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The pottery and kiln of Green Spring: A study in 17th century material culture

James M. Smith

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THE POTTERY AND KILN OF GREEN SPRING: 
A STUDY IN 17TH CENTURY MATERIAL CULTURE

A THESIS

Presented to
The Faculty of the Department of Anthropology
The College of William and Mary in Virginia

In Partial Fulfillment
Of the Requirements for the Degree of
Master of Arts

by
James M. Smith
1981
APPROVAL SHEET

This thesis is submitted in partial fulfillment of the requirements for the degree of

Master of Arts

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Approved, February 1981

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ABSTRACT

The focus of this study is directed at the operation and production of a mid-17th century pottery kiln at the site of Green Spring in James City County, Virginia. The underlying theoretical approach used, centers on how the manufacture and usage of this pottery acted as a reflection of certain cultural adaptations made by the English in their colonization of the Tidewater region.

To achieve this end, a detailed analysis of the Green Spring's kiln and the pottery it produced was undertaken. It is shown that the kiln structure was derived from a design commonly used for the making of roofing-tiles in medieval and post-medieval England. Also the limited number of crude lead-glazed and unglazed earthenwares produced at the site is found to be directly associated with the English ceramic tradition of the rural peasantry.

The study suggests that the Green Spring's kiln and pottery provided a small but integral component in the method by which the English settled Virginia. And it is concluded that this material represented a short-lived attempt to establish a local industry, spawned by the interaction of various subsistence activities, that was ultimately unsuccessful.
THE POTTERY AND KILN OF GREEN SPRING:
A STUDY IN 17TH CENTURY MATERIAL CULTURE
INTRODUCTION

Any study of material culture, whether it be pottery, gravestones or toothbrushes, requires some conceptual hat-rack from which to hang its theoretical cap, with the hope that this will spare it from the all too common rigor mortis of the sterile descriptive account. When I first began this project, my original intention was somehow to demonstrate that the production of a small group of locally made pottery in mid-17th century Virginia represented an adaptive mechanism on the part of certain English settlers. My perspective of the colonization of Virginia was to view it as a transplanting of an established cultural entity into a new, even exotic, underpopulated environment. Due to this frontier condition, the English were forced to make adjustments in their behavioral patterns which allowed them a means of being better able to cope with a fundamentally different econiche. The development of this adaptive system would both affect and be reflected in various areas of their material culture, including the manufacture of locally made pottery at Green Spring. While I do not reject the basic thesis of this approach, it has become apparent that the application of ecological adaptation to a single, specific, small-scale, short-lived pottery, whose sole evidence consists of a rectangular kiln base and a few thousand sherd and tile fragments, is stretching the adaptive concept.
beyond its limits — much like skating on theoretically thin ice. Instead, I have found it necessary to shift away from an ecological—environmental orientation to a more culturally systemic approach, one that will perceive material culture in general and pottery in particular as an integrated part of Virginia's early frontier culture.

THE FRONTIER CONCEPT

The English colonization of Virginia in the 17th century was carried out by a fundamentally rural, agrarian society. In the early Stuart period, England's economy rested primarily on subsistence agriculture, based on the medieval pattern of extensive tracts of unsettled land, preponderance of tiny settlements in combination with pasture farming (Anderson, 1971:5-6). Braudel (1967:18) estimates that the English (and European) population during this time comprised a vast peasantry in which 80% to 95% of the people lived from the land and nothing else. "The rhythm, quality and deficiency of the harvest ordered all ... life" (1967:18). The attraction of the North American wilderness to these agrarian peoples lay in the abundance of land and the availability of a vast, technologically exploitable energy source, wood.

As used in this study, the frontier concept involves the sociocultural changes that occur in an intrusive culture, faced with a new environmental situation, as it goes about the business of colonization. In simplistic terms,
colonization takes place when a technologically superior society intrudes into areas occupied by less technologically advanced groups. These areas are usually peopled by a small, scattered indigenous population and are normally abundant in natural resources (Billington, 1967). Confronted with this new, sparsely settled environment, the intrusive culture normally undergoes a process of simplification in its social content. Its members lose a degree of complexity and specialization within a frontier setting. Sahlins and Service perceive this situation as an indicator of a basic evolutionary precept: the generalized, non-specialized culture is more "... highly efficient in dealing with an extensive, relatively open environment" (1960:52). An intrusive culture, if it is to survive and flourish, "... must exhibit a ... loss of complexity" and become more unspecialized as it adapts itself to the new series of ecological relationships imposed by the new environment (Lewis, 1975:38). The end result of this process produces a different cultural form, utilizing different material culture, from the parent entity.

The frontier is further characterized by impermanence and transience within the intrusive group. Their demographic patterns include high rates of mortality, unbalanced age and sex distribution (predominantly young males) and population growth through immigration rather than locally native born (Keeler, 1977). The transient nature of the frontier coincides with material waste and frequent
abandonment. Farming and building practices tend to be temporary and impermanent, particularly the waste of land resources through over-exploitive, mono-crop farming (Morgan, 1975). Turner considers certain processes of economic change, viewed as a succession of developmental stages, to be common to a frontier situation (1920:44). His sequence begins with fur trading (not very applicable to 17th century Virginia) and proceeds to pioneer pasture farming, small primitive farming (subsistence farming directed toward self-sufficiency), and terminates with intensive farming (surplus production exchanged for cash or goods).

The question of culture change provides one of the most important considerations in analyzing a frontier society. It signifies the gradual development of an initially unspecialized, impermanent, unstable population into a fixed stable cultural system. Robin Wells expands this point by suggesting that "... a frontier system is a dynamic social network of a particular kind which covers an extensive geographic area and which links a number of culturally diverse societies ... the dynamic nature of the frontier system is a consequence of continuous structured change which occurs throughout the system" (1973:6). In this context, Wells is defining the frontier as a systemic network of small communities rather than the thin edge of settlement. This process of cultural maturation is evident not only in the development of a stable and permanent social structure, but also in its associated material culture, as will be shown in
the next chapter.

For the purposes of this study, the central question to be addressed will focus on the systemic role of the Green Spring's pottery in its relationship to Virginia's early frontier culture and especially the socio-economic subsystem. As used here, the term socio-economic refers to both subsistence activities (those actions that are related to the production, acquisition and distribution of food resources by a specific group) and economic activities (those actions that result in the production of material goods and services through the combined interaction of a specific group with the material resources and technological base available to them [see Renfrew, 1972]). To achieve this goal, the following analysis will center on five separate areas:

1. A definition of material culture as it applies to archaeology and the study of ceramics.

2. An overview of the socio-economic conditions of Virginia's early colonial period and Berkeley's role in its development.

3. An understanding of the kiln technology utilized at Green Spring as it relates to its Anglo-European counterparts from the medieval and post-medieval periods.

4. A precise inventory of the Green Spring's pottery, including the vessel types, their method of manufacture, their probable on-site function, their
spatial distribution and their interrelationship with the English ceramic tradition of the mid-1600's.

5. A consideration of the significance of the Green Spring's pottery as an integrated part of the socio-economic conditions of early colonial Tidewater, Virginia.

THE INITIAL EXCAVATIONS

Today, the site of Green Spring forms part of the Colonial National Historical Park, located 3.5 miles north of Jamestown above Powhaton Creek (fig. 1). In its colonial context, the area was first patented by the then Royal Governor, William Berkeley, in 1643. It began as a substantial 984 acre tract and later was increased to 2,090 acres by 1661. With the construction of Berkeley's first "manor house" in the latter 1640's, the site was continuously occupied throughout the colonial period and into the 19th century (Carson, 1954).

During the winter and spring of 1954-1955, the National Park Service (NPS), under Louis Caywood's direction, excavated the first and second manor houses at Green Spring and the adjacent outbuildings, primarily related to the site's 17th century occupation. As Caywood states, the excavations "... were carried out to search the area in the vicinity of the mansion house [partially excavated in 1929 by J. Dimmick] for the remains of buildings and features and to expose the foundations of the buildings for further measurements,
and especially for elevations" (1955:5). This somewhat less than ambitious research design was more normal than not, given the time period and the NPS's perception of the fledgling field of historical archaeology.

In his site report, Caywood describes a variety of 17th century structures, including a rectangular brick base to a pottery kiln. This structure represents one of the earliest known extant potteries in English North America. The kiln was in operation near the midpoint of the 17th century and apparently was producing both coarse, flat, unglazed roofing-tiles and crudely made, red-bodied, glazed and unglazed earthenwares. Caywood claims that the "... age of the kiln is undisputed [emphasis mine] as it falls into the period of earliest occupation of the site. Pottery from the kiln was found associated in the lower strata of the earliest trash pit ..." (1955:13). Furthermore, he maintains that this "earliest occupation" spans a 20 year period, 1660 to 1680, based on the identification of English wine bottles. As will be shown later, the kiln's 20 year production time is much too long and Caywood's "undisputed" dating is approximately 10 to 15 years too late.

As a final introductory note, I should make a brief mention about the cataloguing system used for the Green Spring's material. At times, trying to work with it can be a strange and frustrating experience. The catalogue does not always differentiate between the individual features on the site and the associated artifacts recovered
from each. Such an occurrence is more common when the cata-
logue is dealing with the non-structural components, par-
ticularly trash pits. It is not unknown for a group of arti-
facts, including the locally made pottery, to be assigned a
site context composed of 4 separate, unrelated features
scattered over a large portion of the site area. Apparent-
ly, the underlying rationale of this system places a much
greater weight on the artifact types than on their con-
textual association - what they are instead of where they
were and how they were used. While this approach may serve
to help identify and quantify various material, it is woe-
fully lacking as a source for interpreting the components
of the site regarding their function and time of use. Thus,
within this study, any dating of the potter's manufacture
and any interpretation of the pottery's functional use will
be derived from other sources and not from the Green Spring
site.
CHAPTER I

MATERIAL CULTURE - DEFINING OF THINGS

Material culture today is so much a part of our everyday lives that any understanding of our relation to it can only serve better to understand ourselves and our linkages to the past. We are a society intertwined with the acquisition and pursuit of things. Studies of material culture, whether they be modern, historic or prehistoric, use material culture as both a "passive and active" indicator of attitudes, adaptations and behavior (Rathje, 1979:19). Archaeology, in whatever guise we wish to consider it, is ultimately concerned with material objects and the people who produced and utilized these objects. Rathje suggests that the single defining characteristic of archaeology should be its "... focus on the interaction between material culture and human behavior and ideas, regardless of time or space" (1979:2). For some, this represents a tiresome and outmoded concept, a resurrection of the old notion of mental template championed in the mid-century by Rouse (1939), Krieger (1944), Brew (1946), Ford (1954), Gifford (1960) and a host of others. But Rathje is not simply exhuming old concepts from the theoretical dustbin. He perceives human behavior and material culture operating in a systemic manner, an interdependency in which a change in
either sphere affects the other.

The question becomes - how should we perceive material culture? We need to establish a definition that not only does justice to the ceramics at Green Spring but one that can incorporate any and all facets of material things. Michael Schiffer (1972:157) argues that culture itself represents a behavioral system of self-regulating and interconnected subsystems, which procures and processes matter, information and energy. In this sense, self-regulating means that at least one variable is maintained within specifiable values despite the on-going changes in a cultural system's environment, the negative feedback and homeostatic concepts of cultural ecologists. This activity of procuring and processing matter, energy and information directly produces material goods (i.e., material culture). John Bennett expands Schiffer's definition through his "transformational" process (1976:23). To Bennett, the physical environment is transformed into natural resources through the intervention of human behavior. The natural resources are then forged into goods and services as needed by the cultural system. As such, material culture represents a manifestation of cultural need. It provides a function that satisfies some aspect or requirement as defined by a particular society.

Following in this same vein, Marvin Harris contends that his concept of cultural materialism "... is the strategy ... [that is] most effective ... [in understanding]
the causes of differences and similarities among societies and cultures. It is based on the simple premise that human social life is a response to the practical problems of earthly existence" (1979:ix). To which could be added that this response represents an adaptation to various environments, met in varying degrees through the intervention of material culture. The theoretical underpinning of cultural materialism is aimed at the problems of understanding the relationship among parts of the socio-cultural systems and the evolution of such relationships, parts and systems. Though Harris is more concerned with the "mode of production" than the final product (material culture), his thesis can be boiled down to the perception that how a society goes about satisfying its minimal requirements for subsistence offers the most basic insight into that society. A direct correlation exists between the mode of production in material life and the general character of the social, political and spiritual processes of life (1979:55). The production of food and other energy forms employed by a society rests on the given restrictions and opportunities provided by a specific technology interacting with a specific habitat (1979:51).

This leads us into what Rathje calls the social context of technology (1979:17). If material culture denotes the end product of cultural need, then technology represents the means to achieve this end. For our purposes,
technology equates to the tools by which a society "articulates" with its environment (White, 1949:364). It symbolizes the "... life sustaining adjustment between man and nature" (White, 1973:44). In a characteristically human (and especially American) response to problems, we have developed and relied upon technology as the final authority, the ultimate answer. From the beginning of European colonization in America, technology has been awarded a prime role in the development of our modern social system. The North American wilderness, transformed by technology, has resulted in our relative abundance, as we perceive it, today (Garretson, 1976:12).

In a more historical context, Fernand Braudel asserts that: "Everything is technology: not only man's violent exertions, but also his patient and monotonous efforts to make a mark upon the external world; not only the brisk changes we are a little too quick to label revolutions ... but also the slow improvements in processes and tools. Technology is also all those innumerable actions which certainly have no innovating significance but which are the fruits of accumulated knowledge" (1967:244).

Returning for the moment to purely material culture considerations, James Deetz offers a more traditional definition. He maintains that material culture is "... the culturally patterned data which provide the archaeologist with insights to life in the past" (1977:10). When dealing with non-modern societies, material culture becomes the
most "culturally sensitive data available" (1977:10). Further, Deetz, echoing Schiffer and Bennett, suggests that it forms that segment of man's physical environment which is knowingly shaped by him according to culturally determined plans. Here, Deetz is including anything and everything that has intercontact with man, be it pottery, houses, shrubbery, children or skywriting. These physical entities of the natural environment are transformed into material culture whenever they are modified in whatever way by human behavior (Deetz, 1967).

In a less systemic but more philosophical (and lyrical) manner, Henry Glassie views material culture as an extrasomatic or superorganic phenomenon, reminiscent of Kroeber's and White's attitude toward culture. To Glassie, "... it is both more profound and theoretically easier to read an artifact as the end product of a mental process of design, as a projection of thought rather than as an element in performance, as an expression of cognitive pattern rather than a reflection of behavioral pattern" (1977:27). Furthermore, Glassie sees material culture not as a reflection of cultural need, but as the "... materialization of a mental dynamic" (1977:27). His perception is one of structuralism, following the concepts of Chomsky's underlying structures in language and the deep-seated mental universals of Levi-Strauss. Material culture forms an alternate type of communication system, integrating the group from within and segregating the group from without. Glassie seeks to
identify the cognitive correlates of material culture, and then to record those shifts in cognition over time in order to create an "authentic" history (Glassie, 1975).

Glassie's position alludes to an early work by Braudel in which the term "material life" is used to denote the "... repeated actions, empirical processes, old methods and solutions, handed down from time immemorial ... " (Braudel, 1967:xii). In addition, Braudel contends that "... everything in the familiar setting of our present day lives can be seen to be a heritage, an ancient acquisition" (1967:212). "An order becomes established that operates down to the very depths of material life. It is inevitably self-complicating, being influenced by the propensities, the unconscious pressures, and all that is implicit in economies, societies, and civilizations [cultures] " (1967:243).

Through technology and material culture, man has created for himself an artificial environment. One of the primary functions of any material culture study is then to gauge how a society articulates with its artificial world. No longer can material culture be viewed as a passive tool of human inventiveness. It is an active component of any society with both positive and negative effects on behavior. But material culture is a double-edged tool cutting in two directions. Through its transformation of the natural environment according to the satisfaction of some cultural want, it serves the needs of a given society. It represents the physical manifestation of a group's adaptive response to a
particular ecological setting. But material culture also acts to restrict the potential exploitation of the environment by that same group. It functions as a type of cultural blinder. It limits the range of possibilities to a smaller bundle due to the patterns of cognition already ingrained into the society. As a present-day example, we utilize only certain types of architectural forms. These are usually arranged as units of squares or rectangles grouped together into larger rectangles or squares. Glassie suggests that this phenomenon is predicated upon our unconscious desire (cognitive pattern) to live and work within multiples of twelve foot squares (Glassie, 1975). By so doing, we are obviously limiting ourselves to a tiny slice of the potential architectural forms available to us. We make use of those pieces of material culture which are already integrated within the system. This process does not necessarily lead to an evolution of new material forms based on past forms, but often produces an involution or intensification of these forms. Clifford Geertz, in his study of Javanese agriculture, demonstrated how the process of involution brought about cultural stagnation in certain rice-growing societies (1968). So much of these people's energies and time had been invested in the infrastructure of rice agriculture, that it became culturally impossible for them to utilize any other subsistence options. As Deetz argues, "the relationship between the human and inanimate components of these systems is not a one-way street. Behavior is
reflected in material culture to be sure, but material culture ... is reflected in behavior as well" (1977:11). We are both master of and slave to our material culture.

The focus of the remainder of this study will be directed at the operation and production of a mid-17th century pottery kiln in James City County, Virginia. The underlying theme of the analysis will be to place the manufacture and usage of this pottery into a broader perspective – one which deals with the systemic role of the pottery as a reflection of certain adaptations made by the English in their colonization of the new and different environment of Virginia. This approach incorporates what Matson calls "ceramic ecology" (1965), the perception of the relationship between raw materials and the technology available to the potter with the use of his products in his culture (i.e., material culture). In Matson's view, "... unless ceramic studies lead to a better understanding of the cultural context in which the objects were made and used, they form a sterile record of limited worth" (1965:202).

For a pre-industrial or folk group, ceramics form part of a larger food network, interwoven into the production, preparation and storage of food. And these food habits are inseparable from a society's entire way of life. They cannot be fully understood apart from a group's natural and man-made environments, its social organization and its culture. To perceive these relationships between variables equates to Jay Anderson's foodways concept. It refers to
the "... whole interrelated system of food conceptualization, procurement, distribution, preservation, preparation and consumption shared by all members of a particular group" (Anderson, 1971:xl). A group's foodways is an intrinsic part of its culture. It is the bundle of ideas carried by the members of a group as part of their cognitive equipment. Foodways is the patterned behavior and material culture shaped by the food quest. As a conceptual tool, it offers a holistic research vehicle to the cultural complex by focusing on all aspects of a group's food habits, including its ceramic forms. Anderson equates foodways to the more general subsistence studies in cultural ecology, except that he emphasizes the food quest itself (1971:xl). This echoes the systemic approach, based on the premise that human actions of any kind are not discrete, independent components. Instead, these actions are composed of a "... complicated integration of cognitive material and behavioral elements" (Rathje, 1979:24).
CHAPTER II

THE SOCIO-ECONOMIC DEVELOPMENT OF 17TH CENTURY VIRGINIA

The emergence of Virginia as the most important Crown Colony in the 17th century rested foremost on her production of tobacco. Prior to the late 1630's, Europe's appetite for tobacco outstripped the ability of the colony to satisfy it. This period was a boom, get-rich-quick era that lasted less than 30 years. By the end of the third decade, production of tobacco had caught up to and surpassed its demand. Consequently, the market collapsed and stayed in a generally depressed state for much of the century's remainder. A profit could still be made on tobacco, but it no longer represented a sure path to wealth, or for the small farmer a comfortable livelihood. Even given this situation, the steadily increasing population of Virginia remained addicted to raising tobacco (Morgan, 1975:135-36).

The rate of growth in population during the boom era doubled between 1625 and 1629, from 1300 to 2600 (Greene and Harrington, 1932:134-55). By the time of the civil wars in England, which ended the "Great Migration" in the 1640's, the population of Virginia had reached 8000. And yet with this dramatic increase in numbers, the ability of the colony to sustain its own members through local food production was meager at best. The fundamental problem
was you could not eat tobacco. To combat this situation, legislation was passed during the 1630's and '40's which required every landowner to plant at minimum two acres of corn. This increased corn production was "undoubtedly a factor in Virginia's ability to feed her growing population" (Morgan, 1975:136). Equally important, however, was the coincidental development of pasture farming—livestock.

Both cattle and swine were well adapted to Virginia's climate, and both became significant economic factors. In 1643, the legislature enacted a fencing law, which in effect gave livestock the run of the land. A man was required to place a fence around his crops that was at least 4½ ft. high and in good repair. If these conditions were not met, then any damages that his crops incurred from someone else's livestock were unrecoverable. The law was a boon to both the increasing number and size of animal herds and to the farmer's crop (Wm. & Mary Quarterly, 1926:118).

By mid-century, every planter was also a cattleman. A large portion of the worldly goods of both affluent and "ordinary" men was bound up in their cattle. A York County inventory of 1646 declared a particular estate worth 1,380 pounds of tobacco, of which a cow, calf and young bull equalled 850 pounds of tobacco, or 65% of the estate (Morgan, 1975:133). Raising a herd of cattle supplied a means of acquiring wealth and a dependable food source, particularly the dairy products. Cattle also represented a high
return on a small initial investment. And unlike tobacco, the demand for cattle from both the local and the foreign markets remained constantly high, especially in the West Indies (Laing, 1959:143-64). As Morgan (1975:139) points out, an interesting correlation existed between the development of the cattle industry and the growth rate of immigration. The raising of cattle was not only sustaining the local population as a reliable food supply, but it was also developing into a source for economic stability.

Because of the mode of subsistence practices during the 17th century, tobacco growing and cattle raising fitted neatly together in an agrarian environment. Virginia's settlers utilized a swidden or slash-and-burn system of agriculture - a method ideally suited to forested areas. The dense vegetation cover can be quickly removed and easily converted to useable nutrients by fire. It requires a simple technological base, usually only an axe, digging stick and hoe. After an area is burned off, crops are planted between the remaining stumps without the need of a plow. A swidden system is characterized as being land extensive, labor intensive, highly productive over a short time span and tends to be small in scale. It is usually associated with a dispersed population of low density because of the long fallow time necessary to regenerate the soil structure. The cooler the climate, the longer the fallow time required. Temperate areas, such as Virginia, do not have continuous day by day build-up of the
soil structure by organic decomposition. The rate of natural regeneration is checked by the lower winter temperature (Harris, 1972:248-51). By burning the vegetation, the pH level of the soil and the calcium, potassium, phosphorous, potash and nitrogen content are increased. The immediate effects of this action serve to raise the natural soil fertility. But the long term effects produce a reduction in the organic material added to the soil. This leads to a more thorough soil depletion (particularly in a mono-crop system) and a deceleration in the recovery period (Vogl, 1969:253-54).

During the 17th century, a fallow time of 20 to 30 years was required before the land was reuseable for cultivation (Morgan, 1975:141). The ratio of fallow to cultivated land was approximately ten to one, meaning that for every acre a farmer had in production during any one year, he set aside ten acres as non-productive. Though this land had no direct agricultural value, it could still be utilized as pasture for livestock, especially cattle. The intertwined relationship of tobacco and cattle production within the same system allowed for a more complete exploitation of the environment, an adaptive adjustment on the part of the early Virginian farmer-planter to frontier conditions, though it should be noted that this inter-relationship can be maladaptive in an area of limited land supply. If prolonged grazing occurs on land within the fallow cycle, the growth of woody vegetation is retarded
which slows or stops the soil regeneration. If grazing continues unchecked, then the once forested area will be converted into grassland, thus becoming unevaluable for cultivation by swidden technology. In 17th century Virginia, this situation was not a significant factor because of the continued availability of unsettled land.

William Berkeley's role in the development of Virginia's economic base was largely limited to his unsuccessful attempts as governor to reduce the colony's dependence on the mono-crop, tobacco system through diversification. As with most of Virginia's "great" 18th century families, whose initial members first appeared about 1650, give or take 10 years, Berkeley arrived in 1642 as the appointed Royal Governor. His background for holding public office followed the not unusual pattern of second-born, dilettante-courtier (Bailyn, 1957:98). During his early governorship, he built what, for the period, was the most substantial private structure in all the English colonies at his Green Spring property (Morgan, 1975:146). At the same time he was building monuments to his newly acquired Virginian pedigree, Berkeley became an ardent supporter of the colony's right to autonomy in trade. While England went through the trauma of her civil wars, he eagerly sought free trade with the Dutch to replace the lost flow of goods from England in the 1640's and early '50's. Parliament, in an attempt to undermine any such informal arrangements, passed the first of many navigation acts (1651) which forbade all
direct trade between the colonies and any foreign power. Berkeley was forced to resign his governorship during this same year, only to be reinstated in 1660 with the Restoration of the Stuarts under Charles II (Bailyn, 1957:90-115).

Within his second term as governor, Berkeley devised a three part plan for economic diversification:

1. The development of towns capable of supporting craft industries, artisans and a stable non-agrarian population. The townspeople would provide manufactured goods to the adjacent rural areas while also serving as the consumers for the agricultural produce.

2. The development of a shipping industry based on the building and repairing of small trading vessels.

3. The free trade of surplus corn, wheat and cattle to foreign markets within the New World.

Berkeley's plan received only scant attention from the English government. In order for the economic blueprint to be put into being, the Colony required a large initial infusion of capital (Morgan, 1975:187). Without the Crown's support, Virginia's only viable means of raising the necessary funds was through the growing and selling of tobacco. The very system that Berkeley wanted to disband offered the only means toward diversification—the double bind in a classic form.

Even though the economic plan was never instituted as government policy, Berkeley did make an attempt to apply it to his own Green Spring holdings. He sought to establish a
small-scale, self-contained, self-sufficient economic sys-
tem that would operate independently of the rise and fall of
the tobacco market. To this end, silk, rice, wine, beef,
dairy goods, glass, lumber and pottery were produced at
Green Spring at one time or another during the third quarter
of the 17th century (Carson, 1954). Though the growing and
manufacturing of these commodities were, for the most part,
unsuccessful, they marked one of the first efforts to de-
velop local craft industries and a town-like settlement
outside the confines of Jamestown. But in this failure
toward economic self-reliance, Green Spring served as the
forerunner of the southern plantation system, and it be-
came the prototype for Virginia's aristocratic-planter era
which reached full bloom in the next two centuries.
CHAPTER III

MEDIEVAL AND POST-MEDIEVAL POTTERY KILNS AND THEIR RELATIONSHIP TO GREEN SPRING

The Oxford English Dictionary defines a kiln as:

"A furnace or oven for burning, baking, or drying of which various kinds are used in different industrial processes, e.g. (a) a furnace for burning a substance, as in calcining lime or making charcoal, (b) an oven or furnace for baking bricks, tiles, or clay vessels, or for melting the vitreous glaze on such vessels, (c) a building containing a furnace for drying grain, hops or for making malt" (1971:694-95).

In most instances the type of material being heated indicates the kiln's function, such as a lime kiln or pottery kiln. For our purposes, the term "kiln" will be used only in reference to ceramic kilns (brick, tile and pottery) in which heat is applied to clay objects to form hardened ceramic bodies.

Most of the following evidence for medieval and post-medieval ceramic technology comes from either excavated kiln sites or from ceramic studies. It relies most heavily on English sources. Beyond a smattering of documentary materials, very little else remains in conjunction to the "potter's art" of the period. Hodges puts this consideration in the following perspective:

"At first sight, the small number of illustrations of potters from manuscripts and other contemporary sources might suggest that during the Middle Ages the potter was held in no high regard or even despised ... On balance, in view of the relatively large number of potteries known to have been operating in Britain, which shows the potter to have been no rarity, one
cannot help feeling that he was despised and that by comparison with other craftsmen his status was a lowly one" (1974:35).

Not only was the potter himself held in low esteem, unlike the position of the local artist-craft potters of today, the entire potting industry from the 12th to the 17th centuries showed little in the way of inventiveness of forms or attempts to improve its technological base. The term "industry" is really a misnomer in dealing with this time period. Except in a few instances, pottery production was relegated to a family enterprise as a "home-made" rural activity, i.e. cottage industry (Jope, 1956). The 16th century saw the development of pottery industrialization along the German Rhine, in northern Italy, central France and on the coast of the Spanish Netherlands. This process had spread to England, particularly in London, Bristol and Staffordshire, by the latter part of the 17th century. But this industrialization did not cause the immediate extinction of the rural potter. Instead, the English pottery developed into two distinct and separate traditions: finer, mass-produced earthen and later stone tablewares were manufactured in the major production centers, directed at the consumers in the urban market while coarse earthenwares were made for local markets to satisfy the needs of the still basically rural peasantry (Stebbing, et al, 1980:6).

In dealing with the 17th century, it must be remembered that the English colonization of North America was
carried out by a fundamentally agrarian, peasant society. As used here, the concept of peasantry equates to pre-industrial, folk societies. Eric Wolf defines peasants as "... rural cultivators; that is, they raise crops and livestock in the countryside, not in greenhouses in the midst of cities or in aspidistra boxes on the windowsill ... The peasant, however, does not operate an enterprise in the economic sense, he runs a household, not a business concern" (1966:2). In the early 1600's, Stuart England embraced a total population of 4 million, of which fully 75% were totally rural and over 90% lived in either small settlements or rural isolation where "... everyone had an almost daily face-to-face relationship with his fellows" (Anderson, 1971:4). Propinquity and isolation form the basic attributes of a rural, peasant society. These qualities characterized the 10,000 small settlements of England and gave the national population what Laslett and Harrison (1963:157-84) call a dominant rurality.

The position of potters in any peasant society, whether we are dealing with historic or modern groups, is (or was) not highly esteemed. In a study of present-day Mexican potters, Foster (1965:43-61) considers their generally degraded status to be a combination of low income, a perception by the population of the potter as neither artist nor craftsman, and a social stigma attached to working with "dirt." Furthermore, Foster suggests that in a peasant setting, potters as a collective group are more conservative in the
manufacturing of their product and in their basic personality structure than are non-potters. They are extremely reluctant to try new methods and are rigidly opposed to innovations in both their vocational and personal lives. The causes of this conservatism are found in the manner by which pottery is produced - the productive process. The manufacture of pottery places a premium on the "... strict adherence to tried and proven ways as a means of avoiding economic catastrophe" (Foster, 1965:49). Because of the many technological variables (raw materials, glazes, slips, fuel and temperature), the potter's economic security rests in his ability to duplicate the materials and procedures which are the least likely to fail. This continuous and constant resistance to change in the guise of new techniques and designs produces a ceramic continuity over time and space - a factor that has become so endearing to archaeologists. The ultimate causes of change in vessel styles and forms are brought about by a change in the consumer or market demand.

Whether or not we accept Foster's hypothesis concerning peasant potters, there can be little argument concerning the conservatism and constancy found in the pottery of pre-industrial societies. And the English of the 17th century were not immune to this phenomenon. As Jope (1956:307) points out, the end of the medieval period was not marked by any significant alteration in the ceramic techniques, "... its pottery traditions have been practiced until recent times
with little change."

THE KILN AND ITS PARTS

The diagram in figure 2 illustrates the various components of a typical rectangular kiln from the historic period. It is taken from a study by Georgeanna Greer in which she describes these parts in the following manner:

"All historic periodic pottery kilns [non-continuous or intermittently fired] had at least one of the following components: a firebox or combustion chamber in which the fuel was burned; some arrangement, often in the form of formal flues, to allow the flames and heat to travel to the firing chamber; the firing chamber itself in which the ware was stacked for the 'burning'; and some arrangement for excess heat and flames to exit after they had passed through the wares. This last component might be a very informal sort of single hole [or holes] in the superior portion of the roof in updraft kilns or a sophisticated set of underfloor flues connected to a terminal chimney in down draft kilns" (1979:135).

To Greer's description there should also be added the kiln superstructure, or dome, which equates to the pot chamber's sides and roof. Greer goes on to describe rectangular kilns from the historic period:

"Rectangular kilns, square kilns, and a few oval kilns (the Frechen type of German kiln) are fired from front to back. One firebox, which occasionally may be divided by supporting arches into two or more parts, appears at the mouth of these kilns ... Within a single rectangular kiln there may be two or three sets of parallel flues originating from the single front firebox and passing through the firing chamber. These are most frequently seen in the simple updraft rectangular kilns used to fire salt-glaze stoneware after the German fashion. The flues are channels constructed at a lower level than the main floor of the firing chamber and are bridged with slightly separated brick or tile. The flues ascend toward the rear of the kiln in the earliest forms. Most of these kilns had a permanent roof when used for stonewares, though the original Roman tile kiln of this type did not ... Although this
Fig. 2 Simple updraft rectangular kiln
(Greer, 1979: 136)
is a simple updraft kiln, the flames also travel somewhat longitudinally in the sub-floor flue, then directly upward" (1979:140,142).

THE KILN AT GREEN SPRING

The present-day site of the Green Spring's kiln is situated on a small rise, approximately 160 ft. north of the standing spring house, overlooking State Route 614 (fig. 3). It is nestled in a very young secondary forest growth of hackberry, thorny locust, honeysuckle and poison ivy with accompanying Virginia fauna of ticks, chiggers, mayflies, black snakes and field mice in warm weather. Caywood describes the kiln's location in the early part of 1955 as follows:

"To the east [of the manor house] was the mount [a small knoll running parallel to the western edge of Rt. 614 and directly north of the pottery kiln] which unfortunately was not completely tested, but from my observation appeared to be entirely man-made ... In this area was the kitchen and the pottery kiln, both of which were completely excavated" (1955:6-7).

Caywood's report indicates that 2.3 ft. of fill, comprising three distinct levels, overlaid the kiln foundation at the time of excavation. The upper .3 to .5 ft. represented a plowzone/topsoil humic stratum of a 19th to 20th century context. Directly beneath this extended what Caywood terms a "sterile" yellow clay lens of .7 to .8 ft. similar to the clay used to construct the mount. It "... may have been an additional layer placed over the mount and its southern extension after the kiln was abandoned"(1:13).
Fig. 3 Site of Green Spring  
(Caywood, 1955:31)
The final level contained kiln related material, including brick rubble, flat roofing tiles with lead-glaze runs and pot scars, and lead-glazed and unglazed pottery, and measured 1.0 to 1.2 ft. in thickness. Caywood describes it as consisting of "... brick fallen from the arched roof, broken earthenware, and 'bats.' Evidence of a four-inch (.3 ft.) wide flue was noted between the arched roof and the south wall of the kiln" (13). This rubble layer rested directly on the floor of the kiln, which itself was an "... extremely hard fired soil, varying from one-half to three inches in thickness" (13).

Caywood offers no description of the kiln structure in his report or in his field notes, except to mention the "... opening, or eye [probable firebox] through which the firing material and unfired vessels had been placed, measured 4.2 ft. in length and 2.2 ft. in width" (13). Further, he estimates the "arched roof" to have stood 7 ft. above the kiln floor. Because of the absence of any more detailed description and because of the poor quality of the original photographs and drawings, this author re-excavated the kiln in the late spring and early summer of 1980 - thus his first-hand knowledge of the flora and fauna of Green Spring.

At the time of re-excavation, a 1.1 ft. thick layer of fill overlaid the kiln foundation. It consisted of an intermixture of forest humus, yellow sandy clay, barbed wire fencing, some brick rubble, clay mortar (none found
to be wedge-shaped or to have a double curvature which would give an indication as to the kiln's superstructure), pieces of flat roofing tile and a few fragments of glazed and un­glazed earthenware. The floor within the southern two-thirds of the kiln was a hard-fired clay fabric intermixed with a grayish wood ash powder. Within the remaining third and within the projecting "firebox", the clay floor was not hard-fired. This point is at odds with Caywood's assertion that the floor in 1955 was hard-fired throughout, including the firebox. Either Caywood removed the northern portion of the floor in the process of determining its depth of one-half to three inches, or the floor was disturbed when "... drainage trenches were made from the front of the kiln and from one side by removing part of the foundation" (1955:12), or the floor was not hard-fired throughout.

The kiln foundation is arranged in two parts (fig. 4), a nearly square 10.9 by 11.1 ft. area which formed the base to the firing chamber, and a smaller 3.4 by 4.0 ft. rec­tangular area along the kiln's north side which formed the projecting firebox. The interior dimensions are 8.6 by 9.1 ft. for the main body and 2.2 by 2.6 ft. for the fire­box. Within the foundation walls, zero to four courses of brick remain. The intact areas are laid up in English bond (alternating courses of headers and stretchers) and mortared together with a coarse sandy clay. The interior surfaces of a majority of bricks show extensive evidence of being very highly fired and are also covered over with
Fig. 4 Kiln foundation, Green Spring
a coarse, blistered wood ash glaze.

The walls of the main body were built to a width of $1\frac{1}{2}$ bricks wide (1.1 ft.) and the firebox to a width of 1 brick wide (.8 ft.). In elevation, the kiln floor is fairly level with only a moderate slope from north to south of .2 ft. and from east to west of less than .1 ft. Along the outer edge of the firebox, the brickwork continues between 1.2 and 1.4 ft. beyond the side walls. As indicated in fig. 4, the area enclosed by these projections contained a compacted, non-plastic, sandy yellow clay - possibly associated with Caywood's second interior level of sterile clay. Neither the firebox nor the main chamber contained visible evidence of any internal divisions or structural components.

I should mention that during the 25 year period since Green Spring was excavated, a question or two has been raised concerning whether or not Caywood had actually uncovered a kiln. Given the rectangular shape of the foundation walls, the hard-fired clay floor, the blistered and charred surface of the interior brick walls, the presence of wood ash along its base and the quantity of wasters and kiln furniture in the interior and adjacent exterior fill, there can be no doubt whatsoever that this structure functioned as a kiln. To draw any other conclusions would serve only to negate the obvious.

MEDIEVAL AND POST-MEDIEVAL KILN TYPES

The English potting tradition, prior to the last half
of the 17th century, was an outgrowth of the Romano-British period, begun in the first century A.D. Corder (1957) describes two main kiln designs, an updraught in which the heat rose vertically through the ware and a horizontal draught in which the heat was funneled horizontally through the ware before escaping through a vent or vents. Both draught types continued in use throughout the post-Roman and medieval periods, though no archaeologically proven lines of continuity have been accurately established (Musty, 1974:42). Beyond the draught system, the circular and rectangular kiln designs employed today have their antecedents within the Roman period. "Roman kilns of both types have been excavated in England and on the continent and undoubtedly influenced the potters who followed this period. The rectangular form was preferred for the burning of brick and tile and the round for the burning of pottery ... " (Greer, 1979:135-36).

The first use of rectangular kilns for pottery production appears to be a continental development. Greer mentions a 14th century rectangular pottery kiln near Bauvois, France and 16th century Germanic examples from Seigburg, Raeren, Frechen and Westerwald (1979:137). In northern Italy, Cipriano Piccolpasso published a treatise, Three Books of the Potter's Art (c.1550), in which he describes and illustrates a rectangular kiln (fig. 5) used for firing "fine pottery" - tin-enamed earthenware (in Jope, 1956:294 and Rhodes, 1968:36). On the other hand, in Great
Fig. 5 Rectangular tin-enamel kiln c.1550 from Piccolpasso (Rhodes, 1968: 36)
Britain circular kilns were used almost exclusively for the production of pottery during this time up to the 18th century (Greer, 1979:137).

An early system of kiln classification derived by E. M. Jope (1956:295) divides the medieval kiln types into two general categories: (a) Horizontal kilns in which the pots were stacked directly on the floor of the firing chamber. The kiln design was either circular or rectangular, usually with the firebox or fireboxes sunken below the level of the pot chamber. This style corresponds to the Germanic tradition along the Rhine, and to the rural groundhog kilns of the 19th and 20th centuries in this country (see Greer, 1977).

(b) Vertical kilns in which the pots were stacked directly above the firebox or fireboxes. The kiln design was predominantly round or oval. The simplest vertical kilns were built with a central platform from which loose fire bars were laid to the kiln wall. This particular design was most prominent in medieval England and the early colonial period in America (see Kelso and Chappell, 1974).

The flaws with Jope's system rest with his criterion of using only a single component, in this case the position of the firebox in relation to the floor of the pot chamber, as his sole determinant. In contrast, John Musty (1974) has developed a much more encompassing classification scheme based on excavated medieval and post-medieval kilns.
in England, including those used to produce "hollow-ware pottery and the manufacture of tiles and bricks" (1974:43). His system is not only applicable to pre-18th century kilns, but also to any updraft (as compared to downdraft) kiln design in use today. By classing the arrangement of fireboxes, Musty has devised 5 separate types (fig. 6). These include:

(a) Kilns with single fireboxes, double opposed fireboxes, or multiple fireboxes — Types 1, 2 and 3 respectively.

(b) Kilns with parallel fireboxes — Type 4, primarily tile and brick kilns.

(c) Kilns without fireboxes (i.e. clamps) — Type 5.

All the known archaeological examples of kiln Types 1, 2 and 3 are either circular or oval in shape. Type 4 kilns are usually rectangular to square with a few horseshoe-like structures also. Musty's classification will be dealt with in much greater detail within the discussion of the Green Spring's kiln itself.

A secondary means of classifying kilns is by the type of fuel source used. Brears maintains that the basic design of any historic kiln depended primarily on the fuel available to it (1971:137-38). Until the advent of petroleum and electricity, fuels belonged to either of two groups — mineral fuels, coal and peat, which produce a short hot flame, or vegetable fuels, fibrous woods which produce a long hot flame. When wood burns, the intensity
Fig. 1—Comparative plans of medieval pottery kilns of types 1-4.

Fig. 6 Medieval pottery kilns (Musty, 1974: 45)
and persistence of the flame varies according to the volume and nature of the gases formed. The more volatile and plentiful the gases produced, the hotter and longer the wood flame becomes (Shepard, 1956:215). In a kiln situation, incoming air flows through the loosely packed wood fuel and enters the kiln as an uneven mixture of long hot flames and relatively cool draughts. If this mixture should directly contact the unfired wares, they would tend to shatter from the thermal shock. To avoid this situation, wood-burning kilns normally have a separate combustion area where the air can intermix to a more uniform temperature (Brears, 1971:138). This was usually accomplished by raising the pot chamber floor, through an arrangement of either arched supports, internal splines, or central pedestals, above the firebox/combustion area (Pryor and Blockley, 1978:33). Because of the nature of the fuel, Brears claims that wood-burning kilns were most often single fireboxed of circular or oval design. The short flame fuels did not require a mixing chamber, thus the floor of the pot chamber could be on or near the same level as the firebox.

Returning to Musty's classification scheme, the Green Spring's kiln with its single firebox fits into his Type 1 category, but its rectangular design is more closely associated with Type 4. In relation to its English antecedents, the kiln incorporates two separate traditions - the combining of a rectangular pot chamber with a single heat source into a vernacular type. All of Musty's Type 1 kilns
were circular (Type 1a) or oval (Type 1b) with an adjacent sunken stoke pit leading in each case into a sub-floor firebox. His Type 4 rectangular kilns were further defined by normally having a series of 2 or more parallel fireboxes below the firing chamber. They were used primarily for brick and tile manufacture. Though as Musty points out:

"Type 4a kilns (parallel firebox pottery (?) kilns) ... are to some extent an oddity in that these contain the elements of a tile kiln plan. The type was originally postulated to provide for the inclusion of the Sussex kilns of Ringmer and Rye. These had been assumed to be wholly pot kilns and thus with a further assumption of a division between tile makers and potters, that they owed their anomalous shape to a copying by potters of brick or tile kiln structures ... The Rye kiln consisted of single flue [firebox] pot kilns built back to back with parallel flue [firebox] tile kilns" (1974:47).

The question raised by Musty in dealing with rectangular kilns of the pre-1700's period is the relationship of pottery production to tile and brick manufacture. In particular, tile manufacture was closely allied to pottery production. Salzman in 1929 observed that "... closely connected with pottery is the manufacture of tiles, the material being in each case clay, and the kiln used being practically identical" (1929:173). In his report on the Penn tileries, Hinton echoes Salzman's comment, though in a more ambiguous manner: "... the Penn tileries also illustrate another problem of any medieval industry, the failure to diversify products. Roof-tiles were made, but so far as is known, pottery was not made at Penn, although both tiles and pots were produced at many kilns"
Unfortunately, Hinton does not elaborate on his final point.

In general, English and Continental tile kilns were smaller than their brick counterparts. The only apparent limit to a brick kiln was the availability of fuel. At Deersum (Netherlands) a 13th century brick kiln had eight parallel fireboxes (or fire channels) and is estimated to have produced over 10,000 bricks at a single firing (Musty, 1974:47). In a kiln such as this, the whole length of the firebox (over 30 ft. at Deersum) would have been stoked and fired. The kiln load was supported above the fireboxes by arches springing from the spline walls. At Jamestown, 3 brick kilns have been excavated, ranging in size from 8.7 by 10.9 ft. to 19.0 by 24.5 ft. and with 2 to 5 parallel fireboxes (Cotter, 1958). In contrast, 2 tile kilns, one at Meaux, Yorkshire measuring 10 by 12 ft. and another at Bexley measuring 10 by 15 ft., each had a single central spline to support the firing chamber and divide the 2 parallel fireboxes (Eames, 1961:144 and Dale and Craiger, 1974:26). Also tile kilns at Clarendon (Eames, 1961) and Boston, Lincolnshire (Mayes, 1965) had 2 and 3 parallel fireboxes respectively.

Beyond the apparent secondary use of tile kilns for manufacturing pottery, such as found at Ringmer and possibly Rye, the only other English precedents for rectangular pottery kilns of the medieval and post-medieval periods are found in a small group of horseshoe-shaped structures.
The best recorded example of this type is a "... sub-
rectangular multi-flue [firebox] type with at least its
basal portion built of brick" located at Brill (Farley,
1979:130). Farley believes the kiln to have had 4 fire-
boxes which were wood burning. He dates it to the first
third of the 17th century. A similar example was found
at Potterspury, which had 2 fireboxes and was also wood
fired (Mayes, 1969). The earliest kiln at Lower Parrock
consisted of a funnel-shaped trench cut into the alluvial
clay. It had a single firebox without any internal struc­
tures (Freke, 1979:81).

As a means of summarizing this point, Musty contends
that:

"Thus as a general working rule it can be assumed
that the hollowware potter also produced roof furni­
ture when it was a glazed ware ... [but] the potters
may also have produced unglazed roof tiles and in
these instances the distinction between potters and
tilemakers becomes somewhat blurred as does that be­
tween pottery and tile kilns" (1974:61).

RECONSTRUCTION OF THE GREEN SPRING'S KILN

The intact brickwork of the kiln at Green Spring and
its redeposited fill offer very little positive evidence
for interpreting its above-ground structure. There were
no indications to suggest any internal construction be­
yond Caywood's questionable assertion that a single 4 inch
wide flue was present along the rear wall. Nor did the
redeposited fill contain any superstructure material, such
as wedge-shaped or double curved clay mortar or daub
fragments. And again Caywood makes no mention of any brick or clay rubble within the fill levels. Thus the questions of how the kiln was fired, how it was stacked and what its superstructure or dome was like can only be inferred by comparison to other sources. In a sense, we are dealing with two different subjects; one represents the known archaeological data - a rectangular brick substructure, and the other represents the unknown technological and functional aspects of the above ground superstructure.

Not only are kilns classed by their combination of heat sources and shape, but they are also classed by their permanence or lack of permanence in their superstructure or dome. In this regard, kilns can be divided into 4 different types:

1. Permanent dome - the kiln roof is built as a permanent brick arch. The loading of ware into the kiln is carried out through either a permanent entry into the pot chamber or through the firebox or exhaust vent.

2. Temporary dome - the superstructure is built after the ware has been loaded into the firing chamber. Most often, a temporary dome consists of clay daub applied over a wattle or wicker work of brush in an arched fashion. In an archaeological context, fragments of the clay daub would be curved on both the exterior and interior surfaces, i.e. double curvature. Freke (1979:81) describes the
kiln superstructure at Lower Parrock as fired clay with woven wattle impressions and embedded sherds and splashes of glaze.

3. Open-topped — with or without a temporary capping of tiles, sod or wasters laid across the uppermost layer of pottery. The kiln is first loaded, usually by ladder, and then covered over before or even during the firing process. In this construction, the whole kiln superstructure acts as a single vent or chimney (Musty, 1974:56, Drury and Pratt, 1975:142). In a 1970 experimental wood-firing of an open-topped kiln with a temporary covering of roof tiles and sod, Bryant achieved a sustained maximum temperature of nearly 1,000°C, or approximately 100°C greater than needed for lead-glazed ware (in Musty, 1974).

4. Clamp— the kiln superstructure is built entirely from the material being fired (pottery, tiles or bricks) with, in some cases, an outer covering of wasters or sod. Clamp kilns for pottery production have been excavated at Gislingham, Sussex and at Chilvers Coton, Warwickshire (Mayes and Thomson, 1968:208-10). They both produced coarse un-glazed earthenware. An experimental firing at Leeds has proven that it is possible to have "... successful glaze firings in a clamp kiln. With the introduction of saggars, clamp construction
was a much more simple operation and glaze firing usual. As demonstrated at Potovens, the basis of the clamp was a stack of saggars covered with broken saggars, turf, etc. Gaps left between the saggars at the base of the stacks acted as flues and the clamp would then be operated as a pseudo-multi-flue firebox kiln" (Musty, 1974:48). This technique is still used today in the production of peasant pottery, particularly in the African Sahara and Mexico (see Rhodes, 1968 and Whitaker, 1973).

In making the jump from a kiln foundation to its superstructure, certain bits of information are available for the reconstruction, making it somewhat less than a blind leap. Within a rectangular kiln such as at Green Spring, a permanent dome would have required two substantial opposing side walls to receive the outward, horizontal thrust of the vaulted roof, and in some cases to allow for a permanent doorway for the loading and unloading. Drury and Pratt (1975:144) have computed that an arched roof standing 1 meter (3.2 ft.) at its peak height would require the two side walls to be between .35 and .40 meters in thickness (1.5 ft. or 2 to 2 1/2 bricks wide). A kiln roof 2 meters at its maximum height would necessitate walls nearly .8 meters or 3 ft. thick. By applying Drury and Pratt's figures to Green Spring, the kiln walls could have supported a permanent dome of slightly less than 3 ft. in height. The interior expanse of 8.6 ft. would make a
3 ft. high arched roof technically improbable. Any greater height would cause the kiln to be structurally unsound, unless some means of exterior support were present. There was no evidence of such supports at the site, nor was there any evidence of wedge-shaped clay mortar in the fill indicating arched brickwork.

A temporary dome did not utilize this same type of massive wall buildup. But it was limited by the space needed to be spanned, particularly in a rectangular design. In the excavated examples of temporary dome types at Laverstock (Musty, 1974), Brill (Farley, 1979), Upper Heaton (Manby, 1965), Potterton (Mayes and Arie, 1966) and Lower Parrock (1979), all the kilns were circular with a maximum diameter of 12 ft. or less. To date, no rectangular kilns with a temporary dome have been reported in the available literature. Farley maintains that a rectangular design with a wattle and clay superstructure is extremely impractical for a kiln width of greater than 1 meter (1974:142). In an archaeological context, temporary domes have only been associated with fairly small circular structures.

Open-topped kilns (also known as Scove or Skotch kilns) are somewhat more difficult to interpret archaeologically. In some cases they are identified more by negative data, such as the absence of arched brickwork, heavy sidewalls or double curved clay daub, than by positive data. In an evolutionary perspective, the open-topped
design was most likely a direct outgrowth of the clamp construction. It probably predates the permanent and temporary domed styles in its development, though no conclusive evidence has thus far been found to validate this point. The advent of the technologically more efficient superstructures in Europe did not relegate the open-topped kilns to solely producing tile and brick. An English single firebox circular open-topped brick kiln at Verwood, built in 1850, continued in production until after 1920. A cart ramp, made from the wasters, extended to the top of the kiln from which the wares were loaded by ladder into the pot chamber. Prior to firing, the top of the stack was covered by a layer of wasters (Musty, 1974:54-55). Musty considers Verwood to be a "vernacular pottery" unlike the commercial potteries or their art-potting successors. As such, Verwood represents a "... long-standing craft tradition" which can be seen as the "... nearest surviving relative of those of the medieval period" (Musty, 1974:55). One necessity of open-topped kilns was to have their vessels stacked upside down for heat retention and capping purposes.

From the above evidence and from the structural remains of the kiln itself, the most plausible interpretation of the Green Spring's superstructure would be to class it as an open-topped kiln. The relative lack of thickness in the side walls negates a permanent dome construction. And the combination of the fairly large interior
expanse in conjunction with the absence of any double curved clay daub further negates a temporary dome covering. This then leaves only the open-topped construction as a logical alternative. Such an interpretation is further enhanced by the presence of a number of highly fired, flat roofing tile fragments in the rubble fill. A more detailed discussion of the tiles will be dealt with in the next section, but, for our purposes now, these tiles are considered to have served two functions within the kiln context: (a) as kiln furniture within the firing chamber clearly indicated by the lead-glaze runs on many of the fragments, and (b) as a probable covering for the kiln, laid directly on the uppermost stacks of ware. As an added factor, these tiles were identical in shape and dimension to the roofing tiles found in association with the Old Manor House. This suggests that the Green Spring's kiln initially functioned as a possible tile kiln prior to its pottery producing period - a recycling of a structure from one function to another. If so, the kiln delineates a rectangular tile design, after the English tile kilns at Meaux, Yorkshire, Clarendon, Ringmer and Rye, with a secondary and subsequently later usage for pottery production. Furthermore, tile kilns of the post-medieval period were normally rectangular brick boxes with open tops or were of a clamp design.

**KILN STACKING AND FIRING**

The following description is a generalized account of
kiln loading for the English ceramic tradition of the medieval and post-medieval periods. Unglazed earthenware vessels were most often stacked together, placed upside down so that the rim of the upper pot rested on the base of the lower pot. With lead-glazed ware, the technique became slightly more complicated. Brears maintains that:

"During the medieval period, the potter had fired his jugs in short stacks, the glazed rim of one resting against the unglazed base of the next. By this rather crude method the pots tended to stick to one another where they touched but unless the glaze was particularly tenacious they could be chipped apart fairly easily. A slightly improved method was to place 3 or 4 parting sherds (i.e., small pieces of broken pottery) between glazed surfaces, thus quite simply reducing the scarring to a minimum. Both techniques sound crude, but they represent the normal practice for placing large jugs, cisterns, bread or brewing pots in the kiln up to the early years of this century" (1971:130).

At Potterspury, the stacking technique for flatwares of fairly large size was to place the dishes on rim edge face to face and then base to base in an alternating fashion. The smaller flatwares were stacked either upright with roofing-tiles used as separators or in a vertical position. Heavily glazed hollowwares were placed in saggars to segregate one from another while the lesser glazed vessels formed both upright and inverted stacks (Mayes, 1969:69). The kiln at Laverstock contained a bottom layer of jugs still intact, standing with their rims fused to the chamber floor. Musty (1974:53) believes the whole stack was fired upside down to a height of 4 or 5 layers.

In general, if a kiln load consisted of a single type of ware, the stacking would be the same throughout. It
became more complicated when there was a variety of vessel forms and an intermixture of glazed and unglazed wares being fired at the same time. Usually saggars protected the smaller glazed pots from thermal shock and fusing to another vessel, though only a handful of sites from this period evidence saggar usage. There are some indications that the larger unglazed pots acted as saggars for the smaller glazed ware (Musty, 1974:54). By the early 17th century, clay pads or bobbs were used to separate the wares after the development of a less liquid lead glaze (Brears, 1971:132).

Dr. Robert Plot in his *Natural History of Staffordshire* (1686) gives the following description of kiln loading:

"After this is done [forming and air drying the vessels] they are carried to the OVEN, which is ordinarily above eight feet high, and about six feet wide, of a round capped form where they are placed one upon another from the bottom to the top: if they be ordinary wares, such as cylindrical butterpots etc. that they are not leaded, they are exposed to the naked fire, and so is all their flatware, though it be leaded, having only PARTINGSHARDS, i.e. thin bits of old pots put between them, to keep them from sticking together: But if they be LEADED HOLLOW-WARES, they do not expose them to the naked fire, but put them in SHRAGERS [saggars], that is, in coarse metalled pots, made of marle (not clay) of divers forms, according as their wares require, in which they put commonly three pieces of clay, called BOBBS, for the ware to stand on, to keep it from sticking to the shragers" (quoted in Mayes, 1969:70).

The actual process of placing the pots in the kiln has raised some questions in light of the kiln superstructure. In an open-topped or temporary dome, loading would have been a fairly simple process of passing the ware over the kiln wall into the firing chamber. In certain cases, such as encountered at Verwood, where the
kiln walls were somewhat higher, ladders would have been used to carry the pots into the kiln. With a permanent dome, the loading occurred through either a permanent walk-in entrance or possibly through the firebox. At the Leeds experimental firings, all the replica kilns were built with a permanent dome. In those kilns without a raised floor, the loading and unloading took place through the firebox, taking 8 hours for each activity, and accounting for 5% of the overall kiln waste. In one particular Leeds replica, the kiln was a double firebox, oval design devoid of any internal divisions. In addition to the 8 hour loading time, it took 2 to 3 hours to lay warm-up fires outside the fireboxes. These were used to drive off any residual moisture in the pots prior to the main firing. To reach the desired 950° to 1000°C needed to combine the lead ore with the silica to form a glass or glaze, the firing required 10 hours of balanced stoking at both fireboxes. The kiln was then cooled to 200°C in 4 hours and the unloading began 2 hours later. In all, from the beginning of the loading process to the completion of the unloading, it took 35 hours, 19 hours of which were spent in the firing and cooling periods. Also it should be noted that in order to keep the kiln temperature rising throughout the firing, it became necessary to rake out regularly the accumulating white ash from the hot bed before adding fresh fuel (Mayes, 1971:69).

An experimental, round, twin firebox kiln was also
fired at Laverstock. During the first hour, the internal temperature rose 50°C, after 4 hours it reached 150°C, and after 12 hours it achieved its peak of 1000°C. But at its maximum temperature, the pot chamber showed as much as a 200°C variance between its coolest and warmest areas. The magnitude of the thermal change depended mostly on the internal stacking pattern - the more tightly packed the greater the difference in maximum temperature, and conversely the less tightly packed the more even the temperature throughout. It was also noticed that during the closing down and cooling period, the amount of oxygen allowed to enter the kiln affected both the color of the clay body and the intensity of the glaze color (Musty, 1974:57).

The amount of wood fuel used to fire the experimental kilns was measured in either faggots (an indefinite volume measure of sticks and branches bundled together) or in the more accurate hundred weight (c.w.t. - 100 lbs.). At the Wattisfield firing, 60 to 100 faggots were needed to bring the temperature up to 1000°C, one faggot being burned every 5 to 15 minutes (Watson, 1968:72-5). At Boston I 40 cwt (2 tons) of wood was used (Mayes, 1961), at Boston II 9 cwt (Mayes, 1962) and at Barton 4.5 cwt (Musty, 1974). A French tile factory in 1355 used 1000 faggots of wood to fire 10 tile kilns, producing nearly 100,000 roofing tiles (Le Patourel, 1968:117). The 100 faggots per kiln figure equates to the Wattisfield figure. In all the experimental
firings, the wood that was used consisted of branches, sticks and lopings taken from any available tree or hedge. They did not use wood split or cut to a predetermined size. Rosenthal (1949:107) notes that the thermal efficiency of updraught periodic kilns was not particularly great - about 10% of the heat was absorbed by the ware and kiln furniture, an additional 40% was absorbed by the kiln, and the remaining 50% or more was lost by radiation from the kiln through conduction to the ground and by waste gases.

Once built, a kiln was not a stable structure until it had sustained at least one firing. As with any ceramic body, a certain amount of shrinkage would occur when heat was applied to it. For a kiln, this loss of volume produced cracks and other structural flaws. Thus repairs and patch-work could have been caused by a pre-firing before any pottery was even made and would not be indicative of a long kiln life (Musty, 1974:52-3). Estimates of kiln shrinkage are closely allied to the same figures for pottery. Jope (1956:299) suggests that a ceramic body loses one-eighth to one-sixth of its linear dimension.

The question of how long a particular kiln was in operation during the medieval and post-medieval periods has not been adequately addressed to date. For the Laverstock kilns, an unsubstantiated estimate has been made that each was in use for approximately 5 years (Musty, et al, 1969:92). At Potterton, Le Patourel (1968:115) calculates
the life of a 16th century multi-firebox kiln as being 10 years. In contrast, Freke discounts any absolute estimates of age. For the site of Lower Parrock, he contends that:

"The potter may have remade his kiln or moved on for reasons which were independent of the serviceability of his kiln. Unlike the Laverstock pottery industry, where such variables as clay sources, accessibility of markets, continuity of labour, and techniques were all more or less standardized, we may assume that at Lower Parrock some of these factors were at an experimental stage. Five years for the life of one kiln may be an over-estimate under such conditions, especially as the enterprise did not form the basis for a more extensive industry" (Freke, 1979:83).

What Freke is implying is that in certain regions where pottery production was not highly developed or was not a traditional industry, we should not expect the kiln life to be very great. Without the attendant infrastructure that builds up within an industrial region over time, the components of a single marginal production source are apt to be less well maintained and more easily neglected and abandoned. In this situation, there does not exist the same magnitude of social and economic investment on the part of a particular group. As will be shown later, the production of pottery at Green Spring was definitely a secondary, marginal pursuit of very limited duration. This point is in direct contrast to Caywood's claim of a production period of 20 years (1955:13). The kiln life for Green Spring was much less, possibly no more than a few years. This factor is based primarily on the limited amount of pottery found at this site, both kiln waste and
domestic usage, and at the only other known site to have Green Spring pottery, Governor's Land.

The method of firing the Green Spring's kiln is not very clear. From the available evidence and comparative examples, the projecting brickwork along the kiln's north side served as the single firebox. As previously mentioned, wood-fired kilns normally contained a mixing chamber below the pot floor. This allowed the long hot wood flame to combine with the cooler draught, thus reducing the likelihood of thermal shock to the pottery. At Green Spring, no evidence was present of any internal supports, such as a central spline or arches, which could have carried the firing floor. The sole exception to this is Caywood's mention of a single 4 inch wide flue along the rear wall. If Caywood is correct in his identification, then it is logical to assume that the interior area contained a series of flues, spaced between the floor supports. Invariably in rectangular kilns, these supports were built as arches with a perforated firing floor above the combustion area (Jope, 1956:296). This arrangement was the same for both tile and pottery kilns. But the absence of any other evidence, beyond Caywood's description, makes this interpretation highly suspect.

If the kiln did not have a raised floor, then the only other choice available would be to have the pottery (and tile) stacked directly on the ground at firebox level. In this system, the way in which the ware was
stacked would determine the internal flue design for each firing, similar to the construction of clamp kilns, except at Green Spring there was an external brick body. On many of the lead-glazed large storage jars, fragments of coarse sandy clay are fused to their rims, suggesting that the storage jars were placed upside down directly on the kiln's ground floor. These jars could have either provided the base to a continuing pottery stack, or they could have formed the supports to a temporary firing floor of loosely laid tiles.
CHAPTER IV
THE ENGLISH CERAMIC TRADITION AND THE POTTERY AT GREEN SPRING

Before discussing the pottery made at Green Spring, we need first to clarify its association to the English ceramic tradition and to gain some idea as to its derivation. By the 17th century, the English potting industry was going through a period of dual development. It had begun to split irrevocably into two spheres with the development of the large-scale urban potteries at London, Bristol and Staffordshire in contrast to the continuation of the small-scale rural vernacular potteries of the agricultural districts. The urban manufacturers sought new innovations in technology, techniques, materials and forms to provide to their ever-expanding market. At this same time, the agrarian potters remained steadfast to the production of a very limited number of forms rooted in the medieval tradition. On the one hand, there was the formation of an industry based on market demands (capitalism) and, on the other, we see a continuity of the rural, peasant craft tradition.

Brears (1979) views the 16th and 17th centuries as a time of increased and improved technology within the urban potteries of the English Midlands. This period marked the introduction of a wider range of vessel types, particularly chamber pots, drinking vessels and "... finely thrown red-ware cups" (1971:18). Such forms as these anticipated the
transformation from communally-used to more individually-used vessels, characteristic of the later Georgian age (Deetz, 1978). In contrast, the rural potteries continued to manufacture the same medieval forms utilizing the same technological base. Even by the late 17th century, they were still displaying the characteristic lack of innovation and conservatism (Farley, 1979:137) that epitomizes their modern-day peasant counterparts (Foster, 1965). Their meager production inventory centered on a limited range of earthenware vessel types. Jugs, cooking pots and storage jars provided, by a large margin, the major part of their output (Hodges, 1974:36).

A description of the vernacular pottery from the Oxfordshire area is presented in the following observations by Stebbing, Rhodes and Mellor (1980:5):

"By the early 16th century the medieval jug had virtually disappeared and with it the lavish use of mottled green glaze. The principal wares were large, high-fired jars for storage of dried goods and jars with bung-holes used for beer or cider making ... Pitchers were similar in shape to the jars but had flat strap handles. Large flanged bowls were also popular and may have been used for washing clothes, kneading dough or in cooking. Watering pots with perforated bases appeared, suggesting that an interest in horticulture was emerging amongst ordinary people; these have been found in excavations at Abingdon and Oxford. These 16th century wares for use in the dairy, kitchen, brewhouse, and garden, rather than fine tablewares, form the basis of the post-medieval country pottery industry."

Much of the tablewares, primarily plates and shallow bowls, of the peasant farmer continued to be provided by wood and pewter well into the 17th century. The demand for pottery in the rural regions was limited more to those
vessels concerned with the collecting, preparation and storage of foodstuffs rather than the consumption of food. Within the post-medieval period, rural pottery had the "... fundamental character of medieval European pottery. Made by peasants ... for the use of peasants ... Equally, colour and texture should be judged more as the accidental interrelationship of body, glaze and firing conditions rather than as a deliberately aimed-for result on the part of the potter" (Hodges, 1974:38). The pottery was also a mirror for the local physical surroundings; if the local clay was of poor quality, then the ware was of an equally poor quality, and, if fuel was scarce, then the pottery, no matter its quality, became more expensive (Brears, 1971:40). At the other end of the spectrum, the urban potteries were producing a more uniform product industry-wide, regardless of their immediate locale. Their access to a variety of clay and fuel resources assured a greater standardization of quality in their wares.

Not only are we dealing with two separate potting traditions in 17th century England, we are also beginning to see the emergence or onset of two distinct patterns of cognition that existed between the urban and rural spheres. In this sense, the pottery represented more than a technological enterprise of shaping, glazing and firing clay. It was also an indicator of an adaptive way of life that clearly defined the differences in perception between town and country existence. The urban dweller of the 17th
century was moving rapidly toward a fundamental change in his outlook, one that attached greater significance to individualism, privacy, artificiality and symmetry. His agrarian counterpart continued to live and subsist within a more communal, organic, medieval world that was dominated by nature and its seasonal change (Braudel, 1967). As will be shown shortly, there is little doubt from which cognitive pattern the pottery at Green Spring was derived – namely, the rural, vernacular tradition.

TECHNICAL ASPECTS OF POTTERY MANUFACTURE

The physical and chemical changes that occur when clay is fired are based mostly on the interaction of the thermal characteristics of water, silica and organic material. As the clay is formed into vessels and fired, it undergoes three distinct changes:

(a) Dehydration - This process begins as soon as the vessel is formed and allowed to air dry to a leather-hard state prior to firing. Once in the kiln, the clay loses its plasticity while becoming more porous as heat is applied. The residual moisture in the crystalline structure is driven off completely when the clay temperature has reached between 570°C and 600°C. At this point, the crystal lattice breaks down causing an irreversible physical change in the vessel from a clay to ceramic fabric.

(b) Oxidation - Unlike the physical process of dehydration, oxidation is a chemical change. It occurs within
a broad temperature range (225°C to 800°C), and chiefly affects the organic (carbon) and iron compounds in the clay. Depending on the individual chemical properties, these compounds, at the proper temperature, are altered to a gaseous state and released as carbon monoxides and dioxides. The change that produces a gas from a solid also adds more heat to the clay or ceramic body, thus facilitating the firing process.

(c) Vitrification - As the kiln temperature reaches the 950°C to 1250°C range, the vessel's crystal lattice becomes fully collapsed and results in a solid, dense body (stoneware) that is impervious to liquids (Shepard, 1957: 20-21).

The change in the clay structure, that occurs prior to the 600°C mark, is also accompanied by an expansion of the silica particles into the space previously taken by the water and the organic and iron compounds. The buildup of the kiln's temperature to this point is extremely critical in the firing process. It must occur at a very gradual rate of increase which allows the water vapor and other gases to be released at a relatively slow rate. If not, the gases will escape too quickly from the clay, ultimately causing the pot to crack or, in cases of severe thermal shock, to explode. Above 600°C, the rate of firing is less critical. Once the maximum temperature has been reached, the kiln is sealed off or closed down and allowed to cool gradually. As the vessel temperature drops to
570° C to 580° C, the heat-expanded silica contracts to a dimension 1/8th to 1/6th less than its original size. If the cooling is too rapid at this point, the contraction rate can once again cause the pottery to crack from the thermal shock (Jope, 1956:299).

PROCESSING THE RAW MATERIALS

A general method of acquiring clay in the 16th and 17th centuries consisted of digging a 3 to 4 ft. deep pit in a clay deposit, known as a cupper. After being dug, the clay was placed in a trough with water to soften it and beaten with a paddle or long spatula to make it more uniform. Once the clay was moistened or dried to the desired consistency, it then went through a process of wedging in which the clay was first cut into slabs to remove stones, sticks and other inclusions and then kneaded to remove any air. At this point, the clay was ready to be thrown on a wheel or molded into bricks, tiles, etc. The formed pottery would then be air-dried and later glazed, if desired, prior to firing (Brears, 1968:8). Some potters of the period would use a clay or pug mill instead of the mixing trough. They would first dry the clay, grind it to a powder, remove any unwanted inclusions and mix it with water to the proper consistency. This produced a more uniform ware of a higher quality (Watkins, 1951).

During the medieval period, a large percentage of the pottery was not glazed, especially the cooking vessels
But by the close of the medieval and into the post-medieval era, lead glaze was used extensively on the interiors of liquid containers and storage pots. After the decline of Roman influence in northern Europe, its usage as a flux for glaze disappeared until about 900 A.D. By the 12th century, the availability of lead glaze had spread throughout Germany, Netherlands, Belgium, France and England (de Bouard, 1974).

A glaze as used here means a "... glassy coating melted in place on a ceramic body, non-porous, and of a desired color or texture" (Rhodes, 1957:56). Further, "... it is known that all glazes have as their principal ingredient a mineral oxide which, in medieval and post-medieval times, seems generally to have been silica; lead only comes in as a flux and as a stabilizer of the glass structure" (de Bouard, 1974:74). Rhodes states that lead "... is the most useful and dependable melting flux in the lower and middle ranges of temperature" (1957:66-67). Its advantages are a low melting point (900°C or even less), a smooth, bright, blemish-free glaze surface and a low coefficient of expansion. Its disadvantages include its need to be fired in an oxidizing atmosphere to prevent blackening, its tendency to blister when contact is made with fire and its vaporization at temperatures near 1200°C (Rhodes, 1957:67). The lead in combination with the silica forms a clear, transparent glass. Up to the 18th century, it was colored by adding 3 different metal oxides:
copper to produce a green glaze, iron to produce a light to dark brown glaze and magnesium to produce a dark purplish brown to black glaze. In clays with a high iron (ferruginous) content, a variable brown glaze was achieved without adding any other material (Rackham, 1961:7).

In a 12th or 13th century treatise, De Coloribus et Artibus Romanorum, the author, Eraclitus, describes the earliest known recipe for lead-glazed pottery:

"But if you wish to lead-glaze the pot, take some wheat flour, boil it in a pan with water, then let it cool and cover the whole of the surface of the pot with it. Then take some lead well solutum (divided?). However, if you want to obtain a green colour, take some copper, or better still, some brass, and mix it in a pot; when it is molten stir it by turning with your hands in the pot until a powder is produced, and mix this with 6 parts of brass filings. When the pot has been dampened with water and flour sprinkle it immediately with lead, i.e. with the filings mentioned above. If you want a yellow glaze sprinkle the pot with pure lead without brass filings. Then place this pot in a bigger pot and put it into the kiln so that it will become more brilliant and beautiful, but in a slow heat, not too much or too little" (quoted in de Bouard, 1974:69).

The application of flour paste as a "siccative" (Musty, 1974) or bonding agent for the powdered lead continued to be used well into the 19th century. At Chatel-la-Lune in Normandy, potters were still dipping their wares into boiled flour as late as the 1880's (de Bouard, 1974). The Centre of Medieval Archaeological Research used the Eraclian recipe in a series of experimental firings. They found that the wheat paste had burned off completely by the time the reaction temperature (approximately 920°C, at which point the lead and silica combine to form the glaze)
had been reached, leaving no residue on the clay or in the glaze (Drury and Pratt, 1975:140-41).

Other methods of applying lead to the pottery included dipping the whole pot in, or sluicing the interior of the pot with a solution of water and galena (lead sulphide) as described by Piccolpasso in the mid-16th century (Rhodes, 1968). Dr. Plot mentions in his Natural History of Staffordshire (1686) that the galena was "... beaten into dust, finely sifted, and strewn upon them [the pottery] which gives them glass, but not the colour" (quoted in Brears, 1971:125). The normal practice was to place the powdered lead into a cloth bag and sprinkle it on the partially air-dried pots. Brears suggests that this "crude" technique of applying the powdered galena had one major disadvantage; only the upper surfaces of each vessel were glazed, the other parts were left completely raw. He contends that "... this patchiness makes it easy to tell if a pot has been glazed in this way ... " (1971:125).

A final technique of lead-glazing involved a more complicated procedure. The initial step was to make a soda-lead silicate glass from the lead oxide powder. This glass or frit was then ground into a powder and applied to the pottery as a slurry with water (Drury and Pratt, 1975:140). By fritting the lead first, a more even glaze was produced on the ware and, according to Rhodes (1975:67), this process made the lead insoluble to acid-based liquids. More recent studies have shown that fritting does not necessarily
preclude lead poisoning (Waldron, 1979:120-21), though the lead in the glaze becomes less soluble the nearer its firing temperature approaches 1200°C. To date, there has been no archaeological evidence to indicate the use of any frit kilns from the medieval and post-medieval periods in Europe or North America (Haslam, 1975:167).

THE GREEN SPRING'S POTTERY

Like many of the vernacular potteries of 17th century England, the kiln at Green Spring was producing a very limited number of red-bodied, glazed and unglazed earthenwares, unglazed, flat, roofing-tiles and unglazed pan-tiles. The vessel and tile fabric in all cases contained a relatively large amount of silica, resulting in a coarse, gritty ceramic body. Due to the clay's sand content and the many organic inclusions, it is probable that the clay source was within the immediate vicinity, possibly on the site itself. Beyond the silica and bits of organic debris, no other inclusions are apparent.

The various fragments of the Green Spring's pottery denote a broad temperature range without any regard to the different vessel types. They vary from an extremely low-fired earthenware body in which the lead glaze has not fully fluxed to an over-fired, blackened vitrified body in which the lead glaze has completely volatilized. This suggests that a wide temperature fluctuation existed during firing of the lead-glazed ware, ranging from a minimum
of less than 900°C to a maximum of over 1200°C. Obviously, controlling the heat within the kiln must have presented some problems to the potter.

The colors of the clay bodies do not vary greatly. They range from a light red to a full brick-red for the earthenwares and are a consistent gray for the few accidental vitrified fragments. The causes of the color are determined by two factors: (1) the composition of the clay, and (2) the atmosphere, temperature and duration of the firing. Shepard observes that the "... amount, particle size, and distribution of iron oxide, together with the characteristics of the clay, determine primarily whether a clay will be white, buff, or red when it is fired to a condition of full oxidation" (1956:103). She further states that "... although color is sometimes taken as a basis for judging the percentage of ferric oxide in a clay, it is at best a rough and at times a misleading indicator because particle size and distribution of the iron oxide and particle size of the clay have a considerable influence on color" (1956:103). In a fully oxidized atmosphere (oxygen is in a greater supply than needed for combustion), the clay colors are clear throughout the cross-section of the vessel wall. In a reduced atmosphere, the clay becomes gray in color. Based on Shepard's analysis, it is most apparent that the earthenwares (hollowwares and tiles) produced at Green Spring were fired in a fully oxidized atmosphere. Such a consideration is
certainly in keeping with open-topped kiln designs. The atmosphere conditions for the over-fired, vitrified fragments are less easily determined — either the clay itself turns to a gray body at stoneware temperatures or the causes of the over-firing were interrelated with a reduced atmosphere.

The following vessel typology is derived solely from an analysis of the locally made pottery excavated at Green Spring during 1954 and 1955. It combines together the material recovered from the kiln (wasters) with the material recovered from the remainder of the site (useable vessels). The use of rim, base and handle fragments to determine the maximum vessel count per type is not meant as an absolute figure. Instead, the count is intended to indicate relative vessel numbers in comparison to the other vessel types as suggested by Freke and Craddock (1979). Also, the use of stippling within the artifact drawings indicates un-glazed areas on the various vessels, and conversely the lack of stippling indicates areas of lead glaze.

THE GREEN SPRING TYPOLOGY

1. Large Storage Jar (fig. 7)
   a. Vessel description: The large storage jars represent the most crudely executed form of all the hollowwares made at Green Spring. The body shape is a wide, slightly bulbous type with a normally thick base and a thinner,
Fig. 7 Large storage jar (composite), Green Spring  
Scale: 2/3
partially everted rim. Twin eared handles are attached with a 3 thumb impression design on opposing sides at mid-body above a 4 cordonning line decoration. The rim interior is partially glazed in almost all instances and a few vessels are fully glazed on the interior. Except for unintentional lead runs during firing, the exterior is devoid of any glazing.

b. Total sherd weight: 162.30 lbs.
c. Total sherd count: 511
d. Maximum vessel count by rims: 35
e. Maximum vessel count by handles: 25
f. Vessel height: 1.20 ft. average
g. Rim diameter: .60 to .70 ft.
h. Base diameter: .70 to .80 ft.
i. Kiln firing: From the presence of lead runs and pot scars on the exterior of the bases and from particles of sand and clay attached to the rims, the large storage jars were fired in either inverted stacks with smaller pots placed inside (thus serving as saggers) or as the inverted base support for stacks of smaller vessels.

The sherd weight and sherd count for the large storage jars account for $\frac{1}{2}$ the total weight and $\frac{1}{3}$ the identifiable number of the locally made vessels recovered from Green Spring.
2. Small Storage Jar (fig. 8)

a. Vessel description: In shape and quality of execution, the small storage jar is quite similar to its larger counterpart, except it lacks handles and is approximately 1/3 the volume. The body is slightly bulbous with a series of four cordoning marks at mid-body, a partially everted rim, and in a few cases knife-trimming scars along the base and side walls. The vessel interiors are glazed throughout, ranging from a light brown to black and a few fragments show the presence of copper filings, while the exteriors lack glazing except for accidental lead runs. Some pitting of the glaze is evident, caused by a chemical incompatibility between the powdered lead oxide and the clay body (Drury and Pratt, 1975:140).

b. Total sherd weight: 27.15 lbs.

c. Total sherd count: 146

d. Maximum vessel count by rims: 20

e. Maximum vessel count by bases: 33

f. Vessel height: .72 ft. - only 1 example of rim to base

g. Rim diameters: .60 ft. average

h. Base diameters: .45 ft. average

i. Kiln firing: As indicated by the lead runs and rim pot scars on the exterior base fragments,
Fig. 8 Small storage jar, Green Spring
Scale: 5/7
the pots were fired in inverted stacks, rim on base.

2a. Planting pot, strainer or cider pot (not shown)

The evidence for this classification consists of one lone base fragment, similar in shape to a small storage jar, with a single hole (.05 ft. diameter) punched into the lower portion of the side wall. Neither the interior nor exterior was glazed. A similar example, identified as a planting pot, was excavated from the Custis site in Williamsburg (Noël Hume, 1974:49). The vessel could also have functioned as a strainer (Pryor and Blockley, 1978:64) or as a cider pot, the hole (known as a bung hole) having been fitted with a wooden tap or cork (Brears, 1971).

3. Pancheons (figs. 9 and 10)

a. Vessel description: Pancheons, or large bowls, are characterized by outsloping side walls, fully everted rims and either a thick footed ring base (fig. 9) or an equally thick flat base similar to the storage jar design. All the vessel fragments contain an interior lead glaze varying from light brown to a green-brown (copper filings) to a full black (from either magnesium oxide or more likely accidental contact in the kiln with smoke or excessive heat). The exterior areas of the
Fig. 9  Pancheon, ring-base (composite), Green Spring
Scale: 2/3
bases and side walls show evidence of having been tool-trimmed on the wheel after air drying, producing heavily striated scars devoid of glaze. Also, in many cases, the interior portion along the base has extremely heavy potting rings.

b. Total sherd weight: 59.90 lbs.
c. Total sherd count: 398
d. Maximum vessel count by rims: 81
e. Maximum vessel count by bases: 40 foot-ring bases
   7 flat bottomed bases
f. Vessel height: .30 to .40 ft.
g. Rim diameters: 1.00 to 1.32 ft.
h. Base diameters: .40 to .52 - foot-ring bases
   .50 - flat bottomed bases
i. Kiln firing: The pancheons were fired in horizontal stacks laid with the rim edge of one bowl resting against the exterior mid-body of the next.

Although the sherd weight and count rank second to the large storage jars in number, the total vessel count (between 47 and 81 depending on the base or rim determination) indicates that the pancheons were the most commonly made and used form at Green Spring.

3a. Colander (not shown)

The colander or strainer does not represent a separate form, though it did serve a separate
function. The 5 identifiable vessels are simply footed pancheons with a series of variable sized holes (.01 to .02 ft.) punched through the bases and lower side walls. In all, only 9 fragments were recovered during excavation, weighing 1.50 lbs. total.

4. Chamber pot (fig. 11)

a. Vessel description: The semi-globular chamber pot-like form has a fully everted rim, a single strap handle extending from rim to mid-body with or without the characteristic 3 thumb impressions at the point of attachment, or the 3 to 4 cordonning mark series around the mid-section. All the vessel fragments display an interior lead glaze, colored by the addition of copper filings and resulting in a light to dark greenish brown glaze with some pitting evident. The bases are flat bottomed, extremely thick for the vessel size (particularly at the juncture of the side wall) and poorly executed. The exterior treatment suffers from an excess of finger impressions and irregularities caused by the presence of organic material in the raw clay prior to firing.

b. Total sherd weight: 4.40 lbs.

c. Total sherd count: 32

d. Maximum vessel count by rims: 10
Fig. 11 Chamber pot (composite), Green Spring
Scale: 1
e. Maximum vessel count by handles: 7
f. Maximum vessel count by bases: 2
g. Vessel height: .40 to .50 ft., no single example from rim to base
h. Rim diameters: .42 to .45 ft.
i. Base diameters: .45 ft.
j. Kiln firing: Apparently the chamber pots were stacked vertically in the kiln in alternating fashion of rim to rim and base to base. Pot scars are evident on the rim fragments along with particles of sand and grit, and on 1 of the 2 identifiable base fragments a portion of a second base has been fused to it from excessive lead runs.

One of the earliest known sources for chamber or stool pots in Europe occurs in a 1557 engraving, "Indolence," by Pieter Breughel the Elder. By the middle of the 17th century in England, chamber pots had become a common place item (Brears, 1971:28). Their presence at Green Spring is somewhat unusual, but certainly not unique given their acceptance and use in the mother country.

5. Small Bowl (fig. 12)
a. Vessel description: Shaped in an undecorated hemispherical form, the small bowls have a thin straight rim, slightly pedestaled, convex base [particularly characteristic of medieval cooking vessels (Jope, 1956:290)] ,
Fig. 12 Small bowl, Green Spring
Scale: 1
and a single small strap handle. All the fragments show some evidence of lead-glazing on their interiors and the expected absence of it on their exteriors.

b. Total sherd weight: 2.00 lbs.
c. Total sherd count: 17
d. Maximum vessel count by rims: 7
e. Maximum vessel count by handles: 6
f. Maximum vessel count by bases: 5
g. Vessel height: .21 to .25 ft.
h. Rim diameters: .45 ft. average
i. Base diameters: .23 to .27 ft.
j. Kiln firing: No external evidence is present to indicate the stacking configuration.

There is some question concerning whether or not these small bowl forms were made at Green Spring. Their tentative assignment to the Green Spring inventory is based primarily on the poor quality of the bowls including some obvious firing difficulties. In one example, the interior lead glaze had completely vaporized, leaving a highly irregular, pitted surface on an over-fired stoneware body.

6. Pipkin (not shown)

The sole evidence for pipkins having been produced at Green Spring stems from 1 short, straight handle-rim fragment (the handle extends from the rim at an approximate 45° angle), 1 base fragment with 3 scars from the detached feet and
8 detached foot fragments. The handle measures .18 ft. in length and the feet vary between .12 and .18 ft. in length. When added together, the total weight of the 10 fragments comes to less than 1 lb. (.75 lbs.).

7. Pitcher (fig. 13)

a. Vessel description: The pitcher illustrated in fig. 13 is questionable as to its Green Spring's affiliation. It not only represents a high form of craftsmanship in its execution (certainly a trait uncharacteristic of Green Spring's pottery), but it also is the only example with an intentionally applied exterior as well as interior glaze. The body follows the classic medieval shape: a pedestaled convex base, bulbous mid-section, straight sided neck, a slightly everted rim with a lower projecting lip and a single strap handle. The attachment area of the handle base to the body displays the diagnostic 3 thumb impressions, but the normal 3 to 4 cordonning marks near the handle juncture are absent.

b. Total sherd weight: 9.4 lbs.

c. Total sherd count: 39

d. Maximum vessel count by rims: 4, tentatively identified

e. Maximum vessel count by bases: 9
Fig. 13 Pitcher, Green Spring
Scale: 2/3
f. Vessel height: estimated .85 ft., no single example complete from rim to base

g. Rim diameters: .30 ft.

h. Base diameters: .20 to .37 ft.

i. Kiln firing: The presence of a rim scar and lead runs on 1 base suggests the pitchers may have been fired in an inverted stack.

8. Sugar Cone (fig. 14)

a. Vessel description: Of the 8 different vessel types made at Green Spring, the sugar cone was the only one totally unglazed. The body is formed as an open-ended elongated cone, having an extremely thick, wide hollow rim and a very narrow squat base (similar to the rim of a glass case bottle) directly above a constricted shoulder. The vessel exterior was crudely executed, particularly along the rim areas, where finger impressions, organic inclusions and rudimentary, unrefined knife-trimming are common. On the interior, deep vertical gouge marks scar the entire inner surface between the rim and the shoulder in a highly irregular fashion.

b. Total sherd weight: 31.10 lbs.

c. Total sherd count: 81

d. Maximum vessel count by rims: 15

e. Maximum vessel count by bases: 5
Fig. 14
Sugar cone,
Green Spring
Scale: 5/9.
f. Vessel height: estimated 1.50 to 1.75 ft., no single example complete from rim to base


g. Rim diameters: .75 to .83 ft.


h. Base diameters: .13 to .14 ft. with an interior diameter of .06 ft.


i. Kiln firing: No evidence on the vessel fragments to indicate the stacking configuration.

The sugar cone form represents the only identifiable locally made pottery that was produced specifically for an industrial function. In processing sugar, these cones were used as molds. Sugar syrup was poured into the cone and allowed to crystallize as it cooled. A string was tied through the hole in the base to prevent the syrup from dripping out and to facilitate storage after crystallization (see Diderot, Vol. 1, Oeconomie Rustique, Suererie, Pl. 3 & 4). Examples of this type have been excavated at a mid-17th century kiln site in Woolwich, England (Pryor and Blockley, 1978:62).

I should mention that a second, less likely interpretation for this form has also been suggested, namely an earthen bell jar which could have been used either to protect seedlings from frost and/or to shield certain types of plants from the sun (Sheridan, 1980: personal communications).

Beyond the fact that Berkeley was known to have established a short-lived greenhouse and nursery, no known historical precedents exist from the 17th century for a ceramic cone of this design serving such a function.

The chart listed on the following page (Table 1)
summarizes the quantifiable data for the 8 primary vessel forms made at Green Spring. The table is arranged in a numerically descending order, excluding the unidentifiable body fragments.

Table 1: Green Spring Typology

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Total Sherd Weight (lbs.)</th>
<th>Total Sherd Count</th>
<th>Maximum Vessel No.</th>
<th>Minimum Vessel No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large storage jar</td>
<td>162.30(48.8%)</td>
<td>511(28.5%)</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Pancheon</td>
<td>59.90(18.4%)</td>
<td>407(22.7%)</td>
<td>81</td>
<td>47</td>
</tr>
<tr>
<td>Small storage jar</td>
<td>27.15(8.3%)</td>
<td>147(8.2%)</td>
<td>33</td>
<td>20</td>
</tr>
<tr>
<td>Sugar cone</td>
<td>31.10(9.5%)</td>
<td>81(4.5%)</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Pitcher</td>
<td>9.40(2.9%)</td>
<td>39(2.2%)</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Chamber pot</td>
<td>4.40(1.3%)</td>
<td>32(1.8%)</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Small bowl</td>
<td>2.00(0.6%)</td>
<td>17(1.0%)</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Pipkin</td>
<td>0.75(0.2%)</td>
<td>10(0.6%)</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Unidentifiable forms</td>
<td>27.50(8.4%)</td>
<td>543(30.6%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>326.50</td>
<td>1792</td>
<td>193</td>
<td>109</td>
</tr>
</tbody>
</table>

9. Kiln Furniture (not shown)

The primary kiln furniture (props and separators) used at Green Spring was mainly comprised of flat roofing-tiles, identical in dimension and shape to the roofing material associated with the first manor house. In size, the tiles measure .81 ft. long, .53 ft. wide and .05 ft. thick, with a projecting lug along the upper edge in most cases.
One of the unusual aspects of the tiles from both the kiln and house areas involves the presence or absence of peg holes. In those tiles with lugs, the peg holes are absent and, conversely, tiles with peg holes lack lugs. All the kiln related tiles contained lugs, while those associated with the manor house showed an intermixture of both types.

The flat roofing-tile fragments recovered from the entire site number 373 (149.4 lbs.) of which 251 (73%) give evidence of accidental glazing from lead runs, 90 (24%) exhibit pot scars and 38 (10%) denote kiln use of more than one firing. The inordinately high percentage of fragments with glaze most likely reflects a certain bias in the collecting of the material during the excavation rather than being an accurate measure of this relationship in the overall tile sample from the site, meaning that the tiles with lead runs were kept while those without were filed away in the backfill pile. But it should also be noted that some of the tile fragments associated with the manor house displayed lead runs on their surfaces. This fact suggests that those roofing-tiles were fired in the same kiln load with the leaded earthenwares. In addition, 6 pan
tile fragments also showed some incidental lead glazing from lead runs. Finally, a very few pieces (7) of the locally made pottery indicate usage as kiln furniture or parting sherds.

The use of roofing tiles as kiln furniture was not uncommon in early to mid-17th century England. They were employed at earthenware kiln sites in Woolwich (Pryor and Blockley, 1978), Potterspury (Mayes, 1969), Potovens (Brears, 1968) and Brill (Farley, 1979).

Previously, I suggested, without offering very much in the way of proof, that the Green Spring pottery was derived from the same ceramic tradition as the rural, vernacular potteries of medieval/post-medieval England. If we consider the following typology of English medieval vessels, as drawn up by John Musty, in light of the Green Spring's typology, the interrelationship between the two becomes much more apparent.

Typology for English Medieval Pottery (Musty, 1974:60):

a. Vessels for the preparation and serving of food - cooking pots, cauldrons, skillets, pipkins, ladles and pancheons

b. Vessels for the storage and transfer of foodstuffs and liquids - storage jars and amphorae

c. Vessels for liquid containers - jugs, pitchers,
aquamaniles, costrels, bottles and ring vases

d. Miscellaneous vessels - beehive bases, urinals, lamps and curfews (large covers for damping fires)
e. Vessels for industrial-craft use - crucibles, sugar cones and butter pots

f. Ceramic material for building - roofing-tiles, water pipes, floor-tiles, bricks and chimney pots

Of the 34 known kiln sites dating to the medieval and early post-medieval periods from which Musty drew his data, 38% of the sites (13) produced 5 different vessel types or less, 53% (18) produced between 5 and 10 different forms and only 9% (3) produced more than 10 different forms. Obviously, Green Spring with its 8 different vessels (9 forms if we include the roofing-tiles) fits neatly into this pattern of production. Also, every one of the pottery types made at Green Spring was also being made and used in England prior to or during the mid-part of the 17th century. Similarly shaped storage jars, pancheons, pitchers and small bowls were found at Woolwich (Pryor and Blockley, 1978), Dover Castle (Mynard, 1970), Waltham Abbey (Huggin, 1970), Malvern (Vince, 1977), Lower Parrock (Freke, 1979), Laverstock (Musty, et al, 1969), Brill (Farley, 1979), Cove (Haslam, 1975), Potterspury (Mayes, 1969) and Potovens (Brears, 1968). Chamber pots from the early 17th century were uncovered at Dover Castle and slightly later at Potovens and Brill. For almost all these sites, the most common vessels were storage jars, pancheons, cooking pots and
pitchers. With the exception of cooking pots, this same proportion of pottery types is consistent with the Green Spring's material (Table 1). Thus not only is the pottery made at Green Spring highly diagnostic of the English medieval tradition in its typology, but it delineates the same relative popularity of a specific number of vessel forms common to its English antecedents.

**DATING THE GREEN SPRING'S KILN**

It will be remembered that within his Green Spring site report, Caywood claims the date of the kiln's operation spans a twenty year period from 1660 to 1680. Given the total number of pottery fragments (1792) and the maximum vessel count as indicated by rim, handle or base fragments (193; Table 1), a twenty year production time would seem, to put it succinctly, absurd. Even if we consider the fact that the entire site was not excavated and the recovered pottery now stored at Jamestown represents only a proportional sample, an inflation of the size would not dramatically alter the meagerness of the total. If only 50% of the 17th century occupation at Green Spring was excavated by Caywood, and we arbitrarily double the amount of the material found, we are still dealing with less than 400 total vessels. For a kiln with an interior area of 78.2 sq. ft. (estimated to be nearly 600 cu. ft.), a 400 vessel production could easily be handled within 2 to 6 firings, depending on the stacking pattern and the size of
the ware (Spleth, 1980: personal communications). As shown by the experimental kiln firings at Boston I and II (Mayes, 1961 and 1962), Leeds (Mayes, 1971), Laverstock (Musty, et al, 1969), Wattisfield (Watson, 1968), and S. Humberside (Bryant, 1977), the entire time involved for a minimum number of potters (or potter) working at Green Spring, including gathering and preparing the clay, cutting the firewood, making the glaze, forming, air-drying and glazing the vessels, and stacking, firing and unstacking the kiln, would be less than two years and more likely less than one.

An adjoining area to Green Spring, the Drummond site at Governor's Land, adds further corroborative evidence regarding the kiln's limited production in that it is the only other site with any quantity of Green Spring material present. Berkeley, in addition to his Green Spring holdings, also had sole use as governor of these 3,000 adjacent acres. Excavation of Governor's Land began in 1976 under the auspices of the Virginia Research Center for Archaeology (V.R.C.A.) and is still ongoing in a very limited capacity. To date, the total inventory of Green Spring's pottery from the Drummond site numbers only 76 identifiable fragments; storage jars, pancheons and small bowls make up 95% of this figure.

Due to the peculiarities of the Green Spring cataloguing system, the Drummond site also offers the most accurate dateable context for the kiln's time of operation. The earliest appearance of the pottery occurs in a 1650+ context, with
the majority of the material being confined to a 1650 to 1680 period (Outlaw, 1980: personal communication). It should be noted that most of the Green Spring pottery was recovered from the fill of various postholes, meaning that the association between the artifact and the feature may either indicate primary or secondary disposal. If the argument presented above concerning the kiln's two year or less length of productivity is valid, then the earliest context for the pottery would offer the most accurate date - 1650+. And if we also consider the probability that the kiln was making flat roofing-tiles for the first manor house, built approximately 1648, then the construction of the kiln would be even a few years earlier. Thus the Green Spring's kiln life most likely spanned the period from the late 1640's to the 1650's in its manufacture of roofing-tiles and lead-glazed pottery, a production time very much in keeping with the average 5 year kiln life of the small vernacular potteries of mid-17th century England (see Freke, 1979).
CHAPTER V
CONCLUSIONS AND SOME FINAL THOUGHTS

The underlying premise to this study of the Green Spring kiln and pottery was, as I indicated in the introduction, to place the manufacture and usage of the ceramics into a broader perspective, one that would deal with the systemic role of the pottery as a part (albeit small) of the socio-economic adaptations made by the English to the frontier conditions of mid-17th century Virginia. On the basis of our definition of material culture, the pottery represented a manifestation of cultural need as perceived by this particular group. It provided a function that sought to satisfy some want, physical or psychological, within the culture. If the pottery defines the end product of this need, then the kiln supplied the technological base by which this process was accomplished. As such, the kiln served as one of the tools or vehicles that allowed these Englishmen to articulate with the new frontier environment. It functioned as a transformer or mediator between the environment's natural resources (in terms of the wood and clay) and the satisfaction of cultural want (in terms of the pottery) through the intervention of human behavior - Rathje's social context of technology (1979:17). But the question remains, what were these cultural needs and what were the socio-economic
adaptations made by the English in light of Green Spring?

It must be remembered that during the time of the kiln's operation, Virginia was being colonized by a still fundamentally agrarian, peasant society, whose population predominantly lived in a rural setting. Virginia's primary attraction to these people centered on her abundance of land and her potential for growing tobacco. These colonists exploited this resource by utilizing a non-technical, non-specialized agricultural system (swidden) that easily and quickly removed the wooded vegetation cover and converted it to readily available nutrients. As used in Virginia, this swidden system required a very simple technology (axe, digging stick and hoe) in conjunction with an intensive labor force and extensive areas of land. It also produced a fairly dispersed population of low density due to the effects mono-cropping had on soil depletion and the time required to naturally regenerate the land (an average of 20 years) by fallowing. The ratio of fallow to productive land was approximately 10:1, meaning that for every one arable acre, ten others were non-arable. Though no longer capable of supporting tobacco, this large amount of acreage was not simply abandoned by the colonists but, instead, was exploited as pasture for livestock, especially dairying cattle. In effect, the adaptation of a swidden agriculture led to the development of a symbiotic-like relationship between tobacco raising and animal husbandry. Not only
did this subsistence pattern cause a more complete exploitation of the environment but it also produced a more reliable food source in the form of meat and dairy products and a greater stability in Virginia's economic sphere.

If we consider the foodways of the 17th-century English (that interrelated system of food conceptualization, procurement, distribution, preservation, preparation and consumption) as involving both their patterned behavior and their associated material culture in this food quest, it comes as little surprise that ceramics and dairying activities were integrated together within a single, common subsistence pattern. On average, a cow from the Stuart period produced 2 gallons of milk per day during the dairy season (May to October), or about 150 gallons per year (Fussell, 1966:116). The bulk of this perishable liquid provided the husbandrymen with their basic protein and vitamin source, in the form of butter and cheese, augmented by beer, vegetables, bread and occasionally meat (Anderson, 1971:118). Based on the assumption that the early colonists' food habits had not altered dramatically from their English counterparts, it was likely that their diet continued to rely heavily upon dairy products. Beaudry (1976), in her analysis of early Virginia probate records, identified 5 different ceramic forms used in dairying activities (also see Kandle, 1980). These include:

(a) basons (basins) - vessels with narrow brims that
vary in diameter between .5 and 1.0 ft., serving a similar function as milk or cream pans and butter pots.

(b) bowls - similar in shape to cups but they tend to be wider than they are deep

(c) pans - shallower than a basin, with slightly out-sloping sides and a large rim diameter

(d) pots - any cylindrical or other rounded form that is deeper than it is broad, used for storing butter

(e) skimming dishes - perforated dishes for skimming cream

If we compare these dairying vessel forms to the Green Spring typology, the presence of marked similarities is very evident between Beaudry's classification and the pancheons, small storage jars and small bowls made at Green Spring. Both forms of pancheons (figs. 9 and 10) relate to the above basin and pan types used for separating cream, clabbering milk, etc. Anderson (1971) mentions that dairying ceramics such as these were invariably lead-glazed on the interior, as was the case at Green Spring. The small storage jars correspond to the pot classification. They were possibly used for storing butter or other similar material. Beaudry's skimming dishes may correspond to the colanders at Green Spring, though this form was known to have been used for washing and straining vegetables (Carson, 1968) in a colonial context. To this
list, Anderson (1971) and Deetz (1977) also add pitchers and, to a lesser degree, large storage jars as playing a significant part in the dairying complex of the 17th century. In part then, the Green Spring's pottery provided a necessary function within the needs of the dairying sphere. As such, these vessels formed an integral component of the basic exploitive strategy of the English as they adapted to the environment of Virginia. In this context, a causal linkage was formed between swidden agriculture, tobacco mono-cropping, dairying activity and the manufacture of pottery at Green Spring.

In addition to the dairying function, the kiln and pottery also delineate a distinct pattern of cognition on the part of their makers and users. The kiln structure represented a common, vernacular style with English antecedents dating to the early medieval period. Its rectangular shape and probable open-topped design denote a simplistic, non-specialized form that was used initially to produce flat roofing-tiles and later glazed and un-glazed hollowwares. The eight different vessel types being manufactured were, in most cases, highly diagnostic of a rural, peasant lifeway. The forms and the frequency of forms mirror the material found at kiln sites throughout 15th to 17th-century England. Because of this relationship, the Green Spring pottery does not fully validate the frontier concept of adaptation as shown by a group's changes in its material culture. The pottery was not
different in its forms, nor in its probable functions from its English counterparts. Instead, the pottery acts to corroborate Foster's hypothesis (1965) concerning the conservatism and constancy of ceramics in peasant societies. And I would add that this factor also suggests that a basic conservatism operates throughout any folk group's overall foodways system, not just in the ceramic component.

Does this point then partially negate the adaptive concept which constitutes one of the cornerstones of historical archaeology in its study of early colonial cultures? In light of Green Spring, I would contend that the answer should be a qualified no. Granted, the pottery does reflect a generalized medieval typology, excluding the chamber pots and sugar cones, but it does illustrate an acute form of functionalism. By no stretch of the imagination can this material be considered as anything but purely utilitarian. The poor quality of its firing, the extreme crudity in its execution and the potter's indifference to (or ignorance of) the obvious irregularities in the clay all attest to the fact that the pottery was made for a single purpose - the immediate needs of Green Spring's socio-economic system. Its absence from any of the other surrounding 17th century sites, except for Governor's Land, adds further evidence to its severely restricted spatial usage. The pottery was an extremely functional, domestic product which was utilized only for the domestic needs of the immediate area. This contrasts markedly
with the small vernacular potteries of England. During the late 16th and early 17th centuries, each served an area within an estimated 20 mile radius of its location (Brears, 1971:15).

The purely functional nature of the pottery also delineates a further adaptive response to a frontier setting, the impermanence and waste associated with the exploitation of abundant natural resources. In this case, the impermanence and waste were confined to a process of experimentation. The many flaws apparent in the preparation of the clay, in the application of the glaze and particularly in the firing of the kiln, in addition to the quite small sherd-vessel counts, give very strong evidence that the making of pottery at Green Spring was a marginal, unsuccessful pursuit carried out by poorly skilled individuals over a very brief time period. This endeavor lacked any substantial investment on the part of the Green Spring inhabitants or the people of the surrounding area to develop the necessary infrastructure in terms of better quality resources, more highly skilled craftsmen or local market demands to maintain an ongoing, successful craft industry. Thus, the Green Spring pottery represents an attempt to establish a local industry, spawned by the interaction of the subsistence activities and the perceived need for self-sufficiency, that simply failed.
FUTURE RESEARCH CONSIDERATIONS

The site of Green Spring, particularly its 17th century components, continues to offer a remarkable laboratory for studying and analysing the process of colonization as carried out by the English in Tidewater Virginia. By no means has its potential for understanding cultural adaptations to a frontier existence been exhausted by this modest study of a small part of its material culture. Even if we consider the site only in view of its pottery production, Green Spring still offers a unique potential to learn how space was ordered and how the internal organization of a small-scale vernacular pottery was set up, including the preparation of clay, the use and placement of pottery wheels, the mixing of glazes and the presence of any other associated structures or features. To date, no kiln site in 17th-century English North America has yet been excavated that includes any information on this aspect of pottery manufacture. It is the author's hope that, at some time in the future, the National Park Service will realize the value that this potential archaeological data could hold for our understanding of pottery production and utilization in Tidewater Virginia and our broader understanding of 17th-century material culture.
APPENDIX A

OTHER 17TH CENTURY KILN SITES IN VIRGINIA

1. Wolstenholme Towne (Noël Hume, 1979:735-67)

Dated to the period of about 1620, the evidence for a kiln at Martins Hundred rests on a fairly large group of coarse lead-glazed earthenwares. These include pancheons, bowls, colanders, bottles, perfuming pots (?), pipkins, dishes, mugs, cooking pots and an alembic for distilling. Noël Hume claims "... they represent the earliest known group of colonial Virginia pottery yet found" (1979:754). The lack of a kiln base and the apparent lack of any kiln furniture raise some questions regarding the certainty of this statement.

2. Jamestown (Cotter, 1958)

Cotter has identified between 2 and 4 structures at Jamestown as probable pottery kilns, all dated to the 2nd quarter of the 17th century. With the exception of one rectangular brick base, 5.5 by 6.2 ft., they consist of circular or oval patches of burned clay. The absence of any directly associated wasters, kiln furniture, or even earthenware fragments places Cotter's identification of all these structures in doubt.

3. Morgan Jones (Kelso and Chappell, 1974:53-63)

Located in Westmoreland County, the Morgan Jones site offers the best evidence of a late 17th century kiln site (circa 1677). Its surviving circular kiln base consists of a 2 part central pedestal and 4 projecting fireboxes, fitting into Musty's Type 3 classification (Musty, 1974:45). The pottery made by Jones mirrors to some degree the Green Spring's material, though in greater number and variety. These were primarily simple storage jars and pans and to a lesser extent jugs, small bowls, pipkins, colanders, mugs, cooking pots, pitchers and cups.

Though no kiln base was uncovered, the evidence of pottery production at the Challis site (James City Co.) is clearly indicated by the large quantity of wasters and parting sherds found. Also Noël Hume indicates the presence of pot scarred sandstone slabs, which he believes formed the floor to the pot chamber. Apparently in operation during the latter 17th and early 18th centuries, the Challis kiln was producing lead-glazed earthenware jars, cream pans, bowls, pitchers, jugs, dishes, colanders and cups.
BIBLIOGRAPHY

Anonymous
1926 William and Mary Quarterly, 2nd Series, VI:118.

Ainsworth, C.

Anderson, Jay Allan

Bailyn, B.

Beaudry, M.

Bennett, J.W.
1976 The Ecological Transition, Cultural Anthropology and Human Adaptation. Pergamon Press, N.Y.

Bennett, J.W., Smith, H.L. and Passim, H.

Billington, R.A.

Binford, L.

Binford, L. and Binford, S.

Bloice, B.J.
Bohannan, P. and Plog, F.

Braudel, F.

Brears, P.

Brew, J.O.

Bryant, G.F.

Carson, J.
1968 Colonial Virginia Cookery. Univ. Press of Va., Charlottesville.

Caywood, L.

Corder, P.

Cotter, J.L.

Dale, L.C. and Craiger, E.L.
de Bouard, M.  

Deetz, James  
1967 Invitation to Archaeology. Natural History Press, Garden City, N.Y.
1977 In Small Things Forgotten. Anchor Press, Garden City, N.Y.


Diderot, D.  

Dimmick, J.  

Drury, P.J. and Pratt, G.D.  

Eames, E.S.  

Evison, V., Hodges, H. and Hurst, T.  
1974 Medieval Pottery from Excavations. St. Martin's Press, N.Y.

Farley, Michael  

Ford, J.A.  
Foster, G.M.

Freke, D.J.

Freke, D.J. and Craddock, J.

Fussell, G.E.

Garretson, L.R.

Geertz, C.

Gifford, J.C.

Glassie, H.

Greene, E.B. and Harrington, V.

Greer, G.H.

Harris, D.R.

Harris, M.
1979 Cultural Materialism. Random House, N.Y.

Haslam, Jeremy

Hinton, David A.

Hodges, H.
1974 "The Medieval Potter: Artisan or Artist?", in Medieval Pottery from Excavations (ed. by Evison, Hodges and Hurst). St. Martin's Press, N.Y.

Hudson, J.P.
1957 This Was Green Spring. Jamestown Foundation, Jamestown, Va.

Huggins, P.J.

Hurst, D.Gilliam

Jope, E.M.

Kandle, P.

Keeler, R.W.
1977 "Home Lots on the Seventeenth-Century Chesapeake Tidewater Frontier," University Microfilms, Ann Arbor.

Kelso, W. and Chappel, E.
Krieger, A.D.

Laing, W.N.

Laslett, P. and Harrison, J.
1963 "Clayworth and Cogenhoe," in Historical Essays Presented to David Ogg (ed. by Bell and Allard), London.

Le Patourel, H.E.J.

Lewis, K.E.

Leyburn,

Manby, T.G.

Matson, F.

Mayes, P.
<table>
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<tr>
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<th>Year</th>
<th>Title</th>
<th>Journal/Book Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noël Hume, I.</td>
<td>1963</td>
<td>Here Lies Virginia.</td>
<td>A. Knopf, N.Y.</td>
</tr>
</tbody>
</table>
Rhodes, D.
1957 Clay and Glazes for the Potter. Chilton Book Co., N.Y.


Rosenthal, E.

Rouse, I.

Sahlens, M. and Service, E.

Salzman, L.F.

Schiffer, M.B.


Schuyler, R.L.

Shepard, Anna O.

Singer, C., Holmyard, E., Hall, A. and Williams, T.

Smith, J.M.

Stebbing, N., Rhodes, J. and Mellor, M.

Thompson, S.

Ucko, P., Tringham, R. and Dimbleby, B.W.
Vince, Alan

Vogl, R.

Waldron, T.

Watkins, L.W.

Watson, F.J.

Wells, R.

Whatley, L.McKay

Whitaker, I. and Whitaker, E.

White, L.A.
1949 The Science of Culture. Farrar, Straus, and Giroux, N.Y.

Wolf, E.
James M. Smith


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