

The 1992 Archaeological Field Season at Fort Cunningham, Bermuda

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ABSTRACT: *In 1991, a major excavation of the ditch at Fort Cunningham took place during a four-week period, when several thousand cubic metres of late 19th century infill were removed. In 1992, archaeological recording of many of the features discovered in 1991 was carried out. The entire facade of the escape was drawn, as well as the faces of the walls of the magazines. Limited excavation of a feature of the 1820s escarp was effected, and further underwater surveys were made of an artifact dump to the east of Paget Island. This report continues discussions presented here last year and displays some of the 1992 record drawings, and further evidence of the development of this major 19th century polygonal coastal fortification.*

INTRODUCTION

Following the 1991 excavations at Fort Cunningham on Paget Island,¹ a further field season was needed to record and interpret these findings in detail. In addition to documenting the ironclad armour at the fort, the 1991 season also unearthed the largest guns ever installed in Bermuda—a pair of 12.5-inch rifled muzzle loaders (RMLs)—and exposed painted camouflage covering the exterior of the concrete buttresses and iron armour shields at the fort. Because of the possibility of rapid deterioration due to exposure to weathering, the painted camouflage was recorded immediately following excavation in 1991. The iron armour fronts, RML guns, and the remains of the 1820s cast iron drawbridge at the entrance (FIG. 1) were examined and drawn in detail in 1991. During the 1991 season, we also found a smooth-bore cast iron cannon resting a short distance off the north shore of Paget Island in about four metres of water, along with an assortment of discarded items, including broken pottery, cables, metal pipes, several large cylindrical objects, and other debris.

In January 1992, a team of nine EARTHWATCH volunteers, as well as two volunteers from the Bermuda Maritime Museum, carried out a three-week project to produce scale drawings, photographs, and notes on both the exterior and interior architecture of the fort, as a further step toward explaining the building and use of Fort Cunningham. This paper is an interim report on the progress of the recording and interpre-

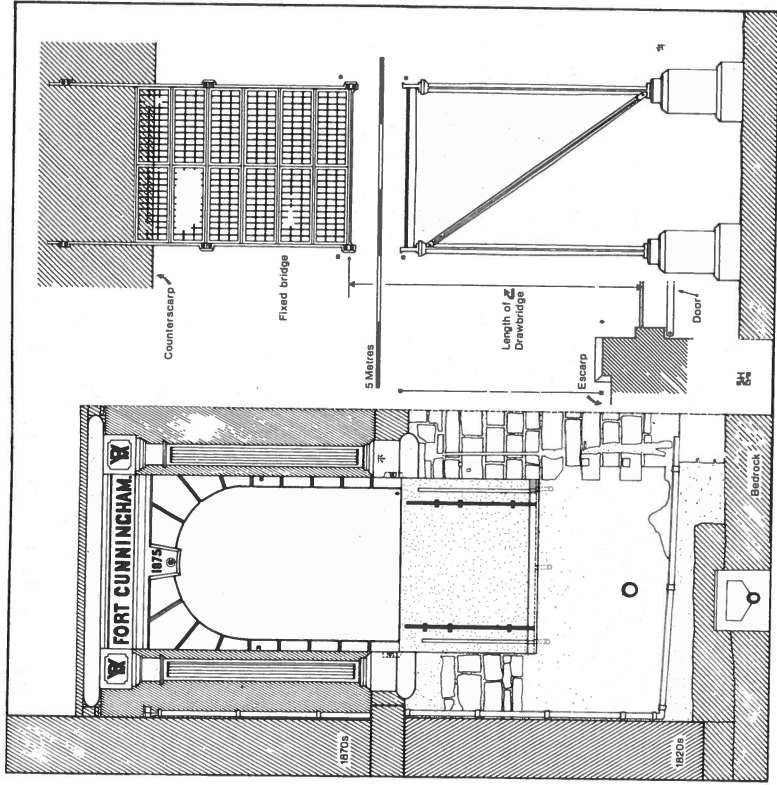


FIG. 1: An elevation of the 1870s gate, which was superimposed upon the 1820s escarp, which itself contains evidence of the recess for the equilibrium bridge. The counterscarp portion of this 1820s bridge in cast iron is extant as drawn.

tation done in 1992, and the proposed direction for further archaeological studies at Fort Cunningham. Although not strictly part of the fieldwork, we also made visits to the Bermuda Archives to study original plans and documents pertaining to Fort Cunningham, and we wish to acknowledge with thanks the help provided by the Archives staff in this effort. This combination of archaeological and archival studies during the 1992 field season proved to be unusually helpful in resolving some important questions about the 1991 discoveries.

THE STONE ARCHES OF THE 1820s ESCARP

A series of thirty-two stone arches was exposed along the 1820s escarp—which survived the 1870s rebuilding at ditch level—during excavation of the ditch in 1991 (FIG. 2). These arches were constructed of dressed hard Bermuda limestone, as seen at other 1820–1850s forts and build-

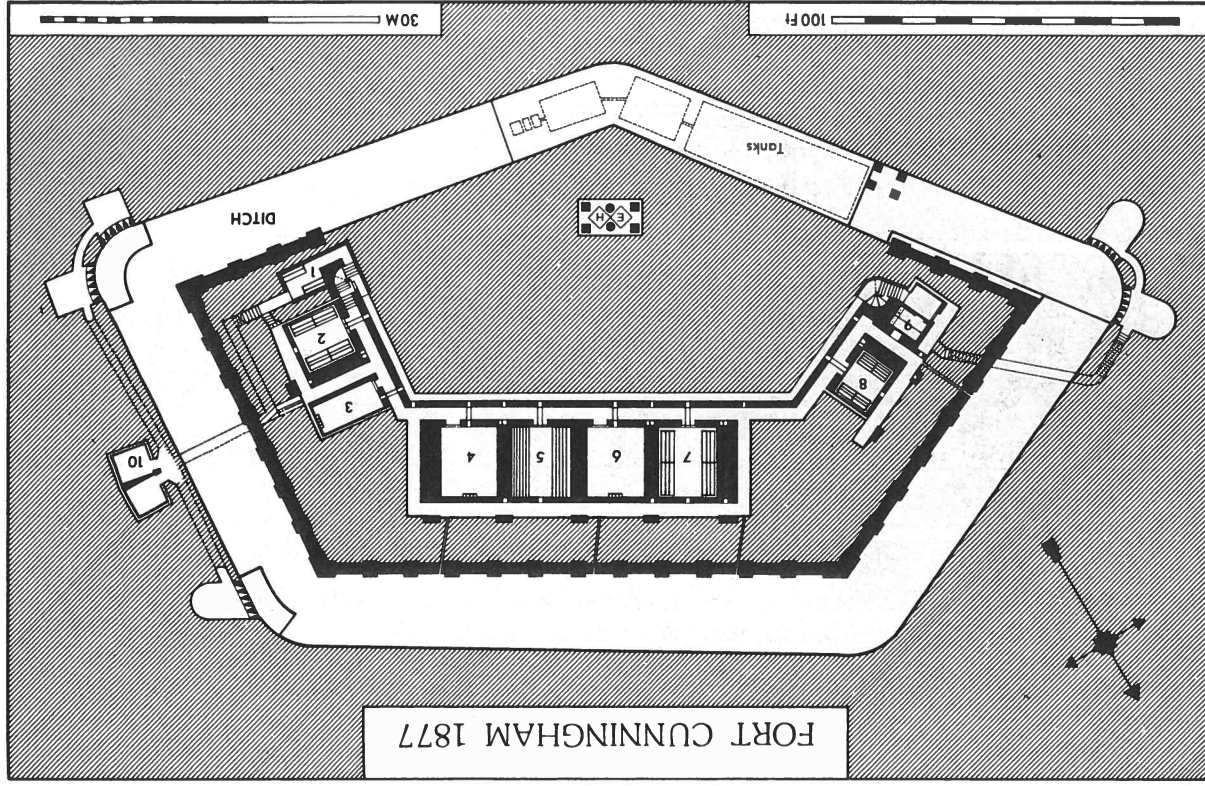


FIG. 2: The secondary ditches for the counterscarp galleries were discovered in 1991 and have been added to this rendition of a record plan of 1877 (PRO WO 78/5406). The plan also shows the thirty-two arches of the 1820s masonry escarp.

FIG. 4: The North face contains Arches 4-10 of the 1820s work and Gunports 8 and 9, originally for 9-inch RMLs. Three false gunports were recorded to the left of Gunport 8.

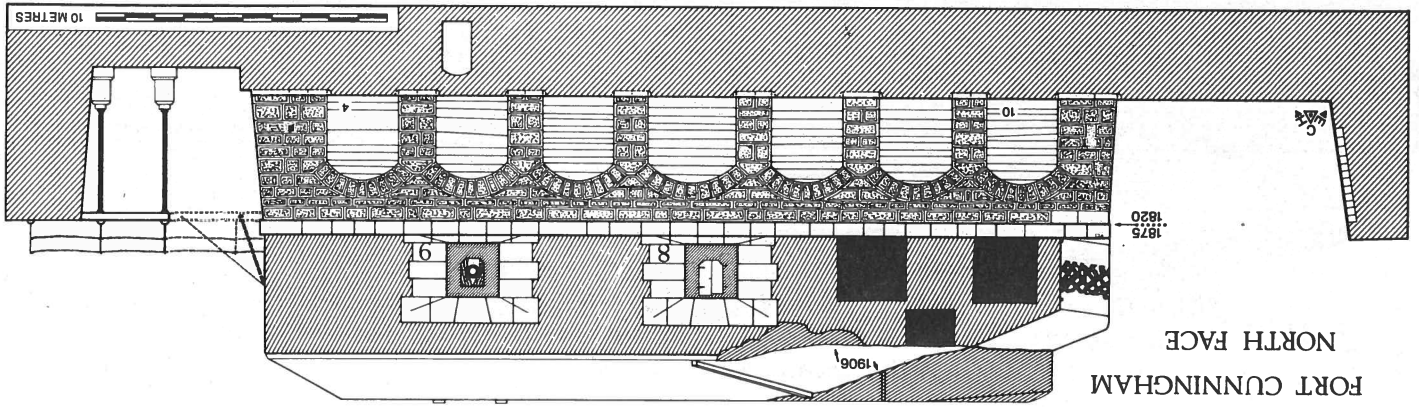


FIG. 3: In 1992, all the escarp faces of the fort were recorded; the West Face contains the entrance to the building and the windows of the living accommodations.

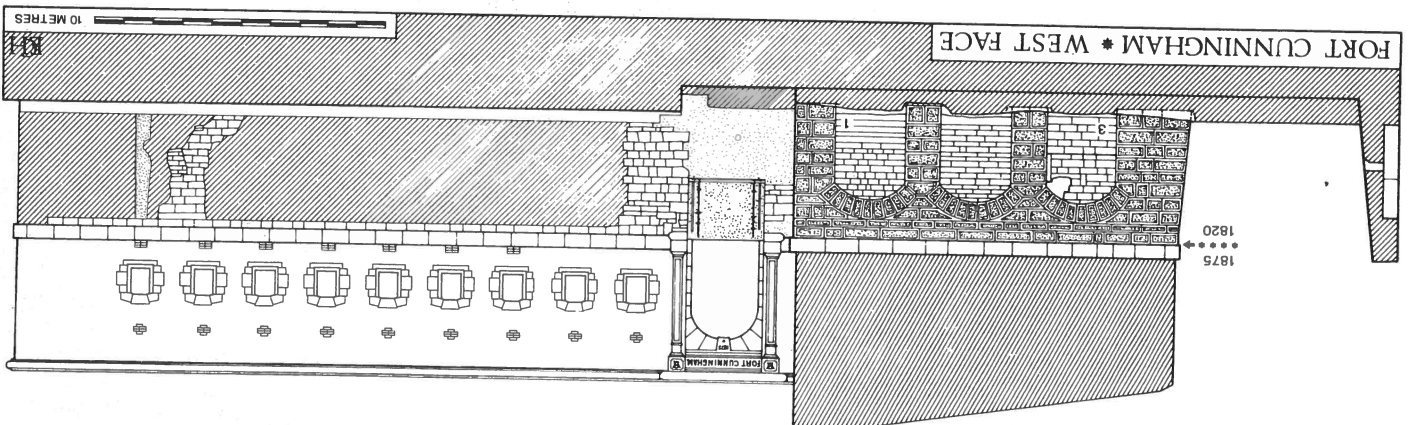


FIG. 6: The East face of the escarp held RML Gunports 1 and 2, surmounted by the foundations for the 6-inch BL gun of 1906, which were cut into the buttress between Gunports 2 and 3. The sequence of filling the ditch is a reconstruction (for '1877' read '1887 Concrete Glacis').

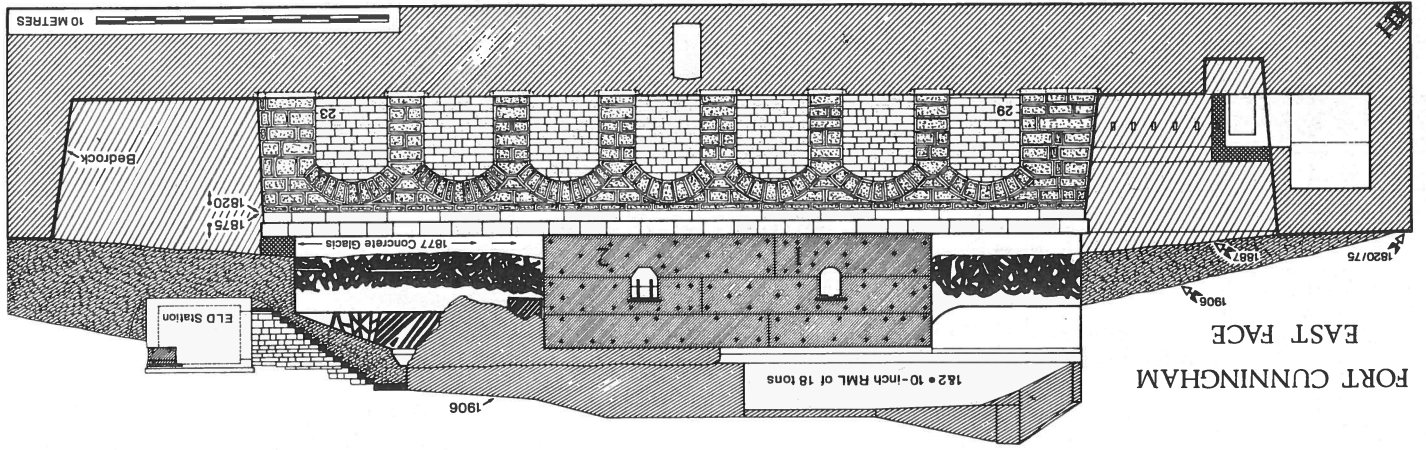
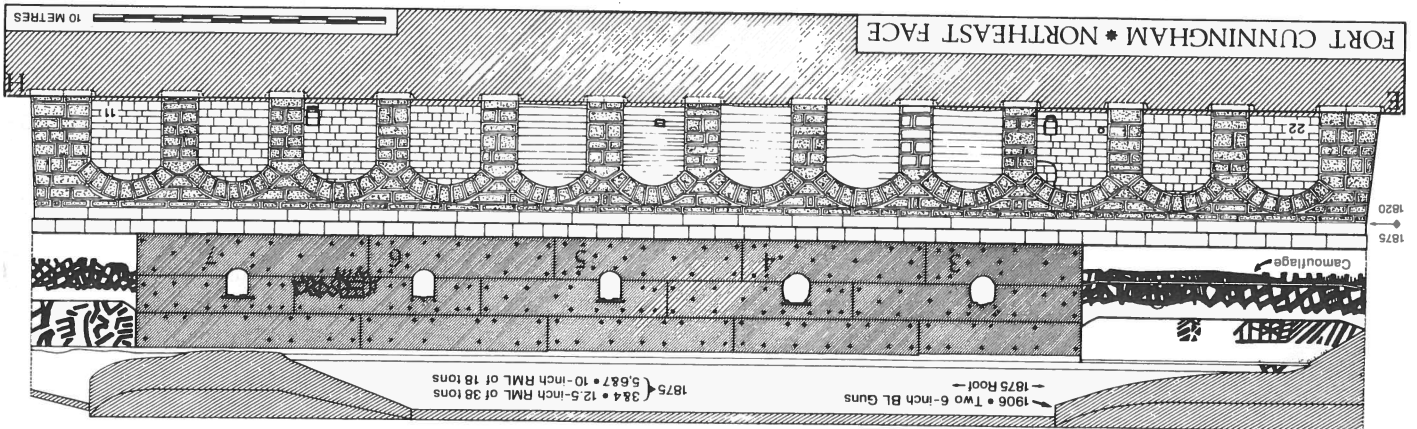


FIG. 5: The main facade of the fort was its Northeast Face, which comprised a wrought iron frontage with five gunports. The position and style of the camouflage is shown, including the only portion left on the iron front (between Gunports 6 and 7).



ings in Bermuda, especially at the Royal Naval Dockyard, Ireland Island.² Two masonry arches can be seen along the inner wall of the Keep at the dockyard, but these differ in shape from those at Fort Cunningham. What they shared was the general function of supporting elements in a masonry wall constructed on or against a base of soft limestone bedrock. However, nowhere else in Bermuda, other than at Fort Cunningham, can one see such an extensive use of stone arches as an architectural device from this period.

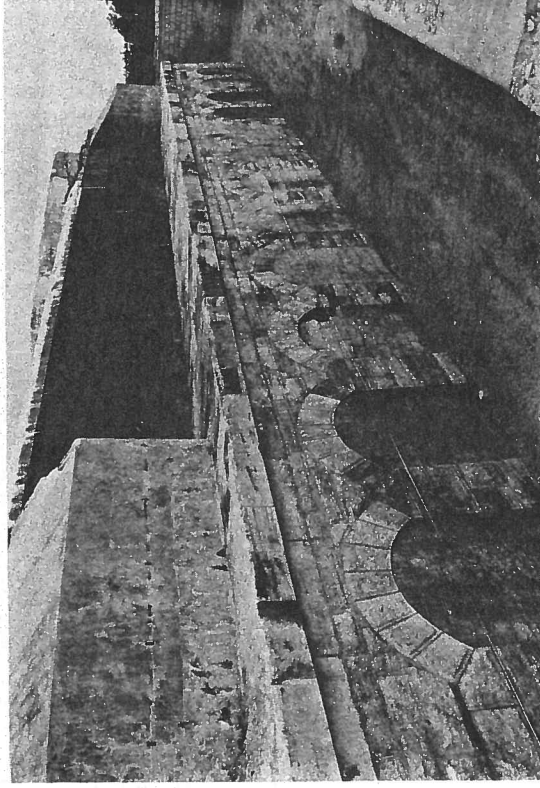
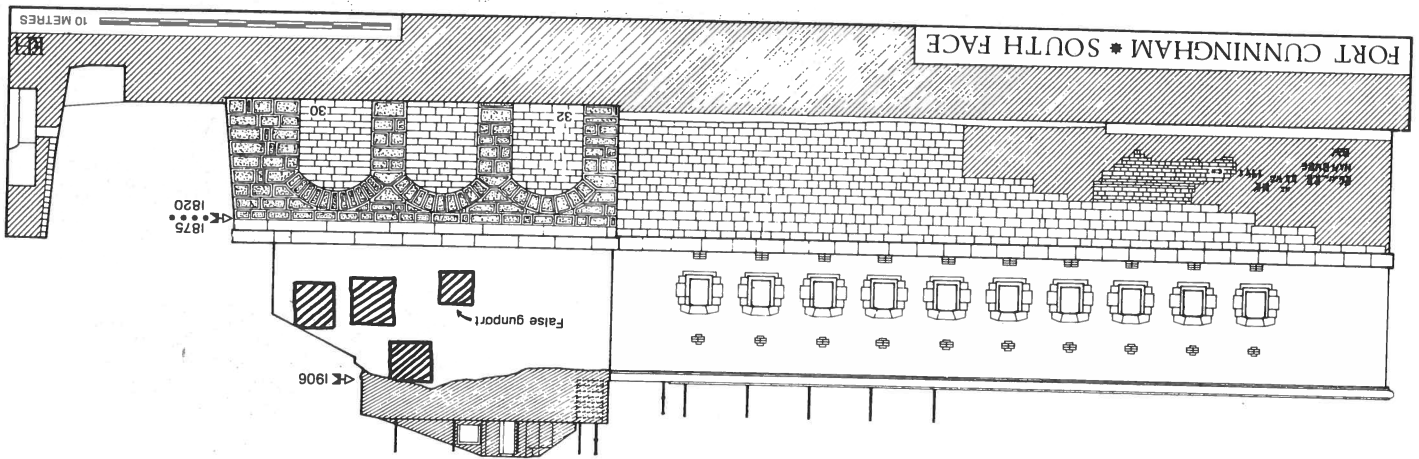


FIG. 8: The northeast facade of the fort in 1992. Arch 20, which was excavated, is the third from the left.

Once these arches were exposed by excavation, the question of their possible function had to be addressed. After drawing them to scale, as a series of elevations (FIGS. 3-7), one arch, the third from the southeast corner along the front of the fort (FIG. 8), was excavated (FIG. 5, No. 20). An outer wall, consisting of regular courses of large blocks of soft Bermuda stone, was removed from the arch (FIG. 9). The blocks in this wall layer were carefully fitted and formed a plug to the inside of the arch. Behind this first wall, irregular pieces of stone rubble, including some fragments of hard Bermuda stone, were found in a rough matrix of mortar. Behind this layer of rubble, we found a second stone wall (FIG. 10), which was duly removed. This wall proved to have been built on the right against a quarried face of bedrock, which perhaps formed the escarp of the ditch during construction. On the left (FIG. 11), a third blocking wall filled a niche in the bedrock behind it. Upon the removal

FIG. 7: The final Arch 32 of the 1820s escarp is found in the South Face of the fort, which also exhibits four false gunports preserved by the 1906 glacis, and graffiti made by German prisoners in 1941.



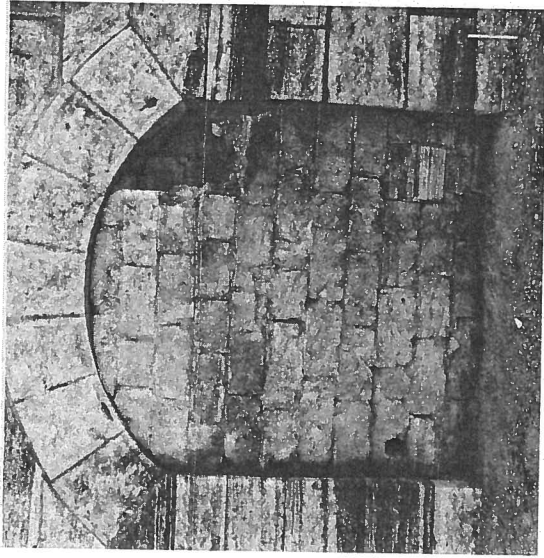


FIG. 9: The outermost blocking wall of Arch 20, prior to excavation in 1992, contained two vents from the magazines—the one on the right having a brick cover.

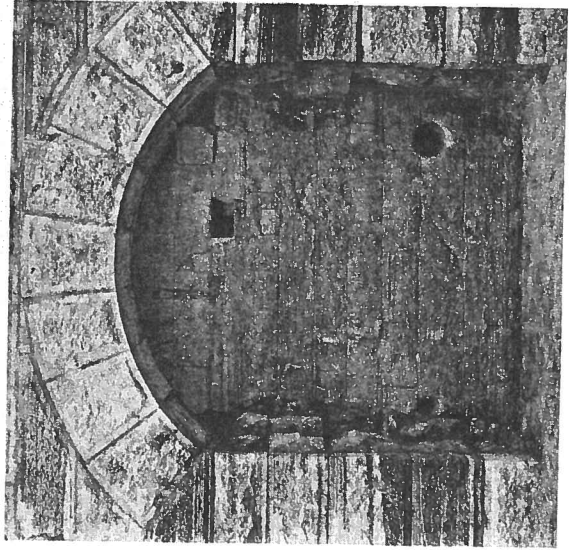


FIG. 10: A layer of loose rubble separated the outer blocking wall in Arch 20 from this inner blocking wall.



FIG. 11: Behind the inner blocking wall in Arch 20, the bedrock face contained an additional blocking of massive stones on the southern side of the Arch.

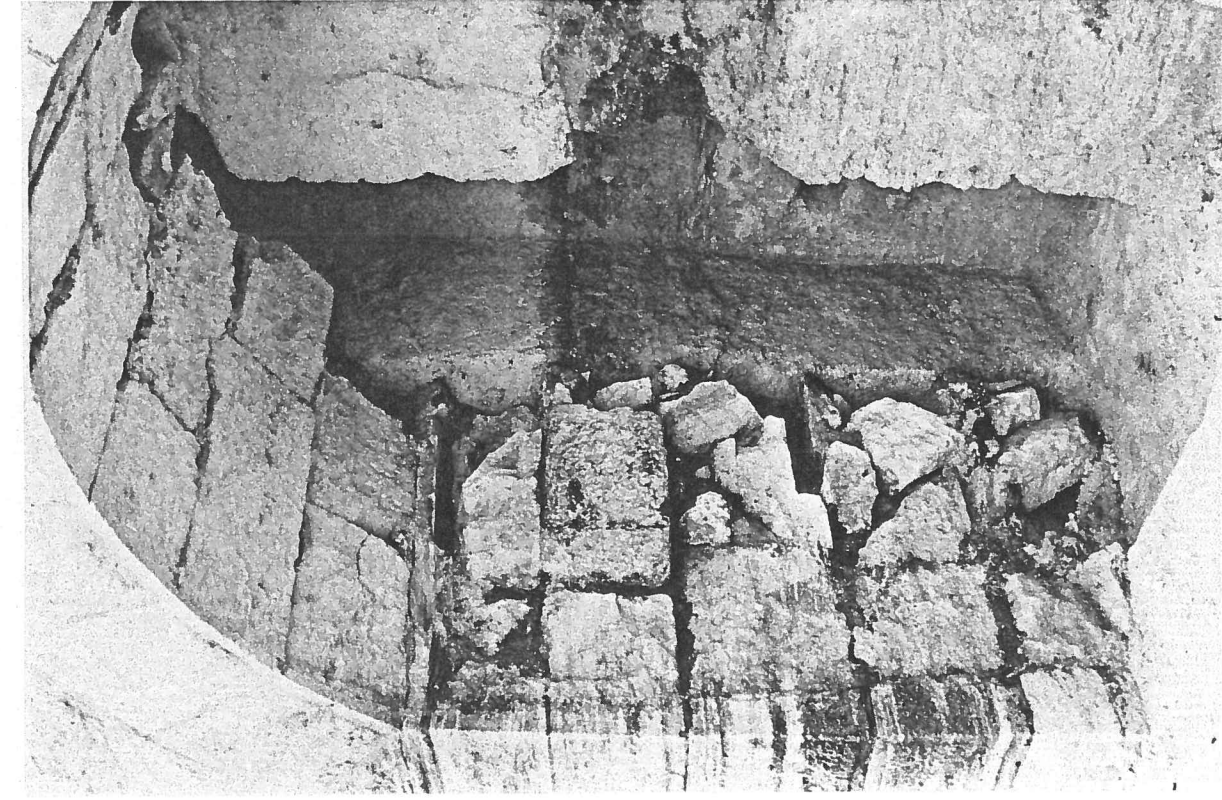


FIG. 12: Upon the removal of the blocks seen in FIG. 11, the recess in the bedrock proved to be a shallow cutting about 50 cm deep. A prehistoric soil layer ran across the centre of the bedrock.

of this last infilling wall, the back of the arch was entirely made of bedrock, as the niche was only two feet deep (FIG. 12). Two drains had been cut through these wall layers and the bedrock to provide vents for the magazines.

At the back and top of the arch, several fragments of worked Bermuda hard stone, in the shape of the roll of a decorative cordon, were found to have been inserted from above between the back of the arch and the bedrock. It would appear that there was a void between the masonry of the 1820s escarp and the bedrock, as the bedrock sloped away from the vertical line of the masonry. This void seems to have been infilled with rubble and broken worked stones, perhaps signifying the destruction of the rampart of the original fort. The worked stones (FIG. 12, above the right side of the niche) with the rolled edge may thus be from the decorative cordon of the 1820s fort: such a cordon can be seen at Forts St. Catherine and Victoria, and the dockyard Keep, all of which are dated to the 1820s.

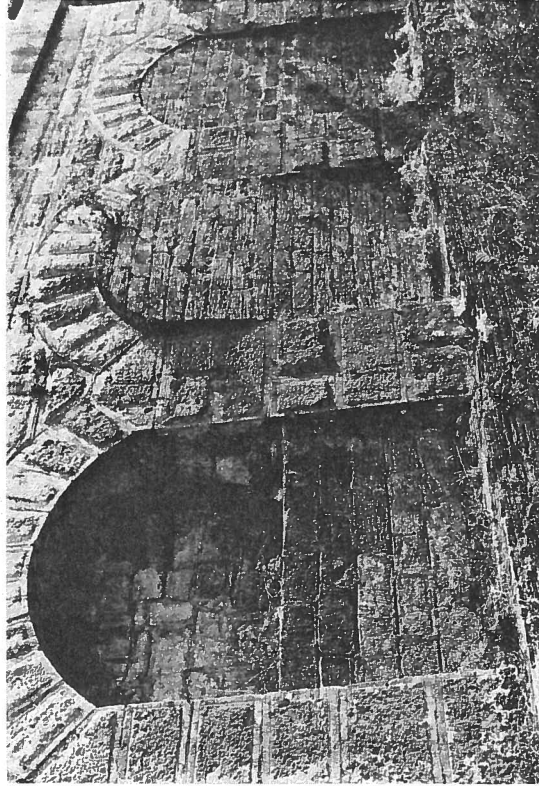


FIG. 13: Arches 1-3 of the 1820s escarp show damage from plant roots and other causes.

Twelve of these arches no longer contain stone blocking walls, but are filled with concrete. One possible explanation for this possible replacement was that the concussion from firing the 1870s RML guns caused some of these stone walls inside the arches to collapse, with concrete used as a strong and simple repair. The last arch (FIG. 7, No. 32) in the southwest face had a blocking wall of hard Bermuda lime-

stone. In another case, the blocking wall in the arch had partially collapsed due to settling and disturbance caused by vegetation growing in cracks (FIG. 13). Such natural processes may also have been a factor in the collapse and subsequent replacement of those arch walls filled in with concrete.

The stone arches of the escarp emerged as one of the best preserved architectural features of the 1820s era of construction at this site. In keeping with much of the military architecture of that period in Bermuda, the escarp embodied a high level of skill and engineering in masonry construction. The purpose of the arches of the escarp as yet defies explanation, since most such walls are usually of solid masonry. The arches were clearly built to have infilling walls of varying types of stone, since the side-walls of the recesses are only dressed for the outermost 25 cm. These arches look to be a splendid example of masonry, and that may finally be what they are—stone arches built more as an engineering exercise than for any military function. Nonetheless, the excavations of 1991 revealed this superb escarp of Thomas Cunningham's fort, probably begun by him in 1815 and completed in the 1820s by his successor, Captain Thomas Blanshard, RE. The upper works of their fort was almost entirely swept away in the rebuilding of the 1870s and the masonry escarp was surmounted by a pile of wrought iron and concrete.

PAINTED CAMOUFLAGE

The most unexpected discovery of the 1991 field season was a complex array of painted designs covering some of the exterior wall surfaces of the 1870s fort. Such colours and designs are commonly regarded by military historians as a form of camouflage invented during World War I.³ However, the 1991 excavations showed on stratigraphic grounds that these designs could only have been applied sometime between 1875 and 1906; that is, between the date of completion for the RML gun installations and the final rearming of the fort with 6-inch breech-loading (BL) guns.⁴ The chronology of the camouflage paint at Fort Cunningham emerged as an important detail, since the archaeological evidence indicated that this technological innovation was older than previously thought.

With this question in mind, a special effort was made in 1992 to locate records at the Bermuda Library that might resolve this question, but no published descriptions of this feature were found. However, this is not surprising, if one remembers that the coast defences of Bermuda throughout the period when Fort Cunningham was in use were off-limits to newspaper reporters, photographers, and others who might reveal the details of their construction and armament to a possible enemy. A systematic search of the back issues of the local newspaper,

The Royal Gazette, for 1824-1906 gave only an occasional mention of Fort Cunningham, which was usually associated with social events at which officers from the fort were present. The public record was generally silent about the nature of Bermuda's coast defences, especially regarding the complex system of forts and other structures, including Fort Cunningham, constructed along the Narrows Channel at the east end of the Island.⁵

A search through the Bermuda Archives was more informative. A collection of twenty-three plan drawings of the fort, covering the period from 1841 to 1910 was found, with information bearing directly on the camouflage and other important details. Many of these were plans of record, prepared by Royal Engineers in Bermuda and sent to England for review by the Office of the Inspector General of Fortifications. Once approved, these plans were redrawn in colour and sent back to Bermuda, sometimes with handwritten instructions placed directly on them by the Inspector General's office. No drawings were found of the camouflage, but one set of plans, dated February 1903, contained handwritten instructions from J. Rainford Stannar, Inspector General of Fortifications, stating that: 'The Aprons of Emplacements are to be coloured to assimilate with the natural surroundings'. These instructions did not specify how this was to be done, thereby leaving the details to the initiative of the local commander. Unfortunately, this reference relates to the camouflage of the post-1900 BL period, when the emplacements would have had aprons rather than embrasures or gunports. They are an indication that the fort continued to be camouflaged in the decade prior to World War I.

An important clue with regard to camouflage in the RML period was found in the Bermuda Archives in the form of a photograph (FIG. 14) —labelled "Bird" at Fort Victoria'—of a man in civilian clothes and smoking a pipe, seated on a 11-inch, 25-ton RML gun at Fort Victoria, not far from Fort Cunningham. This is probably a picture of the owner of the album, a British Army officer, Lieutenant Gerald R. Hughes, and is dated to 1904. The RML is covered with camouflage in designs painted in circular forms and may be indicative of how guns were so disguised in the last quarter of the century. The guns at Fort Victoria fired over the parapet and thus would need to be camouflaged; at Fort Cunningham, the RMLs were in casemates and it was the face of the fort which was painted. This may also explain why the RMLs found in 1991 at Fort Cunningham had no evidence of painting at all.

At Fort Cunningham, the paintwork on the concrete buttresses of the RML period (FIG. 15) pre-dates the conversion of the fort to BL guns around 1906, since it was removed in the partial demolition of the buttresses by the making of the aprons for those two guns (FIG. 6). In addition, it was buried under the three embankments of soil which were raised over the buttresses, in order to make a new earth glacis for the BL

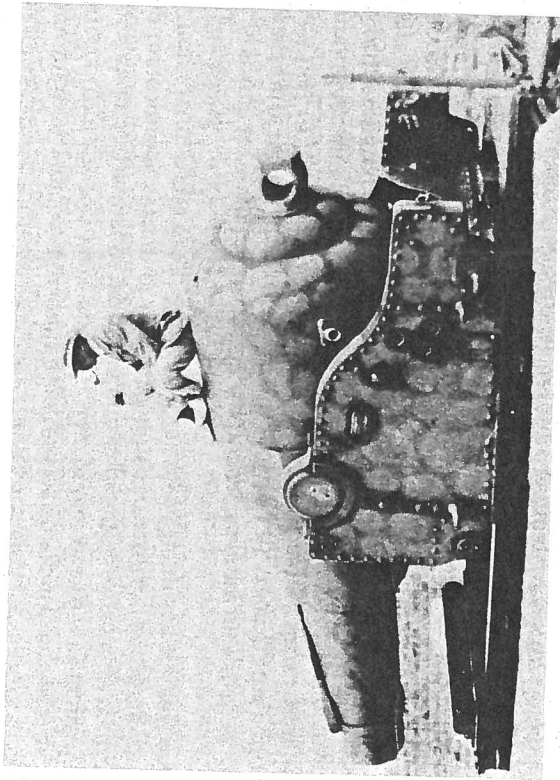


FIG. 14: Photograph of a man called 'Bird' sitting on a camouflaged 11-inch RML at Fort Victoria around 1904. A shell derrick is laid back on the top of the muzzle. (Bermuda Archives, Hughes Album).

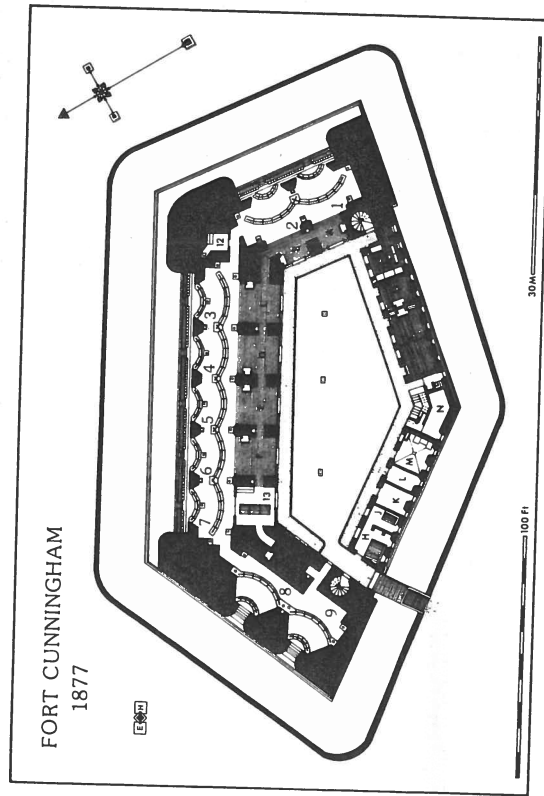


Fig. 15: This drawing of record plan of 1877 (PRO WO 78 / 5406) has been revised to show the correct shape of the concrete buttresses which support the centre and ends of the wrought iron frontage of Gunports 1-7.

guns. Between these mounds, some of the RML gunports were left open to the air for use as windows for the casemates, which now served as barracks. These two stratigraphic factors give a date before which the camouflage was applied to the fort, viz., 1906.

A date after which the paint was applied is supplied by the partial transformation of the fort around 1887, as discussed below. Briefly, the ditch was partly infilled around that date and a rubble concrete apron was laid over the floor of the rampart in front of the wrought iron shields (FIG. 6). This apron covered the bottom three feet of the shields and was removed by machine in 1991. In due course, the apron itself was overlain in part by the 1906 glacis. There was no evidence that the painted camouflage pre-dated this apron, as the paintwork on the buttresses and the shields stopped at its surface. Thus the camouflage belongs to what may be termed the second RML period, i.e., between 1887 and 1906. This military paintwork at Fort Cunningham is therefore perhaps the earliest surviving example of the camouflage of a late 19th century British fort.

The various forms of the paintwork were drawn (FIGS. 4-7) and photographed (FIGS. 16-19, see pp. 39-42). Starting with the southeast buttress, the concrete was painted with false gunports and black brush strokes, the latter perhaps representing treelines. The central buttress had both such features, in addition to red geometric lines on its roof. The iron shield near the north buttress showed that it had been covered with black brush strokes; the buttress itself contained similar features to the central one. Finally, the north facade of the RML part of the escarp contained several false gunports, which imitated the wide openings of the two stone gunports for 9-inch guns in that wall.

THE ALTERATION OF THE DITCH AFTER 1875

Fort Cunningham was the first fort of the polygonal trace to be erected in Bermuda and, as such, it contained a commodious ditch with a series of flanking galleries. As discovered in 1991, the flanking galleries in the eastern and southeast angles had secondary ditches extending a few feet below the floor of the main ditch (FIG. 20), bringing the heads of the enemy below the gunports of the galleries, thus giving further protection to the defenders. Such flanking galleries are found in other Bermuda forts constructed in the 1870s, and their use continued into the new century. It was a feature of these forts that there was no entry into the ditch except by scaling ladders. When the upper works of the first Fort Cunningham (1815-1870) were removed and replaced with the only iron-fronted fort outside the United Kingdom, the ditch was retained in its original defensive posture, including the flanking galleries.

While it was obvious that the ditch was infilled sometime prior to the installation of BL guns around 1906, it was assumed that this was a then

single-period alteration. The 1991 excavation revealed otherwise, although practical considerations made it difficult to excavate the ditch and its fill stratigraphically with a bulldozer and crawler-backhoe. At least two, and possibly three periods of infilling can, however, now be recognized, though in all some 4,000 cubic metres of sand and rubble fill was removed from the ditch during the 1991 excavations.

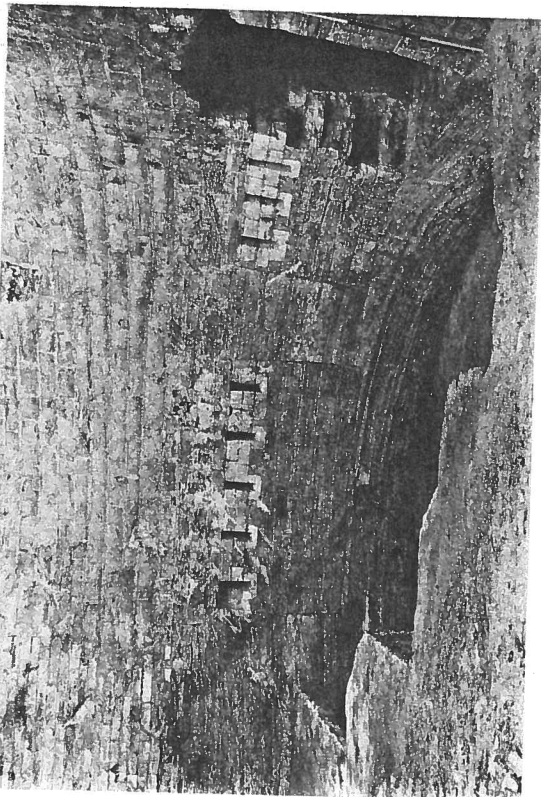


FIG. 20: The southeastern counterscarp gallery was pierced by an entrance into a tunnel (removed in 1991) for a new gallery further west along the southern run of the ditch.

In the Bermuda Archives, a plan of the fort in 1887 showed the ditch completely open, but contained pencilled notes that it was undergoing modifications. Since we know these modifications must have occurred after the installation of the iron armour shield, an approximate date of 1887 for this first major episode of filling seems reasonable. Three major events seem to have taken place at that time. First, a weak deposit of rubble concrete up to a metre thick was laid over the parapet in front of Gunports 1-7 (FIG. 15 and FIG. 6). Secondly, a concrete retaining wall was built across the ditch at its northeast angle, which was mirrored by a similar wall at the eastern end of the south side of the ditch. This latter wall contained a flanking gallery, brought forward from its original position in the southeast angle of the ditch (FIG. 6). A doorway was cut through the gunports of the old gallery and led by way of a concrete tunnel to the new flanking position (FIG. 20). Thirdly, the ditch was

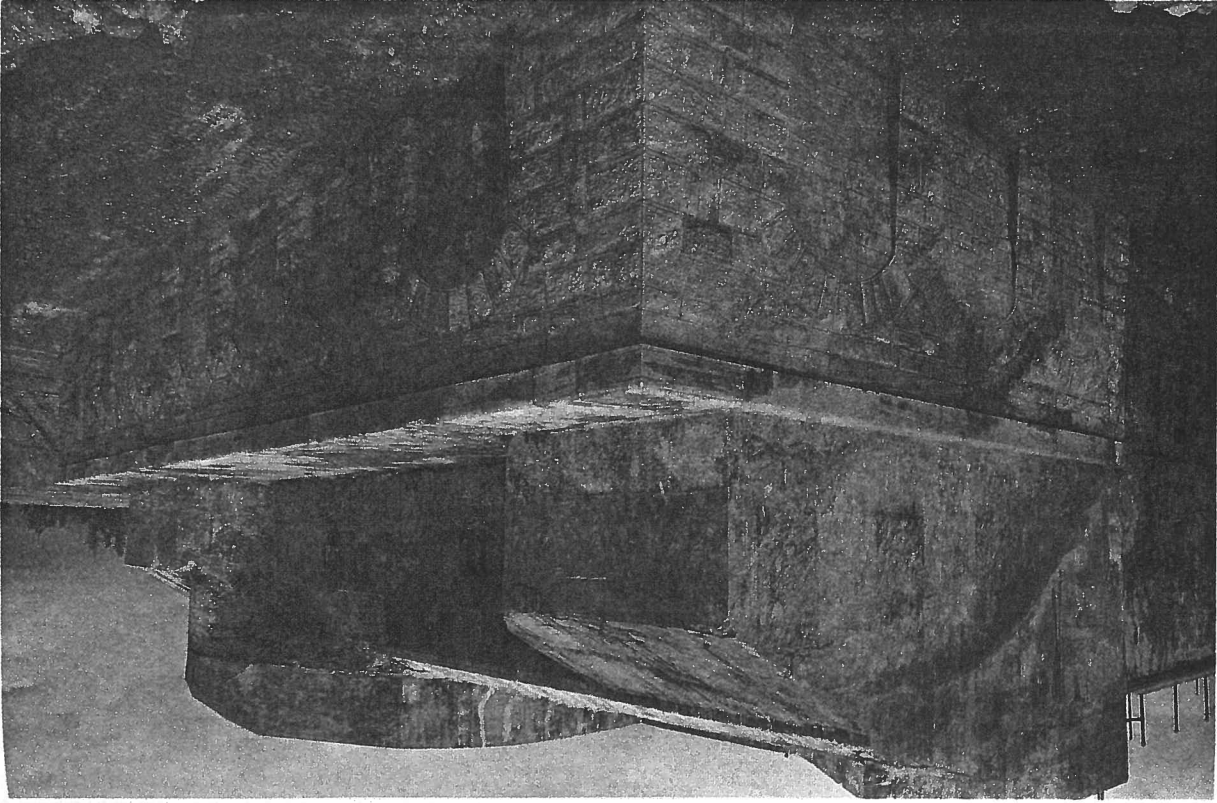


FIG. 16: The southeast buttress of the fort was painted with false gunports and black lines to resemble trees.

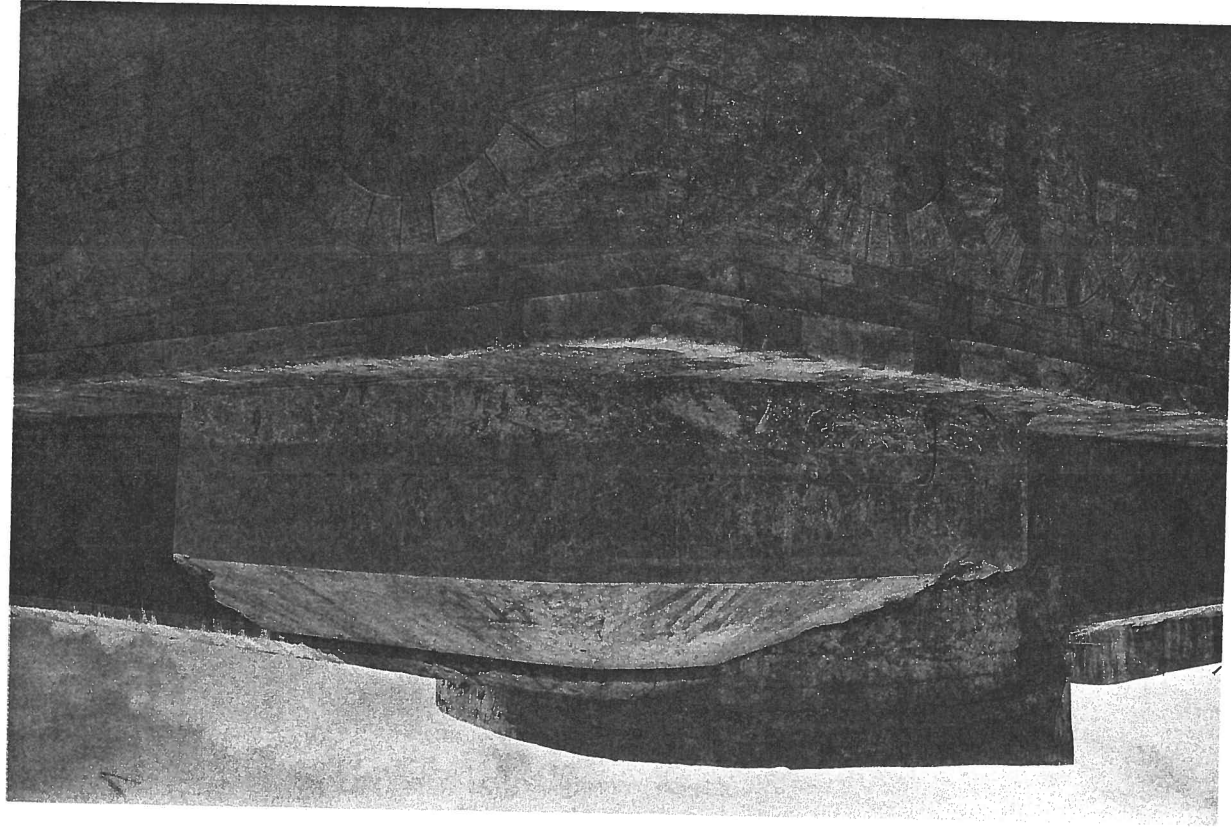


FIG. 17: The central buttress contained erratic black cross-hatched lines on its face, and on the roof were more geometric red bands of paint.

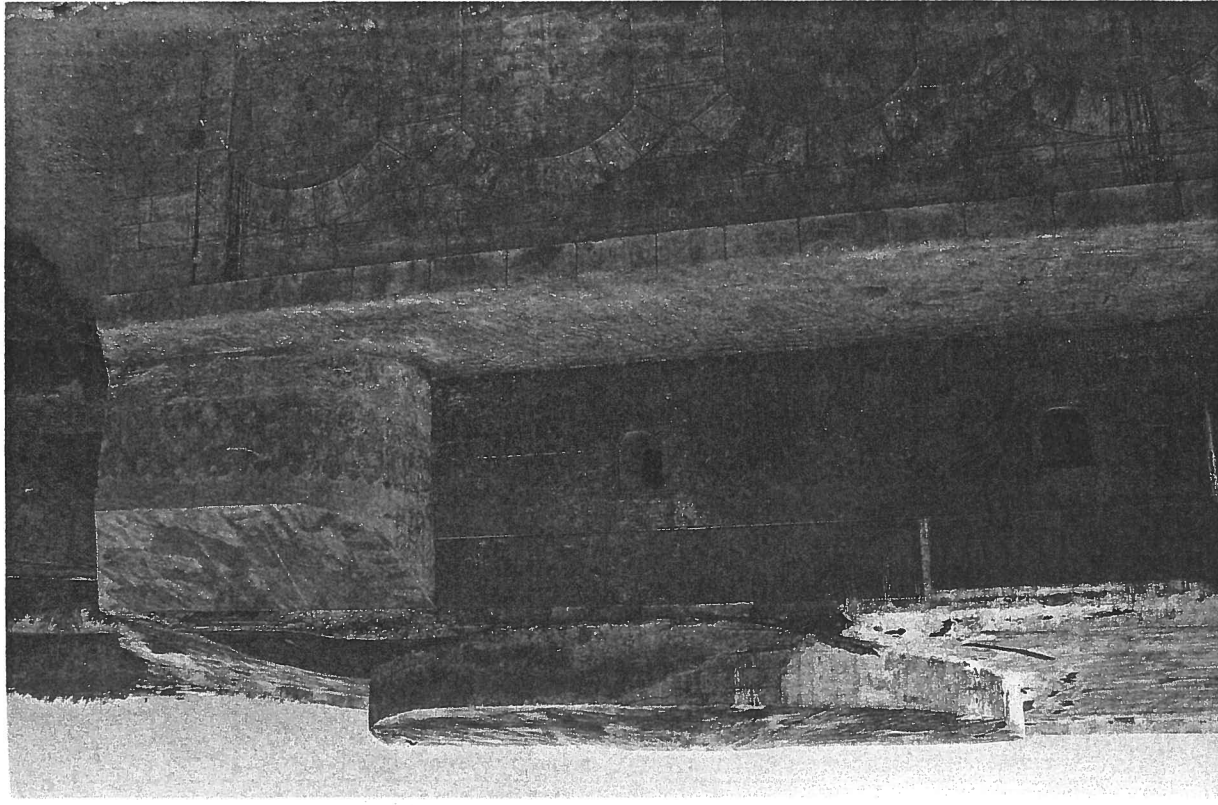


FIG. 18: In this view can be seen the irregular bands of black cross-hatched painting, both on the iron front and the north concrete buttress. Geometric lines of red paint were found on the roof of the buttress.

infilled with clean rubble mixed with some soil deposits, up to the level of the rubble concrete deposit on the parapet, thus forming a new glacis adjacent to the main fronts of the fort. It is important to note that no evidence was found in this fill of the demolition and disposal of the RML guns; this fact may support the dating of 1887 for this event at which time the RMLs were still in use.

From soil stains observed after excavation on the counterscarp wall, it has been suggested that there may have been an intermediate period of infilling, which allowed the southeast counterscarp to continue in use. Due to the necessary use of machine excavation, this thesis cannot be proved from a stratigraphic viewpoint. It would also mean that an enemy could have run into the ditch by way of the slope retained by the gallery. At the same time, a sloping ditch at this point for the retention of the gallery would make it impossible to build the new glacis to the height required by the rubble concrete platform in front of Gunports 1 and 2, as the ditch is not wide enough to raise the soil to that level and yet retain a slope to the gallery.

On balance, it would appear that a single infilling took place around 1887 and that it created a soil and weak concrete glacis in front of the operational guns, for it seems that the guns in the north facade were never mounted, or were possibly removed as a part of this exercise. In the north, the infilling was bounded by a blank wall across the ditch, but the run of the north ditch was still defended by the flanking gallery in the western counterscarp. To the south, however, the flanking gallery covering the southern run of the ditch was buried and therefore it was replaced by a new concrete gallery some 15 metres in advance of the older position, an arrangement recorded in a plan of 1898 in the Bermuda Archives. This alteration preserved the older system of ditch and flanking galleries, lately used in new works of the 1870s, such as Fort Hamilton, Langton and Prospect in the centre of Bermuda, and combined it with the newer system of a sand and soil glacis, so exemplified by the second major period of infilling.

This next episode of ditch filling—or more correctly, the covering of the already-filled ditch—occurred sometime after 1903, but before 1910. In the 'Record Plan of Defence Electric Lights at Fort Cunningham, November 1910' in the Bermuda Archives, the site is shown as having two 6-inch BL guns fronted by a wide glacis with a long slope seaward. This plan represents the second major period of raising the ground level over the old ditch, but it presents an idealized version of such a glacis, in which the soil level rises up to the level of the aprons of the guns on three sides. In effect, according to the contours of this plan, one should be able to walk from one gun to the other across a grass glacis at the same level as the aprons: such a situation obtains in a more typical BL site, such as St. David's Battery, Bermuda erected around 1910, but was not true for this site, showing yet again that such 'record plan' needs to be

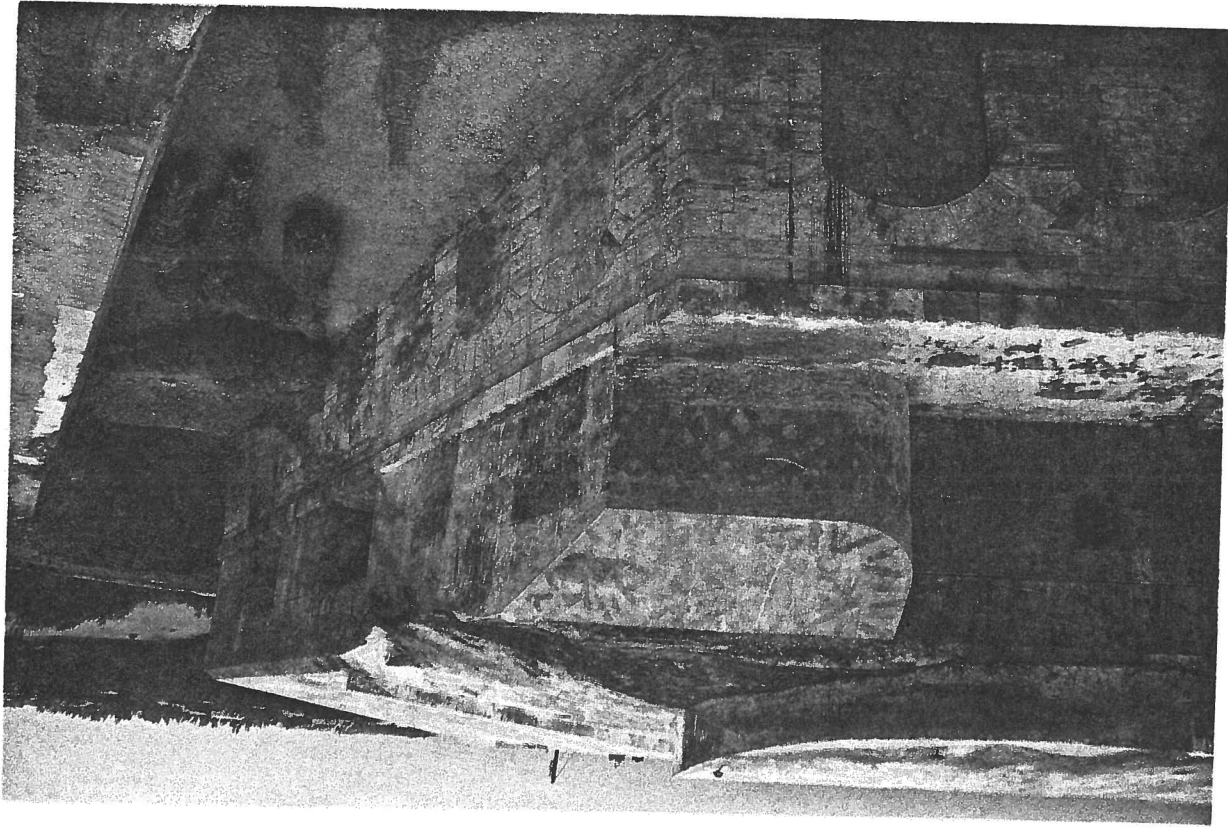


FIG. 19: The north facade of the escarp contained several false gunports painted in solid black. Seven RMLs, two of 38 tons and five of 18 tons, were found lying in the ditch in 1991.

compared with reality.

At Fort Cunningham, the engineers preserved Gunports 1 and 3-6 for use as windows, as the RML casemates became accommodations, and the typical BL glacis could not be built. The glacis were thus raised up against the two BL emplacements, but between them and between the southern gun and the southern RML buttress, it sloped down into a valley in front of the old gunports. This new glacis inadvertently preserved the RML camouflage and other features of that period. To the south, it respected the line represented by the 1887 concrete flanking gallery, but to the north the ditch was infilled in part to the west of the concrete retaining wall of that date. The reason for this sloping glacis in the north ditch, rather than above it, was to cover up the seven RMLs which had been pushed into the ditch as obsolete around 1906. By this time, the notion of defending the fort through the use of flanking galleries was also a thing of the past.

This final phase of earth-mounding is of special historic interest because of its relation to similar practices which evolved for coast defence fortifications in other countries, following the introduction of shell-firing guns during the second half of the 19th century. Once it became clear that conventional masonry and brick forts, no matter how robust, could not successfully withstand the shock of shell fire engineers were quick to mound earth over and around such forts. The first important demonstration of this simple, but labour intensive, technique came during the Crimean War in the Russian General Totleben's defence of Sebastopol against Anglo-French forces in 1854.⁶ Following the Crimean War, Russian engineers, under Totleben's overall supervision, added extensive earth fortifications to the 18th century Swedish stone masonry fortifications at Sveaborg (also called Viapori and Suomenlinna), guarding the approaches to Helsinki harbour.⁷ After the 1862 destruction of Fort Pulaski—a Third System brick fort with walls over two metres thick near Savannah, Georgia—by Union shell fire during the American Civil War, Confederate Army engineers adopted methods similar to those used by Totleben in the Crimea. Massive coast fortifications with mounded earth parapets and firing positions protected by piled sand were constructed by Confederate armies around Charleston, South Carolina and at Fort Fisher, guarding the approaches to Wilmington, North Carolina. When attacked by combined Union land and sea forces, these forts proved especially hard to capture and led to some of the costliest assaults for the Union during the war.⁸

The use of iron armour by the British to protect their coast defences against shell fire during the 1870s was unique and represented a technological and industrial response to the problem of shell fire. Even as used in 1903-1910, the earth mounding as a protective device at Fort Cunningham still left most of the central part of the each iron armoured front unmasked. The earth mounding technique at Fort Cunningham,

starting in 1887, was tried later than in Russia or the United States, and then it was only applied partially, and was not used to anything like the degree seen in those other countries. Yet, we have at Fort Cunningham a perhaps unique example of an attempt to try several of the new major methods of coastal fortification as devised in the second half of the 19th century, but in this case hampered in a full application by the continued reuse of a site which was established in the smooth-bore era. This reuse of the site also complicated the development of the magazines below the fort itself.

THE MAGAZINES AT FORT CUNNINGHAM, 1815-1910

The powder and shell magazines at Fort Cunningham are located below the gun emplacements and were entered by newel stairs to the west of Emplacements 1 and 9 (FIG. 15). There are three periods of construction in the magazines, dating to the smooth-bore, RML and BL eras. Much alteration of the fabric of these ammunition rooms has taken place and it was a part of the 1992 work to record all the facades in the magazines in order to be able to interpret this evolution from a stratigraphic stance. This work is not yet finished and will be reported later, but it may suffice to say that the drawing of these elevations, with their various features indicating major alterations, is perhaps the only way in which such a complex development can be deciphered.

As a part of this programme of recording the underground passages and magazines at Fort Cunningham, a series of twenty-nine wall paintings and inscriptions was discovered and documented. At least twenty consisted of painted markings in black, gray and red pigments in various combinations of geometric shapes. The exact number of these designs is unknown, because they were found in differing states of preservation, ranging from fresh to smeared, covered with lime flowstone, or otherwise obscured. Despite a systematic search throughout the interior of the fort, we may not have found all of the painted designs. They were originally applied over whitewash, covering the stone surfaces, and were generally associated with shell and powder lifts, issuing hatches for shells and powder cartridges, and other magazine-related features of the RML period. These designs were not found inside magazines, but only in the passages and corridors around the magazines. In many cases, additional layers of whitewash had been applied over them at later periods. The designs were visible only after some peeling or staining of the overlying whitewash and plaster layers had occurred.

In order to examine and record these designs, it was necessary to remove the overlying layers, without removing or damaging the underlying layers, which served as a base for the painting. This cleaning

was done by hand, with each volunteer working slowly and carefully with a sharp knife. The condition of the different designs varied greatly, and some proved virtually impossible to clean in anything more than a superficial manner. One painted design in particular was covered by a translucent layer of lime flowstone which had hardened and could not be removed without damaging the underlying painted surface.

Another problem arose after the designs were exposed. Freshly cleaned surfaces produced a fuzzy layer of tiny white spicules within twenty-four hours of the cleaning. This appeared to result from the movement of moisture trapped in the underlying layers, along with the transport of lime, either from the stone or plaster surfaces or both. The physical causes of this process are not known, but the problem required that the painted designs be photographed and recorded in detail immediately after exposure to the air. This was done using slide and colour, as well as black-and-white, films with multiple strobe photography. Scale drawings were also made, showing not only the designs, but also their relationship to adjacent architectural features.

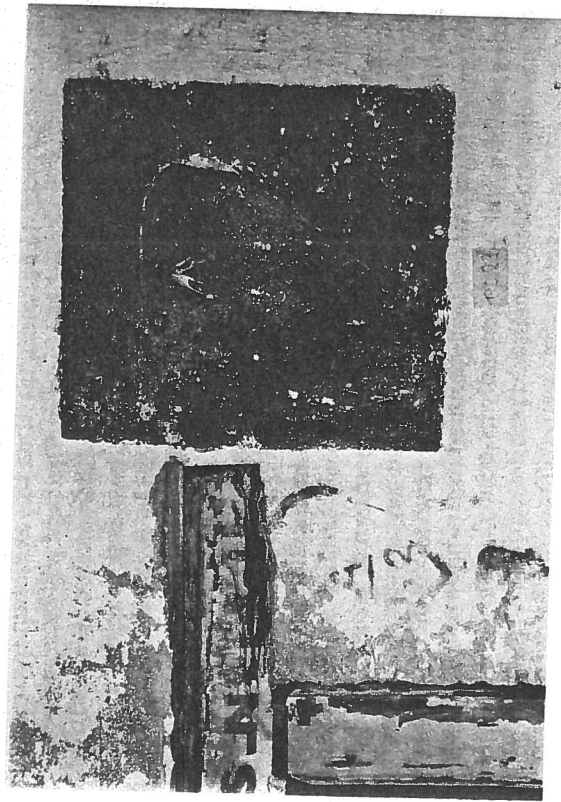


Fig. 21: Two periods of painted magazine markers appear in this view taken in 1992. That on the right appears to belong to the RML period, and the heart-shaped device containing the symbols 'A - 1, 2' to the BL guns of 1906.

As a result of these efforts, Fort Cunningham may now provide the largest and best documented sample of painted wall designs from a late 19th century British fort. Each design consisted of a black square or

rectangle up to about one metre on a side, with superimposed geometric shapes in red—balls, squares and triangles with two rounded corners and a sharp corner pointing down—referred to in our notes as 'heart-shaped' (FIG. 21). The variety of shapes and associations of these wall designs suggests a colour- and shape-coded system of identifying the contents of the nearby magazines. Was this a system intended in some way to identify the contents of each magazine without requiring that someone enter it to check visually, with the resultant danger of accidental explosion? Were British enlisted men manning the fort during the RML period able to read, or did they need colour-coded symbols instead? The analysis of these designs and their associations is continuing in an effort to infer their use; and efforts are also being made to locate British military manuals from the RML period which will explain this little-known feature of late 19th century military technology.

The dating of these designs can be assigned with confidence to the RML period on the basis of four independent lines of evidence. First, there was evidence of superposition of later, possibly early 1900s, lettering over some of the painted designs. This lettering was not applied directly over them, but to one or more layers of the subsequent whitewash coatings. These lettered placards were recorded and were included in the total number of inscriptions in the magazines, wherever they occurred alone. The only non-lettered designs attributed to the early 1900s consisted of horizontal arrows painted in black on flat surfaces of passage walls and curved surfaces of passage corners. One black-outlined 'heart-shaped' design was found next to both a 1900s cartridge issuing hatch and a painted design, but it was not superimposed over the design, so this particular item could belong to either period. Its shape and enclosed lettering was similar to others seen in gray pigment in several other locations, and could represent another example of superposition of 1900s-era designs over earlier RML period paintings. The most common inscription was 'CARTRIDGE LIFT', but there were others as well.

Secondly, three of the paintings had been partly removed due to architectural modifications to the magazines during the first years of the 1900s. The excised sections were filled with brickwork of that era, consisting of yellow bricks with a distinctive orange cast. This indicated that the designs were applied in these locations prior to the 1900s; that is, during the RML period. However, these designs may have been quite late in the RML period, but could have been applied any time between 1875 and 1903.

Thirdly, lettering and inscriptions identical to those on the passage walls of the fort were also found on preserved wooden sills and cartridge lifts inside the magazines that are known to have served the 6-inch BL guns installed around 1900-1906. The close resemblance of

the placards on both the passage walls and on the sills and cartridge lifts suggests that they belonged to the same period.

Fourthly, similar wall paintings on corridor walls near the magazines were also seen at Fort St. Catherine, which lies on the other side of St. George's from Fort Cunningham, again in association with RML period shell and cartridge lifts. Since Fort St. Catherine was not rearmed during the 1900s, these designs presumably could only belong to the RML era there. However, one puzzle remains due to the presence at Fort St. Catherine of lettered wall inscriptions and horizontal arrows along with the painted designs. We tended to identify such inscriptions at Fort Cunningham with the 1900s rearmament of the fort, mainly based on the evidence described above. Yet the same kind of wall lettering and arrow designs were present at Fort St. Catherine, despite the absence of guns, shell and cartridge lifts from the early 1900s. It is possible, therefore, that wall lettering in simple black paint over white wash was a product of the RML period as well, but later than the painted designs.

Work is continuing on the interpretation of these magazine markers, but it is important that they have been recorded, as they are a very ephemeral part of the history of the fort and will be largely lost over the next few years due to dampness and vandalism.

INTERNAL ILLUMINATION AT FORT CUNNINGHAM

Even after the introduction of electricity at Fort Cunningham, underground illumination in and around the magazines continued to be provided by an elaborate system of oil lamps and covered light boxes. A military electric telegraph that communicated with the Royal Navy Dockyard was in place by 1888,⁹ and plans indicate that an electric battery-operated submarine mining system was installed between 1887 and 1890 to protect the approaches through St. George's Channel between Governor's Island and Paget Island.¹⁰ Additional drawings show that electric searchlights were planned for various locations around the fort in 1894, and were completed by 1910.¹¹ These installations included electric generating engines and accompanying oil fuel stores in rooms constructed into the hillside below the southwest side of the fort.¹² Despite these innovations, no signs of electric lighting from these periods appeared in the underground passages and magazines of the fort.

Therefore, it appears that the use of oil lamps and light boxes for underground illumination persisted longer and later at Fort Cunningham than it did at some similar installations at the Dockyard and in other Bermuda forts. This may help account for the unusually good preservation of light boxes and accompanying fixtures at Fort

Cunningham that date from at least the RML period. The main problem faced by the personnel at Fort Cunningham was to illuminate the underground magazines, without exposing the gunpowder stored there to naked flame or sparks (FIG. 22). Military manuals from the RML era described the elaborate precautions required of anyone entering the magazine area of forts and batteries. These measures included special clothing and footwear free of metal buttons and nails, which could create sparks. The handling of oil lamps inside these subterranean areas of Fort Cunningham was no less elaborate.

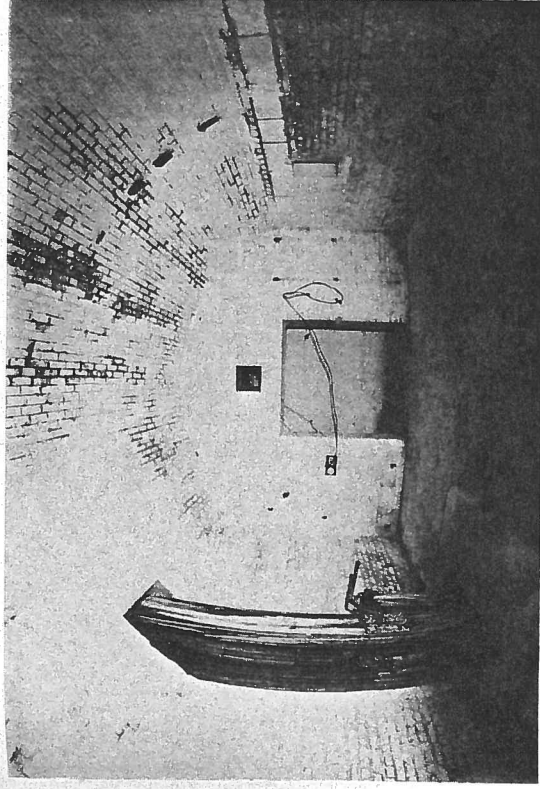


FIG. 22: One of the three-period magazines at Fort Cunningham, which has a central lightbox over its entrance. A cartridge hoist of the last (BL) period stands on the right.

The main underground passage and subsidiary passages connecting the magazines with the shell and cartridge lifts, and other rooms were initially lighted by means of simple light boxes recessed into the passage walls at intervals, in corners, and at critical locations, such as the base of the stairs leading down to the magazines from the parade ground. These recessed light boxes were reached from the floor of the passage they illuminated and were opened from the front to replace the lamp. Each light box had a thick pane of clear glass in a brass frame across the front, and this was hinged, and swung open to admit the lamp. Light boxes of this type were probably in use throughout the fort's underground passages from the 1820s on. The lamps for these light boxes were serviced in a lamp room near the foot of the southeast

staircase. No recessed wall light boxes of this type appeared inside the magazines, due to the risk of exposing the powder inside the magazine to the lamp flame, when the front of the box was opened.

During the RML period, additional lighting was provided for the main passageway in the form of a series of iron-covered fixtures set high into the passage wall. The light inside these fixtures focused downward on to the passage wall and floor. Only one of these fixtures retained its metal cover, so we know less about the operation of this type of light box, than the simpler recessed variety. These light boxes were too high up to be served from the passage floor, and were approached from a light passage running behind, and parallel, to the main passage. The light passage communicated directly with the lamp room, and was elevated to provide access to the top of the main passage.

To solve the problem of lighting the magazine interiors safely, the Royal Engineers constructed a series of seven travelling light boxes over the top of the main passage from the light passage to each magazine (FIG.23). Each of these consisted of an elongated sheet-iron box 'tunnel' with a pair of iron rails along the bottom, and a chain-and-pulley device between the rails. The lamp was lit and placed on a dolly platform, possibly on wheels, which was moved from the light passage through the box and across the top of the main passage to a glass-fronted light box window in the end wall of each magazine by means of the pulley (FIG.24). Unlike the light boxes in the passageways, these windows were sealed and did not open into the magazines, thereby reducing the risk of exposed flame inside the magazines. Lamp gases were exhausted through a vent hole inside and above the top of each window (FIG.25). Each of these travelling light boxes was 53 cm high, 40 cm wide, and 122 cm long, with the rails extending beyond the metal box at each end across the base of the masonry opening in the wall at each end. The best preserved of these travelling light boxes was drawn and photographed in detail, and used as the basis for an engineering diagram of this unique type of fixture.

Although badly corroded in many places, these travelling light boxes were generally well preserved. When cleaned systematically for recording, they revealed details not usually found in such situations. Several broken pieces of flat, patinated clear glass approximately 0.5 cm thick were found on the masonry sills facing the magazines next to the ends of the rails. These were almost certainly the remains of the original glass panes which faced into each magazine. Three brass or bronze chain links were also found in one of the light box tunnels—probable remnants of the original pulley chain. The brass fixtures that held the glass panes inside the magazines were largely intact, along with the bronze pulleys anchored horizontally to the masonry sills at either end of each light box tunnel. One of the light box tunnels showed signs of later modification in the form of galvanized sheet metal lining crudely

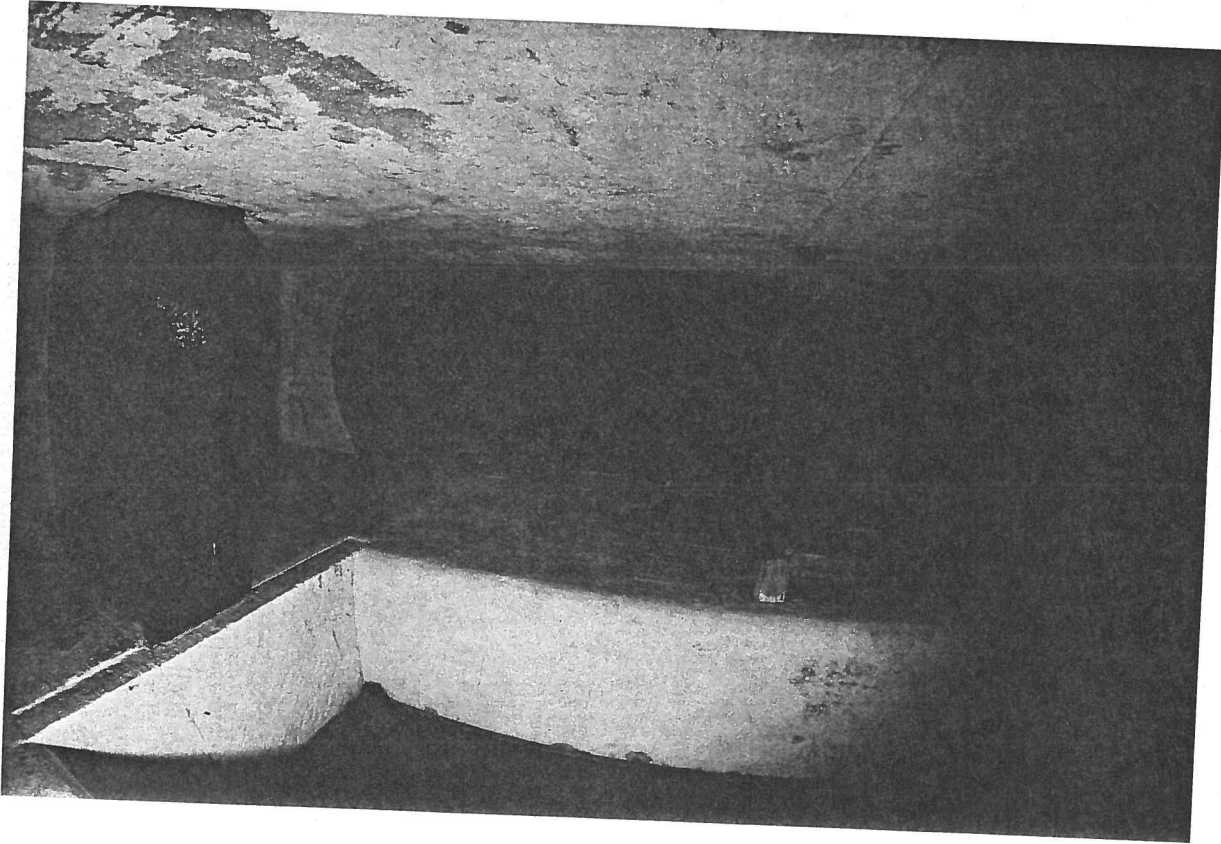


FIG. 23: An iron chamber for a lightbox crosses the corridor of the magazine and connects to the light passage behind the right hand wall.

nalled and bolted in place. Another one of these travelling light boxes had a pulley frame made of iron or steel, instead of bronze. It was heavily corroded and probably was another repair or modification at a later date. These finds show that efforts were made to repair and maintain this system of underground illumination long after the introduction of electricity in other parts of Fort Cunningham.

THE 'ONE CANNON' UNDERWATER SITE

Exploratory diving during the 1991 field season revealed the presence of a smooth bore, cast iron cannon and assorted debris on the seabed in a small cove on the northeast shore of Paget Island, 100 metres from the northwest corner of the Fort Cunningham. The cannon was resting on the seabed at a depth of four metres, depending on the tide. The seabed inside the cove was sandy and level, but with large sand ridges, which partly covered the cannon and other debris items. Our initial hope was that this would prove to be part of a larger gun dump, which could account for the disposal of the fort's principal armament during the 1820s. We knew that the fort had mounted ten 24-pounder guns in 1857,¹³ and thought that this could be one of them, with others buried nearby in the sand. With this in mind, we organized a small dive operation at the cove in 1992.

The dive team consisted of five EARTHWATCH volunteers and staff—three archaeological field workers, a divemaster and a boat tender. Unlike the 1991 field season, conditions were generally poor for diving due to high winds and waves, all of which combined to produce a strong surge effect inside the cove, along with poor visibility. So the dive programme was pursued intermittently as the weather allowed. In spite of these conditions, the site area enclosed by the cove was surveyed completely and was recorded by means of baseline trilateration, direct measurement and underwater photography.

The strong surge caused large sand ripples to form quickly on the seabed, forcing us to re-excavate the cannon and other objects by means of fanning on every dive. However, we were aided by the use of a compact surface-supplied air system known as 'Brownies' Third Lung'. The divers were all experienced and were able to record accurately, despite the surge. Each dive averaged about an hour and was limited primarily by the cold water, which required full wet suits. The site survey and map were established along a thirty-metre baseline, which extended across the seabed on a line more or less parallel to the shoreline. Baseline clips were set at three-metre intervals, and individual objects were then measured in by triangulation. Every effort was made to keep these measurements on the same horizontal plane as the baseline. Eight dives were made at the site during the 1992 field season for a total of approximately thirty-two diver-hours.

Unlike our efforts at the fort, the results of this underwater survey

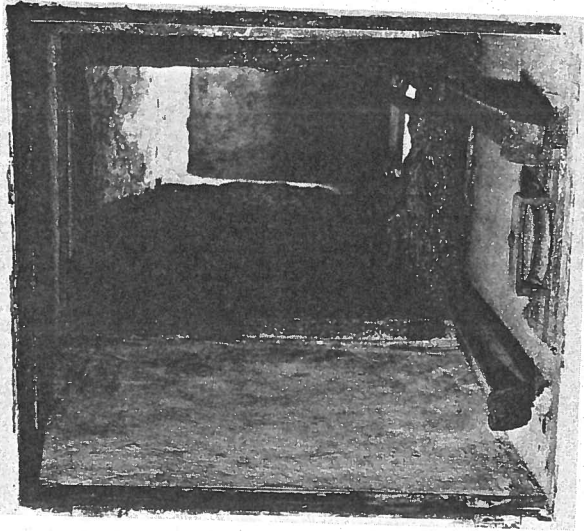


FIG. 24: The lantern was sent across the light chamber on a trolley running on iron tracks, with a pulley for a rope at each end.

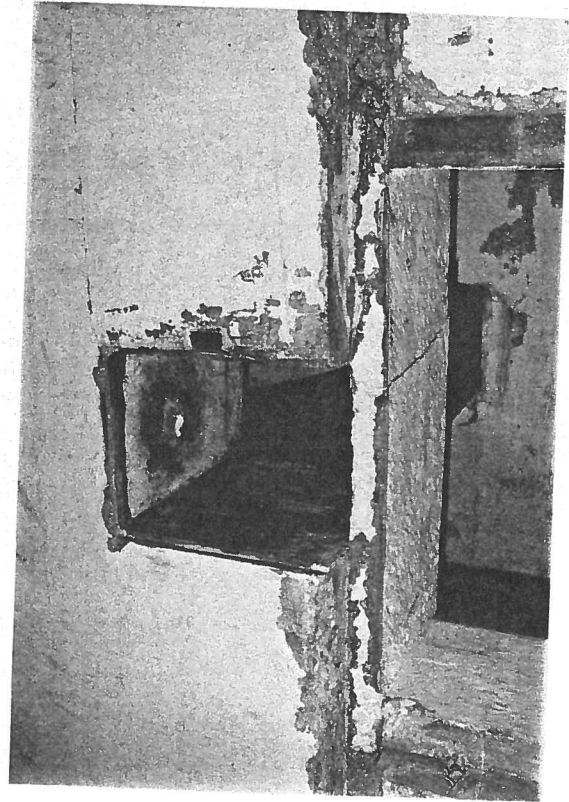


FIG. 25: This detail at the magazine end of the light chamber shows the exhaust vent in the ceiling of the lightbox.

were largely negative. Despite systematic seabed surface survey and subsurface probing, no other guns were found. In most places the sand was shallow and was underlain by coral limestone. The cannon found in 1991 was recorded in detail and proved to be smaller than the 24-pounders described as the early 19th century armament of the fort. The gun showed archaic features more typical of 18th century guns, such as small size, a large number of bands around the barrel and an almost constant circumference of the barrel from one end to the other. The narrow tube-like appearance of this gun was generally unlike the tapered barrels of later cast iron smooth bore cannon. It now seems probable that this was one of the small 12- or 18-pounders—more likely a 12-pounder—installed at Upper Paget Fort (replaced by Fort Cunningham) by Captain Andrew Durnford by 1798.¹⁴

Other debris at the site consisted of discarded pottery, steel cables, a stoneware tub, a collection of faucets and pipes, a large steel dolly with castor wheels attached, two car batteries, and other large, but as yet, unidentified objects. A sample of the ceramics was collected for detailed identification by one of the authors (Triggs). This assemblage included types which were in production as late as the early decades of the present century and as early as the 1830s. In Triggs' opinion the material was deposited over perhaps five decades from the 1870s to the 1920s.

Many broken pieces of pottery were found scattered over the seabed, and there was a definite pattern to the size-sorting of objects in the cove. Smaller items, like pottery, were found farther from the shore than heavy objects, whether large or small. The heavy items, including the cannon, had clearly been pushed off the rock ledge enclosing the cove. These rolled a short distance and remained in place at or close to where they first came to rest. Lighter objects were picked up by the surge and scattered more widely among the sand ripples. Several modern AA-size batteries were found mixed in with the 19th century debris at the base of the rock ledge and on the sandy seabed beyond. Above the water-line, we also discovered a series of steps cut into the limestone directly above the dump area and, on the nearby land surface, there were numerous ceramic sherds of 19th century or early 20th century English origin. All of this evidence indicated that this cove was favoured as a dump site throughout the history of Fort Cunningham and afterwards. Unfortunately, this also meant that no reliable associations exist today between these material remains, so there is little possibility of gaining conclusive information about the fort's history at this site.

The final locus of discard of the fort's 24-pounder guns remains unknown. A large cast-iron smooth bore cannon was found on the other side of Paget Island, in shallow water next to the stone and concrete pier directly below the fort. This gun, with its muzzle shattered forward of

the trunnions, was probably a standard 32-pounder, so it cannot help us to account for the final disposal of the fort's 24-pounders either. In fact, the presence of this gun raises more questions than it answers, since no cast iron smooth bore cannon larger than the 24-pounders were documented for Fort Cunningham at any time in its history.

CONCLUSIONS

The 1992 field season at Fort Cunningham afforded an opportunity to record many of the 1991 findings in detail and to identify and record specific technical and architectural features of the fort, such as the painted designs on the underground passage walls and the light boxes in the magazines and passages, which are better represented at Fort Cunningham than anywhere else in Bermuda. It was possible to relate the stratigraphic chronology of exterior camouflage paint to historic documents in a coherent manner, which demonstrated that this type of military camouflage was present at this fort at least two decades before its more conventionally accepted date of introduction during World War I. The chronology of ditch-filling, and later earth-mounding, was also understood in greater detail, thanks to the stratigraphic evidence and early plans at the Bermuda Archives.

The overall impression provided by the improved chronology resulting from the 1992 studies is one of uneven rates of change in different components of the defensive system at Fort Cunningham. While the seaward-facing defences, such as the RML, and later BL, guns, the iron armour, the electric minefield, and the electric searchlight batteries, revealed innovative changes with, or even ahead of, the contemporaneous state of the art in coast defence technology, the landward-facing defences retained a conservative, unchanging character more in keeping with the original 1820s design of the fort. The 1992 research into the moat-filling sequence at the fort showed a complex series of stages in the progress of filling the southeast corner of the moat, based on the need to retain flanking galleries covering the moat interior along the southern sides of the fort. By keeping the southern sides of the ditch open during the RML period and later, the engineers sought to retain it as a defensive feature along the landward side of the fort. They supported this conservative decision by also retaining the distinctly old-fashioned feature of counterscarp galleries and firing slits at the base of the ditch, even to the extent of building a special room across the ditch around 1887, with firing slits, to replace the original 1820s counterscarp gallery after it was covered by sand and rubble fill.

A final season of fieldwork in 1993 will concentrate on the interpretation of the magazines and the recording of the electric searchlight emplacements on the seaward side of Paget Island.

NOTES AND REFERENCES

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3. Guy Hartcup, *Camouflage: A History of Concealment and Deception in War* (1980), 147.
4. Gould, Harris and Triggs, op. cit., 77-79.
5. Exceptions to this policy of secrecy were rare and tended to be generalized to an extreme degree. For example, note the following item reprinted in the *Bermuda Royal Gazette* for 17 March 1874: 'Bermuda and its Defences (from the *London Morning Post*, December 26, 1873). Commencing at Fort Cunningham, situated at the entrance east of the group, and at the entrance to St. George's Harbour, it is found that all of the latest improvements have been introduced in the erection of this fort—such as iron shields, etc. and when completed ordnance of the heaviest nature will be mounted.'
6. Quentin Hughes, *Military Architecture* (1974), 180-182.
7. Paavo Talvio, 'Viaporin linnoitus ja sen tykistö krinin sodasta vuosisadan vaihteeseen' (The fortification of Viapori and its artillery from the Crimean War to the turn of the century), *Sotahistoriallinen Aikakauskirja*, 1 (1980), 128-177.
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9. Major General 'X', 'Bermuda: Our Oldest Colony', *Illustrated Naval and Military Magazine*, 9 (1888), 199.
10. Bermuda Archives. 'Record Plan of Submarine Mining Test Room, Fort Cunningham, St. George, Bermuda', Corps of Royal Engineers (1887) and 'Observing Station on Glacis, Fort Cunningham, St. Georges, Bermuda', Corps of Royal Engineers (1890). The latter document shows the location of the minefield in relation to Paget Island and Governor's Island.
11. *Ibid.* 'Proposed Electric Light Emplacement at Fort Cunningham, Bermuda, Paget Island', Corps of Royal Engineers (1894) and 'Record Plan of Defence Electric Lights at Fort Cunningham', Corps of Royal Engineers (1910).
12. *Ibid.* 'Record Plan of Defence Electric Lights at Fort Cunningham, Bermuda, St. Georges: Engine Rooms & Oil Stores', Corps of Royal Engineers (1910).
13. Jack Arnell and Edward Harris, 'A History of some of the Islands in St. George's Harbour', *Bermuda Journal of Archaeology and Maritime History*, 3 (1991), 58-FIG. 17.
14. Edward Harris, *Great Guns of Bermuda* (1987), 39.