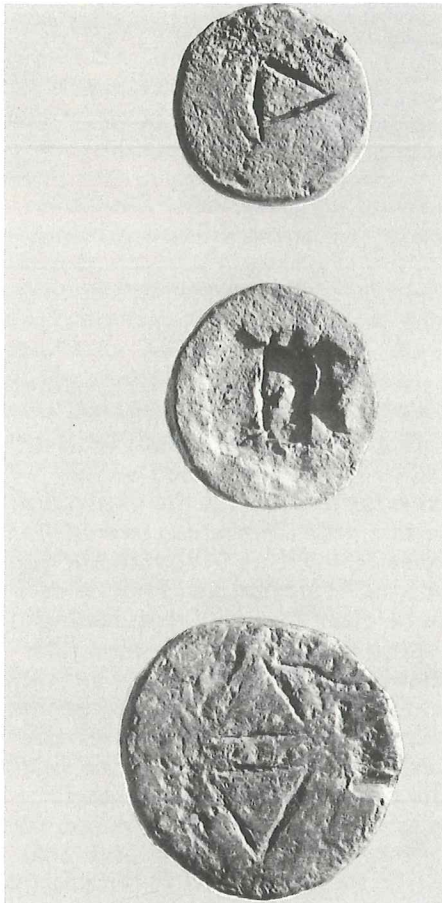


CONTEXT



Inscribed Minoan balance weights from Ayia Irini, Keos, Greece. See "On Clay Tablets, Lead Discs, and Ancient Mathematics," page 6.

INSIDE THIS ISSUE:

Experiments in Lithic Archaeology 4

Eighteenth-Century Ironworking
in Sharon, Massachusetts 6

On Clay Tablets, Lead Discs,
and Ancient Mathematics 8

News from the Office of
Public Archaeology 10

Excavation Workshop 10

Historical Archaeology News 11

Colonial Tavern Tour 11

Excavation at the Golden Ball Tavern

by Ricardo J. Elia

During the tense weeks before violence erupted between British and American forces at Lexington and Concord in April 1775, the British commander in Boston ordered two of his officers on a reconnaissance mission to examine the countryside west of Boston. Not certain whether they would receive a friendly or hostile reception, the British officers made their way west along the Boston Post Road, stopping late in the day at an inn in Weston. According to their report to General Gage,

We stopped at a tavern at the sign of the golden-Ball, with an intention to get a drink and so proceed; but upon going in the landlord pleased us so much, as he was not inquisitive, that we resolved to lye there that night; so we ordered some fire to be made in the room we were in, and a little after to get us some coffee; he told us we might have what we pleased, either tea or coffee; we immediately found out with whom we were, and were not a little pleased to find, on some conversation, that he was a friend to government

Isaac Jones, a prominent Weston citizen and landlord of the Golden Ball Tavern, signaled his Tory sympathies to the British officers by offering them tea at a time when many American colonists were boycotting tea as a protest against British colonial policies. During the previous year, Jones had come under increasing pressure on account of his political leanings. He was censured as an "Enemy to his Country" by one revolutionary committee, and in

March 1774, in a Weston version of the Boston Tea Party, a mob of about 100 people broke into his residence at the tavern and thoroughly ransacked the house.

Despite his apparent Tory sympathies, Isaac Jones eventually joined the side of the united American colonies against the British. However reluctantly, he probably signed an oath of allegiance to the revolutionary cause soon after the fighting actually began. By 1777, at any rate, he was hauling goods under contract to the American Army. His tavern continued to serve the public throughout the war, and remained an inn until 1793.

Built between 1764 and 1769, the Golden Ball Tavern is a fine example of Georgian-style architecture and is listed on the National Register of Historic Places. The property, acquired in 1963, is owned by the Golden Ball Tavern Trust, which lovingly maintains the house under the guidelines of a special "liberation philosophy." Rather than remove all later alterations and additions in order to create an artificial restored version of the house as it may have appeared in the eighteenth century, the Trust has chosen an "archaeological" approach to presenting the house in which successive changes are preserved and presented as a means of understanding the history and development of the house through time.

Visitors to the tavern can see, for example, how the large original 1760s fireplace and bake oven were converted into a smaller fireplace in the early nineteenth century, and how, still later, the second fireplace was itself bricked in and replaced with a freestanding stove, as a response to the in-

Continued on next page.

In this earliest-known photograph of the Golden Ball Tavern (1868), the East Ell can be seen attached to the left of the main house.



creasing scarcity of wood as a source of fuel. In other parts of the house, successive layers of paint and wallpaper are left visible as evidence that the life of the house, like the lives of the people who occupied it, was never static, but underwent continual changes.

In keeping with its "archaeological" approach to historical preservation, the Golden Ball Tavern Trust recognized at an early stage that below-ground archaeology could contribute to a better understanding of the house's history. Over the years, a number of small archaeological test excavations were made in different parts of the property with interesting results. Accordingly, when it was decided to expand the tavern's East Ell in order to provide more space for visitors to the house, the Trust's chairman, Howard Gambrell, Jr., invited the Office of Public Archaeology to conduct test excavations adjacent to the ell.

Compared to the rest of the house, the East Ell has received little architectural consideration. The earliest view of the tavern, a circa 1868 photograph (see figure), shows the ell with a pitched roof. Sometime during the late nineteenth century, the length of the ell was shortened by about three feet, and the roof was altered into a truncated hipped roof. In this shortened form the East Ell has survived to the present day.

The earlier, larger version of the

East Ell was thought to date to sometime around the middle of the nineteenth century. This date was based on the results of a test excavation dug beneath the floor of the west room of the ell by archaeologists from Brown University in 1977. Although only briefly reported, the evidence from this dig seemed consistent with a mid-nineteenth-century date for the construction of the ell. When we began our own excavations, therefore, we were hardly expecting to uncover what we did: evidence proving that the East Ell had, in fact, been constructed much earlier, probably sometime during the 1780s, and that we had almost certainly identified the back kitchen of Isaac Jones's tavern.

Excavations at the East Ell took place under my direction during the last few weeks of the fall. The OPA excavation team, consisting of Project Archaeologist Judy Dolan, John Shea, and several graduate and undergraduate archaeology students, excavated a total of 17 square meters on the east and south sides of the ell. Before beginning the excavation, we expected to find the remains of the earlier foundation wall of the East Ell about three feet east of the ell's present east wall. The artifacts associated with this earlier wall, we were confident, would date to sometime in the mid-nineteenth century.

To be sure, excavation quickly

revealed the location of the earlier east foundation wall of the ell. The foundation was built with uncut or roughly trimmed stones without mortar. As the excavation of this wall continued, two surprises caused us to reevaluate our original expectations. First, it became clear that we were dealing with a foundation for a structure that originally had a cellar beneath it. At some point, probably in the late nineteenth century when the earlier ell was shortened in length, the cellar was filled with sandy soil. In the cellar fill we found dozens of leather shoes and shoe parts, dating to the last decades of the nineteenth century; many similar shoes can still be found in boxes in the basement of the tavern.

Our biggest surprise came, however, as we were examining the artifacts associated with the foundation. Instead of finding numerous whiteware ceramics dating to the second half of the nineteenth century, we were uncovering predominantly eighteenth-century material. Preliminary analysis of the ceramics from the builder's trench of the foundation reveals a heavy predominance of creamware among the imported ceramics. Among the creamware were very small numbers of delftware and salt-glazed stoneware, both of which passed out of fashion after the introduction of creamware during the 1760s. We

also found very small amounts of pearlware, which was introduced by Josiah Wedgwood around 1780 when the popularity of creamware was at its height.

What this ceramic evidence indicates is that the original foundation wall of the East Ell was built at a time when creamware was still the most popular imported ceramic type, and pearlware was only beginning to be used. This places the date of the original East Ell sometime after about 1780, and almost certainly before the tavern ceased functioning as an inn in 1793.

Although subsequent remodeling of the East Ell has obliterated most traces of the original ell, it was not difficult to identify the probable function of the earlier structure. Attached to the kitchen of the main house, one might speculate that the East Ell served as an additional kitchen and storage space, which would certainly be needed in a building that served as both a tavern and the owner's residence. Fortunately, an 1803 inventory of Isaac Jones's property provides the definitive answer. Immediately following a description of the main house, the document states: "One Kitchen One Story High 24 feet by 18 feet adjoining" The dimensions,



Project Archaeologist Judy Dolan records the plan of the earlier wall.



View of the foundation wall of the original East Ell during excavation.

and particularly the adjective "adjoining," fit the East Ell precisely.

After demonstrating that the East Ell was originally an eighteenth-century back kitchen of the tavern, it remained to explain how the earlier excavators had come up with a construction date in the mid-nineteenth century. The problem, it turned out, was not in the dating of the artifacts from the earlier dig, but rather, in their interpretation of the data. The earlier excavation had taken place in the west room of the East Ell, and had been confined to the interior of the structure. In short, without the benefit of examining the exterior foundation walls, the earlier excavators interpreted the construction sequence of the East Ell in reverse order.

A wide variety of artifacts was recovered from our excavations. In addition to the imported ceramics mentioned above, a large number of glazed redware sherds was found. Many of these may have derived from the Hews redware pottery, located across the road a short distance away from the tavern, which was active during the late eighteenth century. Some of the redware sherds were from mugs or tankards, while a majority came from larger storage vessels and crocks. In addition to the pottery, we uncovered a multitude of nails, as well as a variety of hardware and small finds, including a door latch, keys, a lock plate, buckles, an ox shoe, buttons, window and bottle glass, and bones. One rare item was a handpainted fragment of a porcelain figurine, depicting the face of a black youth, possibly a slave.

Our excavations at the Golden Ball Tavern have added important new information about the early history of the house, and have demonstrated how archaeology can be used in conjunction with architectural and documentary evidence to form a fuller understanding of our past. As this is being written, construction is well under way on the newest East Ell; the latest in a long series of alterations to that small structure. Included in the design of the new addition is a plan to exhibit a portion of the excavated foundation wall through clear plexiglass flooring. As it has for over twenty years, the house continues to tell its own story.

Ricardo J. Elia has been Director of the Office of Public Archaeology and Adjunct Professor of Archaeology in the Department of Archaeology since 1982. An article describing recent activities of the Office of Public Archaeology can be found in this issue.

Further Reading

See especially the following sources: Howard Gambrill, Jr., and Charles Hambrick-Stowe, The Tavern and the Tory: The Story of the Golden Ball Tavern (Weston, Mass., 1977); Howard Gambrill, Jr., "Liberation Philosophy: The Golden Ball Tavern," pp. 95-101 in Peter Benes, ed., New England Historical Archaeology, Dublin Seminar for New England Folklife: Annual Proceedings, 1977 (Boston: Boston University); and Constance A. Crosby, "Excavation of the East Ell," pp. 101-105, in the same volume. The OPA report on the recent excavations of the East Ell, currently in preparation, will be available for copying costs. You are also encouraged to visit the Golden Ball Tavern. The Center is organizing such a trip for May 12; see page 11 for details.

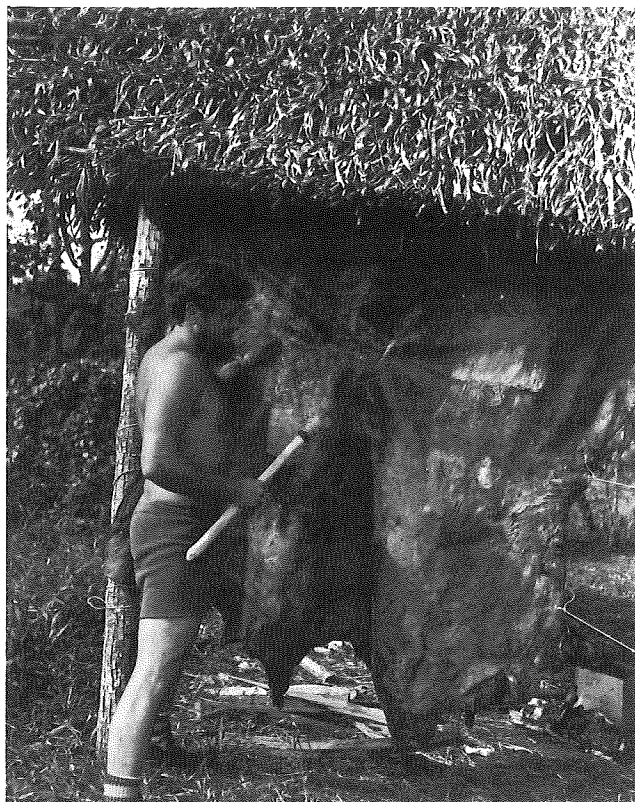
Experiments in Lithic Archaeology

by John Shea

That archaeologists have a fascination with stone tools is no surprise to anyone familiar with the discipline. With the possible exception of ceramics, no other aspect of material culture figures so prominently in the archaeological literature as do stone tools, or lithics. Recently, we have begun to revise our ideas concerning what we can learn about the human past from lithics analysis. Where speculation once abounded, detailed experiments are advancing the frontiers of archaeological knowledge further than ever before.

That lithic studies should have such an important status in prehistoric research really reflects a continuation of a trend established in the early days of archaeology. Stone implements discovered with extinct animals in Western Europe provided key evidence for human antiquity greater than Ussher's estimate of 4004 B.C. for the date of the Biblical Creation. For much of the nineteenth and twentieth centuries, archaeologists have used stone tools as chronotypes, or "zone fossils," believing them to be reliable guides to the age of prehistoric industrial assemblages. The first winds of change, however, arose in the New World. In 1891, W. H. Holmes, of the Bureau of American Ethnology, shattered the illusions of some antiquaries by declaring that the crude implements of an American "paleolithic" were in reality discarded quarrying and manufacturing debris, or roughouts ("blanks") for implements to be finished elsewhere later, produced by more recent Native Americans. For the first time, stone tools were treated as remnants of an active process of production, use, and discard, rather than as direct representations of an historical episode in an evolutionary sequence.

Significantly, Holmes's arguments were based upon observations of Native American stoneworkers, such as Ishi. This was an early use of experimental analogy in archaeology and fostered a



John Shea, the author, scraping cow-hide with a replicated stone tool as part of a use-wear experiment.

trend in lithics analysis in which observations in the present were applied to the study of prehistoric manufacturing techniques. Today, many archaeologists, including this writer, are also flintknappers, craftsmen-scientists adept at duplicating prehistoric stone tools using aboriginal methods and equipment.

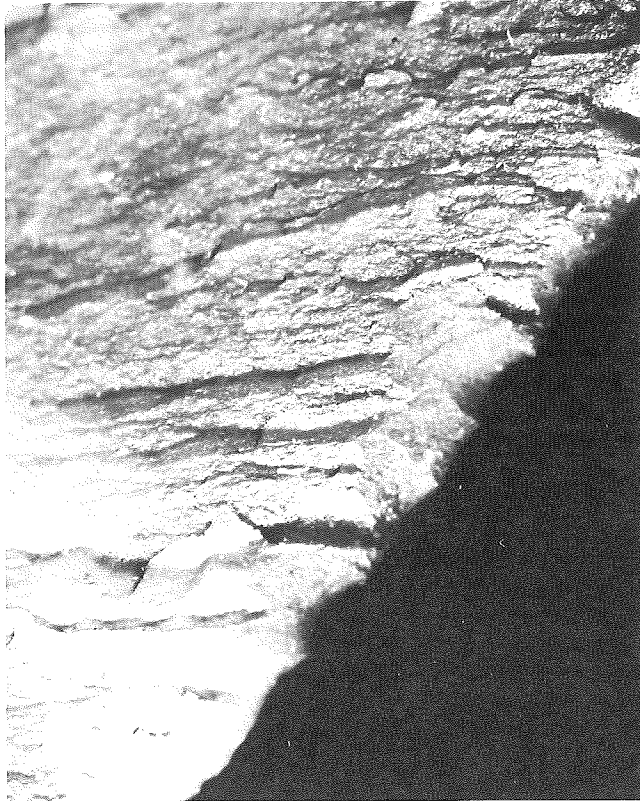
Another, and equally important aspect of prehistoric technology, tool-use, has been neglected for most of the last century of research. Even to this day functional approaches have remained more speculative than experimental. Nevertheless, increasing progress has been made recently in the application of experimental research.

Most of the rocks used by prehistoric man possessed a similar set of physical properties: crystalline structure, brittleness, and conchoidal fracture. When used, these materials develop traces of damage in much the same way as they do during manufacture, by abrasion and by fracture. Such damage is usually preserved, unaltered, on even the most ancient tools. In the 1960s, the research of Sergei Semenov of the Institute of Archaeology in Leningrad affirmed that microscopic wear-traces differed according to the

combination of action and nature of the materials being employed and worked. Semenov's innovation was to fortify his functional assessments by the experimental use of stone tools in order to replicate patterns of wear and damage. More recently, Western archaeologists have refined Semenov's techniques and applied lithic use-wear analysis to both experimental and archaeological assemblages. Two researchers, L. H. Keeley and G. H. Odell, have conducted 'blind' tests, where experimentally used tools are given to the analyst and his accuracy is checked against the experimental records. Their results are roughly comparable, although employing different lithic materials and microscopic magnifications: accuracy rates in locating modified areas, identifying actions employed in their use, and the type of materials worked are generally between 60 and 80%.

This writer's field research in use-wear analysis came during employment as an assistant to George Odell on the Belize Archaic Archaeological Reconnaissance (BAAR), under the direction of Dr. Richard S. MacNeish. There, prior to the analysis of excavated tools, I used my flintknapping skills to construct a reference

Edge damage shown in a photomicrograph. Patterns of damage can reveal the function of prehistoric stone tools.



collection of experimentally utilized tools of Sand Hill chert, the same material employed in the excavated collections, since different lithic materials may develop different wear patterns even after the same use. For nearly four months, members of the BAAR project cut, sliced, chopped, and drilled bones, hides, wood, and other materials. Each tool was carefully examined following use and the signs of wear recorded. A blind test was conducted in which the author's results compared favorably with those of Keeley and Odell. Thus assured of reasonable accuracy, we began to analyze the BAAR collections.

The preliminary results were surprising to all involved with the BAAR project. Most of the utilized tools in all of the assemblages were to be found among the "unmodified" flakes. The bifacially-flaked projectile points showed a diverse number of uses, including wood shaving, meat cutting, and bone sawing, as well as projectile wear. In every site there were more unmodified flakes showing projectile-point wear than there were bifacially-flaked "projectile points," typologically speaking. Other tool types, such as side-

scrapers, end-scrapers, and cores, were shown to have either multiple uses or uses quite at odds with their morphological designations.

The implications of our work grow more complex as our analysis proceeds. The taxonomic conflicts between morphological and functional typologies are illusory and are really little more than reflections of the goals of the different typologies. The morphological approach uses shape as an index of stylistic, or ideological, variability among lithic materials. Functional analysis emphasizes the use to which a particular tool was put and the behavioral context of that item, or of a total assemblage, more as a measure of economic and technological context.

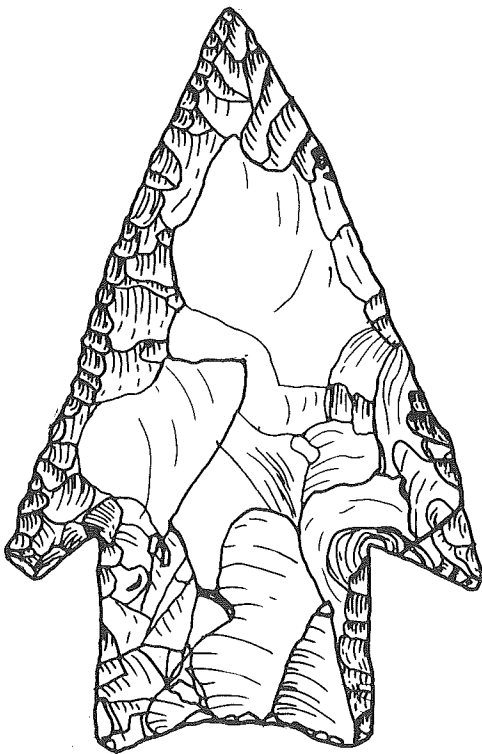
Eventually all of the BAAR collections will be analyzed, resulting in a detailed picture of 10,000 years of prehistory in the Belizean Lowlands, a period that saw the origins of settled village life, agriculture, and the rise of the Maya civilization. By examining the changes in the frequencies of different activities over time, we hope to reveal the fundamental nature of the key cultural and ecological changes in this region. Lithic use-wear analysis on a regional scale has never before been attempted. The results should be of interest to all archaeologists.

That future lithics analyses should illuminate the prehistoric record in even greater detail is to be expected. Stone tools remain virtually the sole traces of human behavior for well over 99% of the archaeological record. It is, therefore, clearly in the interest of archaeologists to understand in detail the materials which comprise their data.

John Shea is a staff member of the Belize Archaic Archaeological Reconnaissance Project and recently taught a workshop on the production of stone tools here at the Center for Archaeological Studies. See Context 3:3 (1984), p. 11.

Further Reading

For more on the Belize Archaic Archaeological Reconnaissance Project, see the articles by Richard S. MacNeish in issues 2:2 (1982) and 3:1-2 (1983) of Context.



Archaic stone "arrowhead." Use-wear experiments have shown that these were not only used for arrows and spearpoints.

Eighteenth-Century Ironworking in Sharon, Massachusetts

by Judith Dolan

Of the many furnaces and forges that once dotted the eighteenth-century Massachusetts landscape, traces remain of only a few. The colonial iron industry was a small but important element in the economic system, and most towns or counties had their own forges or furnaces. During the seventeenth and eighteenth centuries most iron products were supplied by England; however, these small forges were established to serve the communities' need for tools and their repair. Gradually local artisans began casting holloware products and producing wrought-iron materials. The Massachusetts iron industry, however, did not prosper and expand in the post-colonial period, as did the iron industry in other states, and today only a handful of historical ironworking sites, such as the Saugus Ironworks, have been studied in any detail.

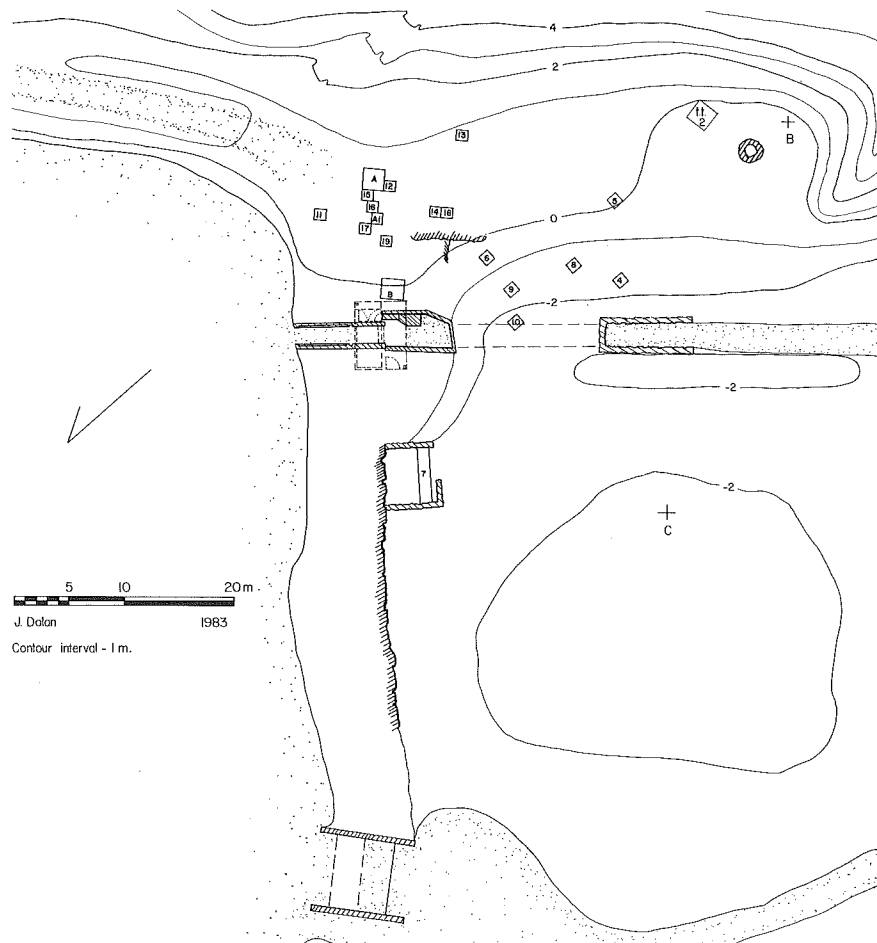
Recently, the Sharon Historical Society sponsored a documentary and archaeological study, through the Center for Archaeological Studies, of one such ironworking establishment. The Ebenezer Man Furnace, known historically as the Stoughtonham Furnace, is located at the southern end of Gavin's Pond in Sharon, Massachusetts. It was built in 1762 by a partnership of nine men, who decided to cast holloware products such as kettles, pots, and pans. One of the original owners of the furnace was Ebenezer Man, for whom the furnace was later named.

The location of the three-acre lot, and specifically the site of the furnace itself, was well suited to accommodate such an industrial enterprise: there were plentiful local supplies of iron ore; Billings Brook, once dammed, provided water power to operate the water wheel; and a steep hillside next to the site provided easy access via a charging bridge to the top of the furnace. The first priority in this

enterprise must have been the construction of a stone dam, thus forming what is now known as Gavin's Pond. Along the east side of the dam the wheel pit, sluiceway, and tailrace were built, and adjacent to this the furnace. The last was a substantial structure, approximately 20-25 feet high and 18-20 feet square at the base, tapering by a foot at the top. The outer walls were constructed of cut and fitted granite blocks, and the inner walls of the furnace opening, known as boshes, were lined with firebrick, a refractory material. Between these two walls the space was filled with stone chips, rubble, clay, or cinders, which allowed the furnace lining to expand and contract with the heat. At least two arches were built on the outside of the furnace, one for the leather-clad bellows and another from which furnace workers tapped the iron and guided it into the sand molds.

While in operation the furnace

was run continuously, and a casting would be done approximately every twelve hours. Just before the iron was tapped the molds were prepared for the casting of holloware objects and iron bars. When all was ready, the bellows were stopped, the iron was tapped, the slag (impurities) was drawn off the top of the molten iron, and the molds were filled with the hot metal. Once cooled, the holloware objects were finished off and prepared for market. This process of reducing the charcoal, iron ore, and limestone into molten iron required great skill. The founder was responsible for loading the correct proportions of raw materials into the furnace, for preparing the casting beds, and for knowing exactly when the furnace was ready to be tapped. Poorly tended furnaces were highly dangerous and more than one is known to have exploded, causing great property damage and personal harm.



Site map of the Ebenezer Man Furnace Site at Sharon, Massachusetts. Remnants of the furnace foundation were found in squares 14 and 18 (upper-center of the map).

The Ebenezer Man furnace was actually the center of an industrial complex; it was surrounded by storehouses, dwellings, a trip hammer, and blacksmith shop. The latter two were located at the western end of the dam, about 150 feet from the furnace, and were used to convert cast-iron pigs and bars into wrought-iron objects. The storehouses were built at the top of the ridge, but the exact location of the Ironmaster's house is unknown. A second blacksmith shop and dwelling house, located about one-half mile south of the furnace, were leased from a neighboring landowner, Benjamin Fairbanks. No account books or business records survived to detail the furnace's daily and annual operations, but with the use of a blast furnace, trip hammer, and two blacksmith shops, the complex would have been able to supply the local community with both cast-iron and wrought-iron products.

Despite what would seem to be a steady operation, the furnace was apparently not always profitable enough to satisfy the owners. In 1770 the furnace was sold to Richard Gridley, Edmund Quincy, and Joseph Jackson. Within a few years the impending conflict between the English loyalists and the colonists was evident, and the

new owners prepared to cast cannon and shot for use by the American forces. Gridley and Quincy owned several mineral rights in the area and secured more to supply the furnace with plenty of iron ore. High-grade ore was also brought up from the New Jersey-Pennsylvania area for use in producing the cannon.

The first cannon produced in America were cast here at the site in 1775. Initially, the traditional two-mold method of casting cannon was used, but this technique later was replaced by an improved process whereby they were cast solid and then bored by machine. A Frenchman, Monsieur de Marasquelles, was instrumental in propagating this new technology throughout the New England iron industry.

In 1777 Uriah Atherton bought the furnace and continued to cast cannon and shot for the remainder of the Revolutionary War. The reasons for the demise of the furnace operation at Sharon are unknown, although it is known that Atherton invested in another furnace in 1780. He may have shut down the Man furnace at this time, taking with him any extra raw materials and tools for use at the new one.

Members of the Sharon Historical Society worked closely with

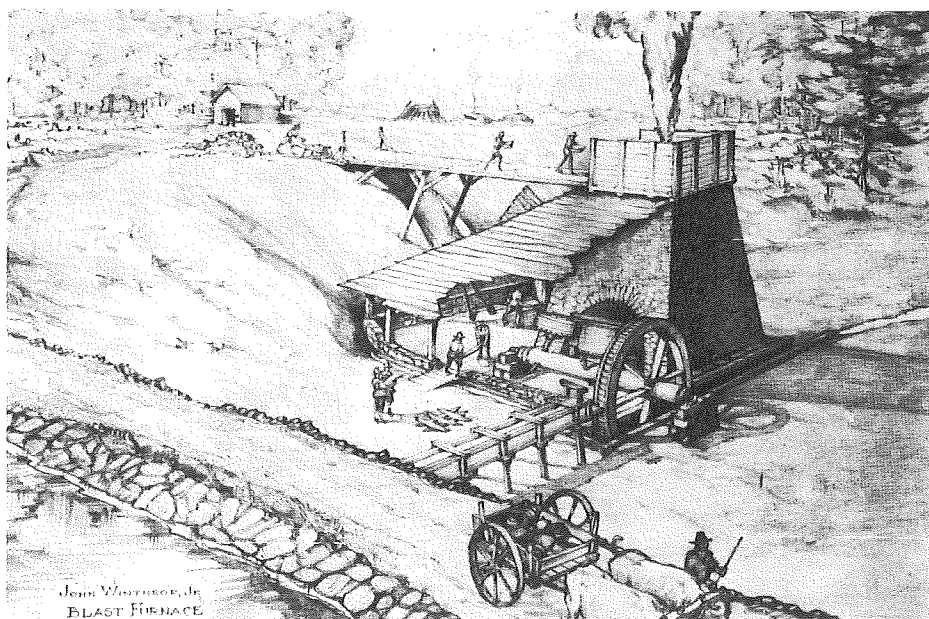
myself and other Boston University archaeologists at the Man furnace site during September and October of 1983. Our excavations uncovered a small portion of the furnace structure that had survived to a height of three feet. We found several samples of the firebrick furnace lining in our test pits, as well as a few nails that had once attached the leather bellows to its wooden frame. A cast-iron wheel was also found that might have belonged to the cannon-boring machine. The only samples of furnace products found were four pieces of shot, ranging in diameter from 1--1¾ inches. The stone-lined tailrace and stone dam are still visible, but the wheel pit and sluiceway have been extensively reworked and thus show nothing of their original construction.

The importance of the Man furnace lies not only in its contribution to the American Revolution, but also in what the study of it can tell us about the development of the ironworking industry in America. The iron industry in Massachusetts during the eighteenth century was characterized by many small furnaces scattered about the countryside, each one serving its local community. The fact that the Sharon Casting Furnace site has survived virtually undisturbed to the present day, unlike so many other early ironworking sites, makes it a perfect target for controlled excavation. The Center plans to continue its work at the site in close cooperation with the Sharon Historical Society to shed more light on an important but little understood aspect of colonial life.

Judith Dolan is a graduate student in the Department of Archaeology at Boston University. Her study of the Sharon Casting Furnace site, sponsored by the Sharon Historical Society, is being conducted to help qualify the site for the National Register of Historic Places.

Further Reading

See James Mulholland, A History of Metals in Colonial America, University of Alabama Press, 1981, and for a description of ironworking in Massachusetts, see Edward Neal Hartley, Ironworks on the Saugus, University of Oklahoma Press, 1957.



Artist's reconstruction of the John Winthrop, Jr., Furnace in Braintree, Massachusetts. The features are comparable to those that once existed at the Ebenezer Man site. Reprinted from Historic Quincy Massachusetts, edited by William Edwards, Quincy, Massachusetts.

On Clay Tablets, Lead Discs, and Ancient Mathematics

by Karl M. Petruso

a-ke-re-wa ka-ke-we ta-ra-si-ja e-ko-te

ti-pa-jo BRONZE, 1 M-unit, 2 N-units

qe-ta-wo BRONZE, 1 M-unit, 2 N-units

"Smiths at *Akerewa* having an allocation:

Thisbaios: Bronze, 1 x $\frac{1}{30}$ talent, 2 x $\frac{1}{120}$ talent;

Q^hestawon: Bronze, 1 x $\frac{1}{30}$ talent, 2 x $\frac{1}{120}$ talent;"

(Pylos tablet Jn01, lines 1-2; reading and translation by John Chadwick, et. al., *The Knossos Tablets*, (4th ed.), Cambridge, 1971.)

In 1956, a British architect and amateur cryptographer named Michael Ventris announced to the scholarly world his finding that the language of the so-called Linear Script B tablets, thousands of which had been discovered at archaeological sites in Mycenaean Greece and Crete since the late nineteenth century, was none other than Greek. Ventris's decipherment of the script represented a milestone in Aegean archaeology. As if overnight, an entirely new dimension had been added to our understanding of the ancient people of this region. This statement must be qualified, however. By no means did Ventris's decipherment of the script, and the subsequent translation of the available tablets by dozens of scholars, catapult the Bronze Age Greeks into the realm of history. Frustratingly little evidence concerning specific events, personal and place names, and the other stuff of history was recorded. Instead, the script served the large and complex bureaucracy which was centered on the palace sites of Mycenaea, Tiryns, Pylos, and Knossos.

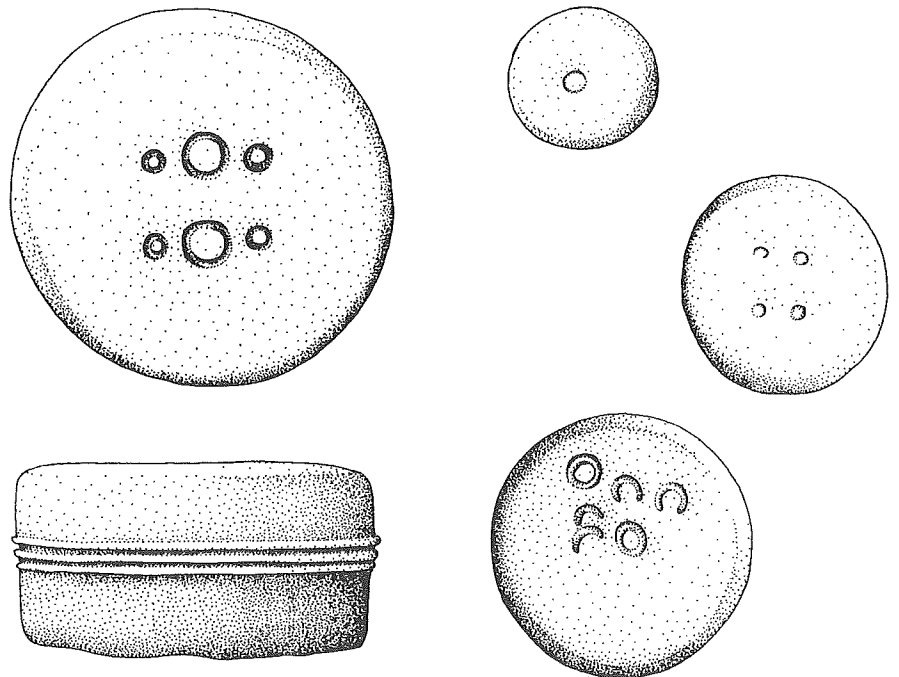
The tablet quoted above is typical in function, content, and organization of the large body of Linear B tablets in that it records the inventory of a commodity in, or to

be disbursed from, the palace storerooms. Emmett L. Bennett of the University of Wisconsin had ingeniously worked out, even before the decipherment of the script itself, the tallying systems of weight and capacity used by the Mycenaean bookkeepers. He successfully identified the fractional units contained in these ancient accounts (that is, the quantities and the ratios that relate them to one another). Bennett's investigations of the tablets enabled him to demonstrate the relative values of the units, but the written evidence was insufficient to prove the absolute values of the units, that is, the ancient analogues of our modern pounds, gallons, and bushels. In order to complete the picture, complementary evidence from the archaeological record was needed.

In 1975 I began a comprehensive investigation of Aegean weight metrology from the point of view of the artifacts themselves, mundane objects of lead and stone in various shapes and sizes, which were used with simple double-pan balances, dozens of which have

been excavated from Aegean Bronze Age tombs. My hypothesis, briefly stated, was that for any ancient system of weight to have been successful, it must have been simple and easily learned; hence, the recovery of the system from an analysis of the balance weights themselves ought to be a fairly straightforward matter. As is the case with so many problems in archaeology, my results have been at once satisfying, mystifying, and provocative.

From 1975 to 1977 I traveled about the eastern Mediterranean, visiting museum and site collections, locating as many balance weights with known archaeological contexts as possible. These I weighed on my own portable but accurate Ohaus laboratory balance. With the aid of a pocket calculator, I began to search both for clusters of masses and for simple fractions and multiples of those masses (e.g., $\frac{1}{2}$, $\frac{1}{3}$, 2, 4, 5, 12, etc.). I was particularly intrigued by the markings, most commonly strokes, dots, and circles, that had been inscribed in the surfaces of



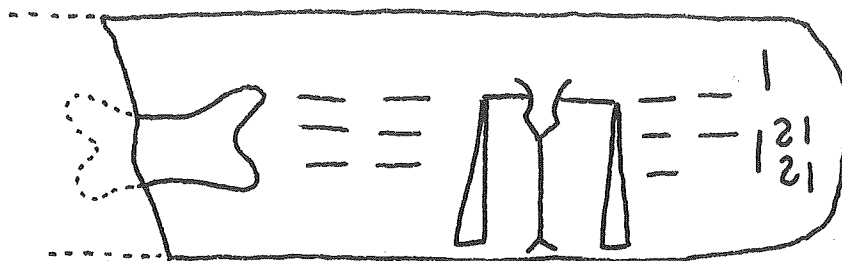
Left: steatite disc from Knossos weighing 1,507.5 g. Interpretation: two units of 10, four units of 1 (= 24 units), indicating a unit of ca. 62.8g. Right: three other balance weights from Knossos, indicating the same system of measurement.

many of the weights (see illustrations). Scholars from the time of Sir Arthur Evans on had argued occasionally that at least some of these markings must have been indicators of denomination within a system at a particular site, but no concerted or systematic effort had been made to interpret these data on an Aegean-wide basis.

The marks on the balance weights proved to be invaluable clues as to absolute masses. It was possible to demonstrate that a system whose major denominations were ca. 60, 481, and 29,000 grams was consistently indicated in the balance weights (see the table of units and weights). The latter two masses represented what we might refer to as the Aegean mina and talent (corresponding to just over one English pound and just under 64 pounds), on analogy with other ancient Near Eastern denominations of weight. Intriguingly, the eighth part of the mina, which was solidly indicated by fractional and multiple markings, does not figure as a unit in the Linear scripts; perhaps that unit had more mundane uses than those units recorded on the tablets by the bureaucratic scribes.

The most satisfying result of this project thus far has been the demonstration that a single system of weight mensuration based on one series of mathematically related masses was in use over a fairly wide and culturally diverse geographical area, including Crete, the Cycladic Islands and southern Greece, during the period from ca. 1700 to 1400 B.C. This is significant in terms of ancient economy. I have argued that systems of weight are tools of industry and ultimately of trade: there is no reason why a single system need exist at two or more widely separated sites contemporaneously *except* to facilitate trade among those sites. Indeed we have much to learn from these unassuming little items of lead and stone, both in the Aegean and elsewhere in the world.

While we are still rather ignorant about the specific mechanisms by which traded items actually changed hands, the study of these artifacts has demonstrated a great potential in suggesting the



Linear B tablet from Knossos: horizontal bars signify tens, vertical bars signify ones. Reading: "60 'oxhide' ingots weighing 52 talents, 2 heavy minas," or a total of ca. 1,510 kg. The ingots thus weigh an average of ca. 25,166 g. each. (From Sir Arthur Evans, *The Palace of Minos at Knossos*, volume IV, London, 1935.)

Linear B Symbol	Denomination	Mass (g.)	Fraction of Talent	Fraction of Preceding Denomination
ΔΥΔ (L)	Talent	29,000	1/1	1/2
~2 (M)	Heavy Mina	967	1/30	1/30
	Mina	483	1/60	1/2
# (N)	Half Mina	242	1/120	1/2
⊗ (P)	1/24 Mina	20.2	1/1440	1/12

Chart showing mechanics of the Minoan system of weight, as indicated by the Linear B tablets.

size and extent of spheres of economic interest. Even more profound and fascinating, though, is the realization that we have much to learn about ancient perceptions of number and mathematical proclivities as a result of studying metrical artifacts such as balance weights. The Egyptian mind earlier on favored a decimal system for the ease of tallying it provided; the people of the Indus Valley cities in the early second millennium B.C. showed in their balance weights a distinctly binary turn of mind, which dictated that masses be consecutively doubled to produce subsequent elements. The people of the prehistoric Aegean appear to have developed a system that was more subtle than either of these, one in which several conversion factors were needed to progress from the smallest to the largest units. On the basis of the evidence currently available, both textual and artifactual, they seem to have possessed a mathematical turn of mind that was at once elegant, simple, and eminently practical.

Karl M. Petruso has been an assistant professor on the Archaeology and Classical Studies faculties at Boston University since 1978. He has published widely in professional journals on the topic of ancient metrology and its implications for economics and mathematics.

Further Reading

See especially "Marks on Some Minoan Balance Weights and Their Interpretation," *Kadmos* 17 (1978) pp. 26-42, and "Early Weights and Weighing in Egypt and the Indus Valley," *Bulletin of the Museum of Fine Arts*, Boston, 79 (1981), pp. 44-51. A complete presentation of the Aegean material by Professor Petruso is in press as a volume of the final reports of the excavations of Ayia Irini in Keos by the University of Cincinnati.

News from the Office of Public Archaeology

by Ricardo J. Elia, Director

The Office of Public Archaeology is currently conducting a number of archaeological surveys and research projects as part of the Center for Archaeological Studies. Organizations sponsoring OPA research include state and federal agencies, local historical societies, and private firms. The following OPA projects are under way at the present time.

Intensive Survey of Fort Griswold State Park

Located in Groton, Connecticut, Fort Griswold is a Revolutionary War fortification overlooking New London Harbor. On September 6, 1781, a British force under the command of Benedict Arnold made a surprise attack on American positions in the harbor area. While the main British force assaulted and burned the town of New London, a detachment of 800 men attacked Fort Griswold, which was manned by about 150 men. After a brief but fierce battle, the British troops overwhelmed the garrison. The Americans lost 88 killed and 52 wounded in a battle that turned into a massacre. Fort Griswold remained a military installation until 1903, when it became a state park. The site today includes the main fort and a river battery, including nineteenth-century gun emplacements, an 1812 hot-shot furnace, and an 1840 stone powder house.

The OPA archaeological survey of the site is being conducted for the Connecticut Office of State Parks and Recreation. The survey will include field mapping, remote sensing, documentary research, and subsurface testing to identify archaeological resources. Fritz Hemans will prepare a topographic plan of the site. Bruce Bevan, of Geosight, Inc., will conduct the remote sensing program. Douglas George, OPA research assistant for the spring semester, is studying the documentary and cartographic evidence of the site. Subsurface testing will commence in the spring. After the fieldwork

and laboratory analysis are completed, guidelines will be prepared to assist the State of Connecticut in developing management policies for the site.

MDC Water Supply Study

The OPA is currently assisting Wallace, Floyd Associates, Inc., of Boston in preparing an Environmental Impact Report of the Metropolitan District Commission's Water Supply Study. This study is exploring a variety of means of increasing the supply of water for the estimated 2.5 million people who use the MDC water system in Massachusetts. Alternatives currently under study include skimming water from the Merrimack, Millers, or Connecticut rivers; increasing water yields on existing MDC watersheds; and developing a number of water sources in local communities.

As part of this study, the OPA is evaluating the potential impacts of each alternative on archaeological and historical sites. OPA archaeologists Judy Dolan, Doug George, and Alan Strauss are conducting research for the project. Because each alternative is still in the conceptual stage, our efforts are focusing on identifying broad regional patterns in prehistoric site locations and historical settlement patterns. Once a preferred alternative has been selected by the MDC, an intensive archaeological survey will be conducted.

Survey of Contact Period Burials in Rhode Island

The Rhode Island Historical Preservation Commission recently awarded the OPA a Survey and Planning Grant to conduct a statewide study of Contact Period burial sites. Project Archaeologist Lauren Cook has been searching through town and county histories, old newspaper accounts, archaeological site files, and other documentary sources in an effort to record all reported discoveries of Indian burials of the Contact Period. Once these sources have been examined, reported burial sites will be checked in the field in order to determine their location and present condition. A management plan will be developed to assist the state in protecting these fragile and important sites.

Other Projects

An intensive archaeological survey of wastewater facilities in the town of Westfield, Massachusetts, is being conducted by Project Archaeologist Alan Strauss with the assistance of John Shea. Field testing to date has located a number of prehistoric sites in the vicinity of the project area. Additional fieldwork will be conducted in the spring. Alan and John also tested an area in Northborough, Massachusetts, that is slated for roadway construction. A preliminary walkover of the site by Ms. Brona Simon of the Massachusetts Historical Commission resulted in the surface discovery of two prehistoric flakes.

Project Archaeologist J. Cooper Wamsley, who was also OPA Research Assistant for the fall semester, recently completed an intensive archaeological survey in Oxford, Massachusetts, for the U.S. Army Corps of Engineers. Cooper is also completing a survey of Huguenot sites in Oxford under a Survey and Planning Grant from the Massachusetts Historical Commission.

Excavation Workshop

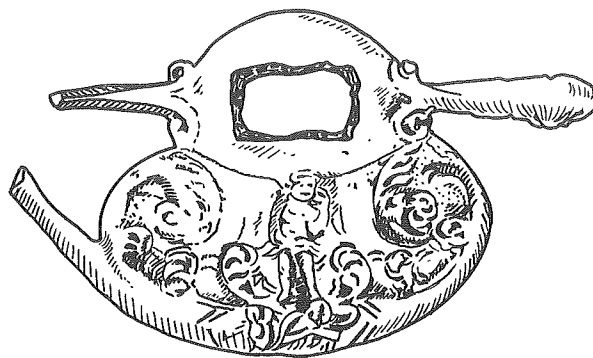
On April 28th and 29th Dr. Mary Beaudry of the Center for Archaeological Studies and Judith Dolan, a graduate student in the Department of Archaeology, will conduct a weekend excavation workshop at the site of a nineteenth-century 'Poor Farm' in Lexington, Massachusetts. Participants will be given hands-on training in excavation, identification, and recording techniques. No experience is necessary and all equipment will be provided.

The cost will be \$50 for members and \$70 for nonmembers (the latter includes membership fees). Enrollment is limited to fifteen people on a first-come, first-served basis. This course carries CEU credit and a 'Certificate of Training' will be awarded upon completion. For more information contact the Center for Archaeological Studies.

Historical Archaeology News

In January several members of the Archaeology Department attended the Society for Historical Archaeology/Conference on Underwater Archaeology 1984 annual meetings, held in Williamsburg, Virginia. Assistant Professor Mary Beaudry read a paper entitled "Old Data, New Findings: '40s Archaeology at Plymouth Reexamined" in a well-attended session on the reinterpretation of historical archaeological sites and interpretive models. She also chaired a symposium on recent archaeological work in Massachusetts. Participants in the symposium included Tamara B. Wamsley, whose paper, "Land Use in Boston Proper," described recent work by the Office of Public Archaeology and the Center for Archaeological Studies in downtown Boston; Douglas C. George, who gave a talk entitled "Reexcavating Plimoth Plantation"; and J. Cooper Wamsley, whose paper, "Indian-White Relations on the Massachusetts Frontier in New Oxford," reported on his research on a late seventeenth-century settlement of exiled Huguenots at Oxford, Massachusetts.

Boston is the meeting site for the SHA/CUA in 1985. The Center for Archaeological Studies will sponsor the conference in cooperation with the North Atlantic Region of the National Park Service, The Peabody Museum at Salem, the Massachusetts Historical Commission, the Boston Landmarks Commission, the University of Massachusetts at Boston, the Museum of Afro-American History, and other local institutions. Center members interested in attending the meetings, which will feature many presentations on New England historical and underwater archaeology as well as related exhibits and tours, should contact Prof. Beaudry, who is overall conference organizer, for further information and for details on how to become a member of the Society for Historical Archaeology.



Almost complete, highly ornate guard from an officer's short sword. Recovered from the site of Fort Christanna, Virginia (1714-1722), during the 1981 excavations directed by Assistant Professor Mary Beaudry. Drawing by Caroline Hemans.

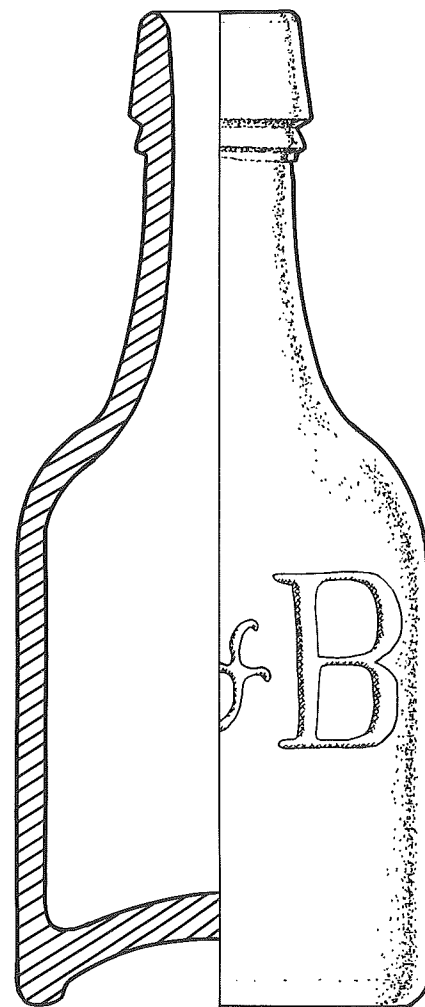


Colonial Tavern Tour

The Center for Archaeological Studies will present a Colonial Tavern Tour on May 12th. Taverns played an important formative role in Colonial America, not only in a social sense, but as a locus for political and community discussion. In many New England towns, taverns were the earliest meeting places. This is an opportunity to become familiar with this aspect of early American life.

The tour will combine an introduction to recent archaeological research on New England taverns with a visit to reconstructed colonial taverns. Beginning at 4:30 p.m., there will be a presentation at the University on recent tavern archaeology. Afterwards, the group will leave by charter bus for a tour of the Golden Ball Tavern, a reconstructed 'Tory' tavern in Weston. To cap off the evening we will then have cocktails and dinner at the Wayside Inn in Sudbury. We anticipate return to Boston by 11:00 pm.

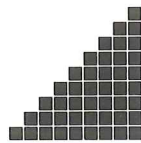
The cost, \$30 for members and \$35 for nonmembers, will cover the presentation, travel, refreshments, dinner, and musical entertainment. A cash bar will also be available.



Late nineteenth-century soda water bottle, recovered from a privy pit during excavation at the Paul Revere House. See Context 3: 1-2 (1983) pp. 5-7. Drawing by Cathy Alexander.

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CALENDAR

Tuesday, April 10

Center Lecture: Karl Butzer, Henry Schultz Professor of Environmental Archaeology, University of Chicago, "Beniali: Historical Archaeology of a Fifteenth-Century Muslim Hill Village near Valencia, Spain." See the previous issue of *Context* for details.

Thursday, April 12

Departmental Colloquium: Karl Butzer, Henry Schultz Professor of Environmental Archaeology, University of Chicago, "Floods, Alluvial History, and Urban Geo-Archaeology in Alzira, Eastern Spain."

Thursday, April 19

Departmental Colloquium: Ian Todd, Associate Professor of Classics, Brandeis University, "Recent Research in the Vasilikos Valley in Cyprus."

Weekend, April 28 and 29

Center Workshop: Mary Beaudry, Assistant Professor of Archaeology, and Judith Dolan, Graduate Student in the Department of Archaeology, will conduct an excavation workshop in Lexington, Mass. See page 11 for details.

Saturday, May 12

Center Tour: Barry Hill, Graduate Student in the Department of Archaeology, will conduct a 'Colonial Tavern Tour.' See page 11 for details.

Center Lectures are held at 7:30 p.m., room 522, at 725 Commonwealth Avenue.

Departmental Colloquia will take place at 4:00 p.m. in Room 501, 725 Commonwealth Avenue.

The Center for Archaeological Studies, which was founded at Boston University in 1980, has as its chief aim the development and coordination of interdisciplinary archaeological programs in education and research on local, national, and international levels. The Center also seeks to increase national and international awareness of the importance of understanding other cultures, and of preserving the world's cultural heritage, by involving professional archaeologists, scholars in other fields, and the general public in the activities of the Center.

Context is the newsletter of the Center for Archaeological Studies and is published quarterly. Institutions and individuals may subscribe separately to *Context* at a cost of \$10 per year. Membership to the Center is open to the public; annual dues are \$20 (\$10 for students); benefits include a subscription to *Context*, invitations to attend our fall and spring lecture series and other events, and the use of our library facilities. The Center also offers special seminars for the public during the academic year and summer field schools here in the Boston

area and abroad. Other categories of membership are: Contributing Member, \$50; Institutional, \$50; Patron, \$100; Benefactor, \$500; Corporate, \$1000; and Life Member, \$400. These categories include a subscription to the *Journal of Field Archaeology*. Please make checks payable to the Center for Archaeological Studies and send to the Center office at Boston University, 232 Bay State Road, Boston, MA 02215. Gifts to the Center are tax-deductible.

Editorial Board: James R. Wiseman, Editor-in-Chief; Creighton Gabel, Acting Editor; Frederick P. Hemans, Managing Editor.

Faculty of the Department of Archaeology: Russell Barber, Mary C. Beaudry, Ricardo J. Elia (adjunct), Creighton Gabel, Howard Kee (adjunct), Gerald K. Kelso, Fred S. Kleiner, Richard S. MacNeish, Keith Morgan (adjunct), Karl M. Petruso, James Purvis (adjunct), Edwin Wilmsen, James R. Wiseman, Paul E. Zimansky.

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