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349

EXCAVATIONS, HALIFAX CITADEL

1979

by John J. Connolly

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Introduction

The Halifax Citadel is being restored to its nineteenth configuration. The current restoration is the culmination of various attempts to rehabilitate the Citadel since it became a National Historic Site in 1951. During the one hundred and fifty seven years of British occupation, the fortification was a functioning installation. It underwent an alternating series of uses and abandonments after the fort was transferred to the Canadian Department of Militia and Defense in 1906. The fort was a prisoner of war camp during the First World War, an unemployment relief project during the 1930s, barrack and storage space during the Second World War and finally a historic site (Dunn, 1977). The effects of climate, vandals and various uncompleted projects have had a debilitating effect on the fort.

The method utilized to restore the evolution of the fort was to divide the Citadel into sections and depict, through period restoration and exhibit, specific temporal frames. The ramparts will be used to show the evolution of the types of guns installed at the Citadel. There are examples of emplacements extant on the site of the rifled bore variety from a later period within the nineteenth century. This area does not present many problems for restoration. Guns of the smoothbore types of an earlier period were removed and their emplacements dismantled or reused. The destruction of documentation by the British left minimal information of the emplacement configuration, location and construction materials. This resulted in the situation where a section of the Citadel was to be restored to a period with unique and characteristic elements without specific documentation. The data that was available was general in nature and referred to material that was standard throughout the empire.

The primary problem with elements of a fortification such

as emplacements and parapets is they are site specific. They conform to general patterns or recommendations but depending on the local terrain, building materials, amount of money, time, and the biases of the engineer, emplacements will vary a great deal. Even within the Halifax Defence Complex, there is variation in the construction of emplacements which are contemporaneous. To determine the configuration of the smoothbore emplacements, archaeological techniques were utilized and uncovered, through a series of excavations, details about the Citadel that were not known or unverifiable in the historic documentation.

The first excavations at the Citadel were undertaken in 1965 by Richard Lane in the Redan (Lane, 1965). This excavation was primarily a notation of the construction details of casemates that were being dismantled and reconstructed. Excavations were conducted in the same year in the ditch of the Citadel to determine the existence of features that would be destroyed by restoration activities (Coleman, 1965). A service tunnel was discovered by construction activity on the west front of the Citadel and pits were excavated to determine its origin. It was attributed to twentieth century military activity (Wilson, 1967). After a hiatus of nine years, excavations were opened on several areas on the west front to uncover details for the restoration (Parmenter, 1977). Current excavations are a continuation of a program begun in 1977 to locate and detail the construction of the smoothbore emplacements on the south front, the northwest demi-bastion and other features associated with the period (Connolly 1978, 1979). Due to the destruction that has taken place, only segments of the emplacements have been excavated and only a partial configuration has been formulated from the excavations.

Destruction at the Citadel has been uneven because of the accessibility of some areas. The south front of the fort, because of the ramp, had more than its share of destruction. The disturbed strathigraphy shows the intensity of destruction. The northwest demi-bastion, because of its relative inaccessibil-

ity and few ordnance changes, does not seem to be as disturbed and should have more information to yield. During the months of July and August, excavations were conducted to uncover further information on the configuration of the smoothbore emplacement, the locations of the guns that were mounted, the configuration of the parapet surrounding the smoothbore emplacement, and the relationship between the chimneys and the smoothbore emplacements.

Historic Documentation - Northwest Demi-bastion

The northwest demi-bastion was structurally completed in 1829 by a civilian contractor named Hays, under the direction of Gustavus Nicolls. The demi-bastion formed an acute angle overlooking the northern approaches to the fortification. The escarp walls of the bastion were constructed from roughly squared local ironstone. The walls were twenty-five feet in height and included two casemates of defence for cross fire in the ditch. The bastion was accessible from the parade of the fort by a flight of stairs on the east side. The west front of the fort was completed first because of the vulnerability to seige from Windmill Hill 600 meters away which was only 13 meters lower than the command of the ramparts.

Although the west front of the Citadel was structurally completed by the end of 1833, ordnance was not mounted until 1853 because the armament plan was not approved in London until the balance of the fortification was completed. Structural and financial problems delayed the completion of the fort. The proposal (Figure 1) consisted of a total armament of ninety pieces of ordnance consisting of eight inch, thirty-two and twenty-four pound guns, eight inch howitzers and thirteen and eight inch mortars distributed in different locations throughout the works. The northwest demi-bastion was armed with an eight inch smoothbore on a common traversing platform at the salient and two thirty-two pound smoothbores on dwarf traversing platforms on each face. The salient gun fired en barbette over the parapet while the guns on each face fired through an embrasure cut through the parapet. There were provisions for reserve ordnance in time of seige, but these would only be temporary

emplacements to be cut into the parapet as they were required.

The smoothbore guns on the northwest demi-bastion were superceded by new ordnance in the second half of the 1870s. The new ordnance was of the rifled, muzzle loading variety, all of sixty-four pound calibre. This ordnance required the dismantling of all the previous guns and the complete rebuilding of the emplacement at the salient. The change in ordnance, although approved on paper, was never implemented. No guns were ever mounted in the emplacements. The number of guns was reduced to two and finally eliminated. Possibly, only two of the emplacements were reconstructed or altered for the rifled guns (Johnston, 1977).

The northwest demi-bastion was left unaltered from the final rearmament until the 1930s when the stairway to the defence casemates was filled in by an Unemployment Relief Project and some of the retaining walls were taken down (Dunn, 1977). This work did not effect the general area of the parapet and the emplacements which were covered by overburden. Subsequent construction work did not affect the status of the emplacements and they remained relatively untouched.

Historical data on the location and configuration of the emplacements consisted of plans and unspecific information. The plans that were available were, for the most part, proposals for the various armament schemes and did not reflect precise locations of the emplacements or the profile of the parapet on the northwest demi-bastion. This lack of detail was pervasive in all the areas of the Citadel and represented one of the major problems in the restoration of the ramparts. To provide comparable data to correlate with existing data, archaeological excavations were planned to locate and determine the configuration of the emplacements. This body of data, if a complete emplacement was uncovered, would be sufficient to restore the ramparts to the early smoothbore period of the Citadel.

Archaeological Excavations

Objectives

Excavations had five major objectives:

1. Archaeology was to recover information on the construction elements of smoothbore emplacements. Although excavations had been undertaken in the two previous years, no complete emplacement had been uncovered for a thirty-two pound smoothbore muzzle loader on a dwarf traversing platform. Various construction elements, such as the racer and the pivot granite, had been uncovered but the front wall of the emplacement was unknown. This wall or the genouillère held back the earth of the parapet and provided protection for the guns and their operating personnel. Its general parameters were known from other military fortifications of the period but as gun installations were site specific, the exact configuration was unknown.
2. The excavations were to locate the exact positions of the guns in the northwest demi-bastion and the right face of the southeast salient. Excavations in the southwest demi-bastion had shown that locations of emplacements deviated from existing historic plans. There was a variation of up to 5.0 metres of in situ material compared to the dimensions of the plans. The locating of the guns on the northwest demi-bastion and the southeast salient would verify their positions relative to the southwest demi-bastion positions. The locating of the guns in the northwest demi-bastion would specify the final smoothbore emplacements for the restoration.
3. The paucity of data on the configuration of the parapet from the smoothbore period necessitated another attempt to recover information. Parapets were constructed to specific recommendations used by military engineers adapted from Vauban. These specifics only applied in ideal conditions which afforded the proper room for the construction of the recommended parapet. The Citadel did not provide ideal conditions. The configuration of

the ramparts of the Citadel provided less than minimal conditions. This means that compromises had to be made in the construction of the parapet. The main hindrance to recovering the smoothbore profile was the later rearmament of the ramparts with the rifled type of gun which utilized a different parapet configuration obliterating many of the characteristics of the previous parapet.

4. The fourth objective of the excavations was locating and determining the configuration of the chimneys on the right face of the northwest demi-bastion. The locations and configurations of the chimneys along the entire west front of the Citadel were required for the restoration. The locations and dimensions of the chimneys differed according to the historic rampart alterations. The modification of one element within the fortification always had an impact on another element. This was the primary tenet of Vauban's systemic approach to fortification construction. The combination of the 'as found' evidence and the archaeological data would provide a complete sequence of the chimney construction.

5. The final objective of the excavations was to complete the work around the southeast salient to determine the configuration of the buildings surrounding the storm signal mast and the location of the foundation of the British signal station. Excavations accomplished in this location in the previous field season did not fully determine the relationship of the features and the signal mast.

Procedure

The northwest demi-bastion was divided into three sections and each assigned an operation number. The left face of the bastion was divided into two sections consisting of operations 2B30 and 2B31. Operation 2B30 was placed over the presumed location of the southerly gun emplacement on the face and operation 2B31 was placed over the location of the northerly emplacement. Opera-

tion 2B32 was located on the right face of the demi-bastion and encompassed the positions of the two smoothbore emplacements and the chimneys for the casemates of defence, numbers 56 and 57. The features on the right face were in close proximity to each other whereas they were far apart on the left face.

The series of two meter square sub-operations were laid out in three distinct grids to delineate the operations over the presumed locations of the emplacements. Conforming to the objectives, two pits were excavated over each of the emplacements to determine their locations and the extent of their remains. These pits resulted in the location of all four emplacements in various stages of dismantling. Sub-operations 2B30F and 2B30C uncovered the remains of one-half of the granite surrounding the pivot with the pivot still in situ. (Figures 4 & 5) There was no indication of the granite racer or the segments which formed the genouillère of the emplacement. The section of granite visible in the excavation conformed to other excavated segments in the southwest demi-bastion. The pivot was located 7.08 meters from the escarp wall and 49.7 meters from the northwest salient.

The second set of pits on the left face of the demi-bastion uncovered another segment of granite. Pits 2B31H and 2B31L contained a small portion of granite, enough to identify it as a part of the granite surrounding the pivot. There was no sign of the granite racer. There was one characteristic of the evidence that seems to point to some modification or anomaly. The front trucks of a platform rested directly on the granite surrounding the pivot for support prior to 1856. Flat iron tracks were used after this date to absorb some of the shock of firing the gun. The excavations revealed an iron track surrounding the pivot in 2B31C. (Figures 21 & 22) This pivot was 7.01 meters from the escarp wall and 29.8 meters from the salient.

The third excavation, located the emplacement on the right face furthest from the salient of the bastion. The two pits 2B32M and 2B32U contained segments of granite that formed the wall behind the pivot and the granite surrounding the pivot.

This was the first indication of the configuration of this granite. (Figure 7) The segments were not complete but were indicative of the general configuration. There was no indication of the iron track as in 2B31H and no indications of the granite racer. The pivot was located 6.95 meters from the escarp wall and 28.2 meters from the salient.

The final set of excavations for locating the emplacements was on the right face in a position near to the salient. (Figures 3 & 6) Two sub-operations, 2B32H and 2B32Q, uncovered sections of the pivot, the granite for the genouillère and the racer system. The pivot was located 7.10 meters from the excarp wall and 22.9 meters from the salient.

Contrary to the results from the excavations in the southwest demi-bastion, excavations in the northwest demi-bastion correlated very closely with the specifications given on the 1846 proposal for the locations of the emplacements. Estimations of the locations of the pivots for the placement of the pits were close for each emplacement. This was also the case for the chimneys on the right face of the demi-bastion.

The casemates of defense were located under the ramparts on the right face and contained ordnance and accommodated troops. To heat the casemates, fireplaces were installed and their chimneys exited through the parapet. The chimneys on the northwest demi-bastion did not appear to have been changed and pits were laid out to locate and determine the original locations. Sub-operation 2B32F was excavated in an area approximating the location given on the plans and in proximity to a flagstone protruding from the parapet. This proved to be the chimney capped by the flagstone and in the right location (Figure 23). The chimney was located 3.05 meters from the escarp and 26.7 meters from the salient.

Profiles of all the excavations were drawn and annotated to provide a section through the existing parapet to delineate indications of the original smoothbore parapet. The parapet was not evident in all cases. The incursions by various destructive

means had obliterated the former appearance of the ramparts. The reforming of the parapet in the 1870s and the reconstruction work carried out in the 1930s and 1950s had taken its toll. The former configuration of the superior slope and the crest of the parapet was higher than the existing material and the interior slope and the banquette seem to have been obliterated.

The remaining objective of the excavations on the northwest demi-bastion was to detail the configuration of the genouillère of the smoothbore emplacement. The relatively complete emplacement located on the right face provided the opportunity to obtain this information. The only other emplacements that were almost complete were two that had been removed by the construction crew in 1970 on the left face of the southeast salient for the installation of a concrete slab over the casemates in this location. No archaeological excavation was done but the emplacements were recorded by an 'as found' recording team. The existence of the emplacement was unexpected and construction had progressed to the point where archaeological work was impossible and unproductive. The data accumulated on the emplacement provided comparative data for the excavations on the northwest demi-bastion. This will enable general rules about emplacement construction at the Citadel to be formulated. A series of nine sub-operations were completely excavated over the location of the emplacement on the right face of the northwest demi-bastion to expose the racer and the pivot/genouillère areas for construction details. These sub-operations were 2B32H, J, P, Q, V, W, BB, CC, DD.

Due to the high degree of disturbance and the deposition of primarily modern material, stratigraphy did not provide any means for relative dating for the nineteenth century. The only concise statement that can be made about the deposition was the absence of nineteenth century artifacts and the occurrence of twentieth century artifacts indicating the deposition was all modern. The earth consisted of alternating layers of clay and loam without any congruency between the sub-operations indica-

ting the matrix had been deposited in piles over the emplacements.

The twentieth century date was verified by the occurrence of a large metal and wooden box directly over the racer of the complete emplacement (Figures 8, 9 & 10) The metal was galvanized steel, the wood was groove and tongue and it was fastened together with wire nails. The twentieth century date was further refined a picture dating from the 1930s showing the box in situ. This apparently was some form of storage box used in the Unemployment Relief Project of the depression years.

The excavations on the southeast salient consisted of three additional sub-operations under operation number 2B23 initiated in the last field season. Sub-operation 2B23P was opened adjacent to 2B23N to further establish the location of the storm signal mast and the buildings that were built at its base to service it. Photos from the various periods indicated different configurations of the buildings and historic documentation did not detail their use. Sub-operations 2B23R and 2B23S were grided over a 0.75 by 2.0 meter area in the presumed location of the south wall of the British signal station. Excavations during the previous summer (Figure 27) failed to reveal traces of the west wall of the station due to the extreme disturbance in the area. The final excavation on the southeast salient was to locate the pivot of the thirty-two pound smoothbore emplacement on the right face. A 1.0 by 3.0 meter pit was excavated over the location of the pivot triangulated by utilizing the remnants of the granite racer. Excavations from the previous field work on the southeast salient did not conclusively locate the pivot hole although the excavations did uncover the foundation. This summer's excavations uncovered the pivot hole and part of the foundation for the emplacement (Figures 24 & 25).

Smoothbore Gun Emplacement

Design Factors

Ordnance technology, by the nineteenth century, had advanced to the point where it had been systemized. The British employed one basic system of ordnance throughout the Empire. The patterns and calibers of guns were issued from a central location and the patterns for the platforms were specified to match the type of ordnance. Engineers and artillerymen were educated to utilize the system as dictated and the compatibility and uniformity of the system was dependable everywhere England was involved. The engineers, in designing fortifications, did not have any leeway in the actual construction of the carriages and platforms but matching the standard platforms to local conditions did call for some ingenuity.

An engineer, given the task of designing an emplacement for a type of gun in a specific location, had several factors to consider in deciding the final configuration. These factors can be broken down into the design and construction phases. Because the platform of the gun can be considered constant due to its standardization, the engineer had only to deal with the emplacement in which it would be installed.

The primary design factors the engineer had to consider were the location and height of the pivot and the distances from the pivot to the racers. The location of the pivot would determine the type of traverse of the platform and the relationship of the platform to the parapet. The distances from the pivot to the racers would be determined by the location of the pivot and the type of platform. The racer, designed to carry the load of the platform from the trucks, would have to be congruent with the locations of the trucks for the platform to function within the emplacement. The secondary factors the engineer would have to consider were the traverse of the guns and protection. The traverse of the guns would determine the

command of fire and the utility of the ordnance in that particular location vis à vis the other ordnance mounted within the fortification and terrain it had to cover. Protection of the gun and its personnel was a defensive factor determined by the command of the ramparts.

An engineer had to take into account two other sets of factors during the construction phase, the types of material available in the area, and the amount of money allocated by London for the emplacement. The local material used for masonry construction to a certain extent would determine the configuration of the emplacement due to load bearing characteristics. Preferred materials were always listed by London but availability was the determining factor. Since the success and very existence of the fortification depended upon the guns, money was allocated fairly readily. The majority of the money went towards the tubes and the platforms with the minority allocated for the emplacement. Usually the engineer requested a lump sum of money for all the emplacements. The sum received was usually less than requested and placed constraints on the plans.

The secondary factor in the construction phase was the background of the engineer. The design option available to him besides material and money was the final configuration of the emplacement. The engineer's training and background would determine his choice of options. What he had read and who were his teachers would influence the final configuration of the emplacement.

The gun emplacements at the Citadel were found to exhibit a number of individual characteristics. The emplacements do not match those emplacements constructed outside the bounds of the Citadel. Even though the majority of the emplacements within the Halifax Defense Complex were constructed within a short span of time, their configurations vary according to the specific conditions and engineers.

Construction Elements

The emplacements excavated at the Citadel, for the most part, were in an incomplete state. The data assembled on the smooth-bore emplacements was mainly a correlation of individual pieces of datum from several locations. The excavations from this field season presented a better opportunity to detail the construction of an emplacement. On the right face of the northwest demi-bastion, preliminary sub-operations uncovered sections of the pivot, the genouillère and the racer system. The emplacement was completely excavated and the data used for comparative purposes. The data allowed for the formulation of a 'type' design for the emplacement installed on the ramparts within the Citadel for a muzzle loading, smoothbore gun on a dwarf traversing platform. When the emplacement was completely uncovered, it comprised the pivot, the pivot granite, a complete racer and the genouillère. Essentially, the emplacement was intact (Figures 12 & 13).

The basic elements of the emplacement were the same as those excavated elsewhere. The pivot was 0.30 meters high, 0.20 meters square and tapered from the base to the collar of the axis. The cramp had the same characteristics as those uncovered in last year's excavation and the same throughout the Halifax Defence Complex. The granite surrounding the pivot was the same size as the granite that was excavated elsewhere within the Citadel. The pivot hole and the cramp slot were located in the same positions on the two segments of granite. The racer segments, although not the same size in length, were similar in cross section. The length of the granite varied according to the traverse of the gun. The three central segments of the racer are roughly 1.4 meters in length with a variation of up to 10.0 centimeters and the terminal segments are cut to make the racer fit a traverse of approximately ninety degrees. The remaining element, not present in other excavation was the genouillère.

The genouillère depicted in the Aide Memoire (1856) did not

conform to the one installed at the Citadel. The diagram of the traversing platform indicated a height of 1.35 meters with a deflection behind the pivot of 0.15 meters giving the platform a maximum arc of 75 degrees. The Aide Memoire did not give any indication of materials used in the construction of the wall. The genouillère in situ consisted of a multifaceted, granite and ironstone construction sufficient to protect the emplacement and hold back the earth of the parapet. The genouillère was constructed with segments of granite as a facing augmented by a mortar and ironstone support wall and foundation. The five segments of granite were cut and chiselled smooth on exposed surfaces to form an abutment for the pivot and a recess for the gun platform. The configuration of the genouillère could be best described as a truncated 'M'. The pivot was mounted at the apex of the 'M' and the platform fitted into the base of the 'M' according to its location in the traverse. The genouillère granite had a total height of 0.93 meters and a total maximum width of 3.50 meters.

The segments were arranged in a three over two pattern with the bottom layer being 0.43 meters thick and the top layer 0.46 meters thick. The top three segments formed the two side walls and the central pivot support whereas the bottom two segments formed a portion of the sidewall and the pivot support. The facets of the wall were a mirror image of each other. The linear distances of the facets are: 0.18 meter, 0.63 meters, 0.51 meters, 0.20 meters, 0.51 meters, 0.64 meters, and 0.18 meters. Two small additional facets occurred on the extreme upper corners of the emplacement. These facets measured 0.10 meters by 0.18 meters and may have been an attempt to blend the corners of the emplacement with the interior walls of the parapet.

The facets of the emplacement were unbroken with the exception of the two slots which were cut into the northwest and northeast corners of the lower segments. (Figure 12) The slot on the northeast end was 0.30 meters long by 0.10 meters high

and 0.11 meters deep. The slot on the northwest segment was incomplete and consisted of a series of drilled holes and partially removed granite. (Figure 15) It was 0.30 meters long, 0.07 meters high and 0.06 meters deep. There were also two holes drilled into the top surface of the upper two extreme segments. These holes were 0.03 meters in diameter and 0.11 meters deep. The mortar joints of the granite segments were between 10.0 and 15.0 millimeters thick. The joints acted only to bed the segments and did not act as a major bonding agent.

The general configuration of the emplacement on the right face of the northwest demi-bastion matches that of the emplacement uncovered on the left face of the southeast salient. Only the length of the segments in the racer and the dimensions of the slot on the left wing of the emplacement, which was complete in this location, were different. The various elements of the emplacements excavated within the Citadel showed a marked consistency and a 'type' emplacement can therefore be formulated for the restoration programme.

Several additional observations are noteworthy from characteristics that were excavated. The drilled holes in the top end segments of the genouillère were located in the same position on both emplacements. The dimensions of the hole precluded their use as a means for lifting the granite segments and they were in an awkward location for laying. These additional holes suggested there may have been additional segments supplementing the present configuration. This possibility can be deduced from the means by which segments were held together in the emplacement. The fact that the mortar between the segments was used only as a bedding mechanism meant that the stresses placed on the genouillère had to be distributed throughout its mass by other means. This was accomplished by boring complementary holes into each layer of granite and inserting an iron pin to immobilize the two segments. The pin, excavated in sub-operation 2B32M, was 0.30 millimeters in diameter and 0.15 centimeters long. It had a collar at the mid-point of the pin 0.10 milli-

meters wide. The holes drilled in the top of the segments resembled those bored to hold the pins, indicating there may have been additional segments of granite on top of the existing structure. These additional pieces may have been used to hold back the earth of the parapet in the cheeks of the embrasure.

To form the throat of the embrasure for protection of the gun, an extra layer of granite shaped to conform to the parapet configuration may have been used instead of sod revetting. The small facet on the upper segments of the genouillère may be the remnants of the angle of the extra segment. A Commission reporting to London in 1856 (Johnston, 1978) recommended that all unnecessary granite and brick be removed from the ramparts to provide better protection from splinters of stone occurring from enfilade fire. The report specifically suggested the removal of the granite and brick in the ravelins. It defends the use of sod revetting in the rest of the work, implying that the granite had already been removed or had never been installed. The fact that the report did not mention granite use on the embrasures meant that the granite was removed prior to 1856 or it was never installed and the holes in the granite were for some other purpose.

The slot cut in the front segments of the genouillère can be explained by one of two possibilities; (1) The slots were cut to accommodate a step on the side piece of the wooden dwarf traversing platform or iron platforms, which were installed at both the locations of the emplacements. The step was attached to wooden platforms by metal hooks and was removable. No specific dimensions are available but on a platform for a comparable 32-pound emplacement believed to be authentic at Fort Frederick, RMC, Kingston, Ontario there is a line of metal hooks on either side of the platform which could hold the removable step. The slots in the granite may have been cut to accommodate the step when it was in the forward position on the platform. The addition of the step would have hindered the traverse of the gun. To alleviate the situation the granite may have been modified. The

hooks on the platform are approximately 0.45 meters above the racer of the emplacement and the slots on the granite are between 0.32 and 0.43 meters above the racer of the emplacement. A plan for a 110 Armstrong approved in 1869 detailed the arrangement of the step. (Figure 17) The fact the step was removable indicated that in the original design of the emplacement its position was not incorporated and had to be later accommodated by the addition of the slots. If the step was 0.33 meters off the ground it would be an appropriate height for an artilleryman to gain access to the platform and service the gun.

(2) An alternative possibility to the step on the wooden platform is that other types of platforms may have been mounted in the northwest demi-bastion and the emplacements on the southeast salient. According to the mounted ordnance list of 1856, there may have been platforms mounted in the left face of the southeast salient and one of the platforms on the right face of the northwest demi-bastion of the iron variety (Johnston, 1978). These iron platforms possibly had significant differences from the wooden platforms, and the alterations on both of the emplacements may have been a response to the variations.

The racer of the emplacements had variations in the lineal dimensions of the granite segments. The racer on the northwest demi-bastion had three central segments approximately of the same length with one unequal segment on each end cut to form an arc of traverse of 90 degrees. The comparative results of the excavated emplacements indicated that the sum of all the segments is equal to one fourth of the diameter of a circle circumscribed by the radius of the platform. This dimension is consistent with the racer excavated on the southwest demi-bastion, the southeast salient and the northwest demi-bastion. Contrary to previous assumptions (Connolly, 79), the racer was equidistant from the genouillère. It was thought the racer was cut to point the gun in a specific direction by varying the length of the racer. This was not the case. The racer was only cut to

make it conform to the 90 degree arc and not to a directional requirement. The variation in the length of the segments made it necessary to abbreviate some segments.

The normal arc for traversing platforms was usually only 70 degrees. Major J.F. Lewis in his book Permanent Fortifications For English Engineers (1890) gives the various radii for platforms and their "arc of training". This book is the only available documentation which specifies that a platform having a 12'10" radius for a 32-pound smoothbore, had an arc of 70 degrees. The emplacements at the Citadel consistently had a traverse of 90 degrees, exceeding the norm by 20 degrees. The variation may be another factor which the engineer changed according to the requirements of the locale. If one considered only the angle formed by the facets of the genouillère, however, the angle then becomes 70 degrees, conforming to the recommended arc. The extra degrees on the racer possibly had been added to accommodate the width of the rear trucks of the platform where they extended beyond the platform.

Parapet

One of the stated objectives of the excavations was the recovery of the smoothbore parapet profile. Past excavations failed to reveal substantive amounts of the profile because of destructive elements and the reforming of the parapets during the rifled gun period. The excavations in the northwest demi-bastion provided the last opportunity to examine the ramparts for a profile because the balance of the ramparts have been totally destroyed or rebuilt.

The walls of the pits excavated over the completed emplacement on the right fact of the northwest demi-bastions were utilized to provide a section through the ramparts. The soil profiles used were the east walls of sub-operations 2B32J, Q, W, and the west walls of the sub-operations B32DD, CC, BB providing a six meter long section. The combined east profiles of the excavations did not yield any clearly defined outline of the

smoothbore parapet or the rifled bore parapet. They lacked the characteristic stratum of black organic material indicating the original line of the sod covering of the parapet. By contrast, the profile formed by the west soil profiles of the sub-operations indicated a very strong presence of the black organic layer in a configuration that was representative of the rifled bore period (Figure 20). There was no indication of the smoothbore parapet. One must assume from this year's excavation and those undertaken in the past that in order to reshape the parapet to the later configuration, the earlier parapet had to be destroyed.

The smoothbore and rifled parapets had three major characteristics reflecting the military technological period in which they were employed: the banquette, the crest of the parapet, and the superior and exterior slopes. The banquettes, during the smoothbore period, were well defined and functionally necessary for small arms combat. The improvement of artillery technology made small arms conflict in a seige situation virtually unnecessary and the banquette became less of a requirement. The crest of the parapet during the smoothbore period was an acute angle and was primarily for the protection of the artillerists and riflemen. As the requirement for the riflemen lessened, the crest was slightly reduced in height but strengthened by a wider and flatter crest to withstand the more powerful rifled artillery. The final change was made in the angle of the superior and exterior slopes.

The sharp angles of the smoothbore parapet were a carryover from masonry parapets used throughout the eighteenth and seventeenth centuries which were angular to deflect the shot fired against them. The advent of the rifled gun made penetration into masonry fortifications much easier and its utility was questioned. The defensive technique that was developed to counter this greater penetrability was absorption as opposed to deflection. The replacement of masonry by earthworks which could be more easily repaired and would absorb the impact of

rifled shells became the new dictum of fortification technology. Angles that were not as acute and less subject to wear were utilized to make the parapet more absorbent. The changes in the technology of the nineteenth century meant that, in most fortifications, remains from earlier periods were obliterated; hence they cannot be documented archaeologically.

The superior and exterior slopes of the ramparts have been obliterated leaving only the interior slope, the crest plane and the banquette as possible sources of information. The soil profile obtained from the west wall of the sub-operations located over the emplacement closest to the salient on the right face of the northwest demi-bastion indicated the presence of the interior slope and the remnants of the banquette. The earth had undergone a certain amount of slumpage but the technique of revetting employed in the construction of the parapet was clearly identifiable.

The profile contained a layer of black organic material which delineated the rifled gun period of parapet construction. With the exception of the exterior and superior slopes, explicit dimensions were obtained. The crest plane was 1.60 meters in width at three degrees in declination towards the escarp. The angle was due to slumpage or possibly constructed for drainage. The interior slope of the parapet was 0.80 meters high with a slope of approximately 80 degrees towards the escarp. The interior slope terminated 0.20 meters out from the crest plane, giving a slope of one in four which was normally recommended. This correlation of angles was possible because of the longevity of the sod revetting maintaining its original configuration. The banquette was 1.40 meters wide with a vertical height of 1.45 meters. This gave the banquette an angle of approximately 47 degrees. The overall height of the parapet was 2.25 meters, almost the recommended height of 2.30 meters.

The replacement of stone and masonry parapets by revetting sod was adapted prior to the advent of the rifled artillery due to its utility in preventing injury to personnel on the ramparts.

The revetting consisted of sods laid in a pattern similar to brickwork. The sods were inverted, roots up, header and stretcher. One sod was laid lengthwise and the next was endwise to act as a tie-in to the earth parapet. Various historical documents (Appendix 1) explain this and other patterns which serve the same purpose.

The profile of the excavated parapet reflected the sod revetting pattern. When decomposed, the sods left a black organic deposit in the soil that was very characteristic. The profile (Figure 20) indicated there had been a 1.20 meter thick layer of sod between the banquette and the crest plane. This layer was not a single mass of black organic material but consisted of alternating lenses of different lengths. This pattern was indicative of the header and stretcher method of laying the sod. The stretchers (the sods that are laid lengthwise) were deposited in lenses of 0.30 meters wide, and the headers (the sods laid endwise) were deposited in lenses of 0.40 meters wide and 0.06 meters thick. The thickness of the stretcher lenses varied according to its placement vertically. The thickest stretcher lens was at the bottom at 0.34 meters, the next higher was 0.30 meters, the third highest 0.15 meters and the last two 0.05 meters. This pattern indicated the headers were not laid in successive courses but at increasing intervals as the revetting approached the top of the parapet. This contradicts the patterns suggested by data on revetting. The variations in the patterns may be a result of a design change or possibly the preference of an engineer.

Chimnies

The parapet configuration used during the smoothbore gun period was changed to accommodate the rifled bore guns. The locations of the chimnies on the south front were also changed at the same time. Documentation indicated the chimnies, which were located within three meters of the escarp wall, were moved back an additional three meters and slightly eastwards. This relocation of the chimnies was confirmed by excavations by the construction crews during the restoration of the southwest demi-bastion. Photographs taken on the northwest demi-bastion in 1879 contradicted these changes in chimney location. The photograph shows the chimnies located in the forward position near the northwest escarp wall with the rifled gun emplacement installed at the salient of the demi-bastion.

As part of the excavation program on the northwest demi-bastion pits were opened over the presumed locations of the chimnies to verify their exact location and configuration. Surface features which indicated their locations were two slabs of ironstone which protruded from the sod in approximately the same location as in the photograph. One pit was opened (2B32E) and completely excavated. The remains of the chimney consisted of a portion of the brick flue and the asphalted brick base (Figure 23) which continued down to the casemate of defense number 57 below the ramparts. The chimney was 0.81 meters square with eleven courses of brick still in situ. The top three courses had been displaced 10.0 centimeters to the north but still retained the same dimension. The north face of the chimney was 3.10 meters from the escarp wall and the bricks were laid common bond. The flue of the chimney was placed on a base of asphalted bricks laid in a common pattern. Eleven courses were visible in the excavation at an angle of approximately fifteen degrees towards the south. The bricks of the base were asphalted to prevent moisture from seeping into the bricks and down the flue to the casemate below. The base covered the eastern half of the sub-operation and its extreme limits were not discernible.

Only one of the two chimneys was excavated. The other chimney was located by the same type of surface feature.

There is no apparent reason for leaving these chimneys in the same location during the parapet changes. When the ordnance was changed from smoothbore to rifled barrels, the emphasis was on the waterfront and not the landward side of the fort. Possibly the northwest front was not considered important enough to expend the money for such a change. No rifled guns were ever mounted on the northwest demi-bastion even though emplacements were built.

British Signal Station

The signal mast located at the salient of the southeast front required a number of buildings to service the system during the British and Canadian occupations. The transfer of the Citadel from British to Canadian hands in 1906 required an inventory of buildings. The British signal station was valued at 35 pounds and plans indicated it to be 37 by 15 feet. Increased use of the salient of the Citadel required the expansion of facilities. The British signal station was removed and a larger building was constructed in 1920.

Archaeological excavations were designed to locate traces of the earlier signal station foundation and to verify its configuration. The excavations were the continuation of a series of pits in the last field season placed to accomplish the same goals but without results. The pits were located between the present powder magazine and noonday gun shed situated on the right face of the southeast salient. The position of the pits corresponded to the south walls of the two signal stations. The only evidence recovered to indicate the presence of a foundation was a section of cement parging 7.1 meters north of the escarp wall which may have been used for a base for a sleeper (Figure 26). The cement was of an irregular shape with a maximum length of 0.82 meters and a maximum width of 0.78 meters. A raised portion of the cement suggested that the sleeper was bedded into the cement and the building constructed on this arrangement. The raised portion of the cement has a maximum width of 0.22 meters (8.7") suggesting a sleeper width of 0.203 (8"). The cement was truncated and not in any definable stratum of soil. The lack of seriated evidence negates any possible way of deter-

mining the cement's period of use.

Telegraph Mast Building

One of the three masts on the southeast salient was utilized to relay information to York Redoubt. Associated with this mast was a small building which appears on some photographs at the foot of the mast. Its exact dimensions and use were not known. Presumably it was a storage shed for the signals for the mast. Excavations in the summer of 1978 uncovered a small portion of the footing of this building and excavations were continued in this season to uncover the balance of the feature. Excavation did not reveal any more significant traces of the footing. The stump of the mast was uncovered and the approximate dimensions of the building could be calculated.

A photograph from 1928 indicated the structure was situated primarily on the west side and behind the mast. The line of cobbles excavated would represent the west wall and the ends of the feature would represent the north-south limits of the building. Calculating from these parameters the building would have been 3.18 meters long and 1.63 meters wide (10.5' x 5.4'). This would suggest that the building was not a form of accommodation but only a storage shed, possibly for signalling devices.

Another feature uncovered in the excavation was the stump of the telegraph mast. Photographs of the mast taken at a distance made only the location and height discernable. No specific dimensions were available. Sometime after 1950 the mast was removed or fell down and no data was recorded. The stump was uncovered in the northeast corner of the excavation adjacent to the noon-day gun shed. It had been made from pine as normally specified by the Royal Engineers. The stump was not round but was octagonal with each facet measuring 0.15 meters a side (Figure 29). The maximum diameter of the stump was 0.38 meters.

Conclusion

Excavations from this field season have attained the majority of the goals formulated for the summer program at the Citadel. The data recovered from the emplacements on the northwest demi-bastion will provide a clear picture of a smoothbore emplacement installed at the Citadel when aggregated with the data recovered from the south front. The correlation of the various facts will allow the restoration process to proceed with a high degree of accuracy. The information for the restoration of the smoothbore parapet was not recoverable but it was confirmed that the revetting process was utilized on the parapets. The information regarding the numerous structures on the southeast salient for both field seasons provided the basis, in conjunction with the historical documentation, for future reconstruction programs.

The past three field seasons of excavation have been directed towards recovering specific structural details for the restoration. Most of the areas pertinent this structural information have now been excavated and future work can be oriented towards the cultural aspects of military life.

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Appendix I. The following information is from the Aide-Memoire (1851).

Sod-work forms a strong and durable revetment: the sod should be cut from a well-clothed sward, with the grass of a fine short blade and thickly matted roots. If the grass is long, it should be mowed before the sod is cut.

Sods are of two sizes; one term 'stretchers', 12 inches square and $4\frac{1}{2}$ inches thick; the other, termed 'headers', are 18 inches long, 12 broad, and $4\frac{1}{2}$ thick.

The sod revetment is commenced as soon as the parapet is raised to the level of the head of the banquette. A layer of sods is then placed either horizontally or inclined a little inwards (i.e. perpendicular to the interior slope) from the banquette: the layer consists of two stretchers and one header alternately, the end of the header laid to the front. the grass is laid downward, and the sods should protrude a little beyond the line of the interior slope, for the purpose of trimming the layer before laying another, and to make the slope regular. The layer is firmly settled by tapping each sod as it is laid with a spade or wooden mallet, and the earth of the parapet is packed closely beyond the layer.

A second layer is placed on the first, so as to cover the joints, or, as it is termed, to break joints with it; using otherwise the same precautions as in the first. The top layer is laid with the grass-side up, and in some cases pegs are driven through the sod of two layers, to connect the whole more firmly.

When cut from a wet soil, the sods should not be laid until they are partially dried; otherwise they will shrink, and the revetment will crack in drying. In hot weather the revetment should be watered frequently until the grass puts forth. The sods are cut rather larger than required for use, and are trimmed to a proper size.¹

This corresponds reasonably well to the description of sod work in the standard contract used in Quebec in 1852.² The sods in use there were 18 inches long, 12 inches broad and 3 inches thick. When used in "Jameb or Parapets or similar work" the sods were laid alternately headers and stretchers and pinned with cedar pins 8 inches long, 1 1/4 x 3/4 inch. Sod work was also laid flat and pinned as required. Finally sods for coping to walls were rounded. These were fastened with cedar pins and backed with loam.

The 1860-61 estimate for the expense magazine at Grand Battery, which served as a basis for the plans for the expense magazine at the Citadel called for a covering of sods laid header and stretcher 12 inches and 24 inches alternatively. Whether this configuration differed from the above because the sods were to cover an expense magazine instead of simply a parapet, or whether all the sod laid in Halifax conformed to this pattern, is unknown.

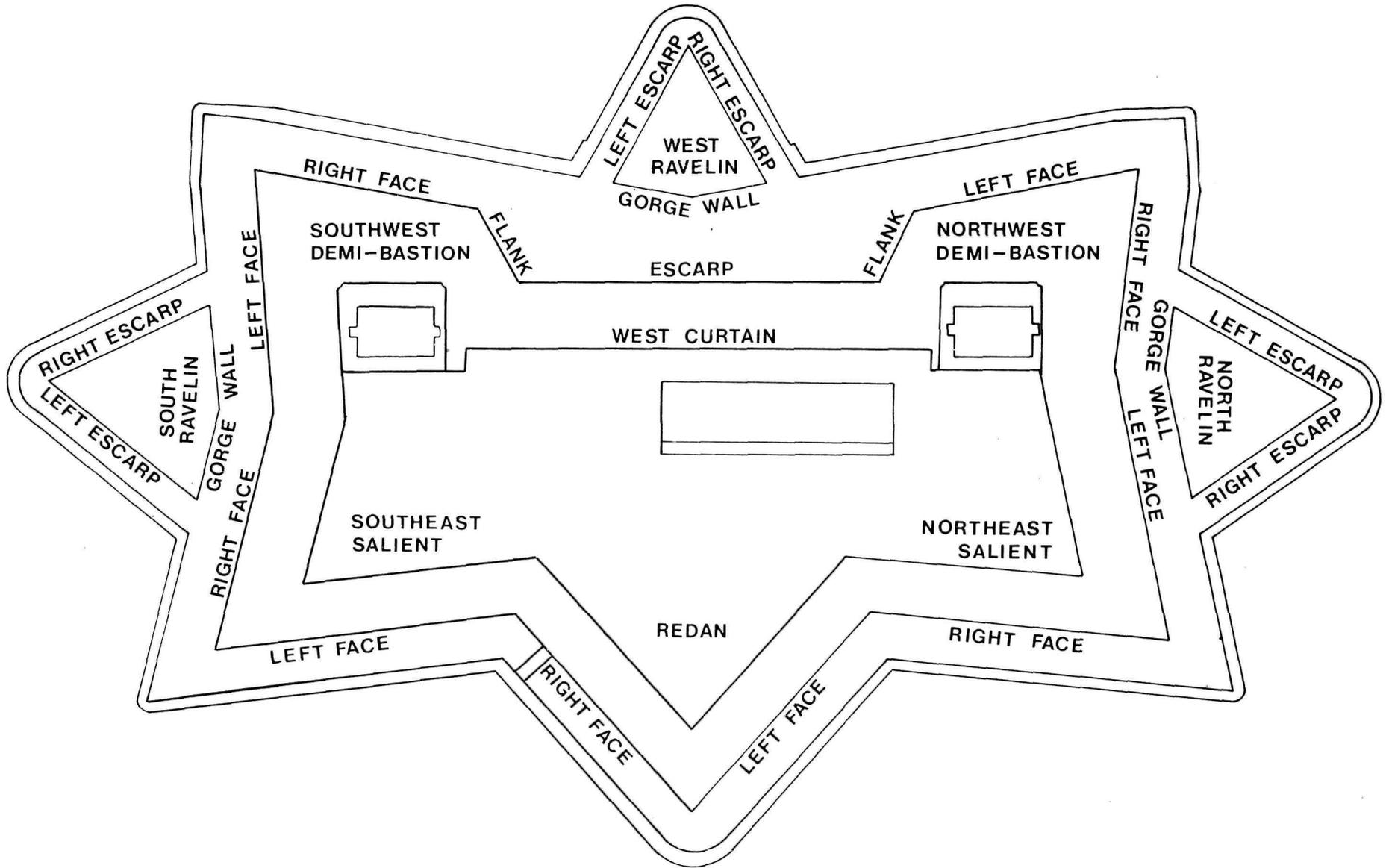
C. Pulsifer
October 2, 1978

Revised
C. Whitfield
June 13, 1979

¹ Aide Memoire to the Military Sciences, (1851), p. 427.

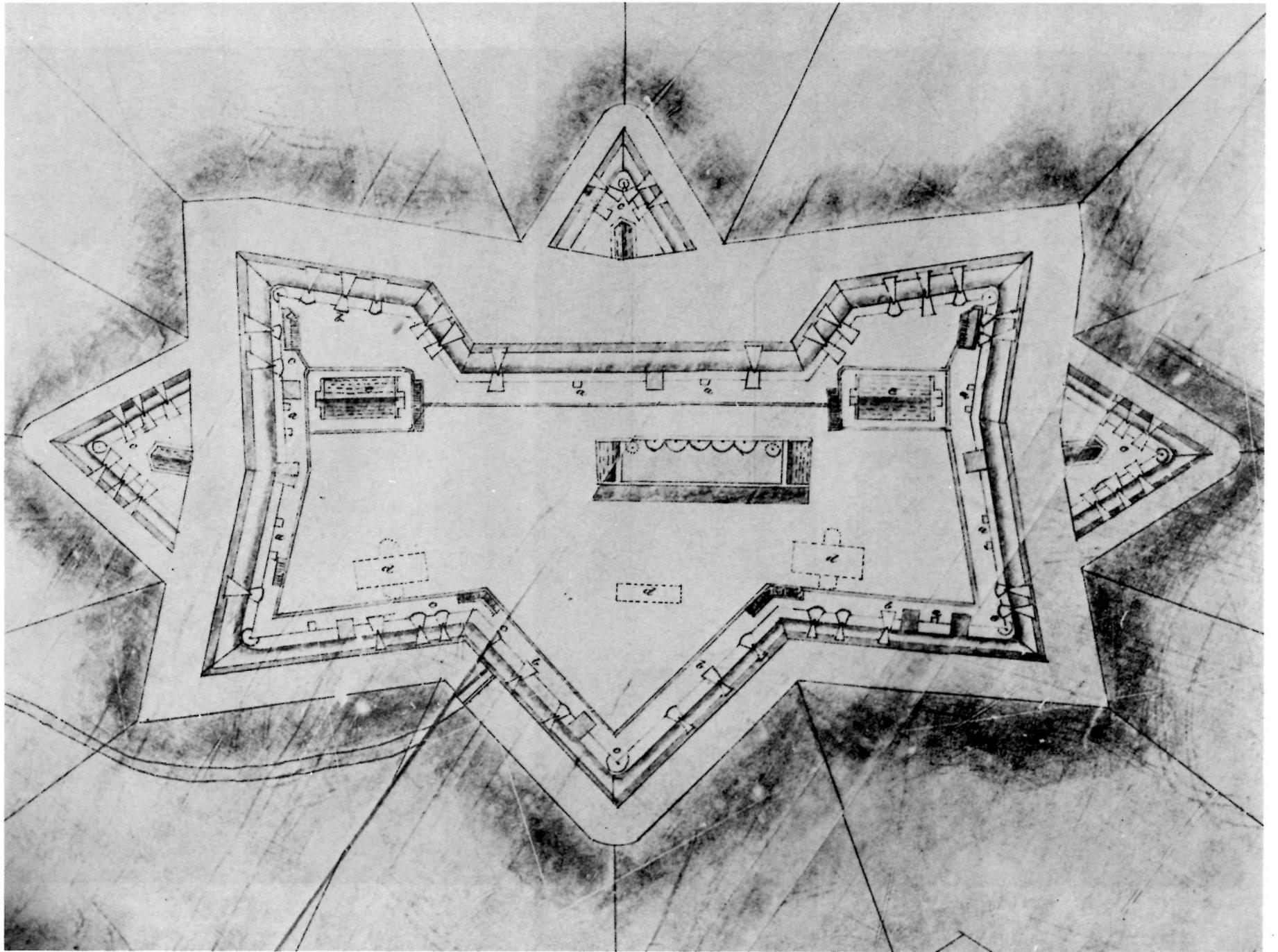
² Archives Civiles de Quebec, Henry Austin Notary Public, Schedule of Contract for Bricklayers', Masons', Stone-Cutters', Paviers' and Plasteers' Work for the service of the Ordnance ...at Quebec, 1852.

1 Location plan for the Halifax Citadel.



- 2 1846 plan of the Halifax Citadel indicating the locations and the types of the guns that were to be mounted on the ramparts in the early 1850s.

Source: Public Archives of Canada



- 3 Corner of granite emplacement emerging from wall of pit 2B32Q. Note the extent of the foundation masonry extending past the granite segments. (Scale 0.50 m)



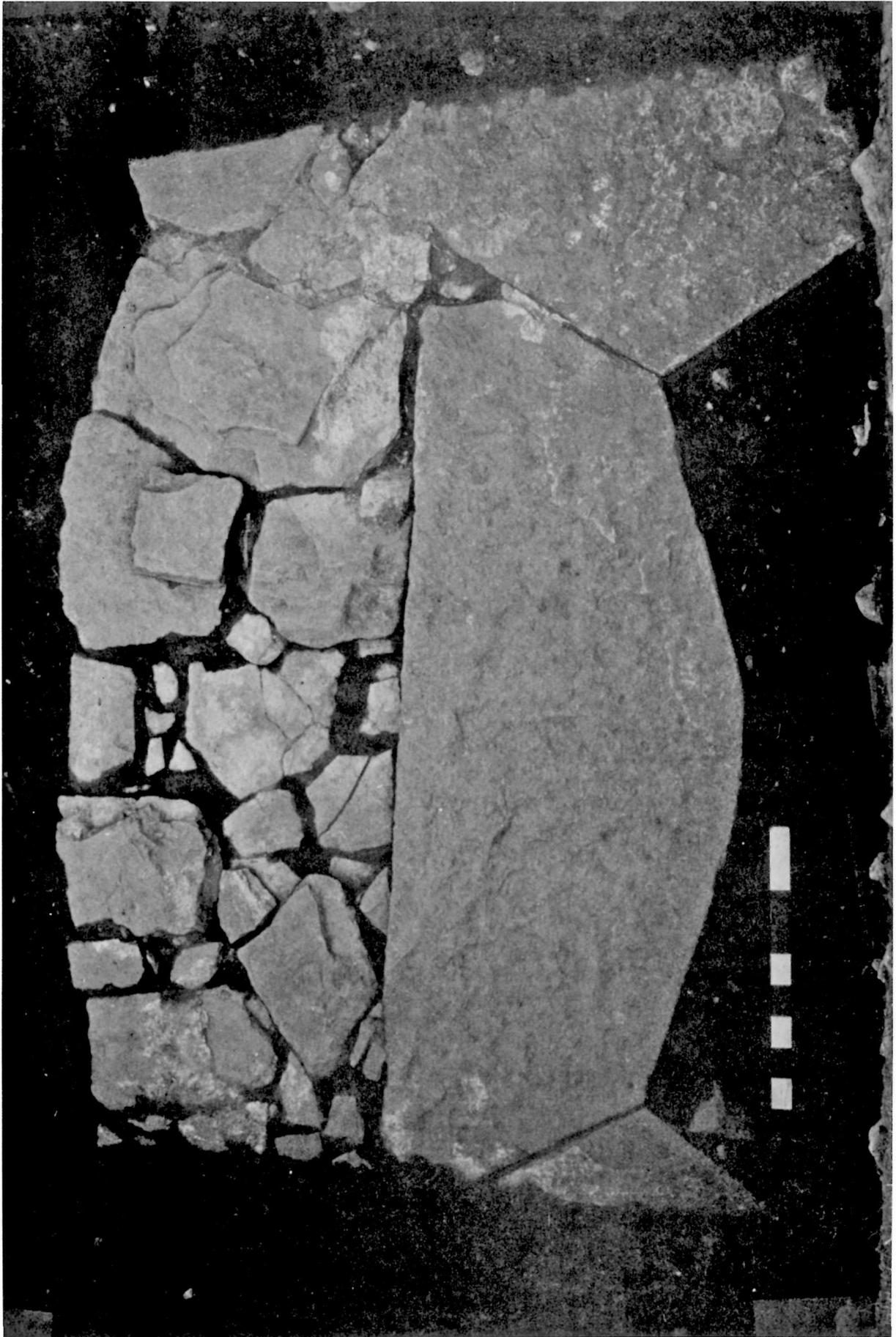
4 Emerging cast iron pivot in sub-operation 2B30F.
(Scale 0.50 m)



- 5 Pivot and granite in situ in sub-operation 2B30Q. One half of the granite has been removed during the dismantling of the emplacement. The groove on the right hand side of the granite is the slot for the cramp which held the two segments together. (Scale 0.50 m)



- 6 Overview of feature in sub-operation 2B32H of ironstone and granite indicating the top segments of the genouillère in situ. This was the first indication of a complete emplacement. (Scale 0.50 m)



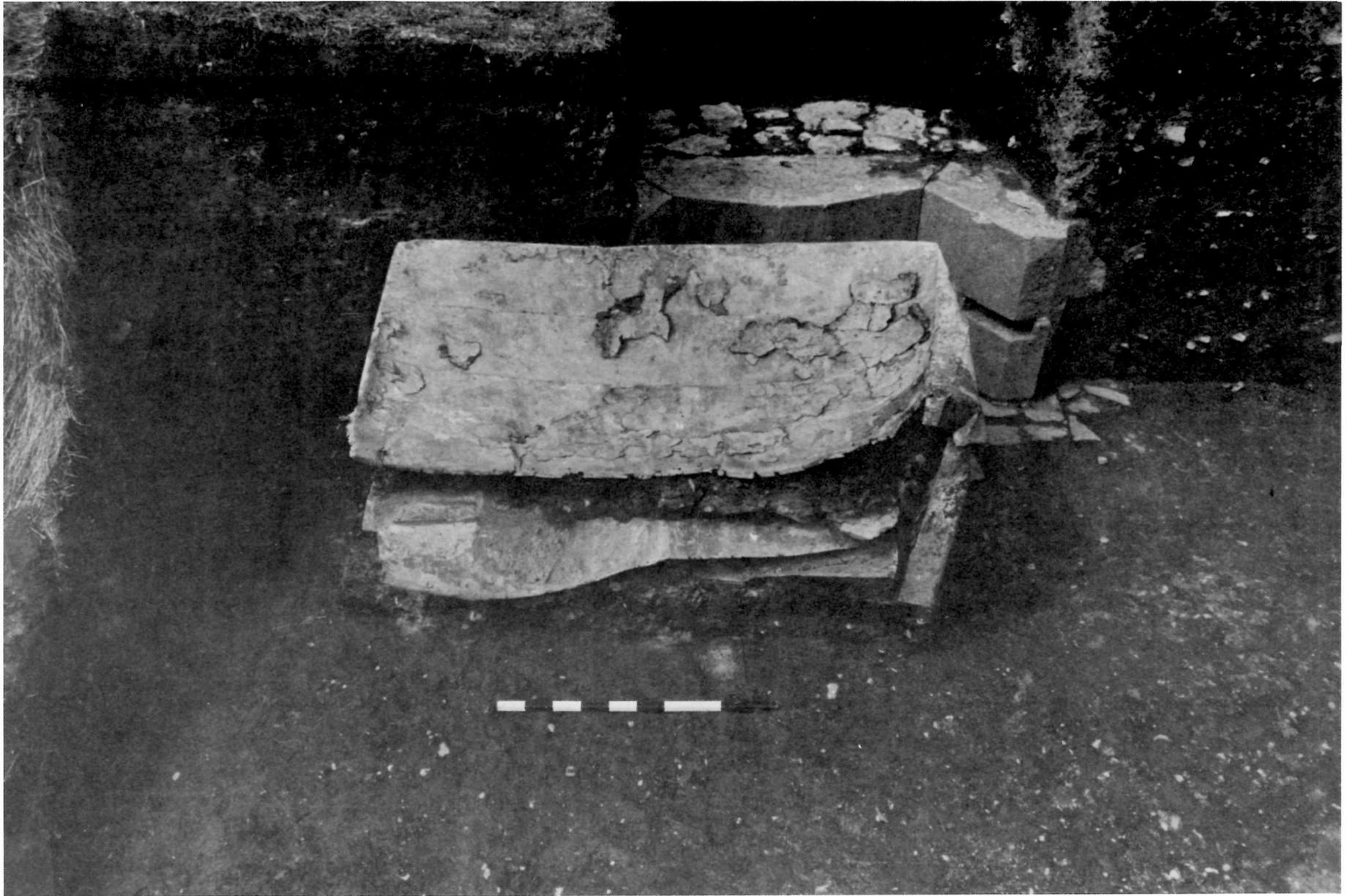
- 7 Granite features in sub-operation 2B32M showing the configuration of the genouillère and the ironstone wall supporting it. Note the iron pin embeded in the left segment of granite and the hole for a pin in the left segment. (Scale 0.50 m)



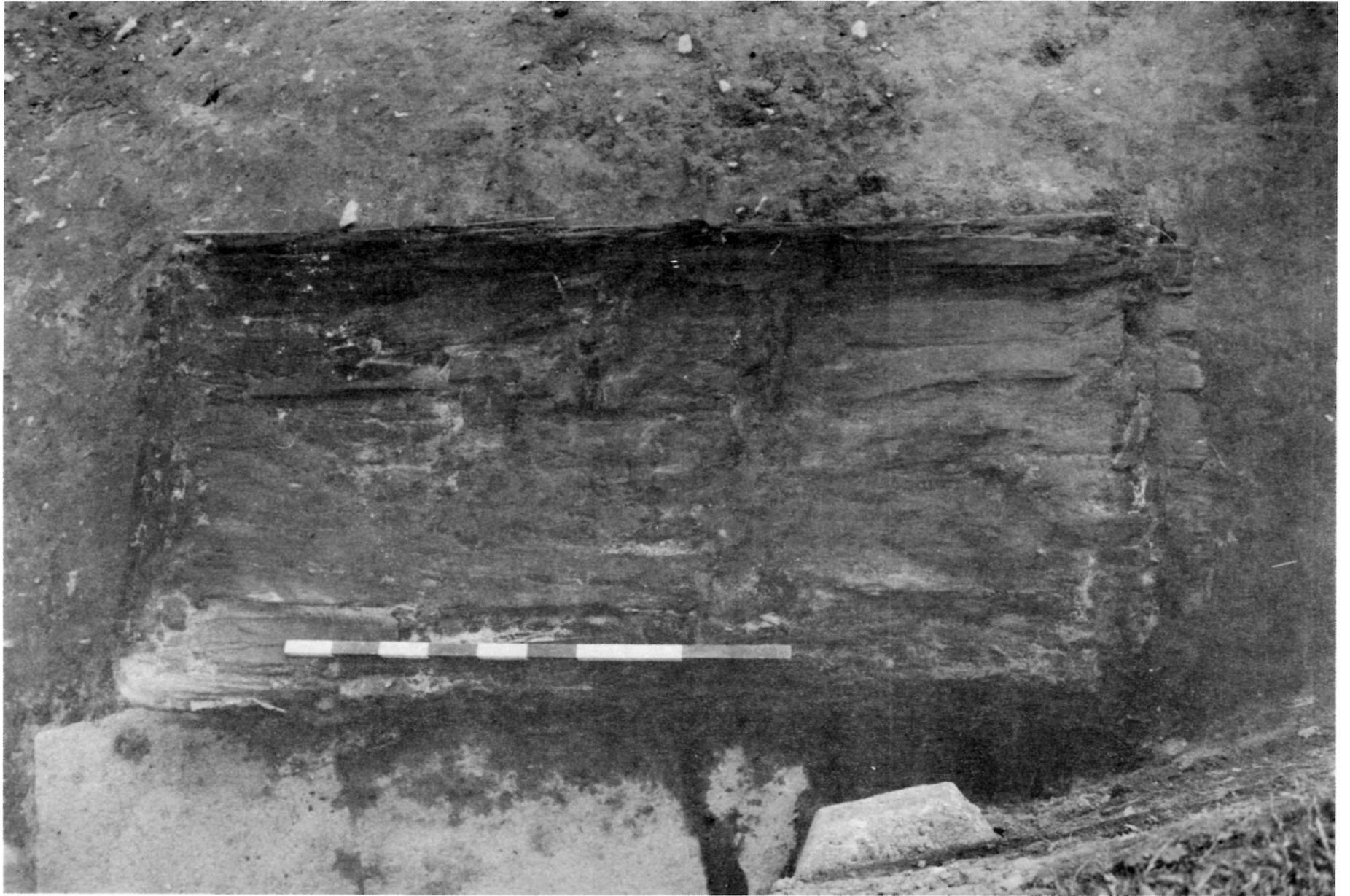
8 Partially excavated metal covered wooden box located on the right face of the northwest demi-bastion in sub-operation 2B32P. (Scale 0.50 m)



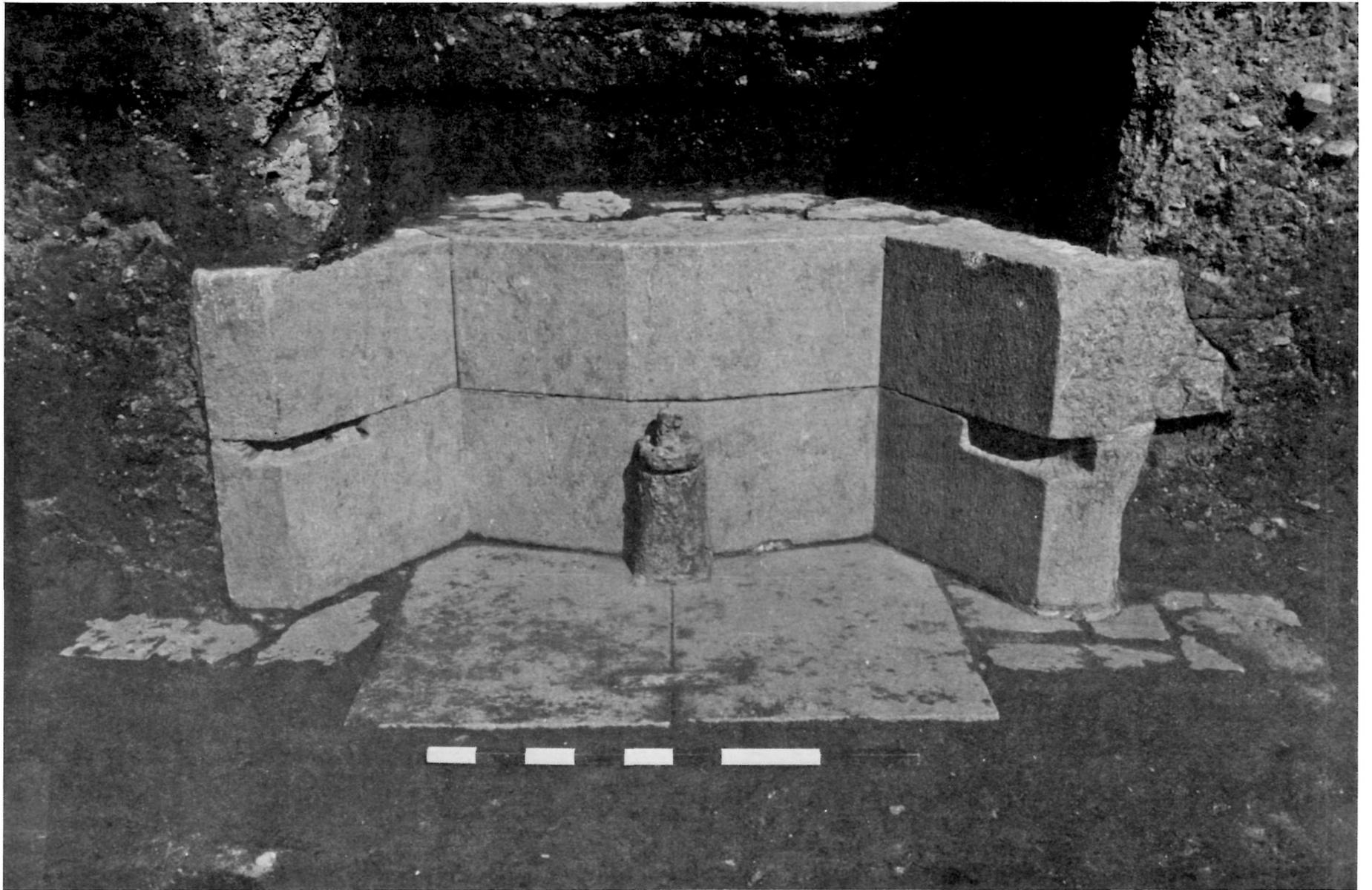
- 9 Metal covered wooden box on top of the gun emplacement on the northwest demi-bastion. The box was deposited during depression Unemployment Relief project in 1930s.
(Scale 1.0 m)



- 10 Overview of storage box with metal cladding removed. The wood was groove and tongue spruce with wire nails.
(Scale 1.0 m)



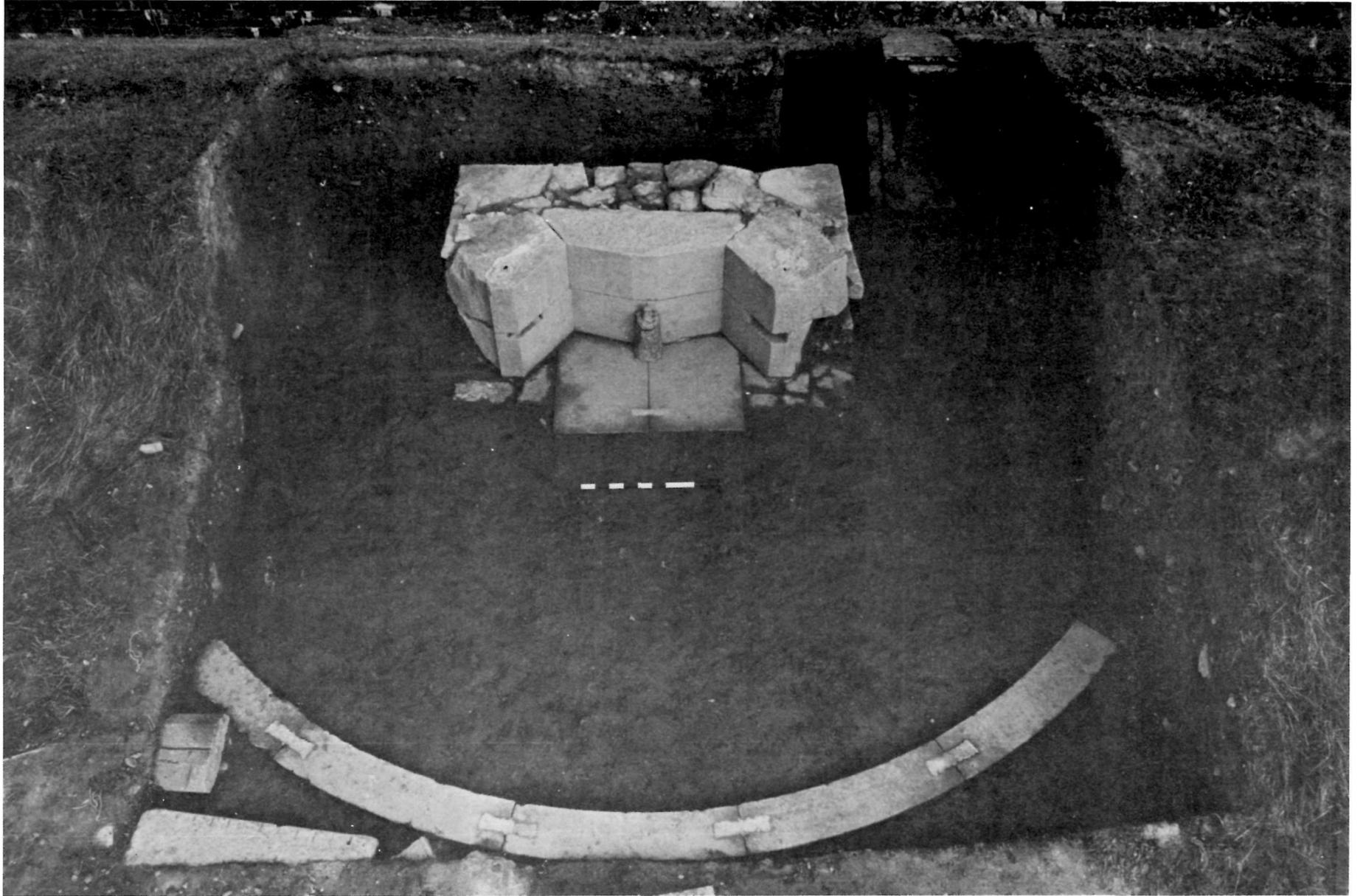
- 11 Overburden on the feature approximates the configuration of the revetting and exposes the faces of the granite.
(Scale 1.0 m)



- 12 Front view of excavated 32-pound smoothbore emplacement on the right face of the northwest demi-bastion. Note the two slots cut into the two lower segments of granite, especially the incomplete slot on the left wing. (Scale 1.0 m)



- 13 Overview of the excavated smoothbore emplacement. Note the two holes in the top segments of the granite perhaps indicating there may have been additional segments.
(Scale 1.0 m)



- 14 Cast iron pivot in situ with forge welded wrought iron axis. Note the extremely narrow joints with mortar between the segments of the granite behind the pivot. (Scale 1.0 m)



- 15 Close up of incomplete slot on the left wing of the genouillère of the complete emplacement. The addition of the slot after the emplacement was finished indicates that the platforms had been changed after the emplacement was built.



- 16 Granite racer from 32-pound emplacement on the northwest demi-bastion. Note the wear pattern on the granite indicating the gun platforms must have been moved frequently to prevent settling of the racer or rusting of the trucks. (Scale 1.0 m)



- 17 Plan of a wooden dwarf traversing platform for an Armstrong type of gun. This platform is equivalent to those used at the Citadel for smoothbore guns. This platform indicates the configuration of the removable steps on the side pieces and their relationship to the front wall.

Source: Royal Artillery Institute

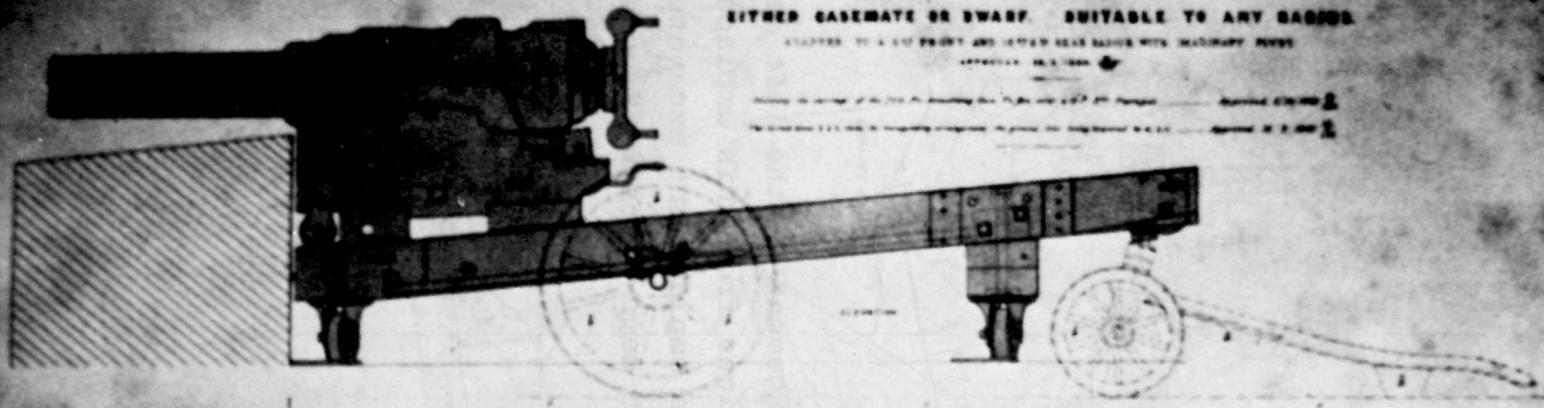
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PLATE

DRAWING OF NEW PLATFORM
EITHER CASEMATE OR DWARF. SUITABLE TO ANY RANGE.

ADAPTED TO A SIX FOOT AND LITTLE LESS RANGE WITH MAXIMUM POWER
 APPROXIMATE 1800 LBS

Having the honor of the Hon. Secy of the War Office to be informed that the Hon. Secy of the War Office has approved of the above design for the purpose of being constructed in accordance with the conditions of the contract for the purchase of 1000 of the same.



NOTE. The size and weight of the gun is such as to be suitable for use in a casemate or on a barge. It is designed to be a portable weapon. The gun should be shipped in three loads and when in use should be placed on a platform. The height of the carriage for the platform is shown by the dotted line, which is subject to the order of the purchaser.

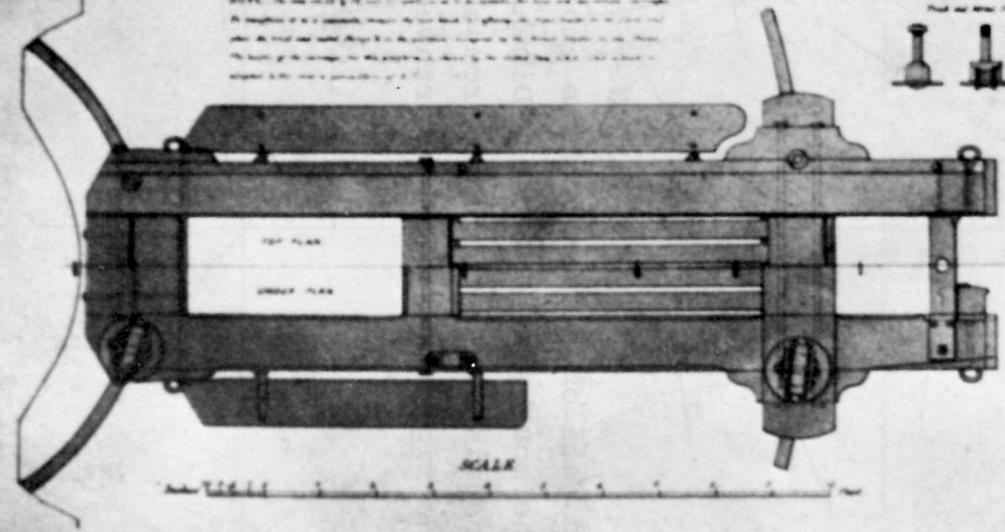


Table of Materials

1. Barrel (Length 10 ft)	1	10	10
2. Carriage (Length 10 ft)	1	10	10
3. Wheel (Diameter 18 in)	2	18	18
4. Bolt (Length 10 ft)	1	10	10
5. Nut (Length 10 ft)	1	10	10
6. Washer (Length 10 ft)	1	10	10
7. Platform (Length 10 ft)	1	10	10
8. Gun (Length 10 ft)	1	10	10
9. Carriage (Length 10 ft)	1	10	10
10. Wheel (Diameter 18 in)	2	18	18

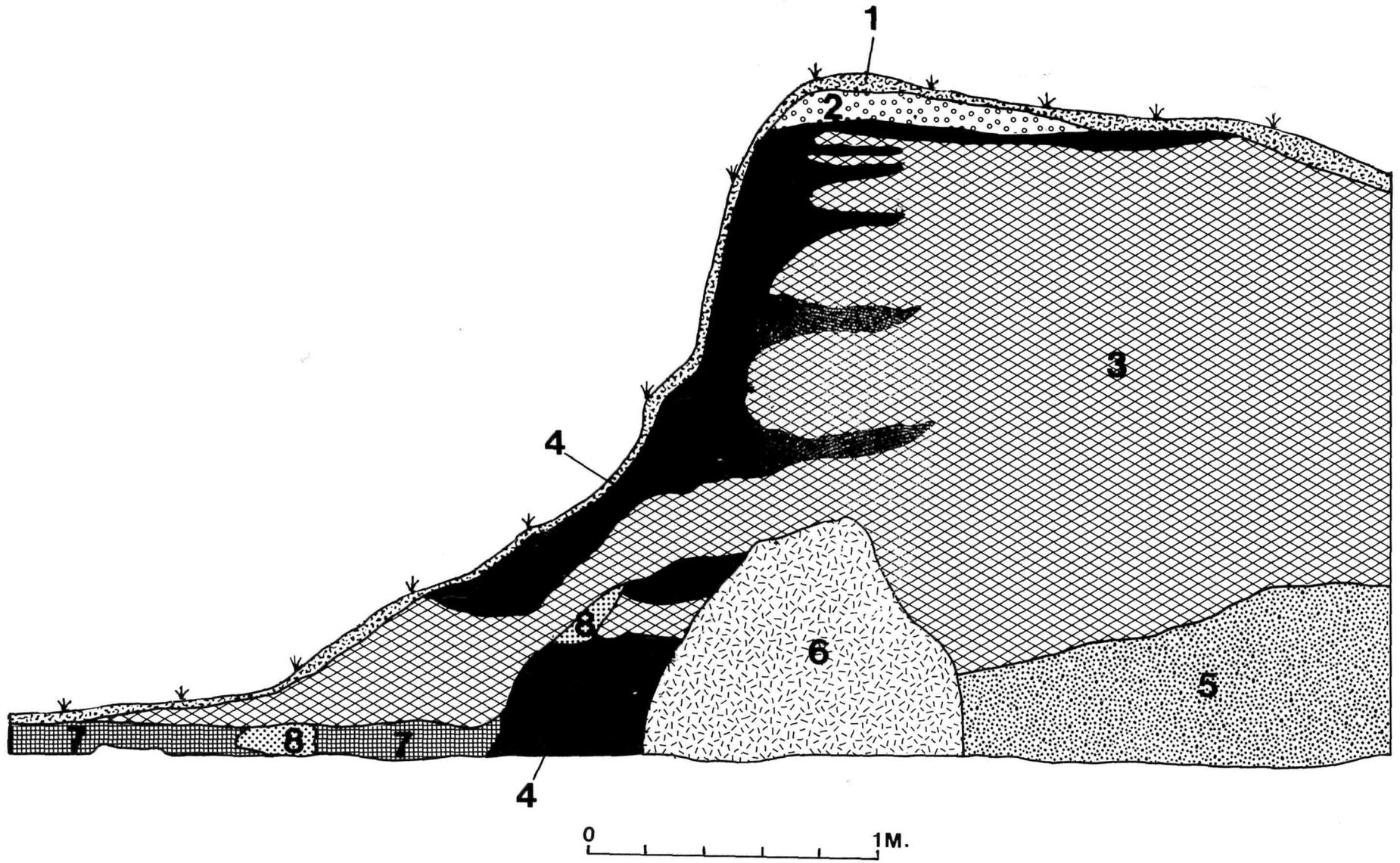
W. H. ...
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Designed and constructed at the Royal Arsenal, Woolwich, London, E. S. W.

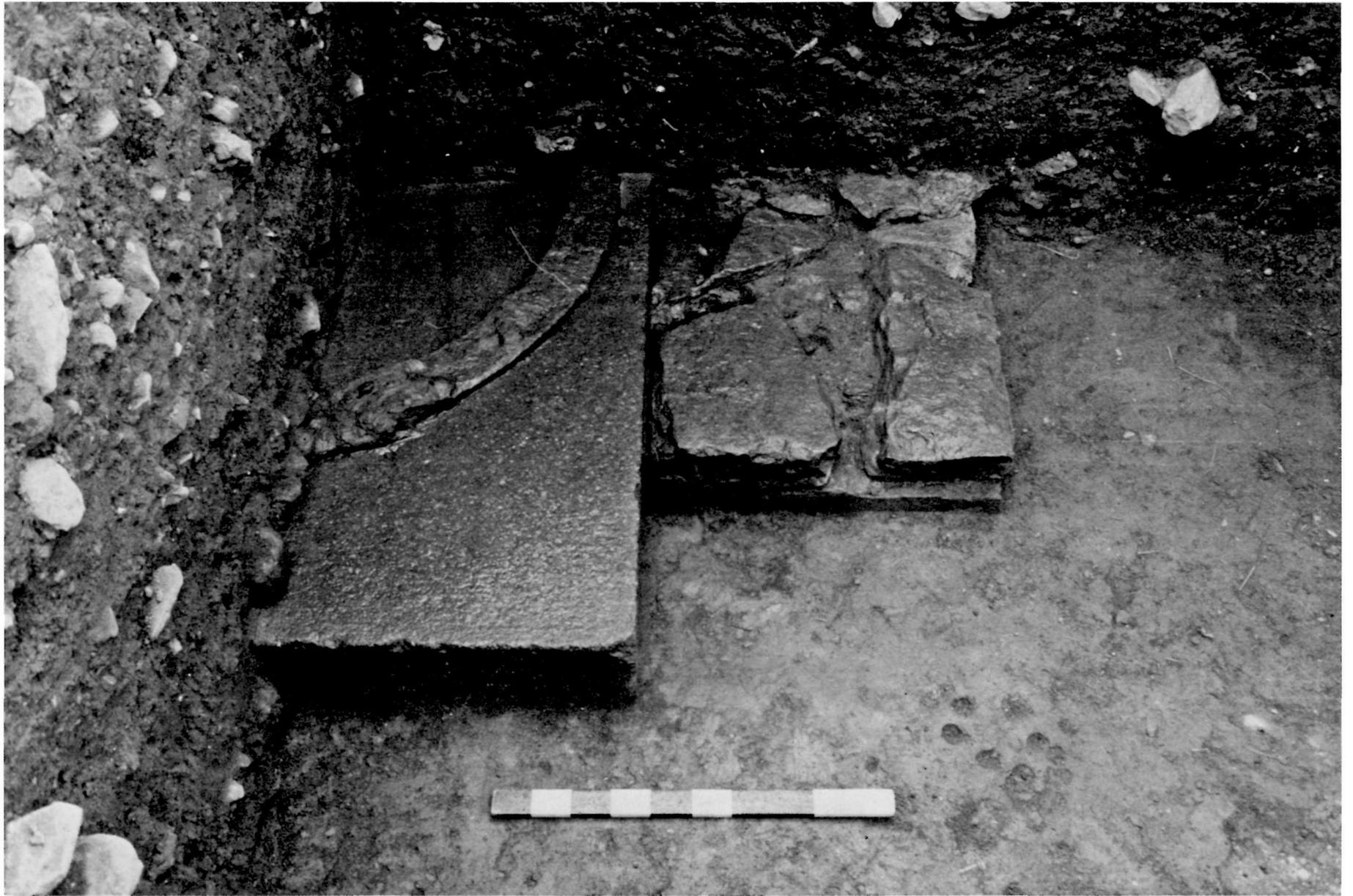
18 Field data on the smoothbore emplacement on the left face of the southeast salient. Dimensions from this emplacement are consistent with those from the emplacement excavated on the right face of the northwest demi-bastion (Figure 19).

- 19 Preliminary field measurements on the complete emplacement on the right face of the northwest demi-bastion.

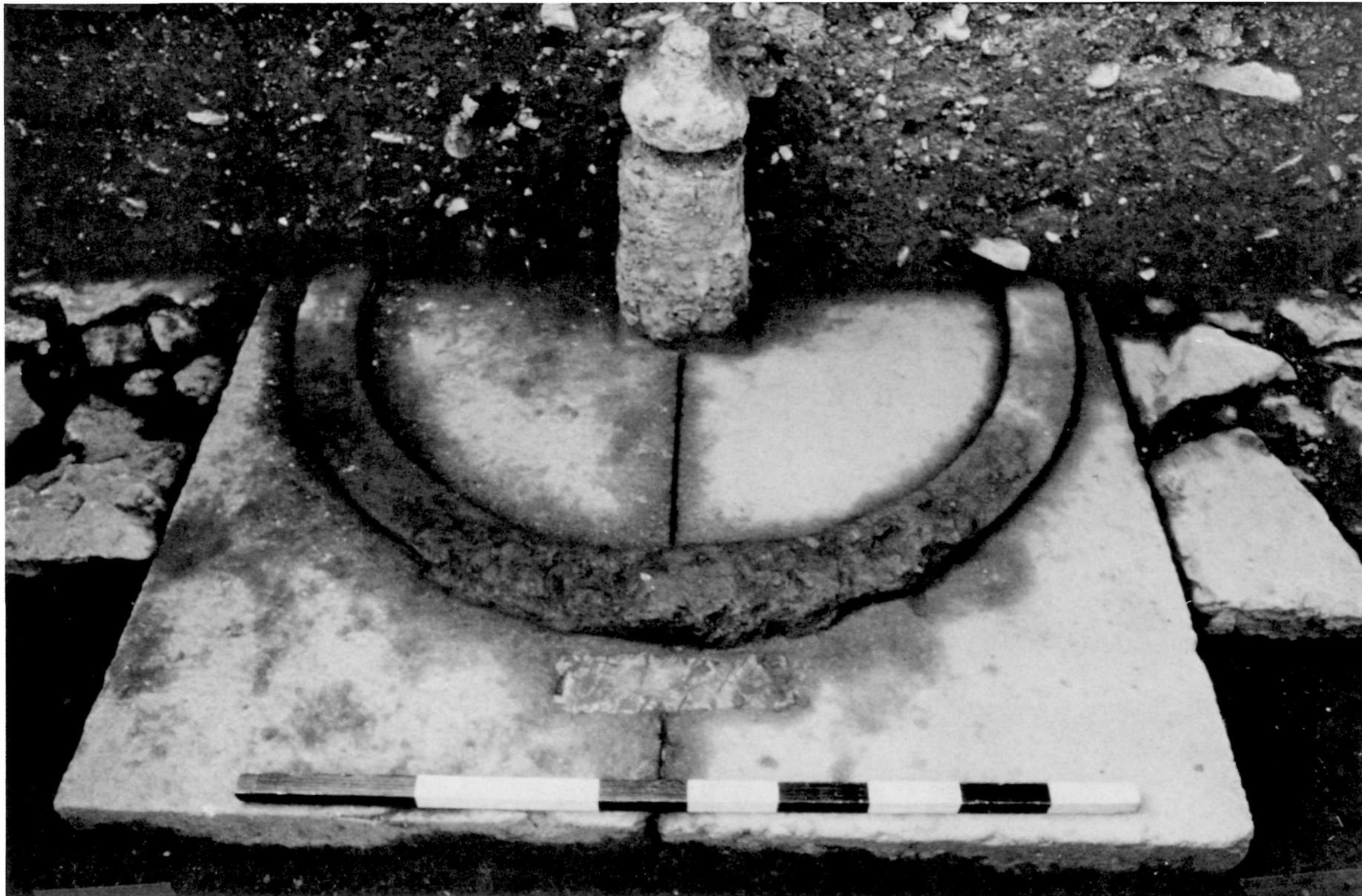
- 20 Soil profile of west wall of pits over the complete gun emplacement indicating the black organic material characteristic of the revetting pattern. (Scale 5.0 cm - 1.0 m)
1. Contemporary sod
 2. Light brown loam
 3. Dark brown loam
 4. Black organic material
 5. Dark brown clay
 6. Dark brown silty clay
 7. Mottled black-brown clay
 8. Beach sand



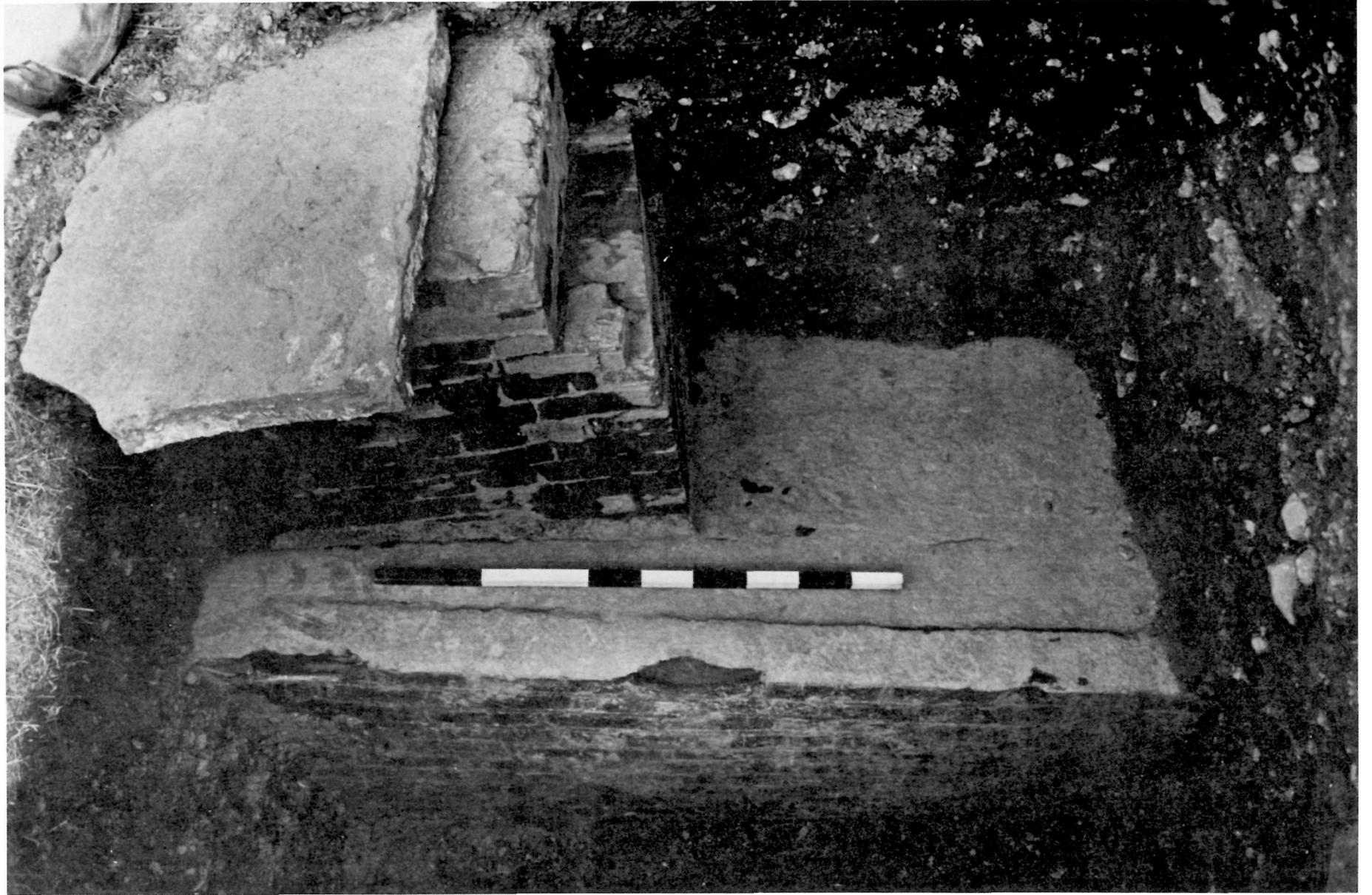
21 Overview of anomalous pivot in sub-operation 2B21N with the iron racer. The pivot is slightly forward and to the left in the baulk. This is the only example of an iron track on a smoothbore emplacement within the Citadel. Other examples of this type have been found elsewhere within the Halifax Defence Complex. (Scale 0.50 m)



22 Overview of anomalous racer and pivot in sub-operation
2B31H. (Scale 1.0 m)



- 23 Excavated base for chimney in sub-operation 2B32F on the right face of the NWDB. Note the seysse asphalt waterproofing on the flue below the chimney. (Scale 1.0 m)



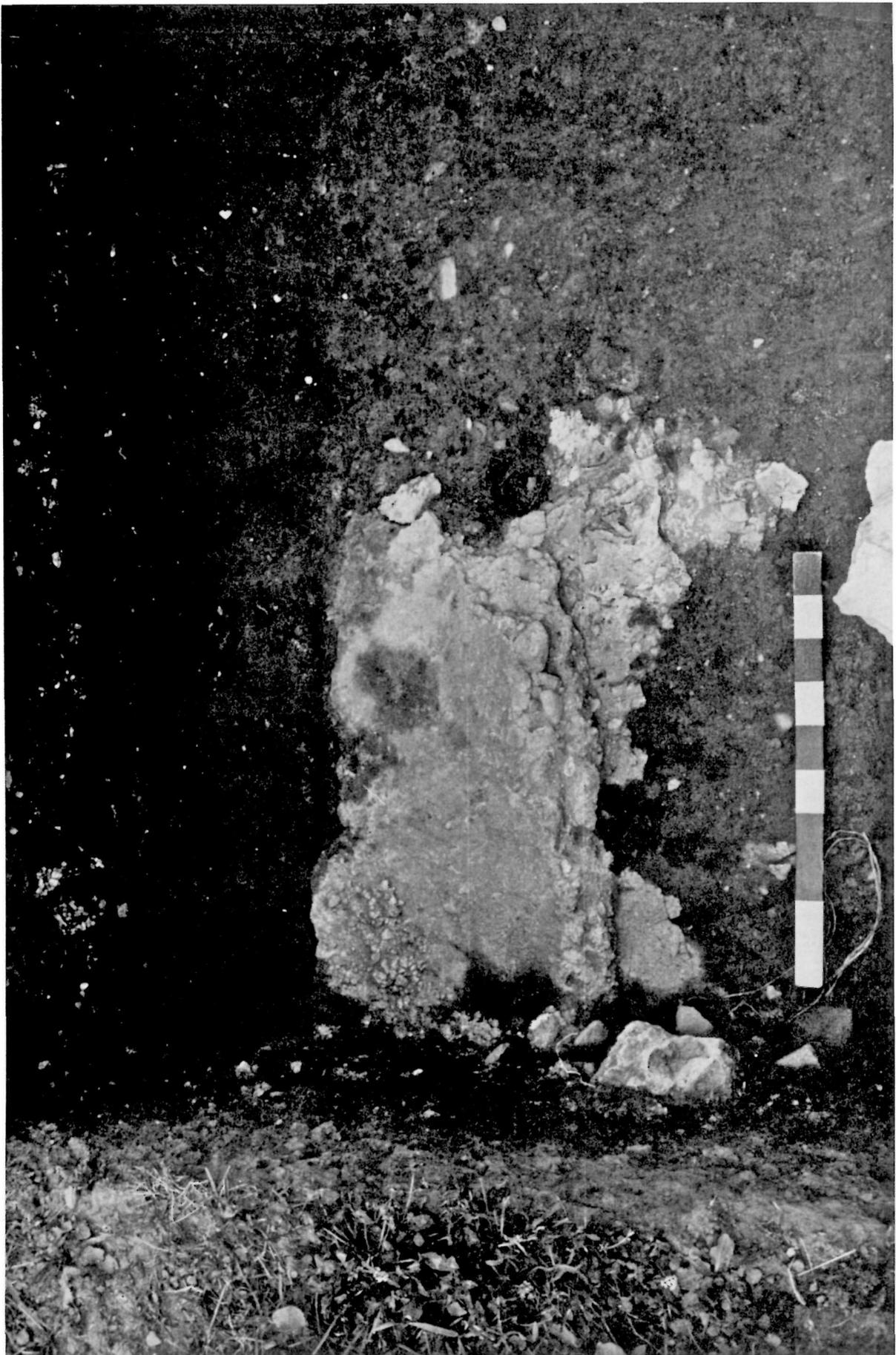
- 24 Overview of sub-operation 2B23T on right face of the southeast salient which exposed the foundation for the smoothbore emplacement and its pivot location.
(Scale 1.0 m)



- 25 Pivot hole of 32-pound smoothbore emplacement on the right face of the southeast salient. This is the foundation of the emplacement with the covering granite removed.
(Scale 0.50 m)



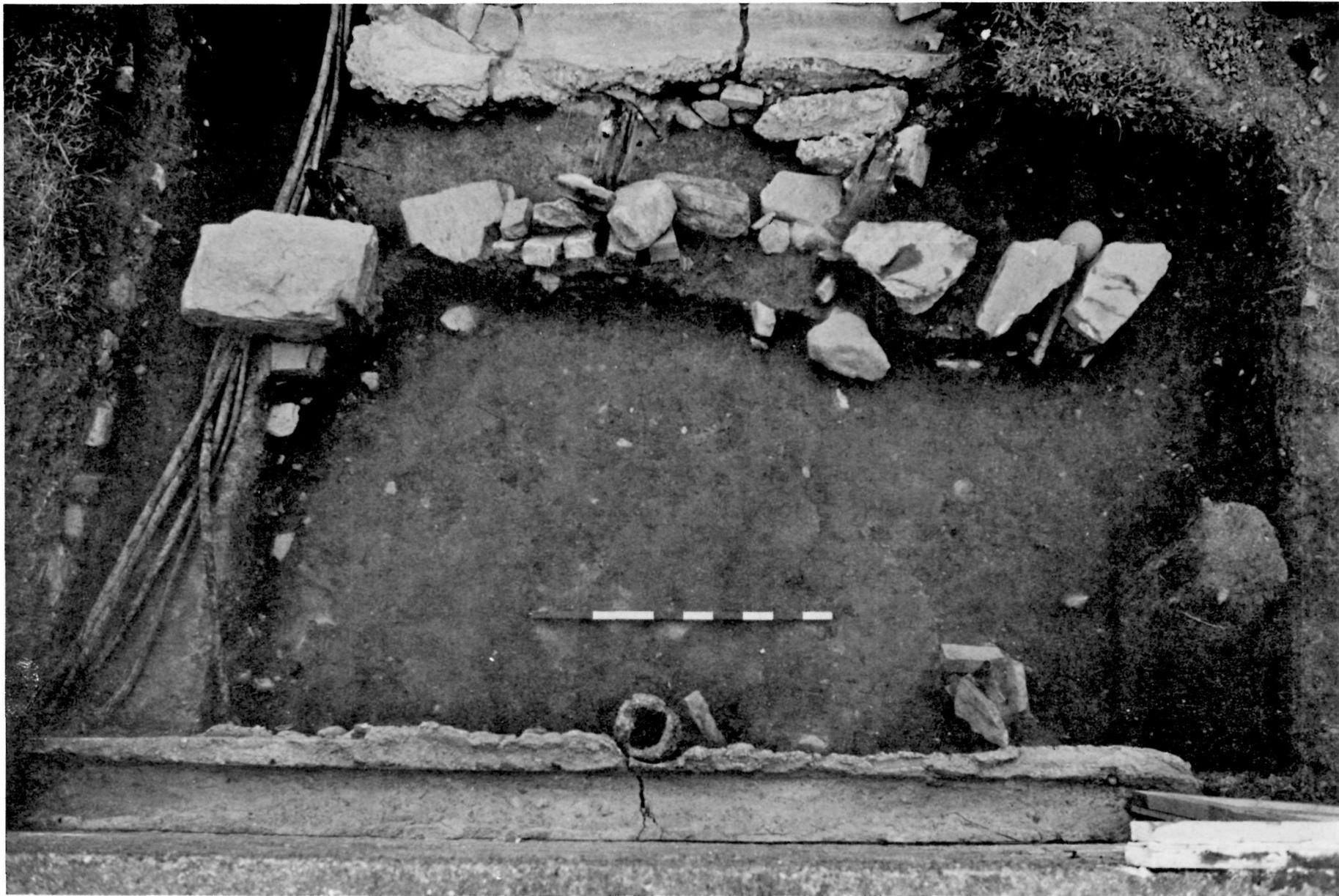
26 Fragment of cement for sleeper of signal station on the southeast salient in sub-operation 2B23S. (Scale 0.50 m)



- 27 Foundation of the building associated with the storm signal mast. This excavation (2B23N) completed in the last field season did not fully provide the dimensions of the structure. (Scale 1.0 m)



28 Overview of sub-operation (2B23P) excavated this field season to determine the entire limits of the building associated with the storm signal mast. The stump of the mast was uncovered but its relationship to the building was not fully documented.



29 Close up of the stump of the storm signal mast in sub-
operation 2B23P. (Scale 0.50 m)



