ARCHAEOLOGICAL EXCAVATIONS, HALIFAX
CITADEL
1978
by John J. Connolly
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Excavations Halifax Citadel
Halifax, Nova Scotia
1978

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Abstract

Archaeological excavations were conducted on the south front of Halifax Citadel to uncover features constructed in the nineteenth century to obtain data that could be applied to the reconstruction. Data was obtained on smoothbore gun emplacements, parapets, drainage systems and building locations. The features that were excavated were either going to be destroyed by the reconstruction process or information applicable to other locations on the Citadel was required and not available in historic documentation. The combined research and salvage aspects of the archaeology produced varying results. The destructive elements that have decimated most of the original fabric of the Citadel have significantly altered some areas while leaving other areas relatively untouched. This inconsistency of destruction is both an asset and a liability. The work completed was in an area that had been disturbed and yet it yielded constructive data. It is presumed in other areas where less disturbance has taken place that more information will be found.
Introduction

The Halifax Citadel is currently in the process of a long term development to characterize the evolution of the fortification and the armament in the context of a British colonial outpost. This development involves stabilization and restoration of existing structures or the complete reconstruction of features that are pertinent to specific periods. Designated as short term objectives are sections of the Citadel that are to be treated as concise units and rebuilt in a short span of time relative to the overall project time frame. The current focus is to restore the southwest front to a period in the evolution of the fortifications. This section of the Citadel was one of the first to be constructed. The paucity of documentary information concerning various features that were located in this area during the early nineteenth century required the employment of archaeological techniques. Data was recovered that will be utilized to present an accurate picture of the area and material that would have been destroyed by construction activity was salvaged.

The evolutionary aspect of the Citadel, in terms of the ordnance, is one of the more outstanding features as it parallels the general development of British artillery during the nineteenth century. The existing masonry structure was started in 1828 by the Royal Engineers to establish a permanent fortification. The three previous forts on the Hill were relatively temporary earth and log structures which fell into a constant state of disrepair. To maintain
the British presence in this area of North America on a more permanent basis, it was decided to construct a system of masonry fortifications surrounding the Halifax Harbour of which the Citadel would be the major landward defence.

The structure was built of ironstone and granite quarried in Purcell's Cove. Its design was consistent with the fortification technology of the early nineteenth century essentially unchanged since the seventeenth century.

Although this system was suitable as a defense against the smoothbore type of ordnance, major improvements in artillery in the later half of the nineteenth century, primarily the addition of rifling to the barrel, rendered the Citadel obsolete. The higher muzzle velocities and the greater accuracy necessitated a change in the Citadel defences if it were to maintain some form of viability. It was not until 1879 that a completely new system of rifled ordnance was installed. The actual structure of the fort was not changed leaving it vulnerable to the power of new guns and its significance as a viable defence declined as the emphasis moved to outerharbour fortifications. The fort was transferred to the Canadian government in 1906 and its functional role changed. It was turned over to the Historic Sites and Monuments board in 1951.

The opportunity that the Citadel presents from the evolutionary standpoint is significant but much of the physical evidence is either buried or partially extant. Historical documentation, in some cases, was absent or gave only vague locations for specific features that would be significant in the reconstruction. This necessitated the use of archaeological techniques. Due to the effect of various destructive elements on the fabric of the Citadel, it was considered of a very low priority for archaeological investigation. The result of this assessment was that there was no program of excavation in advance of the restoration
that was undertaken at any period under Parks Canada.

There have been sporadic investigations during the 1960s (Coleman 1965; Lane 1965; Wilson 1967) mainly the result of features being uncovered rather than planned excavations. It was not until the current project was underway that the need for some archaeology was felt. Excavations were conducted on the west front of the Citadel for several features that were not verified or detailed in the historical documentation (Parmenter 1976). Excavations on the southwest demi-bastion were conducted and uncovered information on the parapet and gun emplacements from the smoothbore period of the armament on which there was little historical and archeological data (Connolly 1977). This work was carried over into the current field season as well as excavations for structures located on the southeast salient.

The paucity of data on the smoothbore period of the Citadel development makes it imperative that all the limited possible sources of evidence are investigated to form a precise picture of the features that existed. The remaining areas, primarily the northwest demi-bastion, should yield the balance of the information on the gun emplacements. This will allow the historical and archaeological information to be utilized to their fullest extent.
Historical Outline

The south front ramparts underwent radical physical changes during the British and Canadian occupations. The ramparts epitomized the evolution of artillery during the nineteenth century and the problem of adapting a new technology to existing fortifications. The ramifications of these changes can only be seen in a broader perspective and the archaeological excavations have to be co-ordinated with the historical documentation. The excavations were very specific in their focus and their contribution to the information on the ramparts has to be understood in the larger context.
Southwest Demi-Bastion

The southwest demi-bastion was constructed between the years 1829 and 1831 by local contractors and the Royal Engineers under the direction of Gustavus Nicolls, Commanding Royal Engineer. The excarp walls of the bastion formed an acute angle and the retaining wall encircled a masonry powder magazine. Incorporated into the bastion were casemates of defence directed into the ditch and storage casemates with access from the parade. Access to the bastion was via a ramp from the parade level to the terreplein of the ramparts. Sections of the right face escarp wall deteriorated by 1830 and fell down or were pulled down for safety. The inadequacies of the design were rectified and the wall was rebuilt by 1834 closer to the specifications recommended by Vauban. All of the original construction was accomplished by using roughly squared ironstone but after the wall failure, granite ashlar construction was utilized for additional strength. Another factor, not fully compensated for in the original design of the Citadel, was the impermeability of the local soil which created constant drainage problems. This problem thwarted the best attempts of any of the engineers to make the fort dry.

The fact that this section of the Citadel was one of the first to be completed should have meant that it was one of the first to be armed. Before the bastion was mounted with ordnance, however, the balance of the fort had to be structurally completed and a plan for the guns formulated. It was almost twenty years before any guns were mounted in
the bastion because many unforeseen problems were encountered in the process of construction (Greenough 1974).

The final plan for the ordnance to be mounted on the southwest demi-bastion was approved in 1846 and the guns were mounted in the years 1852 to 1854. The guns were of the muzzle loading, smoothbore variety all on traversing platforms. The gun at the salient of the bastion was mounted on a common traversing platform firing en barbette and the two guns mounted on either excarp were on dwarf traversing platforms firing through earthen embrasures in the parapet. The guns were mounted on granite segmented racers without iron tracks. The eight inch (46.0 lb.) gun mounted at the salient had an intermediate pivot position and a 270° degree traverse whereas the 32.0 pound guns mounted on the faces of the bastion had the pivot in the forward position with a much smaller traverse.

This arrangement of the guns lasted approximately ten years until the advent of rifled ordnance on the Citadel in the form of breech loading, 7.0 inch (110.0 lb.) Armstrong guns. The implications for the southwest demi-bastion were that one of the two 32.0 lb. smoothbores on each face was dismounted and the 8.0 inch smoothbore emplacement at the salient was converted to accommodate the Armstrong. This rearrangement was accomplished circa 1864. The emplacement at the salient was completely rebuilt and realigned to cover the south front of the Citadel as opposed to the southwest front. The emplacement consisted of two iron racers fastened to a granite segment footing with an imaginary pivot. The Armstrong gun was mounted on a dwarf traversing platform and fired through an earthen embrasure cut in the parapet.

This was not the final rearrangement to occur on the southwest demi-bastion. Although the Armstrong gun was superior to the smoothbore gun because of its rifling, the breech loading apparatus did not work as anticipated and all
British artillery was changed back to the muzzle loading variety. This new technology precipitated a major change in the ordnance mounted at the Citadel and it was decided to completely remove any previous guns and mount the new type. The new pattern gun would not fit any of the smoothbore emplacements so they were dismantled and new emplacements were built. The change was not so radical in the southwest demi-bastion because the new guns would fit the racer system of the Armstrong guns. The main implication of the change was that all the remaining smoothbore guns were dismounted and their emplacements dismantled. The only gun that was mounted in the southwest demi-bastion was the RML (Rifled Muzzle Loading) at the salient. There were also some eight and thirteen inch mortars on ground platforms along the south front in unspecified positions retained from the smoothbore period (Johnston 1977).

The fact that the southwest demi-bastion was to be restored to the 1860s period with the Armstrong and smoothbore periods represented meant that the focus of the archaeological investigations would be oriented to that period. However, because of the paucity of documentary evidence concerning the smoothbore gun emplacements excavation had to be carried out on all the possibilities on the south front. Excavations from the current year are a segment of the program designed to explicate the appearance of a nineteenth century smoothbore emplacement at the Halifax Citadel.
The Southeast Salient

The southeast salient was completed in 1831 utilizing Col. Nicolls's design. The southeast front was not as massive as the southwest front because it did not form a bastion and it did not protect a powder magazine. It consisted of an excarp wall constructed of ironstone and a retaining wall constructed primarily of granite forming an acute angle. Access to the terreplein was via two flights of granite stairs incorporated into the retaining wall. Casemates for the defence of the ditch were constructed under the ramparts and adjacent to storage casemates all of which were entered from the parade level. This section of the ramparts did not suffer the same stresses as the southwest front as it did not fall down during the nineteenth century.

The armament during the smoothbore period was similar to the armament of the southwest demi-bastion. It consisted of an eight inch muzzle loading gun on a common traversing platform at the salient, firing en barbette over the parapet, flanked by 32.0 pound smoothbore muzzle loaders on dwarf traversing platforms, two on the left face and one on the right face. The racer and pivot system was the same as the ones utilized on the west front. The partial changeover to the rifled type of artillery in 1865 meant that the gun at the salient was dismounted and the emplacement rebuilt to accommodate the rifled guns. Instead of the Armstrong guns that had been mounted at other locations at the fort during the same rearmament period, a nine inch rifled muzzle loader was installed. The 32.0 pound guns on the left face of the southeast salient remained but the gun on the right
face was dismounted. The final rearmament in the 1870s saw the removal of all the smoothbore guns and the replacement of the 9.0 inch gun at the salient with a 7.0 inch RML. Supplementing all the ordnance at the southeast salient was a thirteen inch mortar which remained throughout all the changes (Johnston 1977).

The southeast salient was in a unique position in terms of its visibility from all points in the city below the fort and the capability for viewing directing down the harbour for a great distance. Capitalizing on this capability, a signal mast was erected in 1835 to signal the city merchants, harbour related agencies and military installations as to what ship was entering the harbour. The mast was later enlarged and moved to a more convenient location on the salient at the intersection of the right and left face retaining walls. The British, realizing the importance of the signal mast, built a signal station on the ramparts of the southeast salient as early as 1848 to accommodate the signals for the mast. This was later supplemented by a house for the director of signals and various other buildings of unspecified use. Other structures that were located on the salient were a depression range finder pit and a time ball (Morrison 1978).

The British signal station was demolished in 1916 by the Canadians and a larger structure was built with more sophisticated communication equipment. The remnants of all these buildings were gradually destroyed until the late 1950s when there were none left (Dunn 1977).

Archaeological excavations that were conducted in this area of the Citadel were oriented to assessing the destruction of the smoothbore emplacement on the right face and locating the buildings that were built by the Canadians and the British. All evidence that existed on the left face of the salient was destroyed during the 1930s when this section of the excarp collapsed.
Gun Emplacements

The use of smoothbore artillery reached its pinnacle during the middle of the nineteenth century. The technology associated with this style of gun was standardized and had evolved into a sophisticated form of weaponry. The British, due to their wide ranging interests throughout their Empire, had established patterns for all the ordnance distributed to their armed forces and manufactured at the central armory at Woolwich, England. This meant that throughout all the Empire guns and platforms would be consistent and dimensions predictable. The wide range of terrain and situations at the various fortifications meant that emplacements constructed for the guns would be site specific.

The type of platforms that were utilized on the southwest demi-bastion of the Halifax Citadel were common or dwarf traversing. The traversing platform evolved out of the need to quickly train the guns on different or moving targets as opposed to the laborious method of handspiking a gun on a ground platform. The emplacement for a traversing platform had three basic elements. The primary element and the object that took most of the stress when the gun was fired in the earlier versions, was the pivot. This was a cast iron post embedded in some stable material usually a type of stone. Its size and height varied in accordance with the height of the platform but the top of every pivot was shaped to accommodate an iron collar attached at the front of the platform. This supplied the platform with an axis about which it could turn. The pivot could be placed in the
front, intermediate or rear points on the platform to provide different traversing arcs. The second element and the main load bearing structure was the rear racer. This was a curved track on which the rear trucks of the gun platform would sit. It consisted of segments of material, usually stone, joined to form a smooth surface. This allowed the platform to move in an arc in the emplacement giving the gun a wide angle of fire. The third element, not as critical to the operation of the gun, was the genouillère. This was the wall in front of the emplacement which afforded protection for the operation of the gun and held back the earth forming the parapet.

These elements were the constituents of the early emplacement. Later improvements were the addition of iron tracks and the removal of the pivot, therefore distributing the stress of firing the gun over a larger area. This was the basic pattern of elements that had to be present but there was also variability in certain aspects. Comparative gun emplacements in different fortifications throughout Canada have yielded a wide degree of variation. The contemporaneous emplacements at Queen's Battery, St. John's, Newfoundland (Jelks 1965) (Figure 1): Fort Wellington, Ontario (Ashworthy 1966) (Figure 2): the Northwest Arm Battery, Halifax (Figure 19): and the Halifax Citadel, have significant differences. Although the guns and platforms are relatively consistent, the emplacements are definitely site specific.
Archaeological Excavations

During the field season, pits were excavated on the southwest demi-bastion, right and left faces, and the right face of the southeast salient. The excavations were specifically designed to obtain data for reconstruction of different elements of the fortifications. Data yielding both precise details or general locations was required. There were a total of thirty sub-operations derived from four main operations.

Operation 2B15 consisted of one sub-operation and was located on the north end of the right face of the southwest demi-bastion. Backhoe excavations in this area partially uncovered the remains of a smoothbore gun emplacement. It was in this area the previous field season that pits were excavated to locate this emplacement (Operation 2B15A-15J) but they were ten meters south of the emplacement. This degree of error can be attributed to the historic plans which are not exact in their dimensions. The excavations uncovered the racer of the emplacement with the granite segments still in situ held together by leaded, iron cramps and the granite surrounding the iron pivot also joined by iron cramps. These features were supported by ironstone and mortar foundations.

The next operation was located on the left face of the southwest demi-bastion. The work, designated operation 2B20, encompassed eleven sub-operations designed to locate and excavate two smoothbore emplacements shown on historical plans for comparative data. Excavations revealed only one
of the emplacements without any of the granite in situ and the rear foundation was not present. Even though the emplacement was relatively incomplete, it exhibited some characteristics that were different than others previously excavated.

Operation 2B22 was located on the ramparts at the re-entrant angle of the south front. This location was excavated to obtain information about the drainage surrounding an expense magazine built in 1865 to service the new RBL (Rifle Breech Loader) emplacements. The drainage system exhibited a different configuration than indicated by the historical documentation. The courtyard area of the magazine was excavated and information relating to the stairs and the drain was obtained. A feature not directly related to the drainage was encountered. This was a shaft located behind the retaining wall terminating on the dos d'Ane of the demi-casemates under the ramparts.

The final series of sub-operations were located on the right face of the southeast salient and grouped under operation 2B23. These excavations were oriented to locating the various structures that were on the salient built by the British and Canadians relating to the signal system. Building foundations of both concrete and loose rubble were found indicating the British and Canadian signal stations and the director of signals house. No evidence was found of the depression range finder pit that was located on the right face of the rampart. The existing earthen mound on the ramparts was sectioned utilizing a series of pits to delineate the parapet profiles from the smoothbore and the rifle period. Only the profile from the rifled period was found. The indications in the stratigraphy were very distinct providing exact information. The only gun that was mounted on this section of the Citadel was a 32 pound smoothbore gun. Excavations revealed that only some of the granite on the racer remained and the pivot area has to be investigated more extensively during the next field season to determine its status.
Some of the excavations on the salient to locate the buildings were only partially comprehensive and will be expanded in the next field season.

The data that was recovered from these excavations will be incorporated with the data from previous excavations to provide pertinent reconstruction details. The information, especially about the smoothbore gun emplacements and the parapet profile, will be able to fill in some of the substantial gaps in the historic documentation.
Gun Emplacements - Excavations

There were three locations excavated where smoothbore gun emplacements were the predominant feature. These were operation 2B15, 2B20 and 2B23. Some emplacements were partially extant while others were under two meters of overburden. As was the case in previous excavations, the overlying stratigraphy was disturbed; therefore, artifactual evidence was out of context. Overburden was primarily secondary deposition from other areas of the Citadel.

The first emplacement excavated was the site of a 32 pound muzzle loading, smoothbore gun mounted in 1852 on the north end of the right face of the southwest demi-bastion. The emplacement, because of the construction activity and the removal of a great volume of earth from the ramparts, was uncovered by the backhoe. At the first indication that there was a feature in this location, the backhoe was stopped and the site evaluated (Figure 3). The substantial volume of earth over the emplacement and the need to proceed with the reconstruction necessitated using the backhoe as the primary excavation tool. Therefore, overlying stratigraphy was removed and excavation by hand was used only for a final uncovering.

The foundation for the pivot was not completely uncovered but measurements on the escarp side of the ironstone and mortar feature indicated that it was 1.7 meters high by 3.6 meters wide. The foundation was constructed on the compact clay that formed the majority of the fill for the ramparts. A pit 2.0 meters by 2.5 meters was laid out
over the area where the pivot should have been. Underlying a stratum of ungraded sand and beach gravel, truncated to only 30.0 centimeters thick by the backhoe, was evidence of the pivot hole. It consisted of two granite blocks connected together by a single cramp with a hole 32.0 centimeters square to hold the pivot (Figure 4). The two granite blocks measured together were 1.34 meters wide by 1.10 meters long and 42.0 centimeters thick. The two segments of granite were joined along a line which bisected the pivot hole. The cramp joining the two halves was 30.0 centimeters by 10.0 centimeters and leaded into a hole in each block of granite and protected by a surface covering of lead. Most of the surface lead was not present and the iron cramp had begun to corrode (Figure 5). The parallel striate in the iron indicated that it was a wrought iron cramp as opposed to a cast iron cramp which would make it more malleable and easier to fit into place. The granite had been squared and chiseled smooth on all visible sides.

An aspect of the pivot granite indicated a problem which plagued the artillerists during the first half of the nineteenth century when traversing platforms with pivots were initially utilized. A triangular segment of granite on the escarp side, in front of the pivot was missing. It's shape was characteristic of the lines of stress generated when the shock of firing the gun was transferred from the pivot to the granite. The point at which the pivot granite should have been the strongest was in fact its weakest point therein causing innumerable problems. This problem was rectified by Col. Colquhoun, who in 1861, designed the emplacement with an imaginary pivot distributing the stress to iron tracks on the racers by using hollow ground trucks (Great Britain 1846). A refinement of the pivot granite was installed circa 1855 at Point Pleasant Battery in Halifax Harbour. The pivot was moved to a more central
position in the granite therefore imparting more support to the pivot (Figure 6).

The second series of excavations were designed to locate and excavate two smoothbore gun emplacements on the left face of the southwest demi-bastion in proximity to the salient (Operation 2B20). Plans from the first half of the nineteenth century placed them 20.8 meters and 26.9 meters, respectively, from the salient angle. Utilizing this information, test pits were excavated in the assumed locations with the net result of only one emplacement being located. This was apparently the emplacement closest to the salient. Complicating the situation was the fact that one of the smoothbore emplacements was dismounted when the Armstrong gun was installed in the new emplacement at the salient. Included in this alteration was the moving of the chimneys along this front to accommodate the sweep of fire of the new gun. Therefore, most of the reference points shown on plans were eradicated or altered. A more thorough search failed to reveal the presence of the second emplacement. It was assumed that it was removed when the gun was dismounted.

The emplacement that was excavated consisted of only the ironstone and mortar foundation surrounding the pivot. The escarp face of the foundation was 2.7 meters wide by 80.0 centimeters deep (excavated depth) and 2.20 meters long. The pivot hole was 22.0 centimeters by 8.0 centimeters by 18.0 centimeters deep, and located 1.2 meters behind the escarp side of the foundation. There were no fundamental differences between this emplacement and the one excavated in 1977. The construction of this emplacement, however, seemed to be more substantial and better defined. The design of the foundation was squarer and less rambling than the foundation from the right face (Figures 7, 8, 9).
Excavations were terminated at a depth of 2.5 meters for safety precautions and further excavation was accomplished by the backhoe. The foundation of the emplacement continued to a depth of 1.42 meters from its maximum height and terminated on a footing which was constructed on top of the asphalt waterproofing membrane over the arches of the casemates 51 and 52. The footing was 61.0 centimeters high by 3.25 meters wide and consisted of slabs of ironstone and mortar. Apparently, to provide more stability for the foundation, the engineer built the emplacement on something more solid than the clay of the ramparts. This was not possible on the right face because there were no underlying casemates (Figure 10).

As the backhoe excavations continued, another feature was revealed which located the second smoothbore emplacement. The removed emplacement at the salient was constructed with two flanking walls which housed brick shell and ammunition recesses (Figure 11). When the earth was removed from the recess of the right wall, it had only a footing of rubble and gravel. When the shell recess on the left wall was excavated, it had an ironstone and mortar footing. Further excavation revealed that the recess was constructed on the foundation of the second gun emplacement.

The foundation of the gun emplacement served as a support for both the shell recess for the rifled gun emplacement and the new location of the chimney (Figure 12). The asphalt was installed between the years 1851 and 1854 and the smoothbore was mounted during the time period on the ramparts. With the advent of the rifled gun in 1864, the smoothbore gun closest to the salient was dismounted and at least one chimney was moved to accommodate the new gun. The foundation of the gun emplacement provided an appropriate base for the shell recess and a stable platform for the corbelled chimney. The foundation was identical in construc-
tion to the first foundation. The footing was 42.0 centimeters high by 3.50 meters long with a foundation of 3.12 meters in width and 1.52 meters high. Longitudinal distances were unobtainable because of the superposed emplacement. The distance between the emplacements was 3.25 meters, an usually close spacing for traversing platforms. The Aide Memoire recommended the gun on traversing platforms be no closer than 10.7 meters (35.0 ft.) between the pivots. These guns on the left face were only 6.5 meters (21.3 ft.) between the pivots. This close proximity must have caused much confusion if both the guns were being fired and traversed at the same time.

During the second rearmament of the southwest demi-bastion, according to the ordnance reports, there were only two smoothbore guns remaining on the entire bastion; one on the left face and one on the right face. However, excavations have revealed two smoothbore emplacements existing on the right face after the Armstrong gun was installed. The granite of both the racers and one of the pivots was still in place. This does not necessarily mean there were guns mounted but the emplacement at least had the capability as opposed to the dismantled emplacement on the left face of the bastion. One of the smoothbore guns was supposed to be mounted on the left face but no evidence of the granite was uncovered. This would suggest that the two smoothbores were mounted on the right face and the both emplacements on the left face were dismounted. The orientation of the Armstrong gun was southeast, covering the range of fire of the smoothbores on the left face but leaving the right face more open. The dismounting of one of the guns on the right face would mean that the armament on the west front, south of the west ravlin, would consist of only one smoothbore gun. To offset the lack of cover given by the RBL, it would seem tactically more logical to leave both smoothbores on the right face.
In effect, the smoothbore on the left face would be superfluous whereas it would be required on the right face. The dismounting of a gun, however, does not necessarily mean that the emplacement is removed. The smoothbore on the right face of the southeast salient was dismounted in 1864 when the RML was installed at the salient but the granite for the racer is still in situ. The only evidence to suggest otherwise was a list or ordnance mounted in 1873 indicating there was a smoothbore on the right and left faces of the southwest demi-bastion.

The final excavations on a smoothbore gun emplacement were conducted on the right face of the southeast salient. Three pits were excavated to locate the pivot and determine the extent of the racer. There were only three extant granite segment exhibiting indications of hole for the iron cramps on either end of the racer. Excavations were designed to determine if there was a foundation next to the extant granite to indicate that the granite had continued.

Excavations revealed a foundation of mortar and ironstone rubble and that it continued to adequately support additional granite. The foundation was underlying a stratum of crushed gravel and compact clay indicating the area had been disturbed in the recent past. Another pit was excavated to locate the hole for the pivot. It was not located but the ironstone and mortar foundation was encountered. Excavation will be undertaken in the next field season to uncover more of the emplacement. The total number of elements of emplacements excavated were three racer systems and five pivot areas. This information in conjunction with historical documentation can be utilized to tentatively conceptualize the appearance of a smoothbore gun emplacement in the nineteenth century.
Construction Elements

The emplacement for a 32 pound smoothbore muzzle loading gun mounted on a dwarf traversing platform can be broken down into its constituent elements. The typical emplacement that was installed at the Citadel can be standardized utilizing the data obtained from the emplacements that were excavated and extant material. Data obtained from the two field seasons of archaeology and data from other sites can be consolidated to provide an accurate description of the construction methodology used in the first half of the nineteenth century.

Pivot

The pivot was made of cast iron with a square base of 20.0 centimeters and an overall length of 90.0 centimeters. The pivot extended 20.0 centimeters above the ground level and the balance was embedded in the granite which surrounded the pivot (Figure 13). The axis of the pivot extended 12.5 centimeters above the base and was 5.0 centimeters in diameter (Figure 14). The axis was inserted into a hole cast into the base of the pivot until the collar which surrounded the axis met the base. The collar was the same shape as the base and 3.0 centimeters thick. The axis protruded 9.5 centimeters above the collar. There was an opening through the axis for the insertion of a restraining pin. The pivot was not square above ground level but rounded on one side and tapered slightly towards the top. This curved side of the pivot could be turned towards the genouillère or towards
the racer depending on the circumstances. Extant remains at the Northwest Arm Battery in Point Pleasant Park, Halifax, indicated the curved side was towards the parapet whereas as found records from the southeast front of the Citadel indicated the opposite. The pattern of the pivot was consistent within the Halifax Defence Complex for the smooth-bore guns on dwarf platforms. The extant remains from the Northwest Arm Battery and the Point Pleasant Battery plus the information from the Citadel indicated a standard pattern.

Granite

The granite surrounding the pivots of the guns at the Citadel was 1.35 meters wide by 1.10 meters long, formed by two segments joined by a cramp. The hole for the pivot was located in the middle 15.0 centimeters back from the escarp side of the granite. The granite was chiselled smooth on all exposed surfaces. The granite, within the confines of the Halifax Defence Complex, showed variation mainly in the location of the pivot hole and a small deviation in the overall dimensions of the granite. The emplacements at Point Pleasant Battery and the Northwest Arm Battery were of a newer pattern, installed circa 1855, with the pivot located nearer the center of the granite to prevent the failure exhibited by the emplacements at the Citadel.

Racer

The racers were formed of granite segments of approximately equal size and shape joined together in units of five (Figure 17). The major variation occurred when a segment was abbreviated to limit the traverse of the gun. Each segment was chiselled smooth on the top forming a width of 20.0 centimeters. This chiselling continued on the side for a depth ranging from 0.04 meters to 0.08 meters (Figure 18). These faces were
the only part of the racer to protrude above the surface of the terreplein. The chiselled portion of the granite formed an arc of approximately 21.2 degrees with the radius of the arc from the center of the pivot at 3.80 meters. The maximum dimensions of the granite were 50.0 centimeters wide by 40.0 centimeters deep and 1.40 meters long with a variation of five percent. The standardization of all the segments excavated at the Citadel was not evident at other sites. Comparative evidence from Halifax sites, Queen's Battery, St. John's, Partridge Island, St. John and Fort Wellington, Prescott, indicated a wide degree of variation in the smooth-bore racers during the same temporal span. This variation occurs with the introduction of the iron rail to the racer to provide easier movement and later to absorb the stress of firing. The requirement to have the racer as smooth as possible to facilitate traversing of the gun necessitated as few joints as possible. The racers at the Citadel without the iron track were cut in large but manageable segments. As soon as the iron track was introduced circa 1855, the requirement for the stone to have a smooth surface was not as critical. Therefore, racers were cut in irregular lengths with more joints conforming only to the general circular pattern of the track.

Cramp

A critical element in the design of all the granite and the joining together of all the pieces was the cramp. Information from the segments of the various emplacements excavated at the Citadel indicated that the cramp was a tension joint. Not only did the lead hold the cramp into place but the configuration of the hole cut in the granite for the cramp acted to hold the segments together. A trapezoidal slot was cut into the granite with the narrow side of the slot towards the joint between the segments (Figure 20). At the wide end
of the slot a rectangular hole 5.0 centimeters deeper than the bottom of the slot was cut to accommodate the protrusions on the underside of the cramp. The trapezoidal slot tapered from 8.5 centimeters to 5.0 centimeters in a length of 15.0 centimeters and was 2.5 centimeters deep. To take advantage of this configuration the iron cramp was narrower at the center than at the ends. The protrusions on the cramp and the lead held it in place but the tension of the shape of the cramp provided most of the lateral strength. The double capacity of the cramp effectively keyed the segments together. Racers where the iron track was employed depended more on the track for staying together because each segment was attached to the track.

Foundations

Foundations for the emplacements that were excavated and extant were all consistent. They were all of rubble ironstone and mortar construction and their only variation was in the general dimensions of the foundation. This varied according to the location and the footing on which the emplacement was to be constructed.

Genouillère

The final element in the construction of the smoothbore emplacement was the genouillère. To this date no in situ evidence has been archaeologically excavated on the Citadel or located to correspond to a picture taken in 1879 at the Citadel showing some form of wall in front of the pivot. Some as found plans from the early 1970s have come to light and detail one of the emplacements of the left face of the southeast salient. This emplacement was destroyed to allow a concrete slab to be poured over the casemates on the east front. The plans indicated a wall consisting of three seg-
ments; a front wall and two sides angled away from the front wall. The genouillère was 88.0 centimeters high by 1.2 meters with the side walls 64.0 centimeters wide and the same height as the front wall. This emplacement was uncovered in an area that was assumed to have been obliterated by later development. The possibility of more emplacements exists in areas that have not been as disturbed such as the northwest demi-bastion.
The design of a nineteenth century fortification relied mainly on the principles devised by Sabastion le Prestre de Vauban. The major tenet of his designs was that all parts were inter-related and form one complete system of offensive and defensive angles. One of the most conspicuous elements of the system was the parapet which surmounted the ramparts. The parapets had two functions in Vauban's system. It had to provide cover for the troops and guns and give the advantage to the defending troops. To fulfill these functions a complex formula of angles and specific dimensions were devised for given situations. Although many of the major sections of a fortification were variable, due to topography, the parapet had to be consistent, theoretically, within prescribed limits.

Generally, the parapet had to be no less than 5.5 meters (18 feet) thick at its weakest point (Supplementary Notes on Permanent Fortifications 1864) and built one foot thick for each pound of shot fired against it (Yule 1851). Normally, the optimum thickness of a parapet would have been calculated from the heaviest gun available at a given time period. Therefore, an ideal parapet that would defend against a 32 lb. gun would be 32 ft. thick. The parapet had to be at least 2.3 meters (7.5 ft.) high due to several factors. This was the minimum height that would provide protection for a soldier who was loading his rifle behind the parapet. To retain sufficient cover in a time of siege when a parapet crest would be worn down, a parapet had to be
as high as possible. The angle formed by the superior slope had to intersect with the covered way on the counterscarp and this necessitated a high angled parapet. What engineers actually built in practice, however, seldom conformed to theory.

Practical factors such as money, material and local terrain were more often the factors determining the size and shape of any particular fort rather than strict adherence to Vauban's principles. The Halifax Citadel was a small and relatively simple fortification in comparison to the massive European forts but cost cutting and the disregarding of the basic principles of Vauban led to many compromises. These compromises were later complicated by the introduction of rifled artillery and new parapet designs.

The first parapets on the Citadel ramparts were constructed utilizing the technology and the general designs that had remained unchanged from the seventeenth to the middle of the nineteenth century. The profile was capable of handling the smoothbore ordnance but the advent of the rifled barreled gun made this technology unservicable. The profile of the parapet was redesigned in response to advancements in artillery. It was to this later period that the archaeological excavations were addressed. The majority of smoothbore parapets at the Citadel were obliterated with the revision in the armament and this was confirmed by archaeological excavation (Connolly 1977). The shape of the rifled profile was also obliterated by later additions and removals of earth by various agencies. There were some areas, however, that had the potential of still having some evidence buried under large piles of overburden deposited on the ramparts.

A site along the south front was designated operation 2B23 at a point 50.0 meters west of the southeast salient. The location was chosen for the large amount of overburden
and the steep slope on the escarp wall possibly indicating the area was not as disturbed as other areas. One sub-operation was laid out at right angles to the escarp wall measuring 1.25 meters by 6.0 meters. Excavation was facilitated by utilizing arbitrary 50.0 centimeter lot sizes due to the deposition of modern overburden. Excavation was continued until the buried sod, indicative of the former level of the parapet, was encountered plus an additional 50.0 centimeters to verify that this was the sod level. The primary soil structure of the earth deposited on the rampart was clay, ranging from a silty light brown clay to a dark brown clay with varying degrees of inclusion of gravel and cobbles.

Excavation indicated a very distinct profile of black organic material starting at the coping stone of the escarp wall and continuing to rise to a high point of 2.1 meters (73.73 ASL), 4.5 meters behind the escarp wall where it assumed a level configuration for a distance of 1.2 meters (Figure 21). The organic layer dropped vertically for a distance of 40.0 centimeters and then sloped downward at an angle of approximately 45° degrees for a distance of one meter. The slope terminated at a point 6.8 meters (22.3 ft.) north of the coping stone, slightly higher in elevation than the terreplein gutterstone (72.73 vs 72.71 ASL). This configuration resembled the general profile for the later period parapet. The most characteristic elements of the improved type of parapet were the crest plane, the flat section formerly occupied by the crest of the parapet, and the slightly less oblique angles of the exterior and superior slopes. The profile that was excavated resembled the improved profile but there were some differences.

Plans from the period 1860 until the turn of the century are few, therefore, there were only three plans showing the proposed dimensions of the profile which super-
ceeded the smoothbore parapet. Two plans were proposals for the parapets that were to be constructed in the late 1870s and the remaining plan was an "as found" drawing of the ramparts on the southwest front drawn in 1911 (Figure 22) to indicate the existing configuration of the ramparts and the possible location of a recreation hall to be built by the Canadians. The dimensions from the plan drawn in 1874 (Figure 23) had a high degree of variability because of the small scale of the plan. The plan from 1879 (Figure 24), although only a proposal, was generally the most accurate plan. The configuration of the parapet and the dimensions of the profile that was excavated did not correspond. The divergence in the dimensions occurred in the vertical height of the parapet. The 1879 plan indicated an exterior slope of 2.44 meters (8.0 ft.), a superior slope of 4.12 meters (14.0 ft.), an interior slope of 0.31 meters (1.0 ft.) and a banquette including the ramp of 1.52 meters (5.0 ft.). The measurements in corresponding horizontal locations on the excavated profile were 4.4 meters (14.5 ft.) for the combined length of the superior and exterior slopes, 1.2 meters (4.0 ft.) for the crest plane, and 1.1 meters (3.5 ft.) for the width of the banquette. Comparing the two sets of measurements, it was clearly evident that the parapet was not constructed as planned. This factor became more apparent when the vertical heights were compared with the standards usually employed by the Royal Engineers. The absolute minimum height that a parapet could be was 2.3 meters (7.5 ft.) according to Vauban and later modifications of the parapet with the crest plane still were supposed to stay within this height limitation (Portlock 1851). However, the maximum height above the terreplein of the parapet that was excavated was 1.03 meters (3.25 ft.) (75.73 meters ASL) clearly not of sufficient height to be practical. Photographs from the post smoothbore period show the reconstructed parapet in other locations and
it appeared to conform to the norm of 2.3 meters.

One option that remained was the reforming of the parapet in this location into another configuration at a later period. On the south front during the British and Canadian occupations of the fort there were several buildings constructed and expanded, all relating to the signal masts located on the southeast salient. A plan from the Canadian period drawn in 1911 showed in relief the various shapes and heights of the parapet at this particular date. It presented a picture far removed from the situation drawn in the plan of 1879. On the southwest demi-bastion, there was a large mass of earth which was in the shape of a single traverse for approximately one third of the right face. Along the left face, the parapet assumed an irregular configuration with a crest plane varying in width from 1.0 meters to 6.0 meters.

The most pertinent section of this plan indicated that the parapet was altered to accommodate a structure that was built on the ramparts in the same location as the archaeological excavations. This was probably the addition to the director of signals house, expanded in 1906. The structure was only partially showing on the plan from 1911 and was labelled "Stores". The parapet was reduced to 6.5 meters in width, including the banquette and was reduced in height indicated by the relief shown on the plan. The change in elevation was not determinable but the height of the majority of the parapet was given as 2.5 meters (8.2 ft.) above the level of the terreplein and it seems that the altered parapet was significantly lower than this parapet. This, therefore, renders the profile useless for any reconstructive purposes concentrating on the 1870s. This profile has value for any reconstruction that will be done involving the signal mast and signal station.
Expense Magazine: South Front

When the Citadeal was constructed between the years 1829 and 1850 it was equipped with two main powder magazines, one in the northwest demi-bastion and one in the southwest demi-bastion. These magazines stored the large powder barrels. A series of portable magazines carrying a supply of manageable quantities of powder were utilized on the ramparts behind the parapet to facilitate the loading of the guns. It became evident after a period of time that the climate was not conducive to this type of exposed storage and proposals for the building of permanent expense magazines in the ramparts were sent to London for approval. It was not until 1850 that the plans were approved and construction did not start until 1863. The magazines consisted of a brick arch, supported by rubble ironstone pier walls with a courtyard and porch. It was buried under an earthen and sod traverse at right angles to the excarp and projected from the interior slope of the parapet. Access was gained to the semi-subterranean door via a short flight of stairs from the terreplein (Pulsifer 1978).

The south expense magazine, in its present condition had had the traverse removed so that the arch and pier walls were exposed. The courtyard area has been partially removed and filled with rubble. The main object of the archaeological investigation was to define the courtyard area and establish the drainage pattern that was installed by the Royal Engineers. A plan drawn in 1862 by a Corporal Scott, indicated brick drains encircling the magazine confluence on
the north side and exiting through the retaining wall of the rampart into a downpipe terminating in the sewer system. This plan would have adequately disposed of the water but it was never installed. There was no extant evidence of this system on the retaining wall in the location indicated by Scott's plan.

One sub-operation was laid out in front of the expense magazine to encompass the courtyard area and the drainage along the front of the magazine. This sub-operation was later supplemented by three others to conclusively define the frontal drainage system. All excavations associated with the expense magazine were treated as a separate operation and designated 2B22. Excavations covered an area of 9.75 square meters and depths of 2.0 meters. Excavation was extremely tedious, due to the fact that the soil had been compacted by the movement of heavy equipment and trucks along this section of rampart to restore another section. Picks were the main excavation tool supplemented by the use of brick hammers to straighten the pit walls.

Excavations revealed that the drainage system which was installed did not resemble the system that was planned. The system, instead of forming a 'Y' shaped confluence, paralleled the front of the magazine and flowed into a disposal bed via a small opening in the brick drain. The drain consisted of unmortared, coursed bricks and ironstone flagstones. The bricks were laid flat on a bed of clay and a channel 12.0 centimeters in width was formed by laying two courses of bricks on top of the bottom layer (Figure 26). The ironstone flagging was placed over this structure on the west end and bricks were utilized on the east end. The outflow of the drain was located on the west side of the magazine. The channel was formed by two bricks on edge leading into a disposal field of cobbles and gravel.

The drain was 70.0 centimeters below the surface
(72.26 m ASL) and did not slope in any specific direction. This was probably due to soil subsidence around the magazine. The brick drain was covered with cobbles and boulders to provide sufficient drainage around the magazine through the impermeable clay soil. The cobbles were removed from the disposal bed for a depth of 75.0 centimeters until large slabs of ironstone were encountered (Figure 27). These slabs were the dos d'anies which covered the sallyport directly under the expense magazine. This arrangement posed a problem. The engineers went to considerable expense and effort to waterproof the sallyport with the large slabs of ironstone. They then proceeded to direct a flow of water over the area they were trying to waterproof. If the original plan had been adhered to, there would have been no problem. The chanelling of water into this disposal field significantly contributed to the deterioration of the brick arch in the sallyport. The accumulation of moisture in the bricks caused them to exfoliate when the water froze during the winter and leached the lime out of the mortar during the summer.

The drainage system was further complicated by the uncovering of a vertical shaft behind the retaining wall in front of the magazine (Figure 28). The shaft was constructed of unmortared ironstone rubble on two sides and the balance was formed by the rear of the retaining wall and one side of a counterfort. The shaft was 2.90 meters deep by 1.07 meters square. The shaft was covered over with slabs of ironstone and was clear of any fill with the exception of 25.0 centimeters accumulation in the bottom. This debris was cleared out and the shaft appeared to terminate on ironstone. Further investigation, however, revealed a small channel ultimately exiting by a convoluted passage through one of the scuppers in the valley of the dos d'ane between the sallyport and demi-casemate nineteen. The peculiar aspect of the shaft was there was no apparent connection
with any drainage system. The only channels were in the bottom of the shaft and would not have required the effort of providing the shaft. An alternative use, as opposed to a strict drainage function, would be as an access shaft to clean out the drains in the valleys. The fact that the drains surrounding the expense magazine were not connected to the shaft can be accounted for by the fact that the expense magazines were installed in 1864 and the retaining wall was built in the 1840s. The information on the shaft was not apparently recorded and in the intervening twenty-four years, the engineers had come and gone. Therefore, the likelihood that the new engineer would have known about the shaft would have been slim. The fact that the shafts were installed for the purpose of cleanouts was verified by two other shafts were uncovered between demi-casemates which also did not connect with drains and had the same location as the first shaft.

Expense Magazine Courtyard

The requirement for excavation within the courtyard area was minimal because most of the debris that had accumulated was the result of recent deposition. The main rational for the excavation was the verification of the configuration of the stairs and the location of the drain. Historical documentation indicated that there was a set of curved stairs in the courtyard of the magazine which ran up the east side of the courtyard and then turned towards the retaining wall. The majority of the evidence for the stairs was the mortar configuration on the north wall of the magazine. The mortar indicated the location of the steps. According to the documentation, there were two straight steps and three steps which curved out towards the terreplein. The in situ evidence verified the documentation. The steps had a rise
of 21.0 centimeters each and protruded into the courtyard 1.25 meters. The mortar on the wall of the magazine indicated a change in the dimensions of the stairs as they ascended towards the terreplein. The first bottom stair was 21.0 centimeters deep, the second 25.0 centimeters deep, the third 52.0 centimeters and the top 30.0 centimeters. The variation of the depth of the stairs can be explained by the fact that as the stairs curved towards the north wall of the magazine, the dimensions changed in response to the degree of curvature. Stairs in a similar location on the north magazine indicated this change (Figure 29). There were five steps in total to gain access to the magazine but the evidence for the last step was obliterated when the magazine was partially dismantled.
Structures: South Front

The southeast salient of the Citadel was the most prominent section of the ramparts because it could be viewed from the east or town side of the hill as well as having an unobstructed view of the harbour. This advantage was particularly well suited for viewing ships coming into the harbour. Therefore, the southeast salient became the focus of the Citadel's early warning systems.

These systems date as early as 1837, including a flag signalling system and later electric telegraphing systems. Inherent with the uses of these systems with their masts and signals, was the requirement for storage of equipment, shelter for the operator and later a residence for the director of signals. These signalling systems can be divided into two distinct periods by virtue of the operators of the systems. The first of these operators was the British Army and the second, after 1906, was the Canadian Army. The buildings that were located on the ramparts during the British Period were a small signal station, the director of signals hut and a depression range finder pit. The number of buildings in the same section of the ramparts during the Canadian period increased in proportion to the higher amount of use the signal mast received.

The signal station was replaced between 1916 and 1920 by a much larger structure which encompassed an area of both the right and left faces of the southeast salient and conforming to the same basic shape of the salient. The director of signals hut was expanded with an addition to the west
wall and two unidentified buildings were built; one at the foot of the storm signal mast and one over demi-casemates 17 and 18. All of these structures on the southeast salient have been removed or obliterated since the Canadian period. Much construction activity has taken place on the left face of the salient due to the reconstruction of the left face escarp wall which had fallen down in 1920 (Dunn 1977; Morrison 1979). The movement of heavy equipment utilized in this reconstruction and later in the 1960s had an extremely deleterious effect on the remains on the right face. To assess the condition of the remains and define more precisely the configuration of the buildings, archaeological excavation was oriented to locating the buildings as opposed to completely excavating them. Therefore, single pits were opened in the general area of the buildings in order to delimit their foundations. Pits were designated under the general operation number 2B23 and consisted of four pits for the director of signals hut (2B23 D, E, F & G), two pits for the depression range finder pit (2B23B & C), and one for the British signal station (23H).

Excavations for the director of signals hut were located in the southeast corner and the northwest corner of the structure. The pit on the south corner of the director of signals house measured 3.0 meters by 3.0 meters and uncovered the extreme southeast corner of the foundation and the foundation of another adjacent building (Figure 30). Stratigraphy consisted mainly of 20th century deposition varying from 20.0 centimeters to 60.0 centimeters in depth. This layer of sandy loam overlaid a strata of ash and charcoal which consistently covered the foundation of the hut for a depth of 5.0 centimeters. The foundation consisted of poured concrete with a maximum width of 40.0 centimeters, finished with an exterior parging of smoothed concrete. The interior of the foundation was filled with unsmoothed
layer of concrete. Encompassing the foundation was a surface drain formed of concrete and resting on a footing of ironstone flagstones. The corner of the foundation was 9.5 meters from the retaining wall and 46.2 meters from the salient. The north/south section of drain lined up with an opening cut in the granite surrounding the retaining wall. Parallel to the gutter on the south side of the building were five of the cables which supported the adjacent signal mast. The cables were wire rope, encased in a black compound, probably tar. At a point 65.0 centimeters east of the signal hut, the rubble ironstone foundation of another structure was encountered partially covered by the west wall of the noon day gun shed. The proximity of the foundation to the flag mast would indicate that it may be one of the unidentified buildings constructed during the Canadian period (Dunn 1977).

Between the two foundations was a line of three posts 17.0 centimeters in diameter, 90.0 centimeters apart, possibly representing a fenceline. The second excavation for the director of signals hut was located 10.0 meters west of the first pit and was designated 2B23 F. The 1.5 meter by 1.0 meter pit was placed in this location to uncover the east wall of the hut. Excavations revealed only a strata of decomposed concrete without delineating any specific walls. This was overlaid by a stratum of crushed gravel and clay. The pit also uncovered another of the shafts behind the retaining wall constructed similarly to the shaft in front of the expense magazine. The inconclusive results of this excavation required more investigation and another pit was excavated 4.0 meters further west to locate the end wall of the addition to the hut.

No foundation or footing was encountered but a distorted brick feature was revealed (Figure 31). This feature ran parallel to the location of the extreme west wall of the
hut. It was of unmortared brick construction and concave similar to a surface drain. It sloped towards the retaining wall where it had been disturbed, possibly by the laying of the ground cable along the south front (Figure 31). If the brick had not been disturbed, it probably could have emptied into another shaft which was behind the retaining wall. This was the only indication that these shafts were used as drainage and this appeared to be a secondary addition. The roof of the addition to the director of signals house sloped from east to west (Dunn 1977) and this brick feature could have collected water from the roof and channeled it into the shaft. The features that delineated the location and size of the building reflected what was drawn on historic plans. The measurements of the hut corresponded to what was described in 1916.

The balance of the pits that were excavated on the southeast front were extremely inconclusive. Of the three buildings that were built in this area no specific information to contribute to their locations was obtained. Excavations for the British and Canadian signal station as well as the depression range finder pit will continue in the next field season.

Gun Tube

The final excavation of the field season produced the largest results. The barrel of a seven inch, rifled, muzzle loading cannon was excavated. The gun was located in the fall of 1977 by utilizing historical documentation which specified that permission was granted to bury the gun in 1916. It was thought that the barrel may have been dumped in the ditch but backhoe excavations over the last twenty years did not turn up any trace of the gun. Intensive investigation of the southeast salient revealed a small segment of iron
protruding from the ground. Subsequent investigation identified the barrel and it was excavated during the field season (Figure 32). Although the barrel was a significant discovery, 3181 kilograms of discovery, there were extant examples at the Citadel. Material relating to the carriage of the gun or equipment for the servicing of the gun was the main orientation of the excavation. However, the excavation did not bear out the possibilities. There was no associated material in the pit related to the gun.
Mortar Platform

The construction activity associated with the restoration of the southwest front exposed a rubble ironstone feature similar to pavé. The feature consisted of unsquared ironstone rubble beded in the clay of the ramparts at the terreplein level (Figure 33). It was partially disturbed due to the activity of the backhoe but its overall dimensions were 1.63 meters by 2.33 meters. The surfaces of the flagging were unsmoothed and generally uneven. The pavé was 15.1 meters west of the expense magazine and 4.22 meters south of the retaining wall.

Comparison of this location of the pavé with plans from 1846 indicated that this could have been the location of one of the smoothbore mortars that were mounted on the south front. There were six mortars of the eight and thirteen inch variety mounted on the south front circa 1880 (Johnston 1977). Although the mortars had wooden platforms, this ironstone feature may represent an attempt to provide a more stable base during inclement weather. The dimensions of a mortar platform for an eight or ten inch mortar were 2.85 meters by 1.95 meters (Aide Memoire 1846) which approximate those of the ironstone feature. According to the plan there should have been another platform 9.2 meters east of this location but tests proved negative.
Conclusions

Archaeology at the Halifax Citadel is cumulatively assembling data on specific features which are pertinent to the reconstruction effort. The design of the smoothbore gun emplacements and the configuration of the parapet are dependent on the information that archaeology can provide. The comparative approach, utilizing intersite data will complement the work at the Citadel as well as compile useful information on subjects that have not been extensively researched. The excavations on the south front recovered data that would have been destroyed by the backhoe in addition to recovering artifacts, such as the gun barrel. The inconclusive excavations will be continued in the next field season. This section of the Citadel has yielded a significant amount of information given the degree of disturbance that has taken place during the British and Canadian occupations. The south front, for various reasons, has borne the brunt of destructive elements. If the percentage of material that remained in a disturbed area was any indication of the amount of historic fabric that remains in areas that are not as disturbed, such as the northwest front, there should be a large amount of material in situ pertinent to the restoration.
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Racer system of the smoothbore gun emplacements at Queen's Battery, St. John's, installed circa 1862.
2 Gun emplacement excavated at Fort Wellington. Note the irregular segments, iron track and different configuration of the pivot.
Front (escarp) side of foundation of pivot of a gun emplacement on the right face of the southwest demi-bastion. This was uncovered by the backhoe. Note the volume of overburden.

Scale: one meter.
Front (escarp) side of granite pivot block with ironstone foundation partially excavated. Note the forward location of the pivot hole and the configuration of the fracture lines.

Scale: one meter
An *in situ* cramp leaded into place with surface lead removed.

Scale: one-half meter.
Pivot in granite at Point Pleasant Battery inverted due to wash out. This was installed four years later than those on the Citadel and improved by moving the pivot closer to the center.

Scale: one-half meter.
7 Emerging foundation for gun emplacement on right face of southwest demi-bastion.

Scale: one meter.
Foundation of gun emplacement on the left face of the southwest demi-bastion in process of excavation. Note the rectangular shape of the foundation compared to Figure 7.
Excavated foundation of smoothbore gun emplacement. Note the extreme deposition of overburden.

Scale: one meter.
10 Front (escarp) side of foundation of smoothbore gun emplacement after removal of overburden by the backhoe.

Scale: one meter.
Relationship of the foundations of the smoothbore emplacements on the left face of the southwest demi-bastion.

Scale: one meter.
Superposition of shell store and chimney on the foundation of smoothbore emplacement on the south front.

Scale: one meter.
13 Extant pivot with axis still in place. Note the contrast between the sub-surface and exposed portion of the pivot.

Scale: one-half meter.
14 Axis of the pivot. The axis and collar appear to be forge welded to the base.
Overview of cast-iron pivot with wrought iron axis removed.

Scale: one-half meter.
Overview of the pivot and granite from a smoothbore emplacement at the Northwest Arm Battery, Halifax.

Scale: one-half meter.
17 Racer of smoothbore gun emplacement on the right face of the southwest demi-bastion uncovered by the backhoe. Note the irregular termination of the end granite segment.

Scale: one meter.
Cross section of a granite racer and foundation. Note the contrast between the smooth top surface and the irregular sub-surface granite.

Scale: one meter.
Granite racer without iron track. Note the irregular length of the granite segments. Emplacement located at Northwest Arm Battery, Halifax.
Trapezoidal slot for wrought iron cramp in racer segment.
21 Cross section of mound of earth on the south ramparts (drawing by J. Gasparac).

1. Sod Zone
2. Light Brown Loam
3. Black Organic - Buried Sod
4. Light Brown Clay
5. Dark Brown Clay
6. Limestone
22 1911 plan detailing the configuration of the southwest demi-bastion. Note the greatly altered shape of the parapet.
1874 plan showing proposed locations of the RML emplacements and the parapet.

Source: Public Record Office
24 1879 plan of the Citadel showing the locations of the RML emplacements and the parapet.

Source: Public Record Office
25 Plan of excavations in front of the expense magazine.

Scale: one meter.
26 Brick drain, northeast corner of expense magazine.

Scale: one meter.
Overview of disposal field in front of expense magazine on the southfront with cobbles removed and outflow of the brick drain. Large slabs of ironstone in the bottom of the pit are the flagging over the sallyport.

Scale: one meter.
Overview of opening to shaft behind the retaining wall of the south front.

Scale: one meter.
Curved stairs in front of the north expense magazine similar to those in the south expense magazine.

Scale: one-half meter.
30 Southeast corner of the director of signals house. The posts and foundation in the foreground are as yet unidentified. Cables south of the foundation are from the signal mast.

Scale: one meter.
31 Brick feature at the west end of the director of signals hut. The distorted end overlies another shaft which may have been utilized as a drain. The cable intruding in the pit is from the lightning conductor system. Note the concave depression in the gutter above the drain which was 0.60 meters too high to be utilized.

Scale: one meter.
32 Recovered seven inch rifled muzzle loading gun tube on the southeast salient.

Scale: one meter.
33 Possible ironstone mortar platform on the terreplein of the left face of the southwest demi-bastion uncovered by the backhoe.

Scale: one meter.