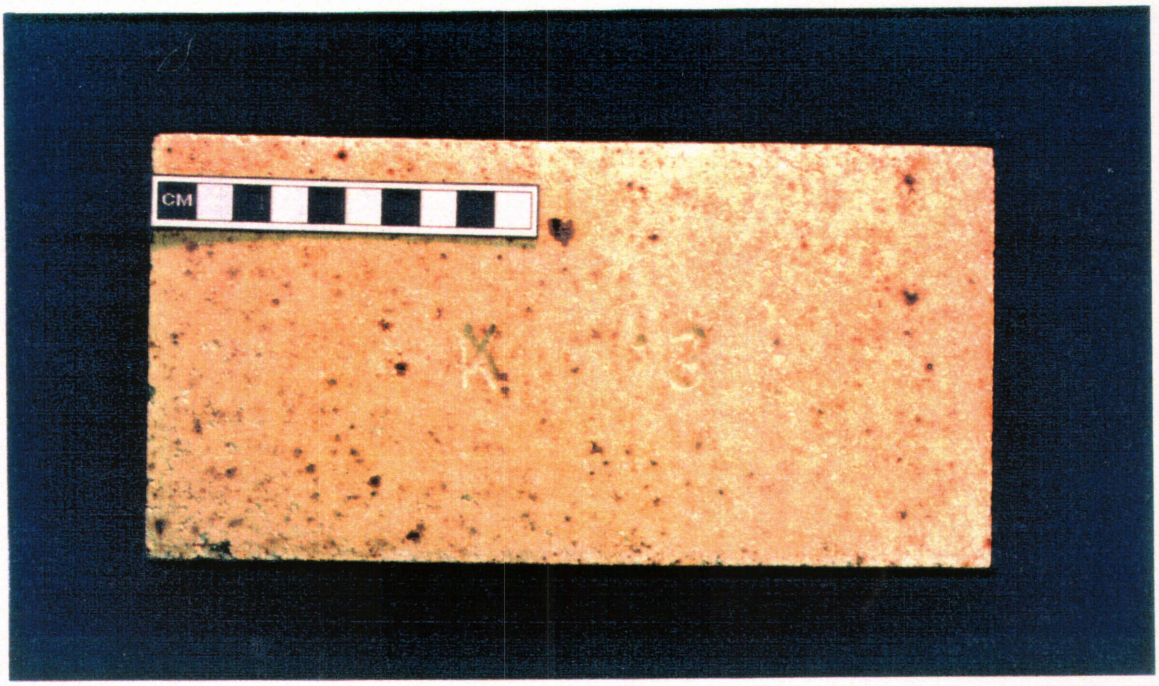


Figure B.9 Claybank straight firebrick, c.1980.

Figure B.10 Claybank hand-molded firebrick. Typical of the many unusual shapes made from the mid-1920s to 1989.

Figure B.11 Claybank circle firebrick, c.1980. (Numbers represent size of circle and are relatively standard among firebrick manufacturers).

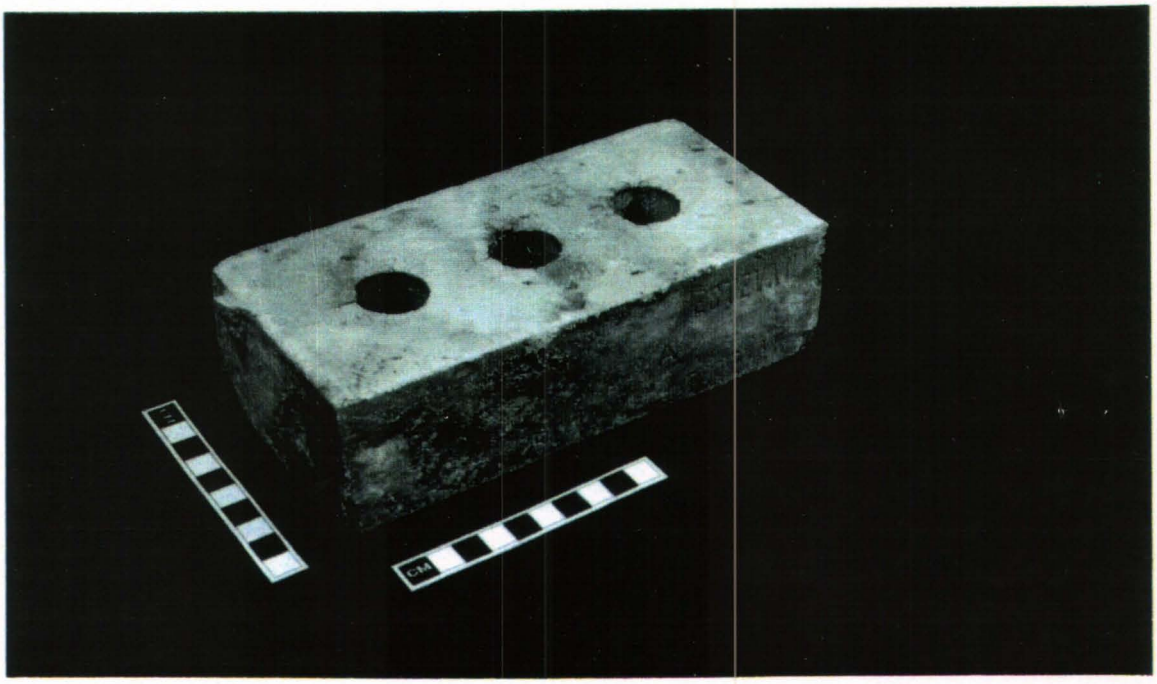


Figure B.12 Estevan non-textured brick from the 1950s. Most 1946 to c.1962 Estevan product has the company name impressed on the side opposite to the facing side (faintly visible here).

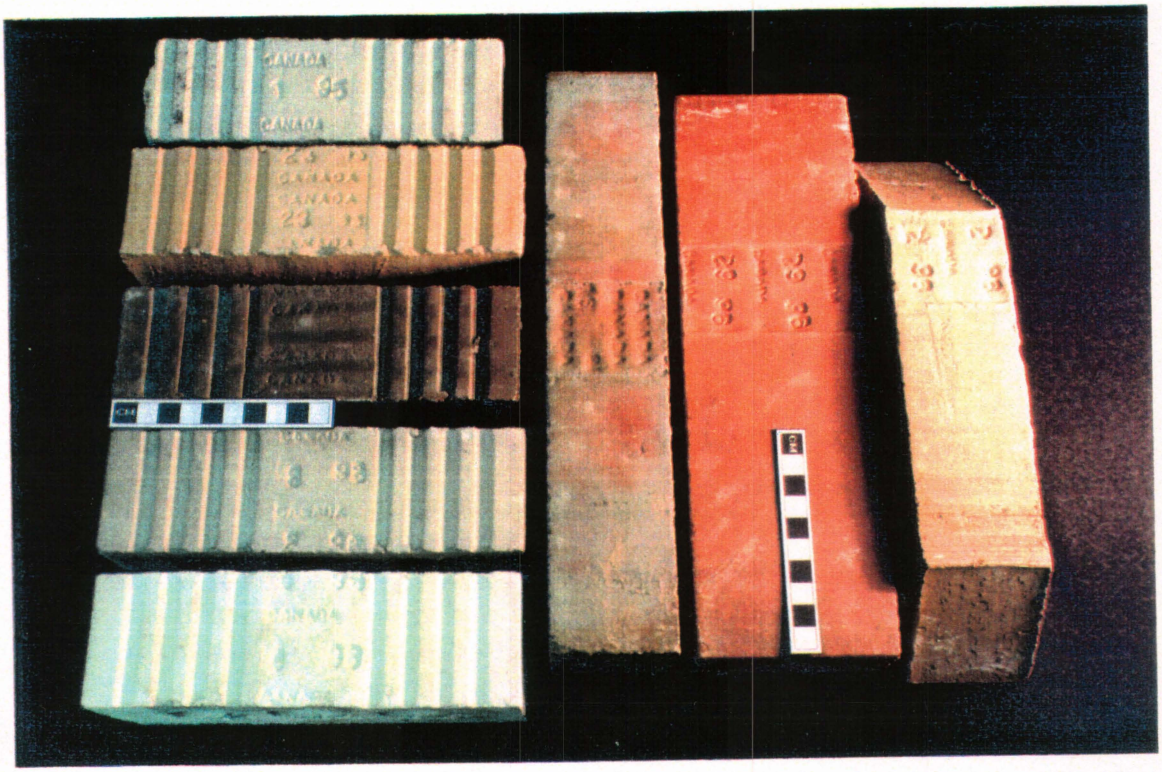


Figure B.13 1981 to 1996 Estevan bricks with contemporary dating code in place of specific plant location.

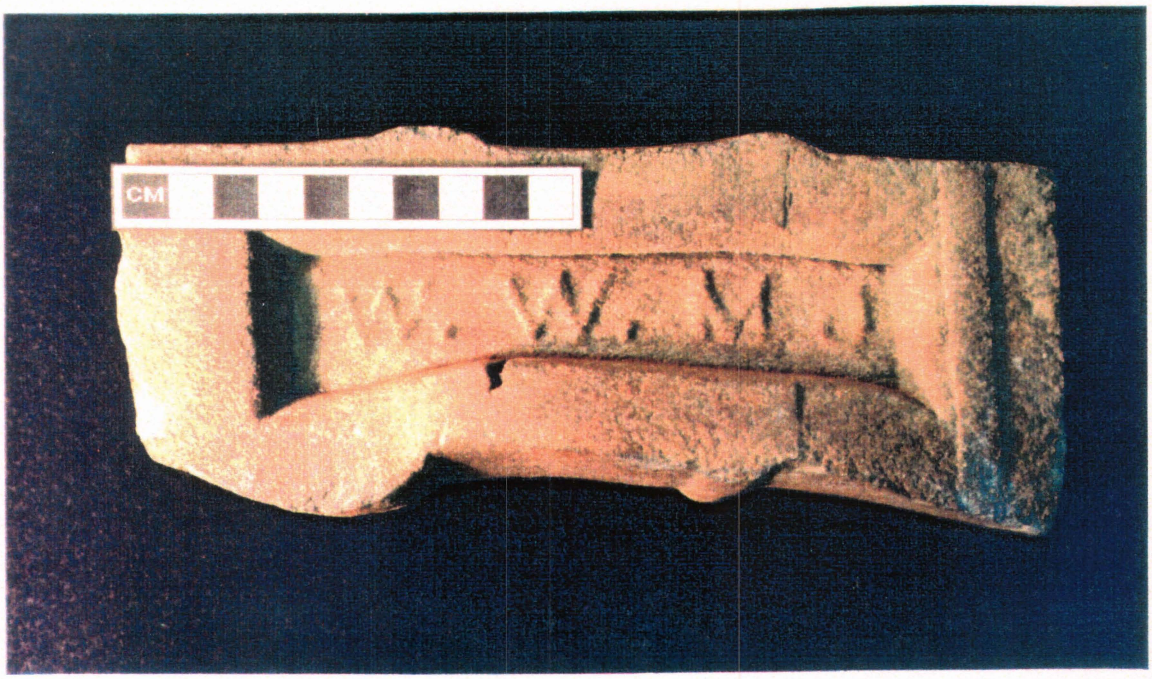


Figure B.14 Moose Jaw/Wellington White, 1899-c.1913.

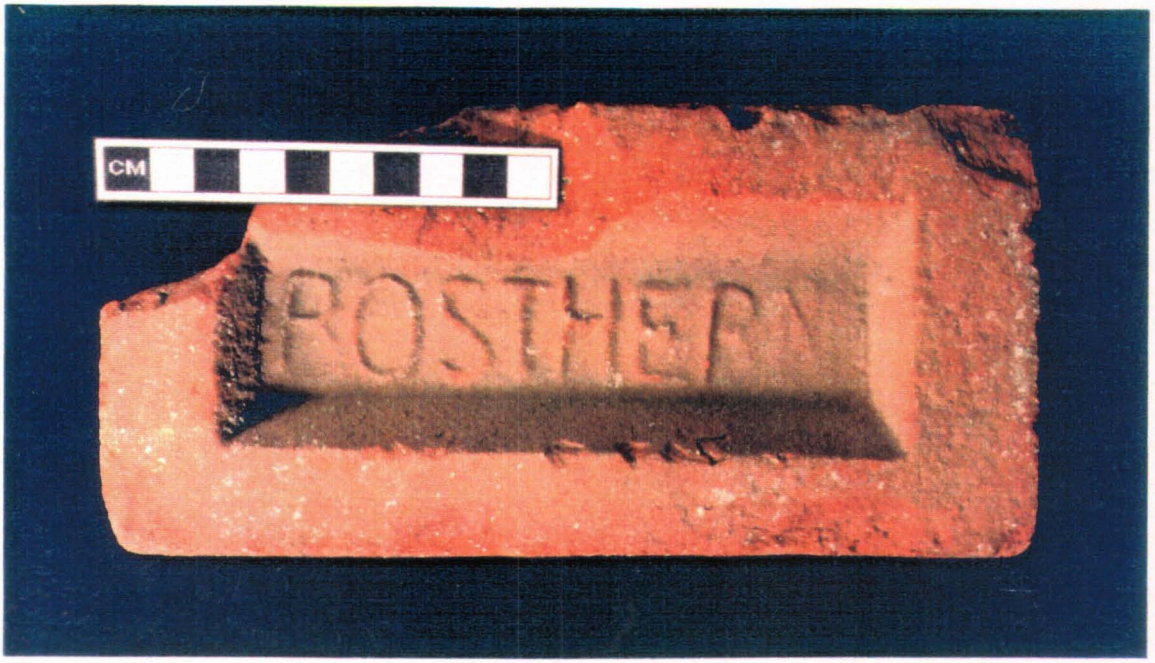


Figure B.15 Rosthern, 1904-1914.

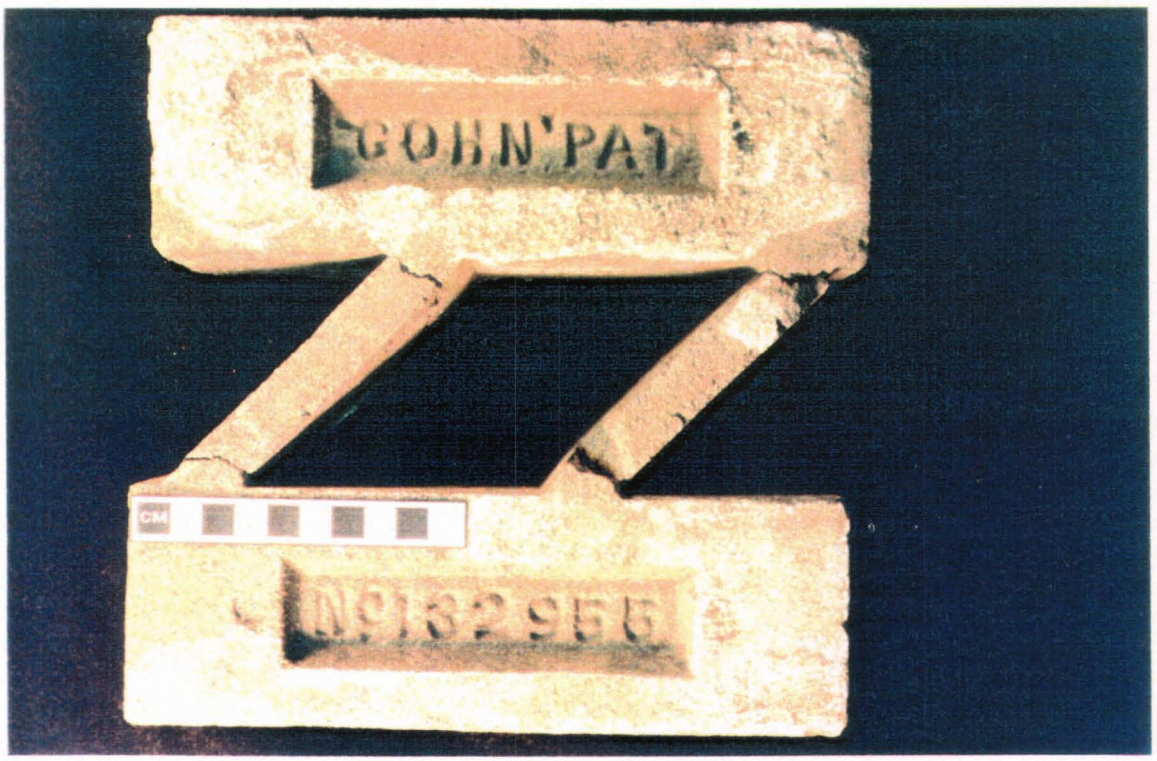


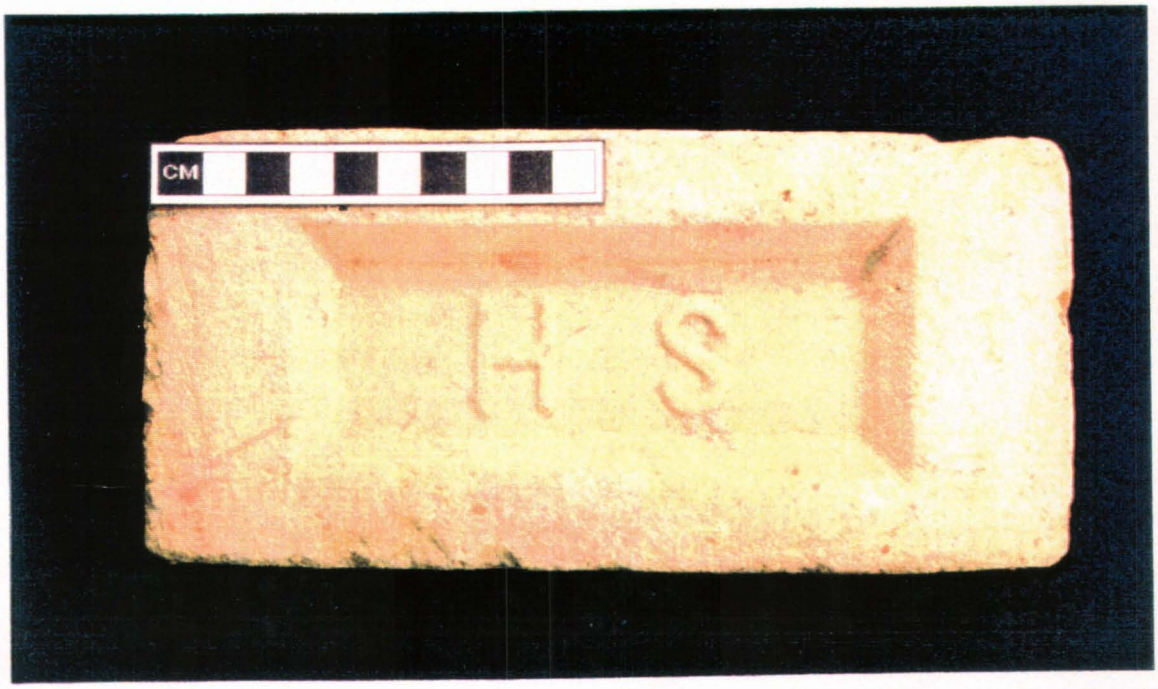
Figure B.16 A cement brick included here due to its mimicking of soft-mud brick branding. Gohn hollow-brick made from 1913 to c.1915 at the Saskatoon (later 'Gohn') Trussed Wall and Building Company in 'Factoria', by A. C. Gohn.

B.3 Bricks imported into Saskatchewan

B.3.1 Manitoba-made bricks (information from Henry 1992).

Figure B.17 Alsip Brick, Tile and Lumber Co. Ltd., Winnipeg, 1902-1957.

Figure B.18 A. Snyder and Co., Gilbert Plains 1910-c.1915, Portage la Prairie 1910-1930.



B.19 H. S. Stephens, Portage la Prairie, 1892-c.1908.

B.3.2 Alberta-made bricks (information from Manson 1983).

Figure B.20 Canada Cement Co., Sandstone Valley, 1906-1923. Brick is burnt clay, despite company name.

Figure B.21 Redcliff Pressed Brick Co. Ltd. 1920-1971, I-XL Industries Ltd., 1971-present. Brick type most frequently found in Saskatchewan.

Figure B.22 Redcliff Premier Brick Co. Ltd., 1921-1961.

B.3.3 American-made firebrick (information from Gurcke 1987).

Figure B.23 Harbison-Walker Refractories Co., Missouri, 1935-1942.

Figure B.24 Chicago Retort & Fire Brick Co., Chicago, Illinois, 1904-1942.

Figure B.25 Not specifically listed in Gurke 1987.

Figure B.26 St. Louis Vitrified & Fire Brick Co., St. Louis, Missouri, c.1927.

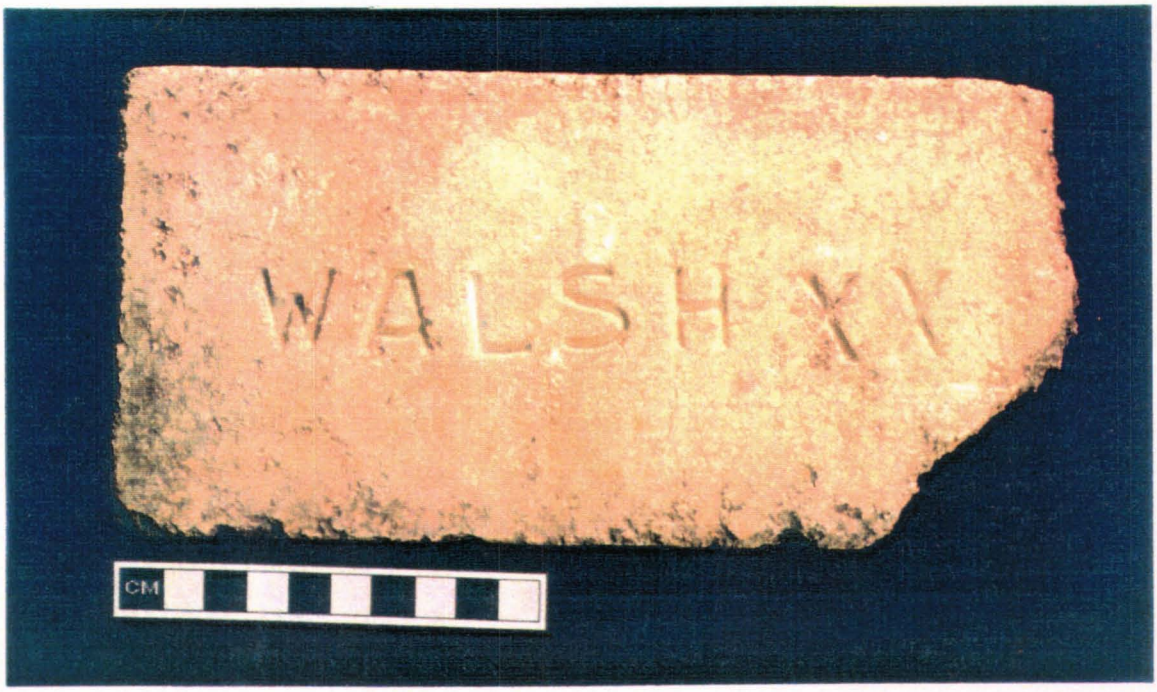


Figure B.27 Walsh Fire Clay Products Co., Missouri, 1921-1927; or Harbison-Walker Refractories, Pennsylvania (also located in Missouri), 1930-1942.

Appendix C Geological Examination of Saskatchewan Clay Resources

The realm of Saskatchewan's clay resources has had a great deal of scientific examination in the last hundred years, as the province possesses some of the largest reserves of commercially exploitable clay in North America, including some of the best high-grade clays found world-wide (Davis 1918:15; Worcester 1950:94-95). Numerous geologists both federally and provincially have undertaken many studies in this domain, especially of the finer varieties used for products such as white dinnerwares and high-temperature refractory brick. However, extensive study began only in this century, leaving the earlier brickmakers to discover the utility of a particular clay, usually of a surface variety, by trial and error. Many of the surface-clays in Saskatchewan have a mineralogical character that makes wares formed with them difficult to dry without cracking (Davis 1918:1), a frustrating problem to correct that has been the bane of several operations, with the adage "if you can dry it you can bake it" (Hudson, interview 1996) demonstrating how integral to brickmaking this characteristic is. Other surface-clay attributes often include a high degree of silt or sand that reduces plasticity—the ability to hold a shape when moistened, and also lowers the vitrification

or melting point of a given clay product when fired, as well as reducing the tensile strength (Hutt 1932:19).

These surface clay deposits were usually formed in beds of water such as lake bottoms, flood-plains and deltas which redistributed the glacial boulder-clays of the Pleistocene epoch as the glaciers retreated (Worcester 1950:15-16). As such they are often found "mixed with gravel and sand deposits, which usually conceal and level up the inequalities of the bed-rock. So thick are they in some cases, that the bed-rock lies several hundred feet below the surface" (Ries and Keele 1912:13). These clays dominated early brickmaking in Saskatchewan as they were easy to extract and plentiful despite their heterogeneous character. Some were excellent brick clays as demonstrated by the Bruno Clay Works Ltd. (Worcester 1950:16), the only industrialized Saskatchewan site to use a surface clay, up to its closing in 1960. Other brickmakers made poorer grade product that found ready local markets in the years before railways provided the first cost-effective mode of transporting this dense, heavy commodity over the long Prairie distances (Ries and Keele 1912:12).

The clays which have proven of more geological interest, as well as economic benefit, are those that occur largely in subsurface beds that stretch across the southern extreme of the province. These were formed in the Palaeozoic and Mesozoic eras when large portions of the Great Plains were alternately covered by great expanses of water, then became dry as elevation shifted, and again inundated as the land sank. When covered by a large sea, areas such as southern Saskatchewan had great thicknesses of sediment

deposited, several which developed into large clay and shale beds—shale being a consolidated, hardened form of clay (Davis 1918:5-6; Hutt 1932:19). Economically the most important of these are known as the Estevan, Whitemud, and Ravenscrag formations with the first two belonging to the Upper Cretaceous epoch and the third to the later Paleocene epoch of the Tertiary Period (Worcester 1950:18). Their relative locations with regard to exposure from erosion are shown in Figure C.1.

The Ravenscrag and Estevan formations have produced valuable brick clays which in several cases have benefited economically by the presence of lignite coal seams above or below the clay beds, allowing both a complimentary mineral resource to be mined and providing a ready fuel for firing any brick produced (Davis 1918: 9-11). The Whitemud formation meanwhile contains the highest quality clays in the province, being a Kaolin clay with a very pale colour both before and after firing. Its refractory properties were recognized as early as the 1880s in the vicinity of the Dirt Hills southeast of Moose Jaw and eventually the brickplant at Claybank was set up to make both high-quality firebrick and facebrick. More western exposures of this formation have proven less refractory but of a good grade for producing tablewares and sewerpipe, resulting in this clay being mined for many years and sent out of province to commercial pottery and tile facilities such as those in Medicine Hat, Alberta (Worcester 1950:10).

Other clays and shale formations exist in the province which have occasionally been used for ceramic manufacturing but seldom

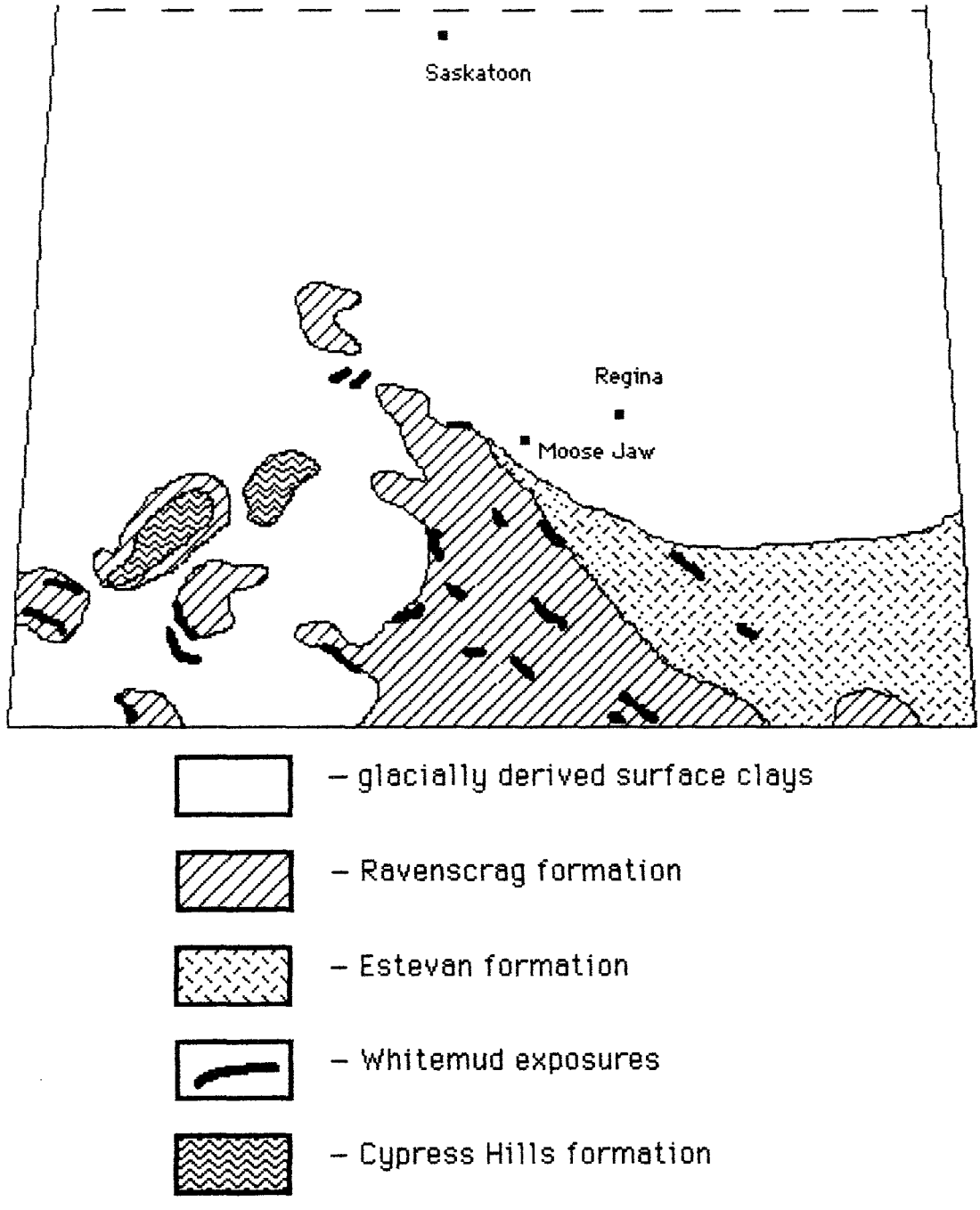


Figure C.1 Zones of clay occurrence in southern Saskatchewan (adapted from Davis 1918:6; Worcester 1950:15)

for brick production. The Cypress Hills formation (also called Eastend) in Figure C.1 is such an example—it has an attribute

of poor drying that makes it a poor brick clay (Davis 1918:11; Worcester 1950:17). Overall, however, there has been and continues to be a wealth of commercially exploitable clays in Saskatchewan, whose decline of brick and other heavy clay industries has not been from loss of quality or quantity of resource but from other factors and trends.

Appendix D Discussion of Firing Technology in Saskatchewan Brickmaking

D.1 Introduction

One of the most useful aspects of an archaeological survey of similar industrial sites is the ability to discuss a specific technological aspect integral to all examples but which exhibits considerable variation. Within brickmaking of the last one hundred years there are two such aspects which warrant special attention—the method of forming and the method of firing the brick product, also termed "kiln pyrotechnology" (Estep 1997:ii). As previously discussed, both aspects had great significance in the success of given operations, with careful matching of forming and firing with a given raw material being necessary to achieve the desired product.

When examining the brickmaking archaeological record, evidence of firing technology is often directly displayed in extant kiln features of structural material and discoloured earth, while the method of forming is usually only indirectly visible on the brick product artifacts. As the previous discussion covered brick analysis with respect to forming methods, this appendix will concentrate on the more archaeologically distinguishable aspect of firing technology, building on brickmaking research such as that of Ruple (1988) and Estep (1997) who maintained a focus upon this in

their respective South Dakota studies. Analysis of this aspect is also supported by Gurcke (1987:28) who notes that "[i]t (firing) is perhaps the most critical stage because the finished product depends to a large extent on this step for its final shape, color, and strength". In addition, Kevin Anderson (1989:52) finds that firing "is probably the step that has undergone the greatest change over the past 100 years."

Attention will be given during this discussion to the relation that these firing technologies and their development had to the development stages of the brickmaking industry as described previously, along with examination of technology transfer and persistence when recognizable.

D.2 Periodic Firing Methods

Brick firing methods can be divided into two main groupings—periodic and continuous. With periodic firing the fire is built and extinguished with every load of brick product, while with continuous firing the fire is maintained within a kiln during sequential batches of brick or brick product being loaded, fired, cooled, and unloaded. Two main sub-groups exist within each category, this section will examine the periodic examples which are well represented in the Saskatchewan brickmaking record.

D.2.1 Up-draft Scove Firing

The small-scale and often single-purpose nature of most non-commercial brickmaking was usually reflected in the methods of firing, where sophistication and permanence of design was

unnecessary. Most kilns in these situations were some form of an up-draft scove, introduced earlier, where a stack of green, unfired brick became the actual kiln. Fire channels were formed in the lower portion as the stack was constructed, with the subsequent firing gases moving straight up through the mass of brick. In the simplest form of a scove the complete stack was torn apart after sufficient firing, with little remaining evidence of the kiln except heat discolouration of the ground underneath, as at Fort Carlton. However, one Saskatchewan site, Karilowa, may have had an interesting variation where a form of scove retained a functional usage instead of being torn down. This site possessed very soft, low-fired bricks that, once dried, could have been used to construct one or more communal ovens—the most likely brick usage (see Figure 5.4). With the initial firing of the ovens to a point where the exterior surface became hot to the touch, indicating the thorough heating needed for the baking of foodstuffs (Manson 1983:23), the brick would have become partially fired as well. Repeated usage would not have greatly improved the hardness of the brick, as the temperature would have reached similar peaks each time. While speculative, this hypotheses does provide one explanation for Karilowa's unusually low-fired bricks which would have been too soft for any significant structural purpose.

Fort Carlton's brick product was possibly also used for constructing bake ovens, but with the kiln site several hundred metres west of the various fort locations it is unlikely that the kiln itself served as an oven for foodstuffs. It was probably a small scove with a possible English 'Newcastle' design origin as

noted in Chapter 5 (Hammond 1981:23) (see Figure 5.2). This apparent double-firebox design differs with the conventional larger scove in terms of fire channel layout: the Fort Carlton example appears to have had two fire channels running longitudinally in the same direction, while larger scoves usually had multiple fire channels running across the width of the kiln, fired from both sides (Gurcke 1987:31). The operating procedure of either example would likely have been similar except for the amount of fuel required, which was usually wood which did not require the added complexity of grates (Ritchie 1967:213; Hammond 1981:22).

Most of the early commercial brickyards up to 1900 used the simple side-fired scoves, torn completely apart after each firing. Archaeological evidence of a Saskatchewan simple side-fired example is not presently known, although some of the early sites such as at Whitewood would be good candidates for excavational procedures to uncover these, as was done at Fort Carlton. Beyond the simple scoves, however, are the more sophisticated versions with permanent side walls, alternately being termed Dutch, Scotch, or case kilns as introduced in Chapters 3 and 4. A significant improvement was realized in the sealing of the outer walls against unwanted drafts, saving much of the time spent plastering a simple scove kiln and achieving somewhat better control of the firing procedure (Keele 1915a:194). With this modified form the scove technology was able to persist to the middle of the twentieth century in Saskatchewan.

The Shand site represents one of the later, larger-scale seasonal brickyards, with activity as late as 1926 (Pawson

1992:30) (see Figures 5.26 to 5.29). It has intact bases from all four of its Dutch kilns, with the low, arched fireboxes still visible. The brick outlines suggest that the south end in all four kilns was permanent in addition to the side walls, allowing entry from only one end. Most Dutch kilns left both ends open for loading (Keele 1915a:194; Davis 1918:21; Gurcke 1987:29). Coal was used in place of wood for fuel, as this was mined simultaneously with the clay at Shand and Estevan. Grates were necessary for the coal ashes to settle, leading to more complex fireboxes than with the simple scoves, but this was made practical by the permanent nature of the sidewalls (Estevan History Book Committee 1981:91).

Dutch kilns were frequently used in the early phases of year-round operated brickplants, often in conjunction with one or more of the advanced down-draft kilns. Despite their inefficient fuel usage and minimal firing control, Dutch kilns were inexpensive to build and advantageous for firing large amounts of lower-grade, common brick, as long as fuel was inexpensive and plentiful. While the labour cost of firing was comparable to more advanced methods per brick fired (Worcester 1950:52), the Dutch kilns had no limit on their size as the down-drafts did with their curved roofs. This allowed very large examples of Dutch kilns, with some in Alberta having up to 72 fireboxes in units over 50 m long, holding over 500,000 bricks at a time (Manson 1983:60-61; Worcester 1950:52). This was considerably greater than the average of about 90,000 bricks per beehive down-draft kiln (Ritchie 1976:103).

At Estevan such a combination of Dutch and down-draft kilns was used for many decades, with the down-draft kilns firing the

higher grade facebrick (Ries and Keele 1912:81) (see Figure 6.31). This arrangement lasted until 1951 when all pre-existing kilns were replaced by a new tunnel kiln (Saskatchewan Minerals 1950:2, 1951:1-2). By this time demand for common brick had waned while standards for uniformity in facebrick had risen, leaving the Dutch kilns of little use. Thomas Ritchie (1967) remarks on this period:

> As structural-frame buildings came into increased use the need for thick walls of brick diminished, and when only facing brick was required, the brickyards, which had regularly supplied underburnt brick for backing and for wall filler, lost a sizable part of their market. They were forced to improve the preparation and burning of the clay so that all the bricks produced were equally burnt [1967:215].

Technology for the various scove kiln forms seems to have originated in Britain and western Europe, being brought along with the pre-1900 European settlers. The terms 'Scottish' and 'Dutch' used for the permanent walled scoves certainly suggest this, as well as historical treatises detailing variations and developments of the basic scove kiln form (Hammond 1981:21-23). Immigration from eastern Canada and the United States, where brickmaking had already become established, would have also brought settlers knowledgeable of brick firing. Some eastern and southern European groups such as Doukhobors or Italians may not have had previous brickmaking and firing skills before arrival in Canada, but they seem to have learnt quickly upon arrival (The Brick of Winnipeg 1904). The Doukhobors in particular would become significantly involved in the Saskatchewan and British Columbia industries, as mentioned earlier.

D.2.2 Down-draft Firing

One of the first developments to replace up-draft scove-type kilns and their inefficient use of fuel with accompanying lack of firing control was the down-draft kiln design. This was represented in two major forms, the round 'beehive' with a domed roof and the rectangular form with an arched roof (Gurcke 1987:32; Manson 1983:79). In the down-draft firing procedure the hot combustion gases rose behind partial 'bag' walls to the curved roof, then descended downward through the brick mass towards a perforated floor which led to a tall exterior stack (Hammond 1981:23) (Figure D.1). Firing in this manner was much more

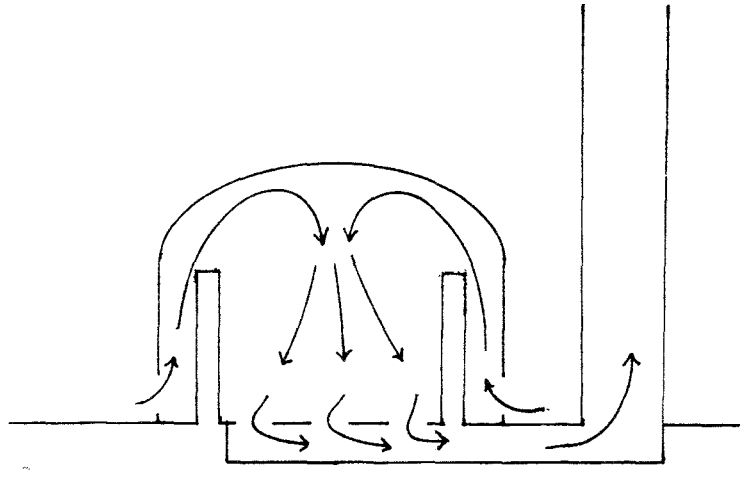


Figure D.1 Cross-section of down-draft operation in a beehive kiln. Combustion gases, indicated by arrows, enter near ground level into fireboxes, move up and over bag walls, then down through floor and out through stack. Adapted from Hammond 1981:22.

even than with the up-drafts, as the combustion gases had time to arrive at some equilibrium in temperature before any bricks were contacted. Higher temperatures could then be safely introduced,

such as for refractory ware (Keele 1915a:195), assisted by not having any cold outer walls adjacent to the green brick. Control of colour was improved by the ability to regulate the amount of air for an oxidizing or reducing atmosphere (Worcester 1950:52; Hammond 1981:23), while the heat that exited into the perforated floor could be piped to other locations and reused for such purposes as drying tunnels or preheating freshly loaded kilns.

A few recent authors have suggested that beehive kilns could have been fitted without bag walls and simply used in an up-draft fashion (Ruple 1988:5; Anderson 1989:52). If this is true, it was likely uncommon, as most sources reviewed mentioned beehive kilns only in association with down-draft usage (Keele 1915a:194; Davis 1918:21; Ritchie 1976:103; Hammond 1981:23; Gurcke 1987:32). Ruple hypothesized that up-draft usage would be indicated by a circular opening in the top of the domed roof; however, most beehive kilns had this 'Pantheon oculus' opening which was covered during firing (Hammond 1981:22; Ruple 1988:5). Upon finding extant examples which all possessed roof openings and perforated floors, Ruple's subsequent assertion was that these kilns were constructed "to take advantage of both techniques of burning brick" (Ruple 1988:5). This is also unlikely, as the fuel efficiency and control of firing would largely be negated by using an up-draft mechanism.

Beehive kilns seem to have become popular in Saskatchewan brickmaking with the transition to full-year operation brickplants after 1900. The Moose Jaw plant of Wellington White had two down-draft kilns installed by 1902 (Moon 1979:30; Knight

1982:28), which appear to have been beehives, while the Weyburn Brick Co. Ltd. had three installed at its inception in 1910 (Ries and Keele 1913:17). While the Estevan Brick Ltd. site did not have beehive down-draft kilns mentioned in Ries and Keele's 1912 report of their 1910 geological fieldwork, a rectangular down-draft was noted at this time (1912:81). However, in Davis's 1918 report of 1916 geological fieldwork, a photograph of the same site clearly shows two beehive kilns which may be adjacent to the earlier-mentioned rectangular down-draft. The Dutch kilns which handled the majority of this company's production sit some distance away to the southwest (see Figure 6.31) One historical account adds that 'octagonal' kilns were used after 1925, perhaps these were rebuildings of the earlier round beehive kilns (King 1967:37). One such shape is visible in an aerial photograph of the site in 1949 (Central Survey and Mapping Agency, Regina, A11877-144), and is in the vicinity of the two round beehive kilns from the photograph in Davis's report. Unfortunately as earlier noted, the 1951 and later redevelopment of the site has likely erased any archaeological evidence of these down-draft kilns.

The Boundary Dam brickplant site outside of Estevan has two beehive kilns, one with a complete roof and one which has collapsed (see Figure 6.46). Unfortunately, as the history of the site is still sparse, it is difficult to ascribe time or usage to the kilns, which closely resemble the Weyburn and Estevan Coal and Brick Co. Ltd. examples. Most likely the Boundary Dam site kilns date from the WWI period.

Claybank is the site best known in Saskatchewan for its down-draft beehive kilns, as nearly its complete production from 1914 to 1989 was fired in these units. Six were initially constructed, with four more added in later decades, each with 12 fireboxes and an interior diameter of 9.75 m (32 feet) (Fulton 1994:12). All are currently extant, although regular maintenance and rebuilding over the life-span of the plant may mean that none of the materials in the current kilns date to their original construction. Early photographs (Figure D.2) show a distinctive bulged shape to the vertical wall portion of each kiln, capped by a single wide steel band at the top. These are the only such examples known to the author at present, as beehive kilns usually had straight walls with multiple, much smaller steel bands circling the unit (Ritchie 1967:212; Manson 1983:43, 48, 71, 92; Gurcke 1987:33). The current Claybank kilns exhibit this more common wall and reinforcement style, with only the photographic record indicating the difference of the original versions (Figure D.3). Otherwise, the kilns at the Estevan Boundary Dam site and at Claybank are very similar, which illustrates how comparison of industrial features by obvious visual characteristics can occasionally be deceptive. Alteration to original plans and construction, by repairs and modification, must always be considered when interpreting such features (Kennedy 1979:28).

The beehive kilns at Claybank are accompanied by an elaborate underground system of brick flues leading to the drying tunnels, which could also be adjusted by dampers to heat the main

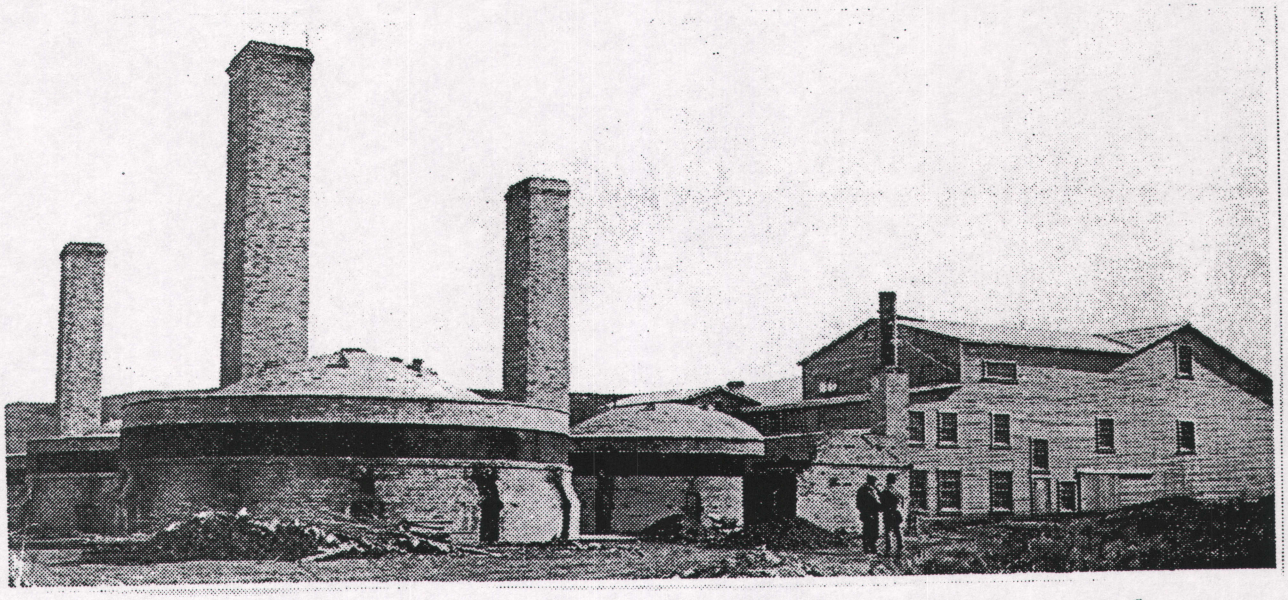


Figure D.2 Claybank kilns c.1930. From Province of Saskatchewan 1930:36.

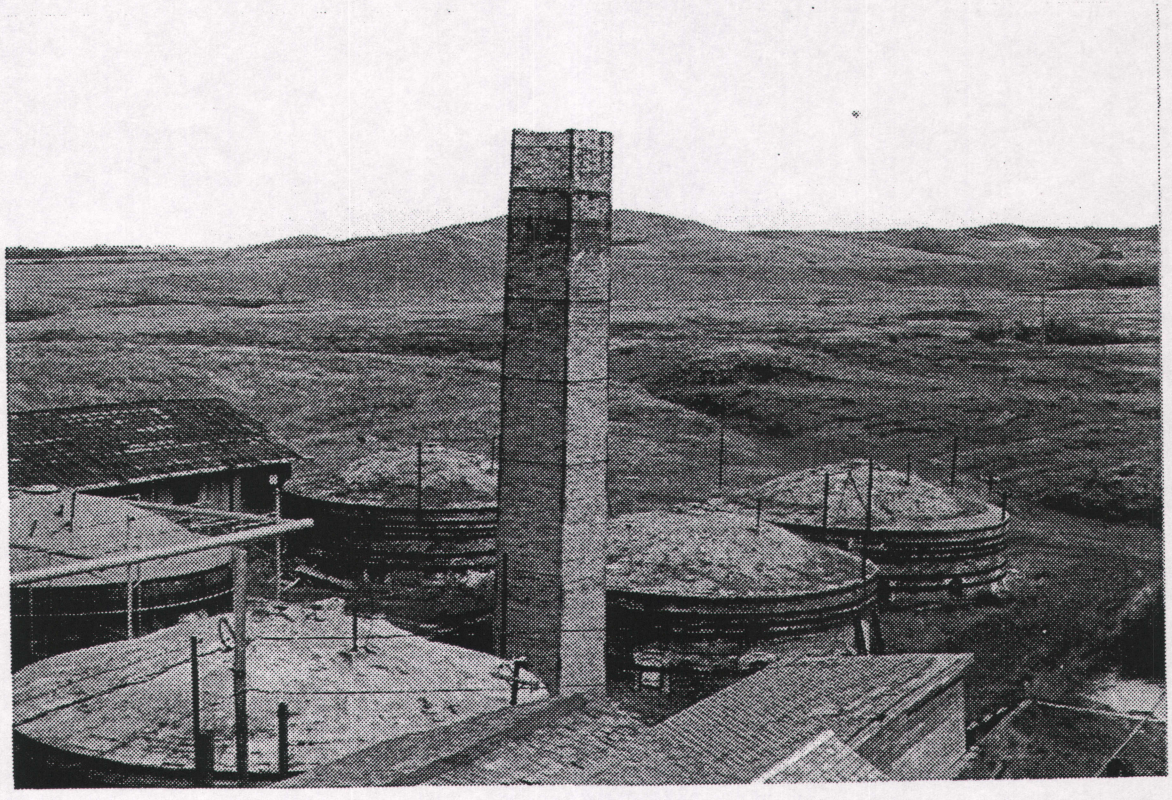


Figure D.3 Claybank kilns in 1997.

manufacturing structure. In this way the Claybank operation maximized the potential efficiency of the beehive kilns, which helps explain how the brickplant was able to operate until 1989 with kilns that were technologically superseded with tunnel variants by the 1940s (Ritchie 1967:223). In addition, Claybank was able to convert six of the ten kilns to natural gas firing from coal in 1960, a feature that was decades overdue in Saskatchewan's brick production (Davis 1918:4; Worcester 1950:51-54; Saunders et al. 1992:15). Gas firing had long been the great advantage of Alberta's brickmaking in the Medicine Hat/Redcliff area, as it was not only less expensive in terms of fuel, but was cleaner firing, requiring much less labour both to tend the firing and to clean the kilns afterwards (Worcester 1950:52). However, in another example of why some technologies persist in the face of seemingly superior substitutes, the four kilns not converted to natural gas continued to be operated with coal for certain product lines, where the desired finish could only be created by the use of coal fuel (Saunders et al. 1992:15).

The rectangular down-draft kilns seemed to have been most popular when constructed of multiple chambers in large production facilities, such as at Russell, Ontario, which in 1914 had three 12-chamber rectangular down-drafts with 12 individual stacks per unit (Ritchie 1967:213). On the prairies the multiple chamber design was used several times in the Medicine Hat/Redcliff area of Alberta (Manson 1983:68, 77) but does not seem to have been used in Saskatchewan. The single Saskatchewan example noted earlier is recorded from the Estevan Brick Ltd. site in 1910, with the

geologists Ries and Keele finding that: "[b]urning is done chiefly in Dutch kilns, but some [is done] in a rectangular down-draft kiln" (Ries and Keele 1912:81). The number of chambers is not mentioned, but as this kiln seemed to be less commonly used than the Dutch examples, it likely was a relatively small, single-chamber design. It may be visible behind the two beehive kilns in the c.1916 era photograph of the site (see Figure 6.31).

The exact origin of the down-draft process is vague, but appears to have been in widespread use both in Britain and North America by 1900 (Hammond 1981:23; Gurcke 1987:11). Unlike the scove type kilns, which were largely associated with the cottage-industry nature of seasonal brickmaking, down-draft kilns were almost exclusively associated with fully industrialized brickplants which operated year-round. Because of this, the diffusion of this technology was more likely through trade journals and other forms of media, rather than by the movement of individuals with prior knowledge of kiln construction. This was largely a result of the improved communication systems which were being established by the later 1800s, a trend which would continue to influence technology transfer to the present.

D.3 Continuous Firing Methods

The up-draft and down-draft kiln designs discussed varied considerably in sophistication but all shared the characteristic of being periodic. Improved uniformity of brick production and efficiency could be gained if a kiln structure never had to be shut down, with the stages of firing occurring simultaneously and

continuously. This led to two main forms of continuous kilns, one where the firing zone advanced through a kiln of multiple chambers, and the other where the brick product moved through a tunnel with varying stages of temperature. Both types were represented in Saskatchewan brickmaking, the multiple chamber design having been used at the Bruno site and the tunnel design having been used at the Estevan Brick Ltd. site.

D.3.1 Multiple-chamber Continuous Firing

The first successful fully continuous kiln was designed in 1856 by Friedrich Hoffmann of Germany and was being used in Britain by 1870. The earliest designs were circular with a dozen or more chambers arranged around a central stack, which evolved into oval and eventually rectangular shapes of two parallel, linear rows of chambers (Hammond 1981:23-25). The introduction to North America seems to have occurred soon after Britain's first examples were constructed, with a particularly large example installed at the Don Valley Brick Works in Toronto by 1907. This held 50,000 bricks in each of its 26 chambers (Ritchie 1976:104). Saskatchewan's single version, previously described in Chapters 3 and 6, was constructed at Bruno about 1914 and used until the plant's shut-down in 1960.

The design of the Bruno kiln was actually 'semi-continuous' by strict definition, in that it had only one linear row of chambers instead of two (as in the later rectangular continuous models), therefore not fitting into the 'race-track' category usually applied to multi-chamber continuous kilns (Gurcke 1987:32). However, it

was essentially continuous in practice, and termed as such by clay engineers such as Worcester (1950:52). This was due to its ability to have the firing zone advance through the row of nine chambers, then either be restarted at the original end or potentially reverse in direction, facilitated by tall stacks on either end of the structure. In terms of its draft as compared to the periodic up-draft and down-draft versions, the Bruno kiln could be designated as a 'side-draft', with a large number of flues and dampers to control the flow of combustion gases (Figures D.4, D.5).

Firing of the kiln was from the top with fine coal, which as earlier noted limited the usage to middle-grade wares that would not be adversely harmed by settling coal ash. Because the main product at Bruno, structural tile, was usually stuccoed when used in building facing, this was not a major problem. The top-firing method in itself had a striking similarity both in function and in architecture to that used with coke ovens, particularly with multi-chamber, linear-arranged examples called the "beehive block system" in metallurgical terms (United States Steel 1957:91). In both cases coal was dispensed or charged from above into a high temperature environment, where heat was retained not only by the brick walls of the chambers (arched at Bruno and domed in beehive coke ovens), but by earth fill piled up to the highest points of the roofs. Electric or steam-powered 'Larry Cars' ran on rails above the coke ovens to dispense the coal, while at Bruno a simplified form of elevated wooden troughs were placed across the top of the kiln structure to perform the same function, albeit manually (United States Steel 1957:91; Kennedy 1979:20-21) (Figure D.6).

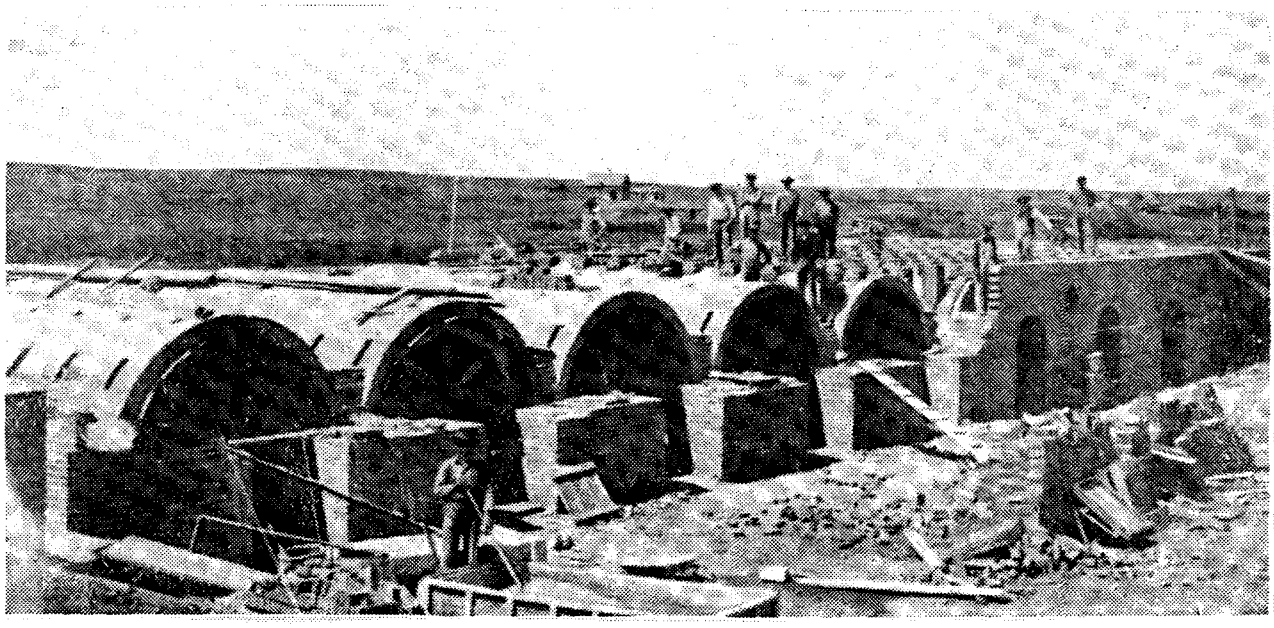


Figure D.4 Construction of the Bruno kiln, c.1914. From Province of Saskatchewan 1930:34.

Figure D.5 Bruno kiln in 1985. Courtesy F. Korvemaker, photographer.

A further similarity between the Bruno kiln and coke ovens was the linear arrangement of large brick doorways which had to be torn apart after either the firing or coking of a chamber was complete (Kennedy 1979:23). In at least one coke oven version, the Mitchell Oven, as used at Leitch Collieries in Passburg, Alberta, these doorways existed on both sides of each chamber, as they did with Bruno's kiln. Built in 1910-1911, not long before Bruno's kiln construction, the Mitchell Ovens used one doorway to allow entry of a mechanical pushing device to remove the produced coke out from the opposite doorway (Kennedy 1979:41-42). At Bruno one doorway faced the interior yard spur line which brought brick from the dryers, while the other doorway led to the loading dock by the main railway spur line (William Lemke, personal communication 1996) (Figure D.7).

It is hard to determine how much direct influence that coke oven technology actually had on the Bruno kiln design but many of the similarities are striking. Either the kiln designer merged traits of coke ovens with the continuous kiln designs begun by Hoffman, or the similarity of forming coke and firing brick resulted in simultaneous innovations. Regardless, with both the technological features and the contribution made to Saskatchewan's overall brick production from 1914 to 1960, Bruno's kiln can be considered the most significant single example in the province.

Figure D.6 Coal-dispensing 'Larry' on top of the Bruno kiln. Unit rests on Bruno tile blocks.

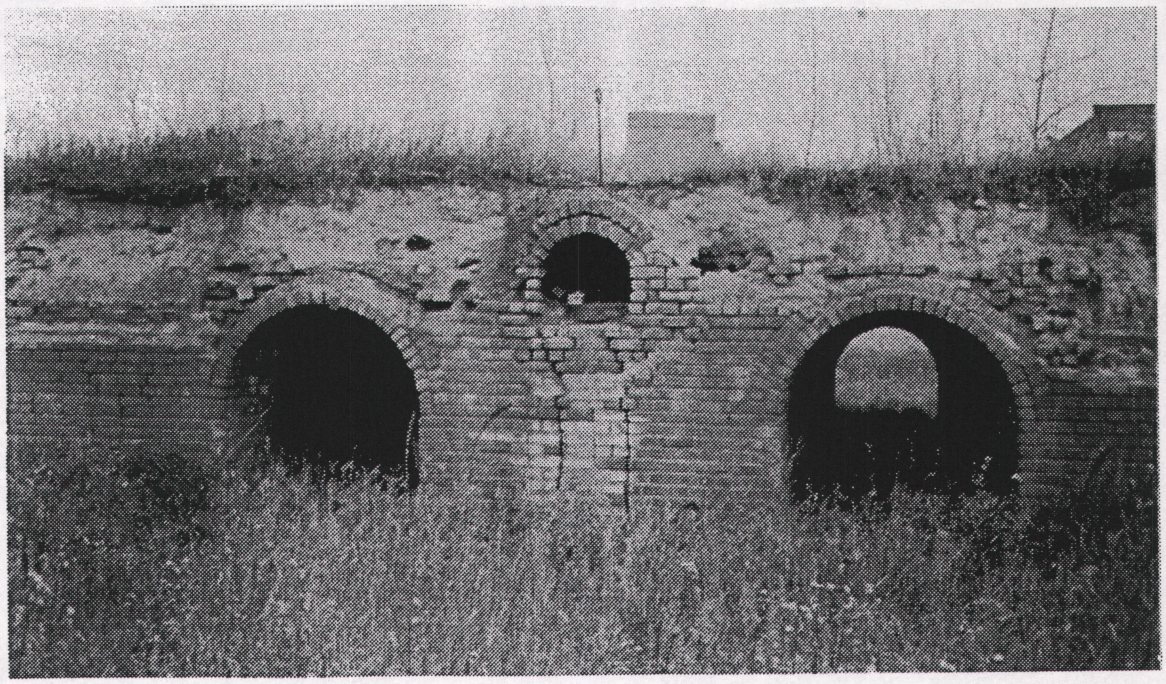


Figure D.7 Two west (yard-side) chamber doorways of the Bruno kiln in 1995.

D.3.2 Tunnel Continuous Firing

Designs for continuous tunnel firing, where the firing zone remains stationary while the brick product moves, go back as far as 1751 to the French Royal Porcelain Factory (Hammond 1981:24). Variations suitable for brick firing were developed much later, due to such technical problems as insulating the bottoms of the flanged-wheel carts, which was accomplished with a sand seal along either side (Jameson 1958:668). In operation, the tunnels, 100 m and longer in length, had multiple fireboxes located at the centre of the unit, with the heat produced moving towards the beginning of the tunnel to preheat freshly loaded carts, each holding 1,000 or more bricks (Hammond 1981:26). Meanwhile, towards the far end of the tunnel, the bricks went through gradually cooler zones, emerging ready to be sorted. The total time involved was under three days, significantly less than the five to six days required of most periodic kilns (Ritchie 1967:227).

By 1889 the first successful tunnel kilns were being introduced to North America, with the first Canadian example set up in 1923, probably in Ontario (Jameson 1958:668; Ritchie 1967:226-227). Saskatchewan's first and only tunnel kiln was set up at Estevan in 1951 as earlier mentioned (Figure D.8) beating the competition in Alberta by one year, as three tunnels were to be built in that province, in 1952, 1954, and 1965 respectively (Manson 1983:127). Such improvement was expensive, which was only made possible at Estevan after the provincial government's purchase of the plant in 1944. Technical setup was also complicated, taking some time to bring the kiln to full operation (Saskatchewan Minerals 1952:1).

Fueling was originally by oil, which was changed to natural gas in 1958 (Saskatchewan Minerals 1958:2), finally allowing reasonable parity of expenses with long-time competitors in the Medicine Hat/Redcliff area. However, this parity did not include long-time Saskatchewan competitor Bruno Clayworks Ltd., who held a significant disadvantage once the Estevan tunnel kiln was operating, leading to the Bruno plant's shutdown less than ten years later.

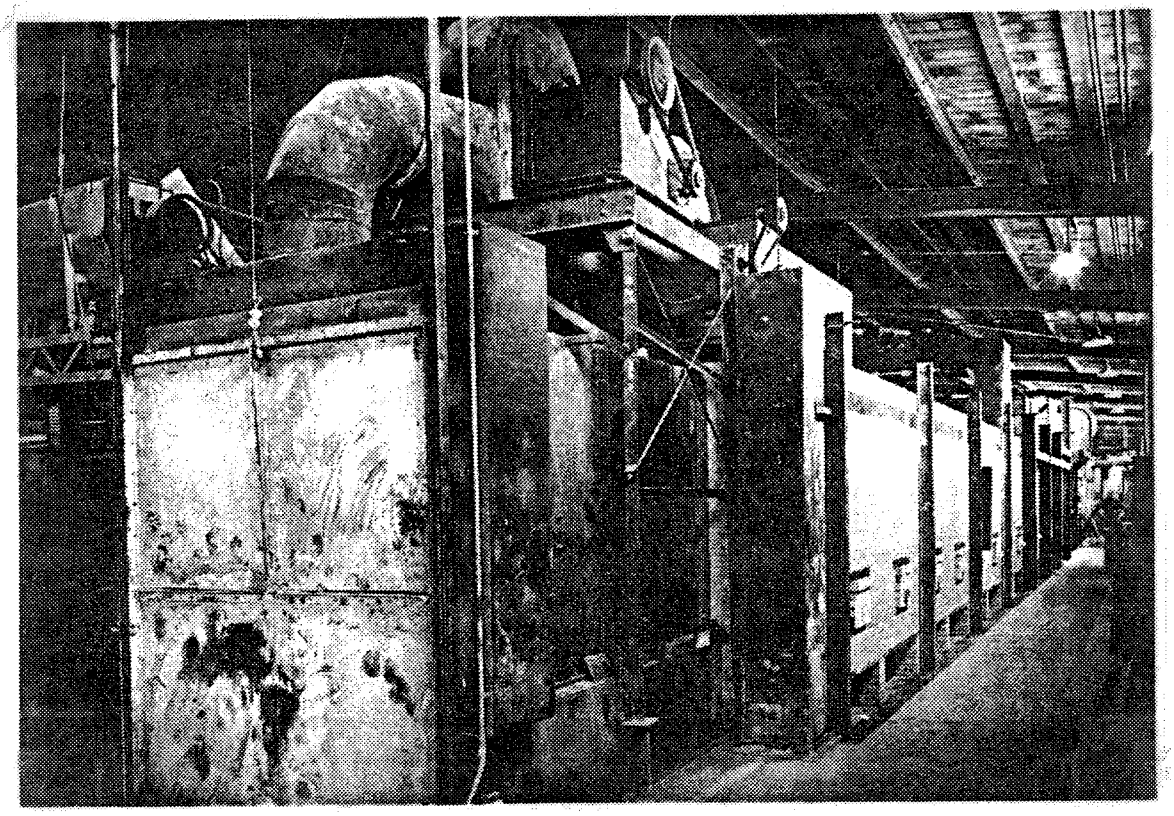


Figure D.8 Estevan tunnel kiln in 1961. From Saskatchewan Minerals 1961:5.

The tunnel kiln was largely responsible for the Estevan plant's success until 1996. Its full capacity of over 300,000 brick

simultaneously drying and firing (King 1967:38) kept it viable up to this date when it finally was purchased by its old Alberta rival, I-XL Industries of Medicine Hat, and subsequently dismantled. Unlike the other major brickmaking sites of Claybank and Bruno, where the kilns were left in place, the Estevan unit was removed and taken to Medicine Hat, where it may see more use. Archaeologically this leaves a gap in Saskatchewan's kiln record, which is balanced by the opportunity to view similar kilns still operating in other locations.

D.4 Analogous Heat-hardening Methods

As the sand-lime forming method was discussed in Chapter 6, some mention is necessary of the heat-hardening of this brick, which in an exception to a true firing was performed by steaming in large autoclaves. These large cylinders, about 2 m in diameter and 20 to 25 m in length, were fairly simple structures in comparison to kilns, with circular doors at the ends which sealed tightly once loaded. The loading itself was performed either with small carts on tracks, similar to tunnel kiln layout, or by small fork lift vehicles. Once sealed, the pressure was raised to about 825 kPa (120 psi), for about ten hours (Keele 1915a:142; Ritchie 1967:219).

Two sand-lime brick manufacturing plants operated in Saskatchewan, of which the structure of one facility, Saskatoon Brick & Supply Co. Ltd., still stands. However, its autoclave component is not known to exist. In addition, no other sand-lime

manufacturers are known to currently operate in Canada (Dun & Bradstreet 1997).

D.5 Summary

The Saskatchewan brickmaking record provides a good array of firing technologies which include all the basic categories that were used across North America, most of which are visible in the archaeological record and some of which are particularly noteworthy for their state of preservation or innovation. Study of such a cross-section of North American technology is beneficial both for the insights on the specific industry of brickmaking and as a model for other analogous industrial studies in the future.

Appendix E Glossary of Brickmaking Terminology

All terms in this glossary relate to bricks or brickmaking, as many terms are used differently in other contexts. Words in italics refer to terms discussed separately in this glossary.

aggregate concrete light-weight concrete produced using ground, burnt clay as a major ingredient. As this became popular in the 1950s, product made with this process displaced a major burnt-clay *brick product*, *structural tile*.

ante-fired the process involving ground, burnt clay being mixed with sand, formed into a *brick* or *brick product*, and subsequently refired or heat-hardened in an *autoclave*. Predecessor to *aggregate concrete*.

autoclave a large cylinder where *sand-lime* or *ante-fired brick* is placed and hardened under steam pressure.

bag-wall partial-height wall used in *down-draft kilns*.

bat broken *brick*, sometimes intentionally done to create partial bricks for masonry uses.

beehive a round *kiln* with a domed roof, usually of a *down-draft* process.

brick a masonry product, usually of burnt clay, with a rectangular parallelogram shape that can be held easily in one hand. This aids a mason in laying brick as the mortar trowel can remain in the hand opposite to the hand lifting and positioning the brick. When a burnt clay item is too large to be held in one hand, or is of a non-parallelogram shape, it is referred to here as *brick product*.

brickmaking — the set of procedures involved with the manufacture of *brick* and *brick products*, usually of burnt clay.

brickplant — a site of brick manufacture set up to operate year-round, generally more industrialized than a seasonal *brickyard*.

brick product — masonry items usually of burnt clay, too large to be held easily in one hand or of a non-rectangular, non-parallelogram shape.

brickyard — a site of brick manufacture set up to operate seasonally, generally less industrialized than a year-round *brickplant*.

buff — yellowish/off-white colour.

burn — term used by the brickmaking trade meaning to fire a clay product to a durable hardness.

clinker — a *brick* that has become overheated during firing and started to vitrify or melt, usually with significant colour change. Commonly produced unintentionally with the older *scove kilns*, of little worth before 1900 when clinkers were commonly used for construction fill, after this date they became fashionable in certain architectural styles when placed amongst *facebrick* for a rustic effect. Difficult to intentionally produce in modern *kiln* environments.

common brick — *brick* of a lesser quality than *facebrick*, used on the sides and backs of brick buildings, and as a structural backing for *facebrick*. Also commonly used for utilitarian fixtures such as chimneys.

continuous kiln — a *kiln* where the firing zone can be maintained indefinitely. There are two major types, the multiple-chamber type where the firing zone moves through multiple chambers being loaded, fired, and unloaded, and the *tunnel kiln* type where the firing zone is stationary while the fired product moves.

cull — a defective *brick* or *brick product* for any of many reasons during production or handling: breakage, cracking, discolouration, mishapened, etc. *Clinkers* are an extreme, specific class of culls.

down-draft kiln — a *kiln* where the firing gases enter near the base, move up and over *bag walls*, then flow down through the fired product to exit into the floor, usually moving to an exterior stack.

dry-press process — machine forming of *brick* under great pressure, with water content of the clay being in the range of less than 10%.

Dutch kiln — a permanent form of *scove kiln* which has permanent side walls and fireboxes, and partially permanent end-walls. Also called Scotch or case kiln.

facebrick — *brick* used for the front or face of a building, generally the highest quality of structural brick.

firebrick — *brick* or *brick product* used in high-heat or 'refractory' situations, resistant to melting at high temperatures—has a high *vitrification* point.

kiln — an oven for firing or 'burning' ceramic wares to a water-resistant, durable hardness. *Brickmaking* kiln types include periodic *scove*, *Dutch*, *beehive*, and rectangular types; semi-continuous rectangular; and *continuous tunnel* or multiple chamber types; among others. A particular kiln may be *up-draft* or *down-draft* in regard to the movement of gases within it during firing. Fuels include wood, oil, coal, and natural or producer gas, among others. Often pronounced 'kill'.

mantelbrick — high quality *brick* similar to *facebrick*, for use with interior applications.

salmon — pinkish-orange colour.

sand-lime — a process to make brick-like items by mixing sand with lime as a fluxing agent, and heat-hardening under steam pressure in an *autoclave.*

scove kiln — a *kiln* made of a stack of the ware to be fired, with passages formed while stacking to permit the firing gases to flow through. This is usually dismantled entirely unless of the more permanent *Dutch kiln* variety. Scove kilns are *up-draft* kilns.

soft-mud process — hand or machine forming of *brick* with the use of molds and a relatively moist clay, with a water content in the 20% to 30% range.

stiff-mud process — machine forming of *brick* or *brick product* by extrusion of clay through a specially shaped and sized die. The resulting ribbon of clay is cut at regular intervals, usually by a wire device which has led to products from this process being called *wire-cut brick.* The water-content of the clay is less than with the *soft-mud process,* being in the 12% to 15% range.

structural burnt clay product — any of a number of predominantly clay products produced and fired/burnt with the same general set of procedures of brickmaking, often simultaneously. This includes *bricks* of several descriptions, various kinds of structural *tile,* clay weeping or drain *tile,* clay sewer pipe and terracotta trim.

tile — within brickmaking, tile refers to extruded *brick product* made by the *stiff-mud process,* which can include structural tile blocks, weeping or drain tile, chimney flues and other forms.

tunnel kiln — a *kiln* consisting of a long, enclosed passage with a stationary firing zone in the centre. The fired product moves through on tracked cars, heating and cooling gradually before and after the firing zone. These are a type of *continuous kilns.*

up-draft kiln — a *kiln* in which the firing gases enter at the base and move straight up and out through the fired mass or the roof.

vitrification point at which *brick* or *brick product* being fired begins to melt. More refractory clays have a higher vitrification point than regular clays, a feature used in *firebrick.*

wire-cut brick brick made by the *stiff-mud process.*