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Morphological Variability in Late Seventeenth and Early Eighteenth-Century English Wine Bottles

William E. Pittman
College of William & Mary - Arts & Sciences

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MORPHOLOGICAL VARIABILITY IN LATE
SEVENTEENTH AND EARLY EIGHTEENTH-CENTURY
ENGLISH WINE BOTTLES

A Thesis

Presented to

The Faculty of the Program in American Studies
The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree of
Master of Arts

by

William E. Pittman

1990

Approval Sheet

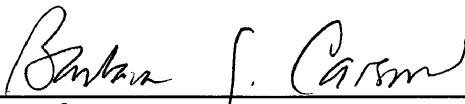
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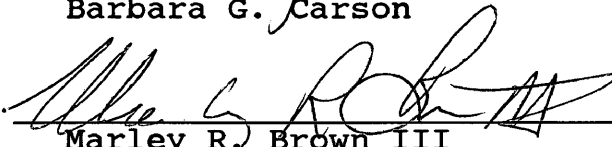


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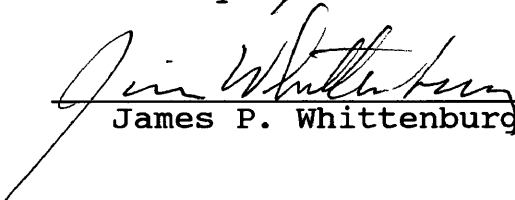
Approved, May 1990



Barbara G. Carson



Marley R. Brown III



James P. Whittenburg

DEDICATION

The author wishes to dedicate this work to his wife, Lisa, without whose loving support and encouragement the course of study in the Program in American Studies could not have been completed.

TABLE OF CONTENTS

	Page
Acknowledgements.	v
List of Tables.	vi
List of Figures	vii
Abstract.	ix
Introduction.	2
Chapter 1. English Wine Consumption in the Late Seventeenth and Early Eighteenth Centuries	6
Chapter 2. Colonial Wine Production and Consumption .	38
Chapter 3. Wine Bottle Morphology in Relation to Methods of Binning	50
Chapter 4. Bottle Morphology and Statistical Analysis	64
Appendix A	102
Appendix B	105
Appendix C	107
Appendix D	112
Bibliography.	115

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LIST OF TABLES

Table	Page
1.1 Wines Consumed by the Goldsmiths' Company . .	14
4.1 Bore Diameter Analysis	70
4.2 String Rim Height Analysis	72
4.3 Lip Height Analysis	74
4.4 Finish Height Analysis	76
4.5 Neck Diameter Analysis	77
4.6 Neck to Finish Analysis	80
4.7 Bottle Height Analysis	81
4.8 Base Diameter Analysis	84
4.9 Resting Point Diameter Analysis	86
4.10 Pontil Scar Diameter Analysis	88
4.11 Kick Height Analysis	89
4.12 Bottle Capacity Analysis	92
4.13 Summary of Minimum and Maximum Observations .	99
4.14 Summary of Statistical Results - Means . . .	100

LIST OF FIGURES

Figure	Page
1.1 1675 Wine Imports to London	20
1.2 Wines Imported During French Prohibition. .	22
1.3 Comparison of French and Portuguese Wine Imports	25
1.4 Wines Imported During the Reign of James II	26
1.5 Wines Imported During the War with France .	27
1.6 Wines Imported During 1697 - 1702	29
1.7 Foreign Wine Imports into England	37
2.1 Retail Wine Prices in Virginia	49
3.1 Evolution of String Rims	58
4.1 Wine Bottle Anatomy.	67
4.2 Typical Bottle Forms	69
4.3 Bore Diameter Analysis	71
4.4 Bore Diameter Comparison	72
4.5 String Rim Height Analysis	73
4.6 String Rim Height Comparison	74
4.7 Lip Height Analysis	75
4.8 Lip Height Comparison	75
4.9 Finish Height Analysis	76
4.10 Finish Height Comparison	77
4.11 Neck Diameter Analysis	79
4.12 Neck Diameter Comparison	79

4.13 Neck to Finish Height Analysis	81
4.14 Neck to Finish Height Comparison	81
4.15 Bottle Height Analysis	82
4.16 Bottle Height Comparison	82
4.17 Base Diameter Analysis	84
4.18 Base Diameter Comparison	85
4.19 Globular & Straight Forms - Base Diameters .	85
4.20 Resting Point Diameter Analysis	87
4.21 Resting point Diameter Comparison	88
4.22 Pontil Scar Diameter Analysis	90
4.23 Pontil Scar Diameter Comparison	90
4.24 Kick Height Analysis	92
4.25 Kick Height Comparison	92
4.26 Bottle Capacity Analysis	94
4.27 Bottle Capacity Comparison	94

ABSTRACT

The purpose of this study is to define the factors which brought about the morphological evolution of English wine bottles from circa 1660 through circa 1750. The hypothesis upon which the work is based is that the shape of the English wine bottle changed through time as a result of three inter-related factors including: changes in the availability and popularity of various types of wine, the coincidental development of the custom of maturing and storing certain types of wine in glass bottles, and the need to improve bin-storage methods in such a manner that bottles could be stored more efficiently on their sides rather than up-side-down. Periods of wine availability and popularity, which are indicators of preference through time, have been researched using primary and secondary documentation concerning wine consumption in England and in Virginia during the period under investigation. This research, and an investigation of the literature dealing with the custom and methods of closing and binning wine bottles, provides evidence that the custom of ageing wine in glass containers developed contemporaneously with the shifts in wine popularity and availability. As the custom of binning and maturing wines in glass containers evolved, so did the shape of the bottles. The need to "lay down" bottles on their sides which used storage space efficiently and was better for the wine provided the impetus to change from bulbous bottle forms to cylindrical forms.

To aid in the understanding of the morphological changes which occurred in English bottles of this period, computer-assisted analysis of specific measurements of a collection of archaeological (fragmentary) specimens and decorative arts (whole) examples was conducted. The results of this statistical analysis provides material culture specialists and historical archaeologists with a simple method for gauging the approximate age of excavated or fragmentary English wine bottles. The statistical analysis also objectively defines the changes which occurred in diagnostically significant neck and base features of English beverage bottles from the late seventeenth century through the first half of the eighteenth century.

William E. Pittman

Program in American Studies

The College of William and Mary

**MORPHOLOGICAL VARIABILITY IN
LATE SEVENTEENTH AND EARLY EIGHTEENTH CENTURY
ENGLISH WINE BOTTLES**

INTRODUCTION

The shifts in wine consumption patterns in England during the seventeenth and eighteenth centuries can be traced through the economic and political events which occurred in England, her colonies, and Europe. These mercantile and political factors not only shaped the changing consumption patterns of middle and upper class Englishmen, but also had far-reaching effects on the English glass industry- specifically in the changing shapes of the glass bottle in which the beverage was kept. This study demonstrates the correlation between the consumption of wine and the customs of storing wine bottles to illustrate the functional reasons for the change in bottle morphology during the period circa 1660 through circa 1750. To this end, this investigation documents the customs and prevalent methods of closing, binning, and aging wine in glass bottles which developed contemporaneously with the shifts in consumer preference. Of equal importance, a statistical analysis of a large group of wine bottles from archaeological and decorative arts collections demonstrates a definable correlation between specific measurements of bottle elements and their date of manufacture. Such a dating tool, when used in conjunction with existing bottle seriations, is useful to archaeologists and other material culture researchers.

E. McClung Fleming set forth a model for artifact study in which the history, material, construction, and function of an object is used as a basis for investigation (Fleming 1982:162-173). He advocated four operations on these artifact properties: identification, evaluation, cultural analysis, and interpretation. This study follows Fleming's model and concentrates on the objective identification and analysis of bottle elements and the cultural analysis of the bottles in relation to wine consumption and storage. This analysis contributes to our understanding of the morphological evolution of English wine bottles through time. The bottles under investigation are grouped into form classifications based on the "...concise and orderly delineation of the physical aspects of the object" (Fleming 1982:167). Seal-dated specimens or bottles of documented ownership excavated from discrete archaeological contexts are used to authenticate the assigned date ranges in relation to the bottle element measurement calculations. The history of wine consumption in England and Virginia was researched to shed light on the functional reasons for the change in bottle forms through time. This interpretation, based on the cultural significance of bottles and their use for storing and aging wine, provides the rationale for the evolutionary change in bottle shape. This approach encompasses the

stylistic classification of English bottles as well as the more practical considerations of function.

Historical archaeologists use the principle of terminus post quem dating in order to understand the stratigraphic sequence of the sites they excavate. This principle, which depends on recognizing the most recent artifact from each excavation unit and correctly identifying the earliest point in time when this artifact existed, provides an indication of a date after which the object was deposited in the soil, thus when the strata were living surfaces in the past. Fragments of English wine bottles, the vast majority of which bear no dated seal, are encountered in great numbers on English colonial-period sites around the world but have contributed little to our ability to date archaeological stratigraphy. Heretofore, it has been difficult to determine a depositional date or date range for the diagnostically significant glass bottle fragments for the late seventeenth and early eighteenth centuries because no objective method of analysis had been developed. The analytical work accomplished by Olive R. Jones for English wine bottles of the period 1735 to 1850 is the first successful attempt to define objectively morphological variability in glass beverage bottles of a later period (Jones 1986). The present study attempts to accomplish a similar goal using English bottles of the period circa 1660 through circa 1750. The objective

appraisal of whole or excavated wine bottle neck and base elements, accomplished by duplicating the measurement procedures and by statistical computation laid out in this thesis, provides another method by which we may better understand English wine bottles from our material past.

CHAPTER 1

ENGLISH WINE CONSUMERISM IN THE LATE SEVENTEENTH AND EARLY EIGHTEENTH CENTURIES

This thesis will define the morphological change in late seventeenth and early eighteenth-century English wine bottles in relation to shifts in wine consumption patterns in England and her North American colony of Virginia. It had been known since the Middle Ages that some wines were improved by aging (Grossman 1977), however, the rise of the glass bottle industry in England during the seventeenth century made the storage of wine in glass containers possible and convenient. This change eventually brought about the practice of binning wine bottles. The morphological change which occurred in glass containers during the closing years of the seventeenth century and the first quarter of the eighteenth century resulted from a need to store glass bottles efficiently on their sides, which prompted the change from globular forms to straight-sided bottles.

The English wine drinker enjoyed a wide variety of wines from the continent of Europe throughout the second half of the seventeenth century, into the first half of the

eighteenth century. The shifts in consumption patterns which occurred during this time are reflected in the quantities of wines which were imported. The availability of wines to the English market was affected by interrelated economic and political events which in turn controlled the retail cost to the consumer.

Governmental control of prices for imported wine had been practiced in England as early as the reign of Henry VIII; by the early seventeenth century, these regulations were no longer in effect (Francis 1972:47). Numerous complaints from the wine-consuming public concerning inconsistent quality and unfair prices for wine prompted a renewal of governmental intervention in the form of price fixing in 1628 during the reign of Charles I (Simon 1964:Vol. 3:37). The consuming public benefited from these regulations by having the maximum retail price fixed so that when there were shortages of wine, exorbitant prices could not be charged by the retailers. Wine merchants also benefited from government regulation of prices and import tariff rates. The wholesale price paid by wine merchants fluctuated greatly depending on the relative quality and quantity of vintages available from the wine growers of Europe. The profits realized by English wine merchants were guaranteed by the regulation of import duties and retail prices. As long as the wine merchants could buy foreign wines at an advantageous

wholesale price, they were assured of a comfortable profit margin.

The process of aging wine in wooden casks had been known from ancient times, and the technique was preserved through the Middle Ages in France and the Rhineland (Francis 1972:144). Old wines were preferred to younger vintages as early as the fifteenth century, when the Bishop of Angers maintained a huge vat in which wine had been aged for fifty years. Bulk storage of old wines was documented by the eminent English philosopher, John Locke, who in 1678 wrote of having seen a vat at Marmoutier in France which held 200 tuns (50,400 gallons) of wine at a time (Francis 1972:144). It is obvious from the documentation that prior to the seventeenth century, aged wines from all over Europe were shipped in wooden casks called tuns, pipes, or tierces, which held 252, 126 and 42 gallons respectively (Francis 1972; Simon 1964; Ross 1983:45). During the second half of the seventeenth century, wines which were not intended to be drunk young were greatly improved by being transferred from the wooden container in which the aging process had begun, into glass bottles where the process of maturing was completed. For still wines, this generally meant the first eighteen months in wood, and the remainder of the aging in glass bottles. Port, which was not thought to be palatable until it had aged for three years in this manner, was the first fortified wine to be

customarily aged in glass (Grossman 1977). Madeira was undoubtedly aged in wood and glass; Queen Anne paid more for aged Madeira than for younger vintages. Luxury wines such as Burgundy and Champagne, were favored by William III, who owned five-year-old champagne (Francis 1972:144 and 147). By the end of the first quarter of the eighteenth century, the aging of French wine was advocated and was apparently a long-established practice.¹ We may also infer that the "bottle" was a common unit of measure by the time of the Restoration as indicated by references to bottles by the dozen being consumed at public dinners. See page 14.

We see from the documentation that the custom of aging wines of various types in wooden and glass containers was well known and appreciated by connoisseurs and wine retailers by the closing years of the seventeenth century. This appreciation fostered the development of glass bottles which could more efficiently and conveniently be stored in the fashionable wine cellars found in England in the second half of the seventeenth century.

¹ "...the saying that the four most desirable things in life were 'old wood to burn, old wine to drink, old friends to talk with and old books to read' was attributed to Lord Bathurst ... [or]...to St Evremond, who died in 1703" (Francis 1972:145).

ENGLISH WINE CONSUMPTION PATTERNS

The English wine consumer was forced by climate, geography,² politics, and economics to develop a taste for foreign wines. Winemaking had been attempted in England before the Norman Conquest, however, the products of these early, mostly ecclesiastical vineyards were inadequate to satisfy the demand in terms of quantity and quality (Francis 1972:4 and 49). The English wine drinker demonstrated a strong preference for dry French wines³ throughout most of the seventeenth century until the penultimate decade when the consumption patterns shifted to the sweeter wines produced on the Iberian Peninsula.

Following retail price regulation⁴ which began in the 1620s, the English wine consumer continued to purchase more of the less expensive wines that were available. As long

² The 49th degree of latitude is generally considered the northern-most limit for optimum wine production.

³ During the reign of James I (1603-1625), the consumption of French wines in London increased markedly from 4,000 tuns in 1603 to 7,000 tuns in the following year (Simon 1964:Vol. 3:1). Spanish "sweet" wines were also imported during the reign of Elizabeth and James I, although the tariff schedules (£0..3..0 per tun on Gascony wine and £0..6..0 per tun on sweet wines) had been purposefully set in favor of the drier wines of France (Francis 1972:40). Because French wines were far more popular, they brought a proportionally larger income from tariff revenues to the Exchequer, and provided the wine merchants with proportionally greater profits from retail sales.

⁴ See Appendix A for tables reflecting the retail price fixed at various times in the seventeenth century. The reader will note that the types of wines remained constant, but the retail prices steadily increased from 1632 through 1662.

as French wines were imported in larger quantities and sold at more advantageous prices, the English consumer preferred them over the products of the other European wine-producing countries.⁵

During the reign of James I, the quantities of wine coming into England indicate that dry French wine was by far more popular than the sweet wines of Spain. The more advantageous retail price of Bordeaux vintages and the relative ease with which it was shipped across the English Channel assured its popularity with English society.⁶

"Sweet" wine consumption gradually increased through the seventeenth century which is not surprising in light of the many references to a general preference for sweetness in English cuisine. Sidney Mintz, in Sweetness and Power, argued that the greater consumption of sugar by the English developed over a long period of time and was not common

⁵ The units of measure used throughout this thesis may be translated into the modern measuring system as follows: a tun equals 953.87 liters or approximately 252 gallons; a butt or pipe equals half a tun, 476.94 liters or 126 gallons; a gallon equals 3785.2037 ml; and a quart equals 946.30 ml (Ross 1983:45).

⁶ As an indication of English preference during the reign of James I, the quantities of sweet Iberian wines coming into England in 1612 amounted to 12,700 butts (or 6,350 tuns). By 1621, the amount had fallen by 56% to 7,200 butts (or 3,600 tuns) (Francis 1972:44-45). French wines were unquestionably more popular among English consumers because they were more economical. What we today would consider a dry red Bordeaux, retailed at a lower rate per gallon than any other type of wine. The documentation of this period does not indicate the specific types of "sweet" wines that were available, but we may assume that they were similar in complexion to sweet sherry or sack.

until the eighteenth century (Mintz 1985:18). As early as the reign of Elizabeth I, however, many references⁷ described the strong inclination toward sweetness in English cuisine even though the quantities of drier wines outnumbered the sweeter wine imported throughout the majority of the seventeenth century (Mintz 1985:134; Francis 1972:115 and 151).

At Canterbury (1603) the English ladies...[were] presented ...with the bonbons, comfits, and sweet meats that were upon the table, "which they enjoyed mightily; for (it is remarked) they eat nothing but what is sweetened with sugar, drinking it commonly with their wine and mixing it with their meat" (William B. Rye 1865:190 as cited by Mintz 1985:135).

The correspondence of an Englishman named Venner in 1628 offered further evidence of the English "sweet tooth":

Canary was often called 'sweet sacke' ...which many people like to take with sugar. This was the usual practice with rhenish and other white wines which were not sweet, and although sack became a very comprehensive term covering most Spanish wine, there seems no doubt that canary sack was initially a different type of wine to sherry or Malaga sack, but that the English taste was always for sweeter and stronger wines..." (Francis 1972:50).

⁷ Mintz noted that "The English habit of adding sugar to wine was much remarked". The English "put a great deal of sugar in their drink," Hentzer wrote in 1598, and when Fynes Moryson discussed English drinking habits in 1617, he commented "Clownes and vulgar men only use large drinking of Beere or Ale...but Gentlemen garrawse onley in wine, with whiche many mixe sugar - which I never observed in any other place or kingdom to be used for that purpose (William B. Rye 1865:190 as cited by Mintz 1985:136).

The English author and cleric, Jonathan Swift (1667-1745) can be considered an example of an upper-middle-class Englishman with regard to wine and culinary customs. The use of sugar to sweeten dry wines was apparently not unusual for English persons of his social status:

He [Swift] took a daily bottle of wine for his health's sake but seldom more. He was able to afford French wine because it was comparatively cheap in Dublin, and although his habit of putting sugar in his wine seems odd it was usual in his day (Francis 1972:151).

The consumption of wines by the middle and upper classes of English society was fairly well documented in public and private records. For example, the celebrated diarist, Samuel Pepys, recorded numerous entries⁸ in his diaries between 1660 and 1667 relating to types of wine and its bulk storage in wooden casks as well as in glass bottles. Wine cellars filled with wooden and glass containers in the fashionable houses of London were

⁸ The following entry for 7 July, 1665 is but one of many which serve to indicate the types and quantities of wines which middle-to-upper class Englishmen enjoyed during this time: "...Up and having set my neighbor, Mr. Hudson, wine-coopers at work, drawing out a tierce [one sixth of a tun or 42 gallons] of wine for the sending of some of it to my wife...at this time I have two tierces of Claret, two half-casks of Canary, and a smaller vessel of Sack, a vessel of Tent, another of Malaga and another of white wine, all in my wine cellar together." Later, on 2 June, 1663, Pepys made another wine-related entry in his daily chronicle: "To-night I took occasion, with the vintner's man, who came by my direction to taste again my tierce of Claret...(as cited by Simon 1964:Vol. 3:121-122).

mentioned with considerable pride as a new and innovative method of wine storage (Ruggles-Brice 1949:15).

Questions concerning public consumption of wine may be approached through the records of London guild organizations. This information provides an indication of public wine consumption during the mid-seventeenth century⁹ and also may suggest the availability of certain wine types. At three dinners given by the Goldsmiths' Company on 17 November, 1665, 4 May, 1666, and 5 July, 1667, the following quantities and types of wine were consumed:

Table 1.1

WINES CONSUMED BY THE GOLDSMITHS' COMPANY

<u>Wine Type</u>	<u>Nov., 1665</u>	<u>May, 1666</u>	<u>July, 1667</u>
Canary	2 doz. bottles	-	6 bottles
Claret	1 doz. bottles	5 gallons	12 bottles
White	1 doz. bottles	6 gallons	6 bottles
Sack	-	10 gallons	-

At a similar dinner given by the Worshipful Company of Ironmongers on 7 July, 1687, 5 gallons of Canary, 3 gallons of Rhenish, 1 gallon of Claret, and 5 gallons of white wine were consumed (Simon 1964:Vol. 3:123). The quantities of wine which were consumed at these formal dinners were

⁹ The social and commercial effects of the Plague of 1665 and the Great Fire of London in 1666 must also be considered when addressing questions of availability.

listed using dozens of "bottles" as a unit of measure¹⁰ as well as gallons. We may infer from these units of measure that by the beginning of the last quarter of the seventeenth century, wines were being decanted into bottles of some description for measurement and possibly for service at table, at the same time that it was customary to draw the wine from casks in gallon measures. However, we cannot be completely certain of the wine preferences indicated by these listings. We cannot know precisely what was meant by "white wine" nor can we deduce how the wine was served at table.

James I seemed to have preferred the products of Bordeaux¹¹ and Gascony, although there are references to purchases of "...sweet wines and Sack...for the use of his household" (Simon 1964:12). These references further suggest that the use of Spanish wines by the royal household was somewhat limited before James' reign.

Whereas in times past Spanish wines, called Sacke, were little or no whit used in our Court, and that in late years, though not of ordinary allowance...and so no great quantity spent...We, considering that often times sundry of our nobility and others...may... desire to have Sacke,

¹⁰ Ross states that in the Queen Anne Winchester Wine Gallon System in use in England before 1707, a "bottle" was equal to 630.87 ml while the "reputed quart" was equal to 757.04 ml. "Quarts" and "Gallons" held 946.30 ml and 3,785.20 ml respectively (Ross 1983:45).

¹¹ James I demonstrated a preference for Frontignan (Francis 1972:49).

our pleasure is that there be allowed to the sargeant of our seller, twelve gallons of Sacke a day, and no more (Simon 1964:Vol. 3:13).

References such as this suggest that very little Spanish wine was consumed at the English Court and that French wine was the preferred beverage. This preference seemed to have been perpetuated by James I's successor, Charles I, who to the day of his execution in 1649, exhibited a personal preference for French wines. Sir Thomas Herbert recorded that just before mounting his execution scaffold, Charles I "...drank a small glassful of Claret Wine" (Simon 1964:Vol. 3:64 and Francis 1972:57). The consumption of wines by Charles I's royal household indicated the wine preferences of the upper social classes; after 1626, the royal household was allowed £4,000 annually for French vintages and apparently no allowance for Spanish wines.¹² If we may assume that this preference was copied

¹² In 1625, the annual allotment for the purchase of dry French wine and sweet Spanish wines amounted to £1,300 and £1,581 respectively (Francis 1972:56). The following year, however, Charles appointed a commission to investigate this expenditure and to recommend areas in which economies could be made. The radical shift in consumption indicated by the recommendations of the commission suggested that French wine was preferred at the English Court. It was recorded that "For provision of sweet wyne...a yearly assignment of £1,584, wherein, considering that Your Majesty useth not those wines, and that anciently there was no such allowance for the house, we thought fit to understand your Majesty's pleasure whether this charge may not be cut off. For provision of French wyne...an assignment of £4,000 per annum, and £300 per annum for leakage and cooperage; we conceive a better bargain for Your Majesty may be had" (Simon 1964:Vol.3:64).

by the lesser nobility, French wines were by far more popular in England at this time than any other type. Following the English Civil War, the Commonwealth (1649-1660) developed some degree of economic and political equilibrium. Trade in England and the wine trade in particular, enjoyed a brief period of recovery.¹³ French wines remained more popular than any other type because they continued to be less expensive than sweet wines from Spain.

Of all the legislation passed by royal edict or by Parliament, the Navigation Acts of 1651, 1660, and 1663 had the most profound effect on English trade in the mid-seventeenth century.¹⁴ This legislation was an attempt to regulate trade and reduce trade deficits that had plagued the English economy for generations. The Acts stipulated

¹³ Customs records of the early Commonwealth showed that receipts in London between 1 March and 26 August 1650 amounted to £5,746 4s. on sweet wines and £5,414 1s. on French and Rhenish wines. These revenue figures did not, however, accurately reflect the true quantities being shipped into London due to the proportionally higher tariff rates paid on Spanish wines at this time (Simon 1964:Vol.3:65-66).

¹⁴ The Navigation Act of 1651 had the most profound effect on Dutch shippers who controlled most European commerce before the English attained a position of maritime supremacy. This was the first of many such pieces of legislation in the seventeenth and eighteenth centuries which attempted to control trade and ultimately economics. There is strong evidence to suggest that all of the Navigation Acts passed by Parliament were either not successfully enforced or were systematically violated. For a more complete discussion of these enactments and their effect on seventeenth century trade, see Wilcoxon 1987 or Ver Steeg 1964:108-109).

that all foreign goods imported to England had to be carried in English ships or in vessels registered in the producing country. This effectively prevented Dutch shippers from carrying wines from France or other countries into English ports and was a major contributing factor to open hostilities¹⁵ between England and Holland (Simon 1964:Vol.3:66; Wilcoxon 1987:13; Mishkin 1975:29 and 115). Serious shortages of wine were recorded in England during the three Anglo-Dutch wars.

The consumption of wine by the lower classes of English society is a topic which requires much additional research. There is very little reliable documentation which addresses questions relating to whom among the poor could afford wine; what percentage of their meager income was expended in the purchase of wine; and how the consumption of beer, ale and gin compared with the consumption of wine by the poor. Some scholars have suggested that the consumption of wine by all but the lowest classes of English society gradually increased over

¹⁵ There were three Anglo-Dutch wars. The first began during the Commonwealth period in May, 1652 and ended in April 1653; the second, during the reign of Charles II, began in June, 1665 and ended in July, 1667; the third also occurred during the reign of Charles II, and began in March 1672, ending in February 1674.

time,¹⁶ but without comparative statistics, a clear picture of lower class consumption patterns can not be objectively derived.

Two serious blows to wine consumption in England occurred in 1666 and 1667 when the importation of all Canary and French wines were prohibited.

In the autumn of 1666, a proclamation was issued "prohibiting the import of all wines of the growth of the Canary Islands, and all further trade and commerce with the said islands, during the King's pleasure, on account of the decrease of treasure caused by the export of money to pay for the same, and also of the injuries lately committed by the inhabitants, in banishing the English Consul and principal officers out of the island of Teneriffe (Simon 1964:Vol. 3:93-94).

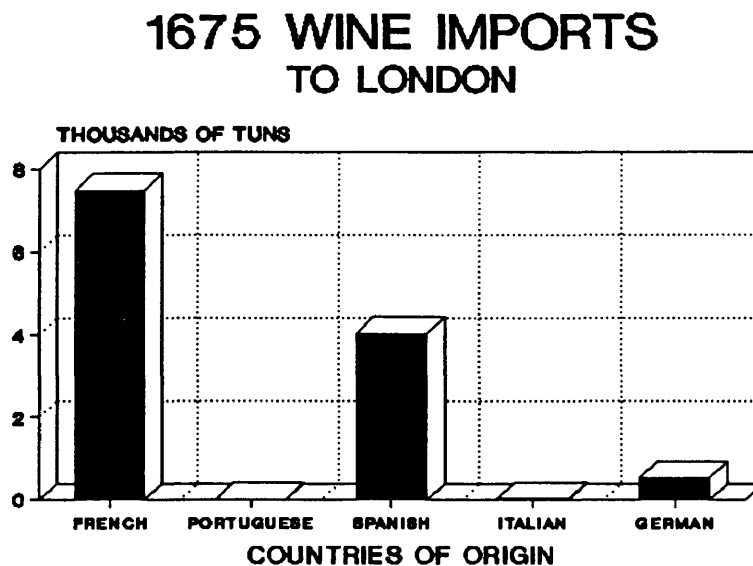
French wines were prohibited in England during the Second Anglo-Dutch war which began in 1665. Because England was simultaneously at war with France and with Holland, normal trade was completely disrupted (Simon 1964:Vol.3:89). Considering that a steadily increasing proportion of the wines consumed in England at this time was produced in the Canary Islands, the 1666 proscription of Canary Island trade, coupled with the 1667 trade

¹⁶ As taverns continued to increase in number, more and more Englishmen turned to wine as their preferred beverage except the lowest social class which increased its consumption of beer and spirits. Wine had been the prerogative of the wealthy and noble orders; the poorer classes in England adopted it in ever increasing quantities (Francis 1972:61).

restrictions against French wines, reduced the availability of all wines on the open market. The interruption of supplies of French wine began to have an effect on the consumption patterns in England where wines were in short supply and became very expensive (Simon 1964:Vol.3:94). French wine was again proscribed during the Third Anglo-Dutch War which began in 1672 and ended in 1674.

Figure 1.1 illustrates the relative quantities of wines which were imported into London in the first year of peace following the Third Anglo-Dutch War. The preference for French wines over those of the other major wine-producing nations of Europe continued until 1679.

Figure 1.1



The tariff rates¹⁷ on imported wines steadily increased, which in turn caused retail prices to rise. The English Parliament, reacting to the disclosure of the Treaty of Dover, prohibited importation of all French commodities in 1679. This prohibition lasted until 1685 and was designed to harm the French wine producers. In reality, the English consumer, the wine merchants, and the Exchequer suffered far more than the French growers who easily found new markets for their products.

With the complete prohibition of French and Canary Island wines, the English wine drinker was forced to turn to other sources for palatable wine. An indication of the small quantities of Portuguese wines imported into England appeared in a report made by Charles Davenport, the inspector-general of customs for Charles II:

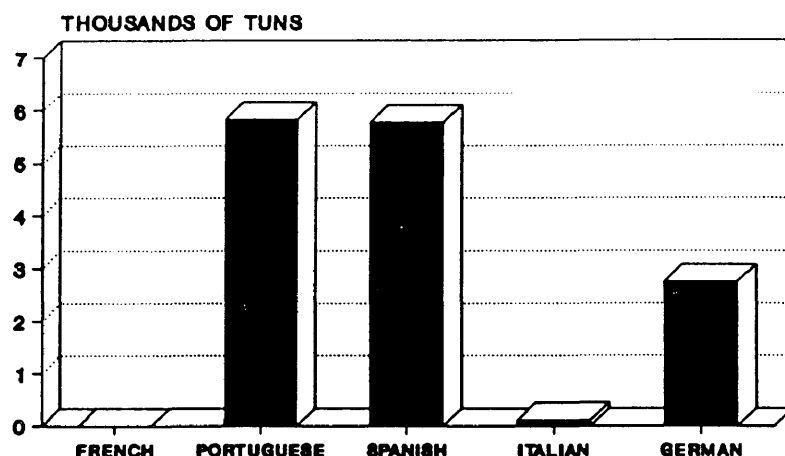
...imports of Portuguese wines before 1675 were confined to a few presents and in the years 1675-8 the imports to London amounted to 43, 178, 378, and 427 pipes respectively (Francis 1972:79).

¹⁷ In 1678, Parliament granted an additional duty on all wines of £12 per tun. In the following year the importation of all French wines was completely prohibited. Even though these trade infringements were intended to be temporary, they remained in force because it was discovered that throughout the war years with France, Charles II had been a pensioner of Louis XIV under a secret agreement signed in 1670 known as the Treaty of Dover. This startling revelation caused an enraged Parliament to impose a complete embargo on French trade (Francis 1972:77).

Spanish wines amounted to roughly half the quantity of French wines received through London beginning in 1675 and during 1677. Following the proscription of French wines in 1679, Portuguese and Spanish wines dominated the market, with Spanish wines holding at approximately half the quantities of Portuguese wines after 1681. Figure 1.2 illustrates the increase in consumption of Iberian wines during the French prohibition.

Figure 1.2

WINES IMPORTED DURING THE FRENCH PROHIBITION 1679 - 1685



In spite of the radical shifts in consumption patterns resulting from the various proscriptions against French trade, little economic change occurred. Foreign wines were still paid for in cash rather than in goods of equal value. The trade imbalance which had plagued the English economy for generations was a popular subject for numerous

publications¹⁸ which called for higher protective tariffs to reduce the trade deficit. One of the most prominent publications of the period was written by John Fontrey¹⁹ in 1663, entitled England's Interest and Improvement. The English had forbidden the importation of French wines in 1667, during the war with France, and had previously prohibited importation of Canary wines in 1666 on the grounds that they were too expensive²⁰ (Francis 1972:76). With peace in 1668, the wine trade suffered further setbacks as higher import duties²¹ were imposed by Parliament

¹⁸ Numerous documents existed as early as the reign of Elizabeth I which described and condemned the economics behind the wine trade. One of the earliest of these was written by William Cecil, Lord Burghley, circa 1566 (See Mishkin 1975:Vol.1:181). The trade deficit was caused by the necessity to pay for wine imports in specie rather than in goods of equal value. This created a continual drain on the Exchequer and contributed to shortages of money in circulation. See A. D. Francis (1972:25-46) for a detailed discussion of the complex trade structure which began in the sixteenth century and was in effect throughout the eighteenth century.

¹⁹ Fontrey demonstrated that uneven trade with France was exhausting the English treasury and he further recommended that all French goods that required no further manufacturing after importation should carry heavy tariffs.

²⁰ Owing to long-standing trade agreements, Canary wines as well as French vintages had to be paid for in specie, creating a severe drain on the Treasury (Francis 1972:76).

²¹ The rates of the new duties were 4d a quart on French wines, sixpence on sweet wines and 1/- on brandy; in spite of the unpopularity of trade with France, French wines were given the most favorable treatment (Francis 1972:76). The tariff rates for French wines were calculated at £16.10s. per tun - £4 per tun less than Portuguese, and £5 per tun less than Spanish vintages.

in an attempt to raise funds to support of the government. As always, the rates were set in favor of French wines over "sweet" wines.

The effect of other commodity markets on the wine trade is illustrated by the development of the English textile industry. As early as 1677, the English woolen trade with Portugal was estimated at £400,000 annually²² and there was pressure on the government to pursue formal trade negotiations with the Portuguese court to ensure that this lucrative market was not lost. The creation of a new export textile market in Portugal provided a great incentive to develop a counterbalancing import trade in Portuguese wines.

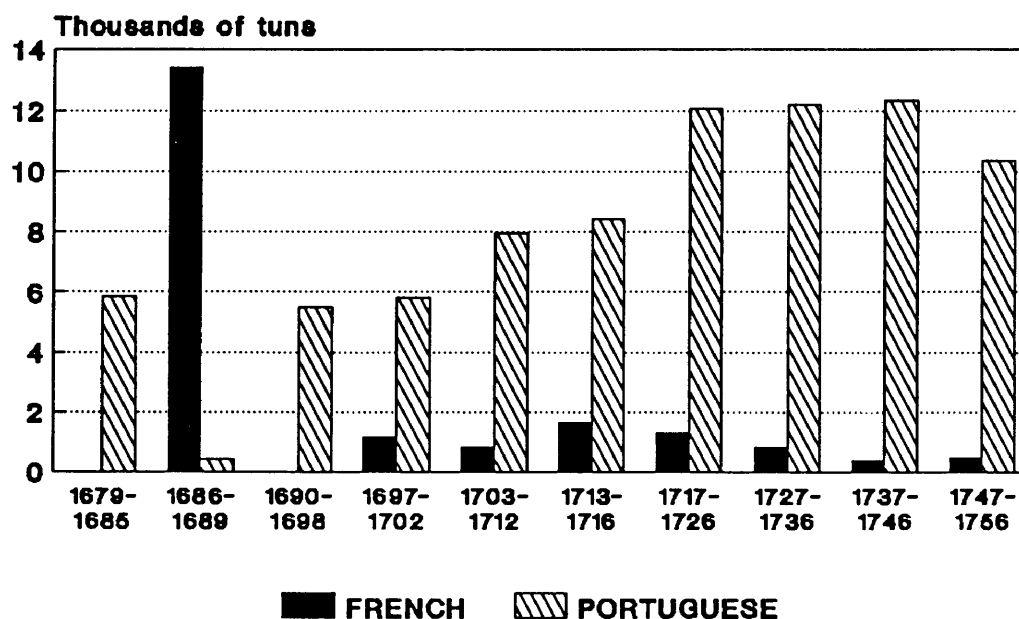
Figure 1.3 illustrates the meteoric rise in consumption of Portuguese wines beginning with the French prohibition of 1679-1685, through the mid-eighteenth century. With no legally available French wine on the market from 1679 through 1685, the Portuguese growers

²² This figure is based upon a recommendation submitted by London merchants to Parliament in 1677 which promoted direct wine trade with Portugal (Francis 1972:79). London wine merchants, anxious for new sources of wine for the ever-increasing English home market, urged that it "...would be very advantageous to import such [Portuguese] wines in exchange for English manufactures, as it would not be necessary to pay for them in specie as was the case for the purchase of French wines. They added that at present the total importation of Portuguese wines amounted to thirty-three tuns, whereas that of French wines was 7,000 tuns. Trade in Portuguese wines was prevented by the new impost, under which they paid £4 a tun more duty than French wines, but if the duties were equalized, a thriving trade could be begun" (Francis 1972:80).

readily filled the gap left by the paucity of French wine.

The years of the French prohibition (1679 through 1685), were the principal cause for the development of the Portuguese wine industry. During James II's reign (1685-1688) there was a brief period of peace, and extensive trade with France was renewed. When the French prohibition

Figure 1.3 **COMPARISON OF FRENCH AND PORTUGUESE WINE IMPORTS**



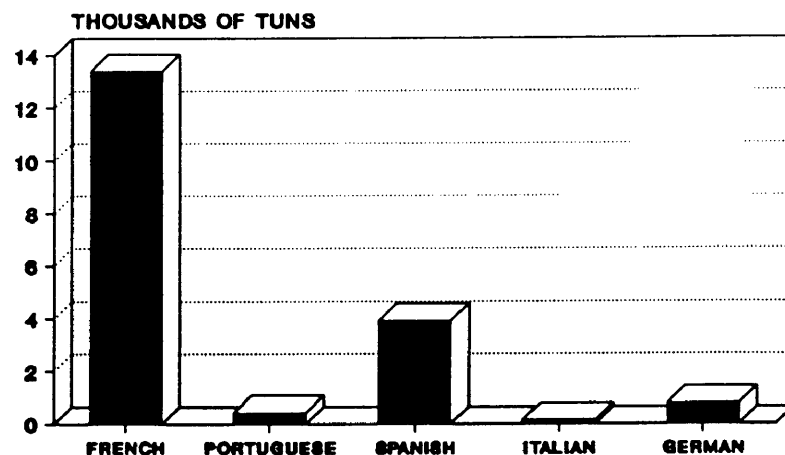
was repealed in 1685, there was concern that the fledgling Portuguese industry would suffer an early demise. During the period of time between the repeal²³ of the French prohibition in 1685 and the ouster of James II in 1688, the

²³ The legislation which forbade the importation of French wines was repealed when James II ascended the English throne in 1685. The duties paid on imported wines were, however, again increased to £14 2s 10d. per tun on French wines, £17 13s 3d. per tun on Spanish and Portuguese wines, and £19 17s 3d. on Rhenish wine.

imports of Portuguese wine were low; however, the industry was well enough established to survive and to compete effectively with French and Spanish wines on the English market thereafter (Francis 1972:97). Figure 1.4 shows the average annual quantities of European wines shipped into England during the brief reign of James II.

Figure 1.4

WINES IMPORTED DURING THE REIGN OF JAMES II 1686-1689



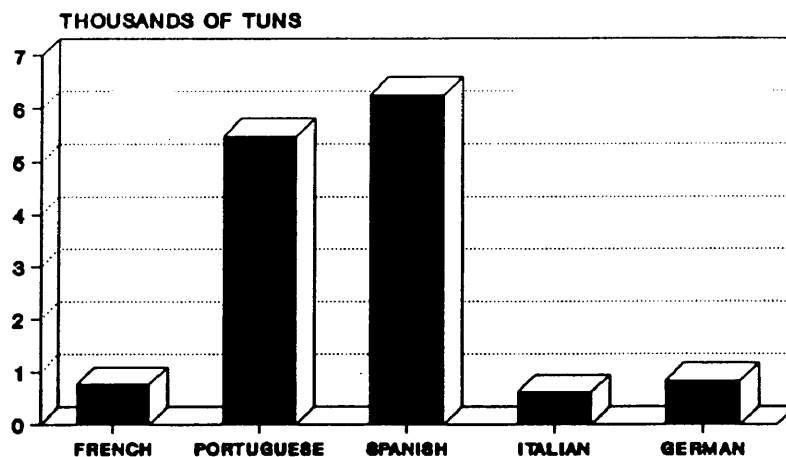
The sudden availability of French wines produced a remarkable and very brief reversal in consumption patterns. The phenomenal increase in the consumption of French wines during the three-year reign of James II indicated the radical shift in consumption caused by the sudden availability of popular commodities in the open market. This rapid shift "...marks a period of reaction and considerable activity in Anglo-French commercial

transactions" (Simon 1964:Vol.3:125). The dramatic increase in the purchase of French wine during this three-year period was a clear indication of the Englishman's old preference for French dry wines when they were available.

The Glorious Revolution of 1688 resulted in another war-enforced embargo of French commodities in England, beginning in 1690. Figure 1.5 shows the sudden decline in French wines in comparison to those of Spain and Portugal caused by the re-activation of the French prohibition during the period from 1690 through 1696.

Figure 1.5

WINES IMPORTED DURING THE WAR WITH FRANCE 1690-1696



During the reign of William III (1689-1702), the

duties²⁴ paid on imported French wines were again raised. French wines were singled out for specific economic discrimination. This prejudice against the products of French vineyards over those of other major suppliers of wines was another crucial factor in swaying the preference of the English wine consumer toward the sweeter wines of Portugal and Spain. When they were available, French wines were more expensive and therefore less popular with the English consumer. The prejudicial tariff legislation against French wines was perpetuated by each succeeding monarch of England until 1860 (Simon 1964:Vol.3:127).

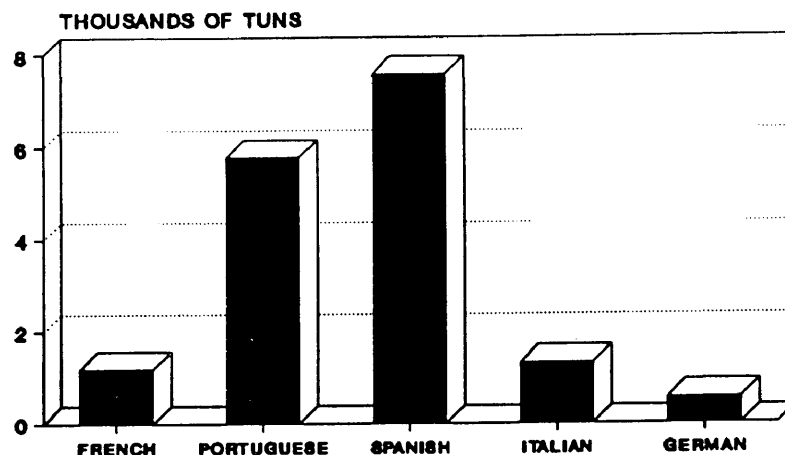
Importation figures for the major ports of England indicated that no French wine was imported in 1682, 1683, 1694, or 1695, only two tuns were imported in 1697, and only relatively small quantities in 1698, 1699, and 1700 (Simon 1964 Vol.3:132) although these figures do not indicate the quantities of French wine which were brought into England illegally. See Appendix B.

Figure 1.6 shows the average quantities of wine imported annually for the last years of William III's reign. For the second time, the consumption of wines from Spain exceeded those of Portugal, but after 1703,

²⁴ In 1693, an additional tariff of £8 per tun was placed on French wines; the duties paid on Rhenish and Spanish and Portuguese wines remained the same as they had been under James II. This brought the total duties on French wines to £22 2s 10d. per tun or 2s 1d. per gallon (Simon 1964:Vol. 3:127 and 1971:53).

Figure 1.6

WINES IMPORTED DURING 1697 - 1702



Portuguese wine assumed the pre-eminent position among all European wines.

The consumption of more Iberian wines than French wines was well established by the closing years of the seventeenth century. This trend in consumption²⁵ seemed to remain constant throughout the rest of the first half of the eighteenth century.

RATE OF CONSUMPTION

The quantities of wines imported from all sources during this period also reflected the shifts in

²⁵ The import duty rates which were charged on the wines were prejudiced against French wines which paid 4s. 0-1/2d. per gallon, while Portuguese wine paid only 1s. 8d. per gallon, and Spanish wine only 1/2 penny more per gallon than Portuguese.

availability and preferential treatment that Iberian wines enjoyed over French wines. The rate of wine consumption suggested by these figures at first appears to be inordinately high, however, John Houghton speaking in 1699, remarked that the quantities were

...a small matter considering what was brought in before the war; for I have been told by the City Gauger that there has come to London in one year 31,000 tuns of wine...(Simon 1964:Vol. 3:131).

This quantity amounted to 7,812,000 gallons which was more than one gallon for each individual in Great Britain during that year. The per capita consumption did not seem to have been excessive according to Houghton who further stated that

... 'tis a pity we do not drink 30 gallons a head, provided it was brought in by our own shipping... (Simon 1964 Vol. 3:131).

The excessive duties on French wine enacted during the reigns of James II²⁶ and William III²⁷ severely reduced

²⁶ During the brief reign of James II, with the great influx of French goods, supporters of the King became accustomed once again to drinking French claret. The fashion grew of drinking certain wines to reflect one's political persuasion. Those with Tory sympathies customarily drank claret, while those who followed the Whig opinions favored Port (Francis 1972:103 and 153).

²⁷ Under William and Mary, the increased duties made claret more difficult to obtain. "Although the Tories clung to claret, King William was showing an increasing interest in Portugal and did not encourage French wines at court except champagne, of which he was fond" (Francis 1972:116).

their availability and affordability in England during the closing decade of the seventeenth century.

...in spite of misdescription, smuggling and other means, fair and otherwise, to procure supplies of French wine in England, the considerable difficulties in the way made it impossible to import sufficiently large quantities. French wines became scarcer and dearer practically every year during the last decade of the seventeenth century; their consumption was more and more confined to a very small coterie of wealthy noblemen and extravagant men of letters, whilst spirits became more gradually popular, the majority of wine drinkers gradually learned to resign themselves to Portuguese wines (Simon 1964 Vol. 3:135).

The years of the French prohibitions contributed significantly toward turning English tastes away from French wines which had been largely unavailable and prohibitively priced.

Throughout the reign of William III, England attempted to re-establish the trade agreements and military alliances with Portugal that had existed during the reign of Charles II. These diplomatic endeavors were brought to a successful conclusion during the first year of Queen Anne's reign, in December 1703, by John Methuen. The Treaty of Methuen was a commercial treaty between Great Britain and Portugal in which Portuguese goods received an advantage

over the imports of other nations.²⁸ This treaty, coupled with waning preference for and availability of French wines begun in the 1680s, and their prohibitive cost in the marketplace, were primary causes for the dramatic shift from the dry wines of France to those of Portugal and Spain. See Appendix B.

By 1701, the wine imports into England from Bordeaux amounted to only 1,732 tuns and it is recorded that

English merchants still believed that claret would be restored to favour if the duties were reduced, but Luis da Cunha, the Portuguese minister, thought that the English were now converted to the sweeter Portuguese wines and the intendent in Bordeaux agreed with this view. The preference for sweeter wines was apparently not a phenomenon peculiar to England, for Dr. Martin Lister visiting Paris in 1698 observed that there was a growing liking for sweetness and strength in the wines fashionable there (Francis 1972:113).

During the War of Spanish Succession (1702-1713), Portuguese and Spanish wines grew in popularity due largely

²⁸ Portuguese wine was charged only two-thirds the customs duty exacted on French wine, and the Portuguese government repealed various restrictions against importing English cloth (Francis 1972:106).

to the vagaries of war.²⁹ French wines were becoming more scarce and their popularity continued to decline. It appeared that Englishmen had become so used to Iberian wines that even when small quantities of economically priced French wines were occasionally available, they were not consumed in nearly the quantities of an earlier generation.

In the closing years of the war [War of Spanish Succession 1702-1713], when the Tories were in power, there was talk of revoking the prohibition of French wine and of reducing the duties. This led to an increased demand and to French wines or wines described as such re-appearing in the market. Nevertheless the long prohibition was taking effect and the public were gradually losing their taste for them (Francis 1972:117-118).

²⁹ With England and France at war, French goods were once again prohibited which in turn ensured a strong place in the English market for Iberian wines. The economy of England also prospered because of the new markets for English cloth in Spain and Portugal. The retail prices for wines in London in 1705 showed a wide variety of wines available, including French wines which were then prohibited. This claret, which was presumably brought into England as prize cargo captured from the French or smuggled in, sold for 5/0 per gallon which was competitively priced with port. In 1708 and 1709, claret sold for as little as £15 per hogshead and as much as £48 per hogshead (£192 per tun) while Portuguese and Spanish wines remained more or less constant at approximately £10 to £15 per hogshead (£40 to £60 per tun) (Francis 1972:124-125). Englishmen had apparently grown so used to Iberian wines that even if they could have obtained small quantities of French wines, they no longer preferred them.

The war also affected Spanish wine production.³⁰ The blossoming of the Spanish and Portuguese wine industries could be seen as the direct result of intermittent warfare between England and France, trade embargoes,³¹ the growth of English maritime supremacy, and the growth of the English textile industry which encouraged new markets on the Iberian peninsula.

In 1713, the year before George, Elector of Hanover, ascended the English throne as George I, peace was restored between England and France. In this first year of legal trade, the quantities of French wine imported³² into England did not compete with imports from the Iberian Peninsula as during the reign of James II. The small quantities of French wine brought into England during the

³⁰ In 1703 a meager 345 tuns of Spanish wine was received in London as opposed to 9,267 tuns of Portuguese wine. The Spanish industry grew to become competitive with the Portuguese toward the close of the War of Spanish Succession. By 1710 and 1712, Spanish production was up to 5,914 and 4,652 tuns respectively. Portuguese wine imports for the same years were 6,712 and 6,703 tuns respectively (Francis 1972:130).

³¹ While the importation of French wines into England steadily declined, the quantities of wine produced in Bordeaux steadily increased. The French easily found new markets for their wines in Holland, Germany, and the Baltic nations. The exports from Bordeaux in 1721 amounted to 34,138 tuns but a very small percentage of this production found its way into England (Francis 1972:141).

³² In 1713, 2,551 tuns of French wine were imported into England. This figure gradually decreased until 1728 when George II (1728 - 1760) ascended the throne. In this year less than 1,000 tuns of French wine were received out of a total annual importation from other sources of 29,956 tuns (Francis 1972:143).

first half of the eighteenth century indicated that even though French wines were again legally available in England, they had been so difficult to obtain and were so expensive in relation to Iberian wines that they had lost favor on the English market.

Wine drinking was seeping a little downwards in the social scale, but the further decline of French wines shows that apart from their cost, the taste for them was being forgotten (Francis 1972:159).

The quantities of French wine that appeared on English tables was modest throughout the remainder of the first half of the eighteenth century. The products of Bordeaux which had been the preferred beverage during most of the seventeenth century had lost their pre-eminent position as the preferred wine of the upper class Englishman.

A definable shift in the tastes of the English wine drinker occurred during the closing years of the seventeenth century due principally to economic and political factors. Dry French wines, which had been more popular and economical throughout most of the seventeenth century, declined in popularity during the reigns of William III and Anne. Prohibitions against French wines in 1679 and 1688 and heavy tariff rates and corresponding retail price increases in 1688, 1693, 1697, and 1698 contributed significantly toward moving English tastes away from the dry wines of Bordeaux. The commercial treaty

negotiated by John Methuen between England and Portugal in 1703 was also a major factor contributing to economic discrimination against the wine products of France. By the mid-eighteenth century, French wines represented a very small proportion of the imported wines consumed at English tables, as indicated in Figure 1.7.

As their preference changed from French wines to Iberian wines, Englishmen became more keenly aware of the value of aging wines to improve their quality and increase their value. Fashionable glass bottles were ideally suited to this type of storage. As the custom of binning bottles of wine in cellars became more widespread, the need for a more efficient bottle form became imperative. The change in bottle form, which was predicated on changing consumption patterns, and on the custom of aging wine in glass containers, was the major cause for the morphological evolution of the English wine bottle.

FOREIGN WINE IMPORTS INTO ENGLAND AVERAGE ANNUAL TUNNAGE

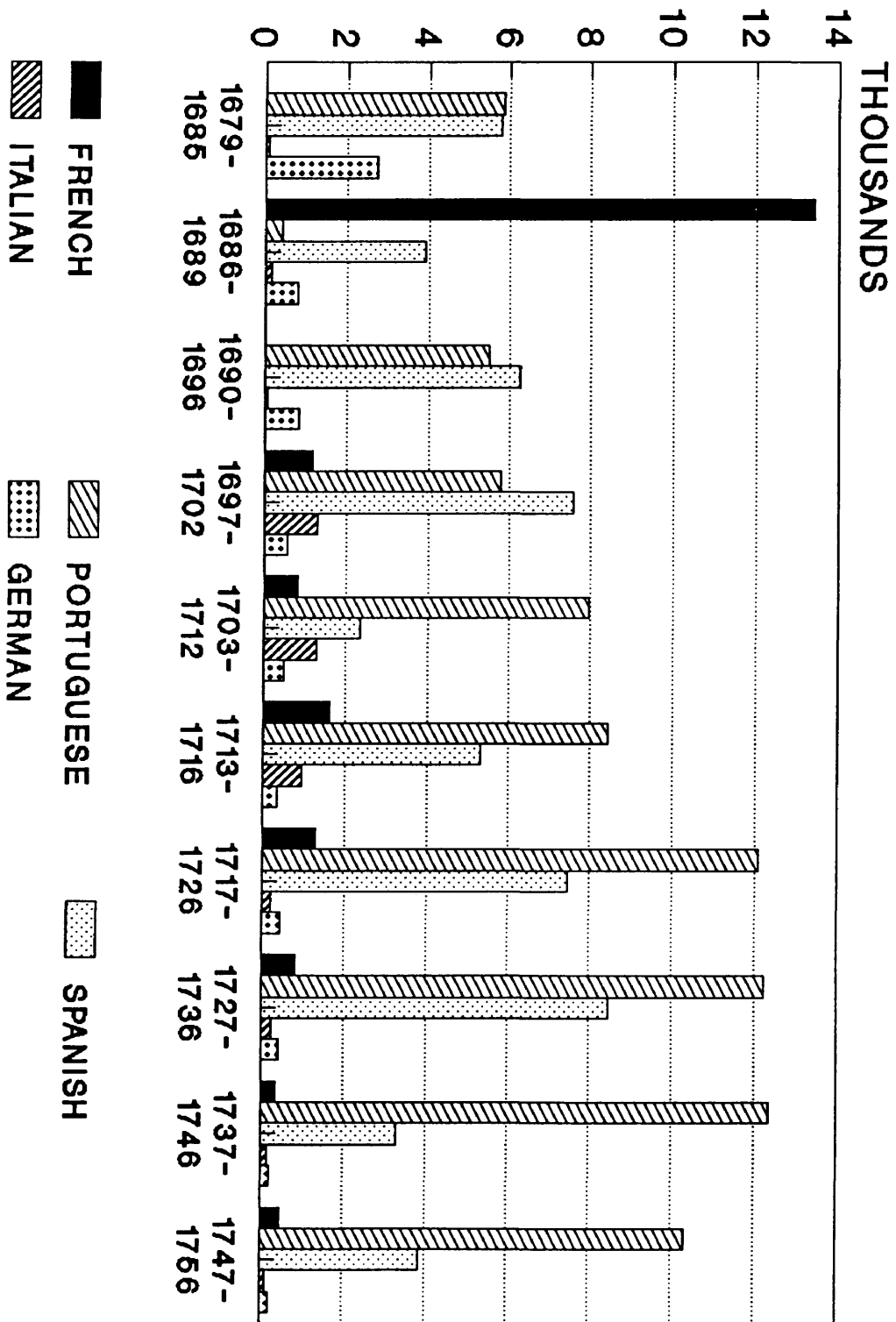


Figure 1.7

CHAPTER 2

COLONIAL WINE PRODUCTION AND CONSUMPTION

Wine consumption patterns in British North America were similar to those in England during most of the seventeenth and eighteenth centuries. The type of wine available to middle and upper class colonial consumers was controlled by many of the same economic factors that shaped English consumption patterns. Even though there are numerous early seventeenth-century references³³ to the bounteous vines that produced grapes comparable to those of European vineyards, the colonial wine-making industry never fully developed. There were three major factors which prevented its development: a persistent lack of oenological knowledge among the colonial settlers (Mishkin 1975:257), a

³³ Early works such as A Briefe and True Report of the Newfound Land of Virginia... by Thomas Hariot (1590), and The Gennerall Historie of Virginia, New-England, and the Summer Isles by John Smith (1624), described the vines and grapes that grew wild in North America. The reader should remember, however, that these early accounts of the abundance and fertility of the New World were largely written to encourage immigration, therefore might not paint a completely accurate picture of the fecundity of the Virginia colony. There were, however, unrefutable references to limited wine production in Virginia during the second half of the seventeenth century. See Noël Hume 1963:205.

readily available and abundant supply of imported wines (Mishkin 1975:261), and agricultural priorities aimed at the more lucrative cultivation of tobacco.³⁴

The profusion of vines growing in America encouraged settlers to suppose that native wines could be produced there. Indeed such an aspiration was specifically mentioned in the first charter for Pennsylvania granted to William Penn (Francis 1972:65).

The Virginia Company attempted wine production as early as 1610. Between that year and the dissolution of the Company in 1624, Mishkin documented nine references to vineyards and wine production (Mishkin 1975:252-253).

Staple grain crops and other marketable commodities, such as wine, were not produced in any quantity until the second half of the seventeenth century when the arable soils in the Tidewater region had been exhausted by tobacco. Soil depletion and the decline of tobacco prices in the mid-seventeenth century not only created significant demographic shifts in the Virginia colony, but also necessitated changes in land use and in the economy as a whole (Mishkin 1976:70-71). The decline in tobacco

³⁴ Tobacco was phenomenally profitable from the earliest years of production. David Mishkin reported that "Colonial tobacco production increased almost tenfold between 1615 and 1619; it increased threefold from 1619 and 1622 (Mishkin 1975:227). Also consult Mishkin 1975:303-310 Appendix I for a complete listing of tobacco prices and production in Virginia between 1615 and 1763).

profits³⁵ forced the economy to evolve from a one-crop, staple economy to one based on greater crop diversity. This in turn required more acreage of inexpensive, fertile land and as a result, the frontier was extended (Kelly 1979:196-198; Mishkin 1975:233).

The English government hoped to reduce the perpetual trade deficits caused by having to pay for wine imports in specie rather than in goods of equal value. It was hoped that colonial wine could be introduced into the European market and compete successfully with French and Iberian vintages.

England hoped that she could redress her unfavorable trade imbalance in wine by cultivating French, Spanish, and Madeira vines in her colonies. She planned to substitute at home, as well as in her colonies, colonial wines of these grapes, for the wines of France, Spain, and Madeira (Mishkin 1975:ix and 57).

³⁵ Tobacco prices were affected by warfare, over-production, and external economic factors. Over-production during 1629-1630 glutted the market and caused prices to collapse. Profit-taking recovered, only to be followed by over-production in 1638-1639. The English Civil War depressed the tobacco market and was followed by another depression of prices during the Anglo-Dutch Wars of the 1650s. The Great Hurricane of 1667 destroyed the majority of the tobacco crop that year and the destruction of the tobacco fleet by the Dutch in 1673 caused serious problems for the colonial tobacco growers. The shortages caused by these last two events and pressure from the English government eventually caused prices to stabilize and encouraged diversification of colonial crops (Mishkin 1975:229-230).

The Virginia Company issued an edict in 1619³⁶ which read in part

...that every householder doe yearly plant and maintaine ten vines untill they have attained to the art and experience of dressing a Vineyard either by their owne industry or by the Instructions of some Vignerons (Kingsbury 1908).

In spite of the best intentions, wine production never developed fully in seventeenth-century Virginia although there were references to Virginia wine and cider during the eighteenth century³⁷ (Mishkin 1975 and Ayres 1973:62).

Consumption of European wines in North America and the West Indies began at a very early date³⁸ and regular importation of wines probably began as early as tobacco

³⁶ The Virginia Company hired French vigneron from Laguedock in 1621 and 1622 to go to Virginia to teach the settlers the skills needed to dress vines and cultivate vineyards. Many of these vigneron apparently were killed in the 1622 massacre which effectively halted wine production during the Virginia Company period (See S. M. Kingsbury (editor), The Records...Virginia Company Vol. 4, May 1623 and Ayres 1973:62).

³⁷ Numerous seventeenth- and eighteenth-century attempts at viticulture in Virginia were made but none was deemed successful. As early as 1663, Sir William Berkeley produced wine from his own vines which he said was "...as good of my own planting as ever came out of Italy" (Noël Hume 1963:205). The most ambitious attempt occurred in 1770 when the House of Burgesses gave financial support to the efforts of Andrew Eustave who put approximately ten acres near the City of Williamsburg under grape cultivation. By 1777, however, this publicly-supported vineyard had failed (Ayres 1973:78-89).

³⁸ Captain John Smith is reported to have drunk sack in Virginia as early as 1609 (Francis 1972:64 and 131).

ships began plying the Atlantic to and from Virginia. The Virginia Colony was not alone in taking advantage of available supplies of foreign wines. William Bradford related in his History of Plimoth Plantation (1624) that between 1624 and 1646 wine was plentiful in New England:

...how ye Lord doth chaing times & things; for what is now more plentiful than wine? and that of ye best, coming from Malago, ye Cannaries, and other places, sundry ships lading in a year. So as ther is now more cause to complaine of ye excess...then of any defects or wante of ye same (Mishkin 1975:Vol. 1:261 and Vol. 2:273).

Established trade routes hindered development of domestic wine production (Mishkin 1975:261). Development of the South Atlantic fishing trade made importation of wines, particularly from Portugal and Spain, convenient and economical. A large North American fishing fleet, which regularly plied the Atlantic from North America to the Mediterranean, was a convenient way to bring in quantities of European goods, including wines (Middleton 1953:194). This convenient trade route may have been instrumental in guiding the wine consumption patterns of the colonists from French wines to heavier, sweeter wines of Spain and Portugal (Mishkin 1975:263).

The tastes of the English colonists generally followed those of England until the middle of the seventeenth century when

...taste turned towards French wines and these were the cheapest. The legal

maximum price for French wine was twenty pounds of tobacco the gallon, while Malaga and Spanish wines cost thirty pounds. The island wines of Fayal and Madeira, which could be imported directly without infringing the Navigation Act, cost only twenty pounds. The gentlemen of Virginia retained a taste for claret until the end of the [seventeenth] century (Francis 1972:64).

Canary, sack, and other sweet wines were luxury wines, were bought in small quantities. The still wines of Bordeaux were the preferred table wines and were known by their estate names as early as the mid-seventeenth century (Francis 1972:66). Colonial wine consumption mirrored that of England: the general preference was for French dry wines because they were the least expensive, and for the Wine Islands vintages which were priced competitively and were easily accessible.

An upper-class colonial gentleman's preferences was shown by William Byrd, who while serving as the attorney-general for the Virginia colony in 1689, provided twenty dozen bottles of claret, and six dozen each of canary, sherry, and rhenish wines for the benefit of the legislative council (Francis 1972:64). While it may be argued that William Byrd's largess does not provide an unbiased picture of overall colonial consumption patterns, this reference showed that in this instance, a larger quantity of French wine was provided than of any other type, and that the same kinds of Wine Islands vintages,

Spanish sherry, and German wines were available in Virginia at the same time that they were available in England.

The taste for claret in the colonies perhaps persisted longer than in England, for although direct communications with France were few and were prohibited by the Navigation Act...some French wine still reached those who were prepared to pay for it (Francis 1972:131).

The Navigation Acts passed by Parliament, first in 1651, were attempts to curtail Dutch trade (Ver Steeg 1964:108-109). The English government also hoped to regulate trade and encourage production of colonial wines made from French vine stocks. Unfortunately, these Acts contributed more to the importation of foreign wine to the colonies than to fostering colonial cultivation because Madeira was omitted from the list of restricted wines (Francis 1972:63). Because of the omission of this readily accessible wine from the list of restricted commodities, it was not only economical, but was the only wine that was legal to import. Colonial merchants and shippers were quick to capitalize on the economic and legal advantages of direct trade between the Wine Islands and North America. The wine trade between the Portuguese island of Madeira and North America³⁹ was well established by the mid-seventeenth

³⁹ "The sailing vessels of the American colonies and English ships sailing to America made it a practice to stop at Madeira for water and provisions. Here they invariably loaded a few pipes of Madeira wine, and it became the fashionable wine of the American colonies, a fashion that

century, before other Portuguese mainland wines had become popular in England (Francis 1972:65). "In 1676 Christopher Jefferson, who called at Madeira to load wine for the West Indies, spoke of an export of 25,000 pipes" (Francis 1972:64).

Though the consumption patterns of the North American colonies and England were similar in many ways, the similar patterns came about for different reasons. The price and availability of wines to the consumer in England were controlled by politically-motivated embargoes, intermittent warfare, and retail price fixing by government edicts. The colonial consumer's choices in the wine marketplace were directly effected by ease in accessibility. The direct importation of wine from the vineyards on the Wine Islands and the Iberian Peninsula to North America via the colonial fishing and trading fleet was an advantage that the English consumer did not have. It was convenient for the colonial fishing fleet to bring back wine from the Iberian Peninsula and the Wine Islands, but English consumers had to depend on wines legally imported through English customs or on limited quantities of contraband wine smuggled in on small coasting vessels. Open warfare, more easily enforceable trade embargoes, trade treaties, and government regulation of tariff rates and retail prices were the causes of the

remained until the turn of the twentieth century" (Grossman 1977:159).

shift in consumerism from French to Iberian wines in England. The economic advantage enjoyed in the colonies, coupled with the loopholes in the Navigation Acts which made it legal to import Madeira, eventually brought about a shift in preference in the colonies from dry French wines to sweeter wines.

RETAIL SALES OF WINE IN VIRGINIA

The retail sale of alcoholic beverages in public houses throughout the Virginia colony was regulated annually by the county courts or commissioners for each county (York County Deeds, Orders, and Wills VII:125-126, 4 November 1685). The courts and commissioners were compelled to fix retail prices for food and lodging for the protection of the public. In addition, the county governments were empowered to control the retailing of food, lodging, and beverages by granting licenses to ordinary and tavern keepers according to Acts of the Assembly.⁴⁰ Thus dishonest retailers or individuals with

⁴⁰ The law, referred to as "...the Nynety Seaventh Act of Assembly..." (York County Deeds, Orders, Wills VII:125-126) required ordinary and tavern keepers to be licensed. Various instances appeared throughout the seventeenth century in the York County Records where individuals were summoned before the York County Court to answer charges relating to the retailing of liquor in private homes or public houses without proper licenses (see the case of William Dyer, York County Deeds, Orders, Wills III:238 25 August 1680).

poor reputations were prevented from operating public houses. Licensing and price fixing guaranteed minimal standards of quality in services and accommodations for colonial travellers.

Relative costs for French wines compared with those of the Wine Islands and the Iberian Peninsula can be traced through Ordinary Rate Lists which were established by the county commissioners and the county courts. Rate lists fixed the maximum retail prices which any tavernkeeper could charge for food, lodging, and beverages. Assuming that the most economical wines would have been the wines consumed in the largest quantities, we see that French wines and those which were directly imported from the islands of Madeira and Fayal were less expensive than wines from Spain (Francis 1972:64). Although references to these ordinary rate lists occurred as early as 1685 (York County Deeds, Orders, Wills VII:125-126), the earliest intact rate schedule for York County did not appear in the Order Books until 1706 (York County Deeds, Orders, Wills XIII:61). The wine prices⁴¹ taken from this rate list for March of 1706/07 read in part:

⁴¹ A "Royall" is equivalent to 7 1/2 pence (Oxford English Dictionary). For the convenience of the reader, the prices indicated in the ordinary rate list have been calculated into shillings and pence with the following results: Virginia wine = £0..5s..0d, Canary & Sherry = £0..4s..3 3/4d, Red & white Lisbon, Claret & white wine = £0..3s..1 1/4d, and Western Islands (Madeira) = £0..1s..8 3/4d.

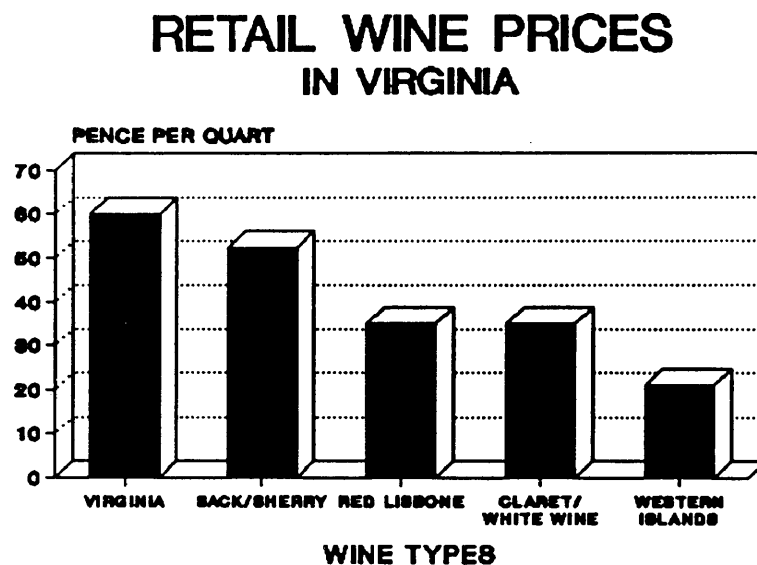
Wines of Virginia product at five shills:per quart
 Canary and Sherry seaven Royalls per qt.
 Red & white Lisbone[,] Claret & white wine five
 Royalls per qt.
 western Island wines three Royalls per quart

Assuming that these price lists indicated not only the relative costs of wine in public houses but also the esteem in which various wines were held, by the first decade of the eighteenth century, wine produced in Virginia was the most expensive, followed by Spanish sherry and Canary wine. Portuguese (Lisbon) wine and claret came next in descending order of expense and Madeira from the Wine Islands was the least expensive. This pattern of price advantage for Wine Islands wines continued throughout the eighteenth century.⁴² It is unfortunate that these price fixing lists could not indicate patterns of consumption, but only those wines which were apparently available in public houses. For purposes of comparison, these retail prices have been converted to pence per quart and Figure 2.1 indicates the price variance.

Although England's North American possessions had the potential to become wine-producing colonies, all the seventeenth and eighteenth-century attempts failed due to readily available supplies of "Wine Islands" wines which could be economically shipped directly to North American ports. The documentation suggested that English colonial

⁴² Additional Ordinary Rate Lists for York County are found in Appendix C.

Figure 2.1



tastes in wines closely followed those observed in Britain, although the taste for French wines seemed to have lingered slightly longer in Virginia. The preference for inexpensive Portuguese, Spanish, and Madeira wines was adopted by colonial wine drinkers as well as their English counterparts, during the first decades of the eighteenth century.

CHAPTER 3

WINE BOTTLE MORPHOLOGY IN RELATION TO METHODS OF BINNING

The advantages of aging wine in wooden casks in order to enhance its flavor and quality have been known for centuries (Francis 1972:17, 19, 41, 166, 239):

...in the fifteenth century [1460] the Czech traveller Rozmital...saw a huge vat belonging to the Bishop of Angers, where wine had been kept for fifty years. Much later, in 1678, John Locke saw a huge vat holding 200 tuns at Marmoutier...(Francis 1972:144).

During the seventeenth century it was found that wine could be aged initially in wooden casks and later transferred to glass bottles to complete the maturation process. Heavy wines such as port, were the first to be aged systematically in glass although it was apparent from the documentation that other wine types, such as burgundy and champagne, were aged in glass as well (Francis 1972:145; Bacon 1939:14; Grossman 1977:123).

The celebrated diarist, Samuel Pepys, recorded in his diary for October 23, 1663 that he went to the Mitre Tavern to see his newly-made bottles filled with wine (Ruggles-Brice 1949:20; McKearin 1971:125). Pepys also wrote that he had seen "...wines old and new ranged in bottles in the cellar..." in the London home of a Mr. Povey (Francis

1972:146). John Evelyn, in 1664, also remarked on the elegant home of Mr. Povey and "...his pretty cellar and the ranging of his wine-bottles". Four years later on another visit to the Povey residence, Evelyn wrote that there "...were divers greate Lords to see his well-contriv'd cellar and other elegancies" (Ruggles-Brice 1949:15). By the beginning of the last quarter of the seventeenth century, the use of glass bottles for aging and storing wine in cellars was a fashionable custom among wealthy English wine connoisseurs.

The manufacture of round glass bottles was carried on throughout Britain from the middle of the seventeenth century.

From the middle of the seventeenth century all English wine bottles were made in so-called "bottle houses" and the glass used for making them was very dark green, amber, or black. There were many of these factories... Nine were in the London, five in Bristol, five in Stourbridge, four in Newcastle, three in Gloucester, two in Newnham, two in Silkstone, Yorkshire, and many others scattered about the country (Powell 1923:73).

By 1695, 2,880,000 bottles were being produced annually in the bottle houses of England (Powell 1923:74). Glass bottles⁴³ for beverage storage was advocated and described in detail by James Worlidge in his Vinetum Britannicum or a

⁴³ Worlidge specifically discouraged the use of stoneware bottles for the storage of cider due to the porosity of the ceramic material and presumably, to difficulties in setting corks tightly in their necks.

Treatise on Cider (Worlidge 1676:103). This document recommended methods for making, closing, and storing cider, providing an intriguingly early reference to binning practices. John Houghton's writings,⁴⁴ entitled Collected Letters (1693), and based on the earlier works of Worlidge, referred to cider being matured in glass bottles "...laid on their sides so that the corks were kept damp... in frames or in sand or straw, or in niches in a wall..." (Francis 1972:146). Because it was customary to age cider in this manner, it is only reasonable to assume that the same techniques were employed for wines.

During the second half of the seventeenth century, English glass beverage bottles evolved from a tall, long-necked, globe and shaft form with a relatively small diameter base to a short-necked, broad-based bottle with a broad, flattened string rim (Noël Hume 1963:205; 1980:63-68; Ruggles-Brice 1949:18-19 and 21; Bacon 1939:15; Godfrey 1975:229). These types of bottles were the first to be used for storing and aging wines and other alcoholic

⁴⁴ John Houghton published Papers on the Improvement of Husbandry and Trade in 1696 which contain recommendations for the bottling of cider. See Noël Hume 1958:774; Francis 1972:146 and 148-149. See also by John Houghton, Husbandry and Trade Improv'd: Being a Collection of Many Valuable Materials Relating to Corn, Cattle, Coals, Hops, Wool, etc...., London, 1727, No. 198.

beverages.⁴⁵ By the beginning of the eighteenth century numerous references to specific wine types, such as champagne, appeared. William III owned bottles containing wine from the Champagne region which was five years old. Queen Anne of England paid more for aged madeira than for younger wine which was not considered palatable until it had been aged for at least two seasons (Francis 1972:144 and 145). It is apparent that the aging of a variety of wine types was well appreciated by the closing years of the seventeenth century and had become a well-established practice by the first decades of the eighteenth century. In 1706, Robert Walpole purchased old burgundy at 4 shillings per bottle, the most expensive wine in his cellar. He also purchased German Hochheimer which had been aged between four and five years (Francis 1972:144). George Granville, Lord Landsdowne, in correspondence to the poet, Alexander Pope in 1706, offered "...a bottle of old claret which has seen two reigns⁴⁶ (Francis 1972:145). In the 1720s, Jonathan Swift had

Among the wines in his cellar ...
hermitage imported from Rouen at some

⁴⁵ "...port-wine was scarcely drinkable until it had mellowed, and this led to a general belief that no wine was good until it had been kept for some years." (Francis 1972:147).

⁴⁶ Granville's reference to "two reigns" may have been an allusion to the reigns of William and Mary (1689-1702) and Anne (1702 - 1714) suggesting that the bottle in question could have contained wine between 17 years of age at the oldest and 4 years of age at the youngest.

expense. He had a disappointment with one consignment which turned sour, but the next lot, though not ready to drink for two years, improved steadily, and after seven years Swift had a few bottles which tasted better than ever (Francis 1972:146).

By 1719 in Virginia, bottles of beer produced in Bristol and London were mentioned in the ordinary rate lists set by the county courts. It was apparent that glass bottles for shipping and storing beer was commonplace by the second decade of the eighteenth century (York County D.O.W. XV:571 See Appendix C).

The shipment of wine in glass bottles had become so wide-spread by 1728, that Parliament passed prohibitions against importing foreign wines in these containers⁴⁷ (Francis 1972:147). This was an effort to curb smuggling which was more easily carried out from small boats with wine in conveniently manageable containers like bottles instead of heavier, more bulky wooden casks. In 1728, a Frenchman named Claude Arnoux, attempted to encourage importation of wines from Burgundy into England and wrote in considerable detail concerning the harvesting, wine-making techniques, and aging of French wines.

⁴⁷ Noël Hume documented the practice of English merchant ships, such as The Rising Sun (wrecked in 1703), which carried beer, wines, and spirits in glass bottles packed in wooden chests for resale abroad (Noël Hume 1974:80). Francis noted that the East Indiaman Mary Galley carried more than 39 dozen bottles of claret on her maiden voyage to Calcutta in 1704 (Francis 1972:134-135).

They [burgundy wines] were matured in casks, from which the excess was allowed to escape from time to time, but were also put into small bottles in which the progress of the wine could be followed... Arnoux recommended Chassagne as a vin de premier which could stand travel well and could be safely left in bottles. He went on to recommend that the wine should travel in the bottle rather than in the cask, saying it could be sent overland to Calais in carts carrying 1,000 bottles...He thought that the wine sent by cart would travel better in bottles and in any case the wine from Beaune should be bottled...(Francis 1972:147-148).

Arnoux went on to describe various burgundies, such as Volnay, Pommard, and Chambertin, which were expected to last from one to six years in bottles.

By the second and third decades of the eighteenth century, aging fine wines had become a standard practice. Jonathan Swift, in the 1730 while speaking of his friend the Reverend John Walsh, mentioned "...a hogshead of the best claret in bottles well corked and laying on their sides" (Francis 1972:146). The need for a glass container with straighter sides to facilitate laying down bottles became imperative. Throughout the remainder of the eighteenth century, numerous references appeared which further support the supposition that wine storage and maturation in glass was commonplace.

BOTTLE CLOSURES

The material used to seal beverage bottles and the methods used to secure the closures in the necks of the bottles are of equal importance to understanding the evolution of binning customs for wine.

...early bottles, whether of glass or some other material, were often caulked not with corks but with wisps of tow soaked in oil and capped with sealing wax. Wooden stoppers and of course glass ones in the earliest bottles or phials were also common (Francis 1972:148).

Helen McKearin documented the use of wax covered with leather or parchment, wads of wool dipped in wax, spills of paper, as well as cork for the closures of beverage containers (McKearin 1971:120-123). Fairly early in the seventeenth century, cork was recognized as the best material for closing bottles for short or long-term storage. The shape of the cork is also important in understanding the evolution of binning customs at various times. Conical corks were common in England by 1635 (Lief 1965:4). In the Philacothonista, published in that year, a reference to corks blowing out of the necks of beer bottles is recorded. In addition, Dr. Martin Lister, while on tour in Paris in 1698, described some of the wines he saw as "loose bottled" while other wines were close corked⁴⁸

⁴⁸ Martin Lister, Journey to France, written in 1698. In Pinkerton's Voyages, Vol. IV, 1809.

(Francis 1972:148). It would seem that both conical and cylindrical corks were used by the end of the seventeenth century, depending upon the type of beverage being stored (Pittman 1989). Conical corks were usually secured in the necks of the bottles with cord and later wire (McKearin 1971:124). The benefits of a tight seal to prevent spoilage of the stored liquid were appreciated very early in the seventeenth century as documents dated as early as 1609⁴⁹ and 1615⁵⁰ clearly indicated.

The configuration of the string rim on the bottle necks changed through time from broad, flattened applied shelves of glass to much smaller, more angular bands of glass as the methods for securing the closures changed. Noël Hume noted that:

The earliest Wine bottles- those that appear in the 1650s- generally possess broad string rims, suggesting that the material used for tying their corks was comparatively heavy, i.e., cord rather than wire...By the end of the century, on the other hand, the string rims had dwindled to small "V" sectioned collars, suggesting that the tying material was now thinner than it had been previously. It could be suggested- though not yet proved - that wire began to be used for tying corks during the last decades of the

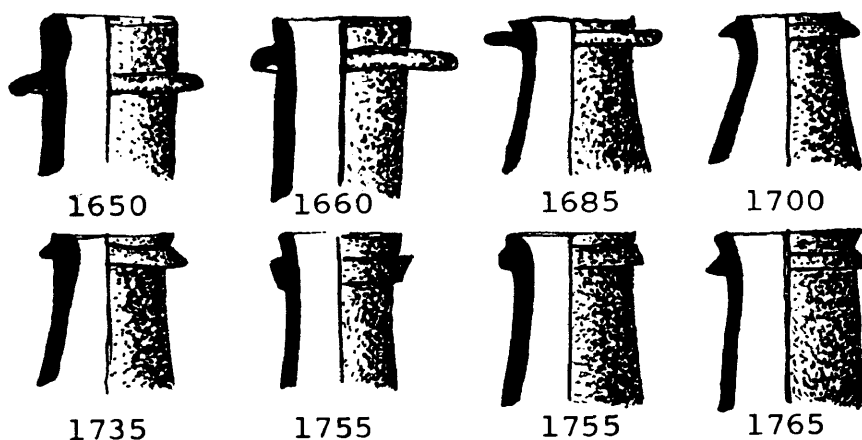
⁴⁹ Delightes for Ladies to Adorn Their Persons, Tables, Closets, & Distilleries with Beauties, Bouquets, Perfumes & Waters, by Sir Hugh Plat, printed in London in 1609.

⁵⁰ The English Hus-wife, by Gervase Markham, printed in London in 1615. This reference also contains one of the earliest descriptions of bottling beer.

seventeenth century. There is no doubt that it was in use by 1703 (Noël Hume:1958:774).

Figure 3.1 illustrates the evolution of the string rims on English wine bottles from the mid-seventeenth century through the mid-eighteenth century.

Figure 3.1



The evolution of string rims on English bottles affirms the assertion that bottle finishes were purposefully engineered to receive a tight-fitting, long-term cork closure during the last quarter of the seventeenth century. It is not coincidental that this change in string rim form occurred at the same time that long-term storage of wine in glass bottles became fashionable.

As the custom of sealing glass bottles with tight-fitting corks developed, the need for a corkscrew to

withdraw the cork became imperative. The earliest reference to bottleworms or corkscrews appeared in 1681 (McKearin 1971:126; Hughes 1960:499). Additional references occurred during the same decade.

Lady Sheelah Ruggles-Brice found a "cork-drawer" at £00-03-06 in the 1686 accounts of a Dr. Claver Morris who seems to have maintained a cellar of a comforting size since he bought also "12 dozen of quart-glass bottles" and "5 dozen of Corks" during the same year (McKearin 1971:125; Ruggles-Brice 1949:19-20).

Corkscrews were an indispensable tool after the use of cylindrical, tight-fitting corks became commonplace.

...cylindrical corks could be inserted flush with the lip of the bottle thus obviating the use of conical corks tied in with packthread or wire. The new form of cork could be longer too and certainly was by the early 18th century...(McKearin 1971:125).

One wonders how tightly-corked bottles were opened before this date. One plausible answer may reside in the expression "to crack open a bottle". Jonathan Swift cited the practice of cracking off the neck of a bottle rather than risking damage to the wine by laboriously extracting the tight-fitting cork. In Swift's Directions to Servants, written in 1730, he rebuked clumsy butlers who had not yet learned the proper use of the corkscrew and were still literally cracking bottles. Within one generation, the corkscrew became a commonplace, valuable household

appliance. In Jonathan Swift's last will and testament of 1745, the cleric bequeathed his bottlescrew and silver and enamelled bottle labels to his friend, the Earl of Orrery (Francis 1972:145-146 and 151).

BOTTLE BINNING TECHNIQUES

The techniques of binning or storing beverage bottles developed co-incidentally with corkscrews (McKearin 1971:125). Considerable evidence suggests that wine bottles were initially stored inverted in wooden frames, shoved into sand, or laid in straw in such an attitude as to keep the tight-fitted corks wet and swollen in the necks of the bottles (Worlidge 1676:pp. 103-104, 107, 109; Ruggles-Brice 1949:21).

Contrary to general belief that binning dates no earlier than the 1730s, the inventory of Beauchief Hall, Derbyshire, taken in 1691, records that in the pantry were: "Thirteen dozen of glass bottles, one pound six shillings; a frame for bottles six shillings and eight pence; one old bottle frame five shillings" (Hughes 1955:1577).

The method of binning glass bottles in frames was practiced in England by the last decade of the seventeenth century. Other methods of laying down bottles were developed as the shapes of the bottle permitted. John Bacon offered convincing proof of the changes in binning

techniques by when he documented the "crust" deposits⁵¹ found in the neck of a port bottle dated to circa 1710:

...in a bottle of mine marked K of about 1710 the crust of the port is to be seen gathered round below the neck of the bottle. This also solves the problem as to how these bottles were laid down, viz., neck downwards with each bottle resting on its shoulder in a hole in a bin. So all of the earliest port bottles were binned upside down. It is also proof of this that old cellars often have bins with holes all over the surface- one hole, one bottle. To-day these holes are covered over by a board to enable the long cylindrical bottles to be laid side by side and then piled up; a great savings in space (Bacon 1939:15).

The Governor's Palace in Williamsburg, Virginia is reconstructed on the original foundations which were laid down in 1706 (Olmert 1985:74). This building, comparable to a small English country house of the period, was designed to reflect the wealth and power of its occupants. Constructed in the latest architectural style and equipped with fashionable appointments, its purpose was to make a strong political and social statement. Archaeological excavations of the cellars conducted in the 1930s revealed various rooms and brick structures which have been

⁵¹ "While the wine is maturing in the pipe, it throws a deposit (crust or lees) just as it does in the bottle. Some of the deposit is not heavy enough to precipitate and remains in suspension, causing the wine to have a dull, or "blind" appearance" (Grossman 1977:27 and 154). This deposit left in the neck of the port bottles proved that they were binned upside down.

interpreted as bins of the type used for storage of wine in bottles (Noël Hume 1963:109). That a prominent building of the first quarter of the eighteenth century in colonial Virginia would be designed with cellars and bins for the storage of glass bottles clearly indicated that the custom of binning was deemed important enough to affect the architectural design of the building. The archaeological evidence did not, unfortunately, suggest whether bottles binned in the Palace cellars were stored inverted or on their sides.

The detailed inventory of the personal estate of Lord Botetourt, taken in October of 1770, listed among other things, the contents of the "Binn Cellar" and the "Vault" which contained "more than nineteen hundred bottles" of a wide variety of wines and other alcoholic beverages (Noël Hume 1963:109; Hood:no date; Powers 1983). To store 1,900 glass bottles in the Palace cellar, they would have to have been stored on their sides, considering the limited space in the bins indicated by the brick foundations.

The documentary evidence thus far examined suggests that glass wine bottle shape changed as a result of the custom of binning beverages in glass bottles. The practice of sealing bottles with tight-fitting corks coincided with references to aging and binning wine in bottles laid on their sides. In tracing the evolution of bottle shapes from the mid-seventeenth century which were long-neck,

globe and shaft forms to the short-necked, bulbous forms in common use at the end of the seventeenth century, there was a gradual but significant change. But beginning during the first quarter of the eighteenth century, wine bottles begin to develop a shoulder and progressively greater angularity in their sides. These mallet-shaped bottles are a transitional form which evolved into the straight-sided forms common after the 1730s. The cylindrical form of the bottles was enhanced by the use of the dip mold in about 1730 (Jones:1985:26). By the beginning of the second quarter of the eighteenth century, the custom of aging wines in bottles with tight corks was standard practice. The bottle forms which were produced throughout the mid- to later-eighteenth century continued to evolve into their modern forms.

CHAPTER 4
BOTTLE MORPHOLOGY AND STATISTICAL
ANALYSIS

Numerous scholars have studied wine bottle morphology throughout much of this century. Most of their efforts have been based on an antiquarian approach to stylistic variations in bottle shapes through time, or have attempted to define the variation in bottle forms in technological terms. The use of seal-dated vessels to assign dates of manufacture to bottles remains the primary focus of numerous investigators including Helen and George McKearin (1941), Helen McKearin (1978), Sheelah Ruggles-Brice (1949), Roy Morgan (1980), and Ivor Noël Hume (1980). Noël Hume presented one of the most widely used seriations of bottle forms in his A Guide to Artifacts of Colonial America. His seriation was based upon 49 bottles; all bore dated seals except one. Bottle seals which carried the owner's names and/or initials, and dates, were occasionally applied to the shoulders or sides of English wine bottles. Since these seals could only have been applied while the bottle was being formed, they are believed to be a reliable indication of the date of manufacture of the bottle. These impressed seal dates

provided the basis for Noël Hume's seriation. In order to use this seriation, a researcher must make a completely subjective decision as to the similarity of his or her bottle fragment to the bottles illustrated in the seriation. Other researchers such as Richard Carillo (1974), Vernon Baker (1977), and W. S. Robertson (1976), have attempted what they believed to be objective statistical analyses. Their attempts were only marginally successful, due largely to inconsistencies in the interpretation of their bottle element measurements which appeared to have been taken not from the actual bottles, but from the "...meticulously drawn illustrations by I. N. Hume" (Robertson 1976; Baker 1977). The obvious limitations in this approach to measurement analysis cannot be overcome. Not only are accurate diameter measurements impossible from the two-dimensional images, but all linear measurements are equally suspect due to the inevitable distortion caused by photographic reproduction techniques.

The detailed study undertaken by Olive R. Jones (1986) which dealt largely with cylindrical bottles of a period later than those under investigation in this study, is the first successful attempt to define statistically the morphological change in English bottles. Some of the statistical analysis employed in the present study is based on the work accomplished by Jones (1986) for cylindrical bottles of the period 1735 through 1850.

This study will objectively define the morphological evolution of glass bottles from the second half of the seventeenth century through the first half of the eighteenth century. It is not the intention of this study to redefine the dating already established by existing seriations. The purpose of this study is to provide an additional tool by which fragmentary or non-seal-dated bottles can be placed in a dating framework. An objectively-derived set of measurement parameters, which can be used to reaffirm the dating established by seriations based on seal-dated specimens, would be a valuable tool for archaeologists and material culture researchers.

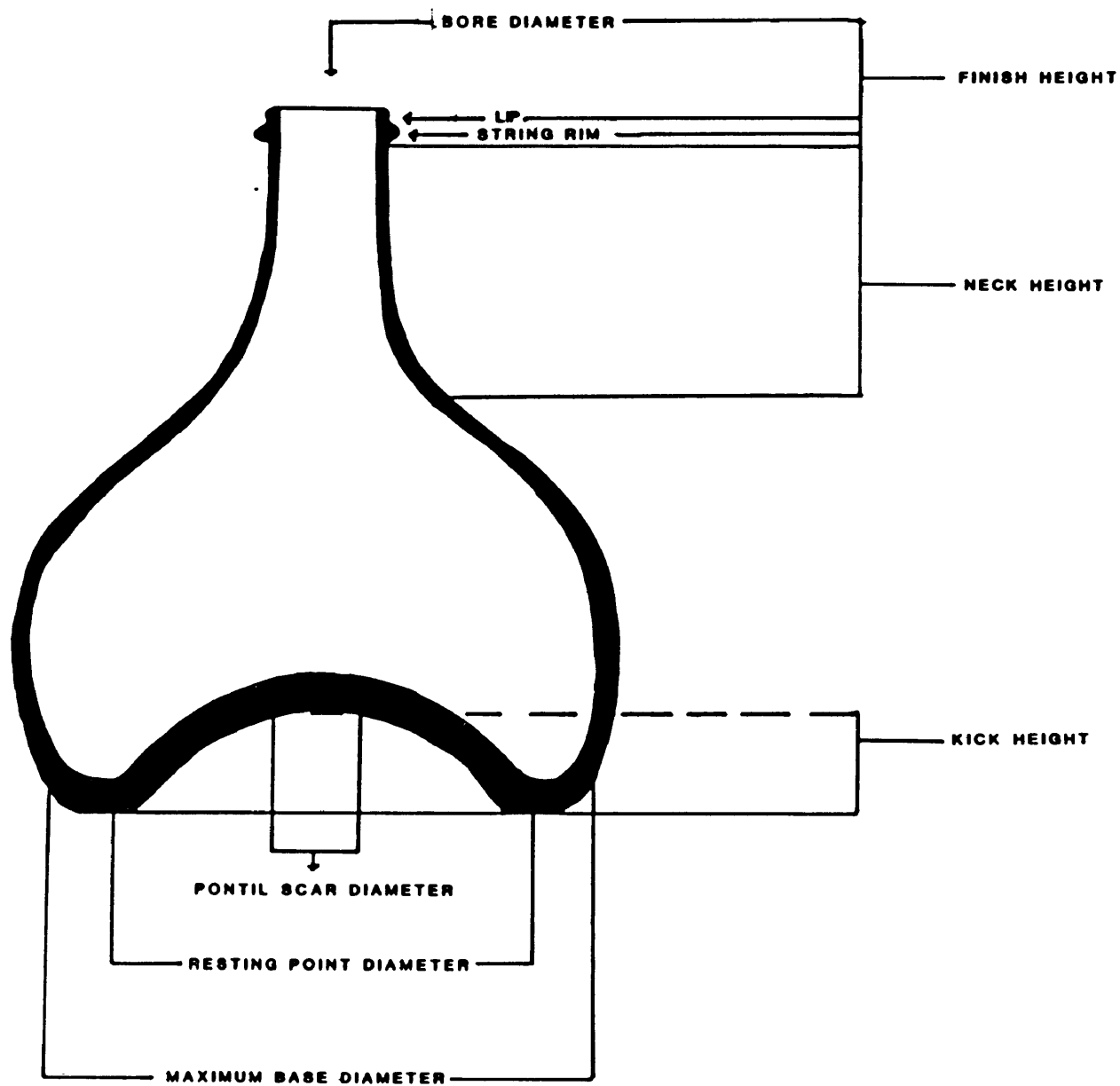
Precise measurements of thirteen diagnostically significant bottle elements from a large sample of actual bottles have been statistically analyzed to aid in the interpretation of the morphological change that took place in English wine bottles from the mid-seventeenth century to the mid-eighteenth century. Figure 4.1 illustrates the standard bottle anatomy which this analysis will investigate. Some of the bottle terminology used in this thesis is adapted from the Parks Canada Glass Glossary (Jones et al. 1985).

For ease in analysis, the bottles used in this study were divided into four classes based on form: flare-sided

(circa 1660 through circa 1680); globular (circa 1680

Figure 4.1

BOTTLE ANATOMY

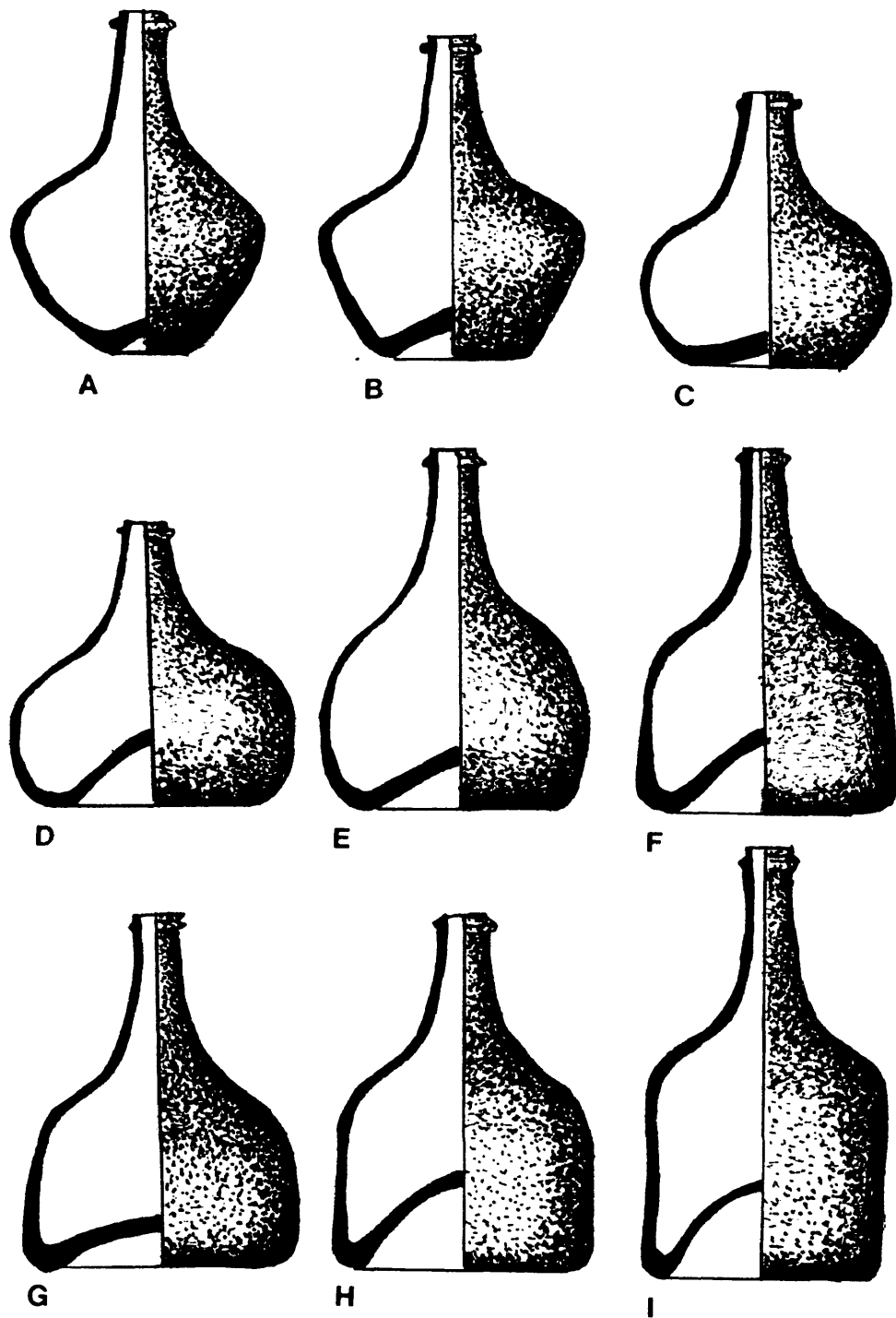


through circa 1715); mallet-shaped (circa 1715 through circa 1730); and straight-sided (circa 1730 through circa 1750), as shown in Figure 4.2. The form classes were based on a consensus of bottle seriations in common use today (Noël Hume 1961, 1980; Morgan 1980). The date ranges represent roughly fifteen- to thirty- year spans during which each form class appeared to be most common.

During the course of the investigation, a total of 275 whole or nearly complete bottles were examined and measured. The measurements were entered in an analytical data management program called Reflex, distributed by Borland/Analytica, Inc. (1985). This analytical database provided the basic statistical computations and produced all the graphic representations and tables showing the raw and classified data.

The bottles which will be considered in this study are archaeological and museum specimens from the Archaeological Collection and the Decorative Arts Collection of the Colonial Williamsburg Foundation, The National Parks Service Collection at Jamestown, and the Archaeological Collections of the Division of Historic Landmarks for the State of Virginia. The following measurements were taken from all of the bottles under consideration whenever possible: bore diameter, string rim height, lip height,

Figure 4.2 TYPICAL BOTTLE FORMS OF THE LATE SEVENTEENTH AND EARLY EIGHTEENTH CENTURIES



A and B above are typical of the flare-sided forms, C, D, and E are globular forms, F and G are mallet shapes, and H and I would be classified as straight-sided forms.

finish height, neck-to-finish height, (external) neck diameter, bottle height, bottle capacity, bottle weight, maximum base diameter, kick (pushup) height, resting point diameter, and pontil scar diameter. All diameter and height measurements were taken in centimeters, while the capacity and weight measurements were taken in milliliters and grams, respectively. Basic statistical computations were performed to find minimum observation, maximum observation, the midrange observation, the arithmetic mean of the sample, the degree of variance within the sample, and the standard deviation within the sample. These computations were conducted for each of the bottle elements listed above.

The statistical computations for each bottle element in each form class were based on a minimum of thirty observations. This sample size was larger than any used in previous statistical studies and resulted in a higher degree of statistical reliability.

Table 4.1

BORE DIAMETER ANALYSIS

SHAPE	MIN. BOR	MIDRANGE	MAX. BOR	MEAN BOR	VARIANCE	ST. DEV.
FLARE	1.6	1.95	2.25	1.90233	0.02666	0.16329
GLOBULAR	1.45	1.85	2.25	1.8756	0.02214	0.14878
MALLET	1.47	1.94	2.49	1.94426	0.03069	0.17519
STRAIGHT	1.58	2.125	2.71	2.12528	0.03261	0.18057

The mean bore diameter for the globular forms (sample size = 50 specimens) was 1.87 with a minor variance of 0.02

within the sample. The minimal degree of variance and a standard deviation of less than 1.5 indicates that there is very little variation on the bore diameters of the globular forms investigated. The flared and mallet shaped bore diameters (sample sizes = 30 flared and 47 mallet) showed a slightly increased mean, variance, and standard deviation, but were still less than the computations for the straight-sided forms which showed the most deviation from the norm with a variance of 0.03 from the mean diameter of 2.12 centimeters. Figure 4.3 illustrates proportional differences between the results described in Table 4.1.

Figure 4.4 illustrates the distribution of bore diameter measurements from a sample of the raw data. This figure shows the remarkable consistency among the bore diameters of all four bottle forms.

Figure 4.3

BORE DIAMETER ANALYSIS

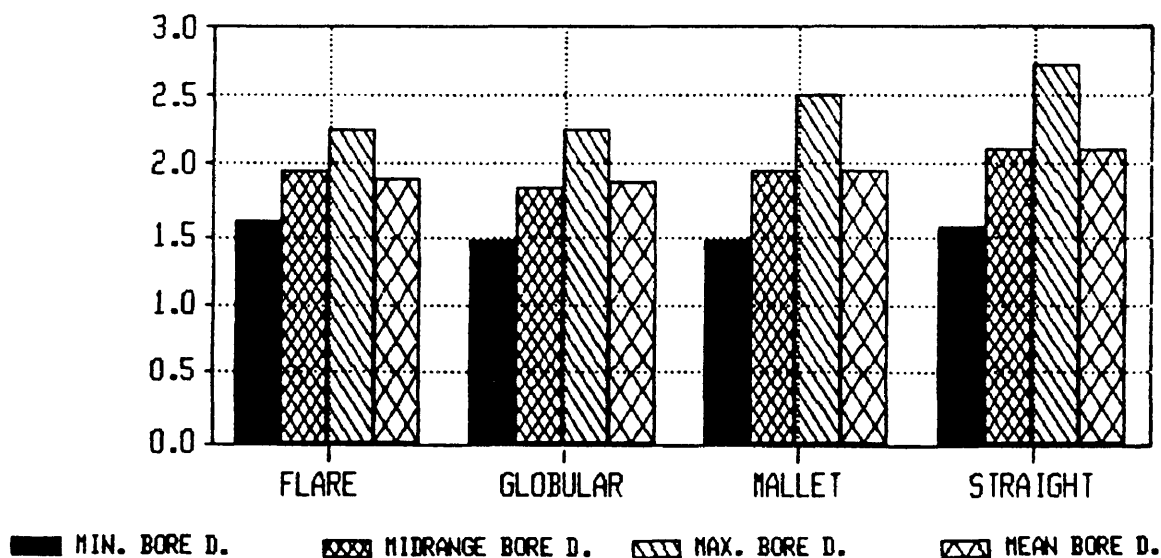
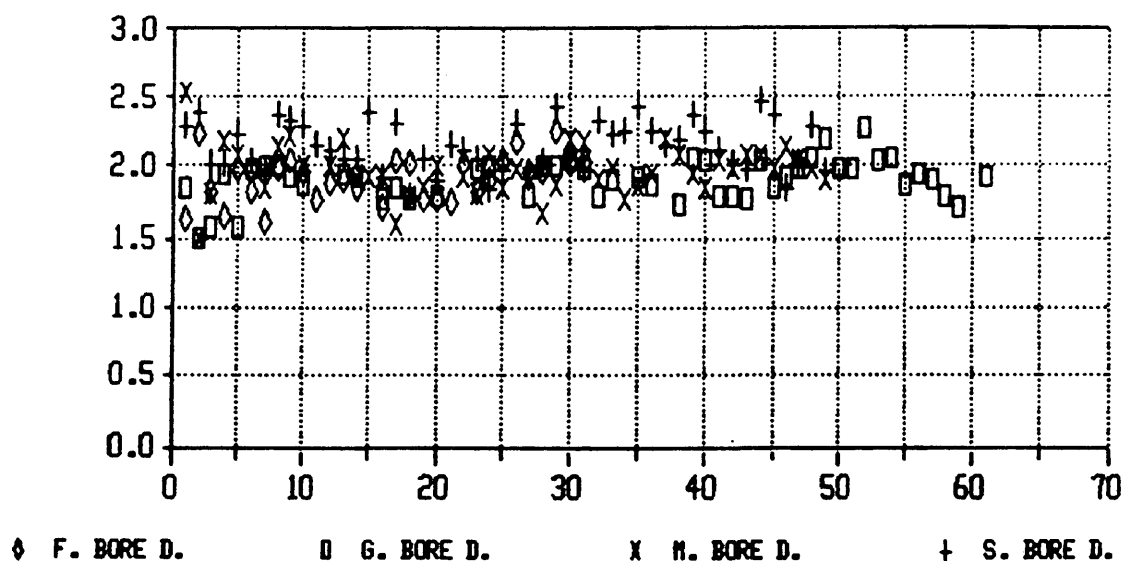


Figure 4.4 BORE DIAMETER COMPARISON



The preceding analysis indicates a minor increase of less than 0.25 centimeters in the diameters of bottle bores from the globular forms to the straight-sided forms.

String rim heights of a sample of 54 globular, 31 flare-sided, 48 mallet-shaped, and 127 straight-sided bottles were analyzed with the following results:

Table 4.2

STRING RIM HEIGHT ANALYSIS

SHAPE	MIN. S.R	MIDRANGE	MAX. S.R	MEAN S.R	VARIANCE	ST DEV
GLOBULAR	0.23	0.5	0.9	0.50907	0.01712	0.13084
FLARE	0.37	0.495	0.8	0.51032	0.00924	0.0961
MALLET	0.29	0.495	0.79	0.50875	0.01422	0.11924
STRAIGHT	0.26	0.6	1.16	0.64354	0.03431	0.18523

The string rim heights of the bottles under investigation again showed remarkable similarity in each of

the four form classes. The mean string rim heights for the globular forms were only 0.13 centimeters shorter than the straight-sided vessels with a minimal variance within the test sample. Figure 4.5 indicates that there is slight decline in the maximum string rim heights in the flare-sided and mallet-shaped bottles compared with the globular form. The mean string rim heights of the three earliest forms remain constant, increasing only with the straight-sided form. Figure 4.6 shows the distribution of the string rim heights of the three earliest forms with a 50% sample of the 127 straight-sided bottles.

The heights of the bottle lips were statistically compared and showed very little fluctuation among the four form classes. The globular lip heights (sample size = 53) were not appreciably different from the lip heights of the flare-sided (sample size = 30)

Figure 4.5 STRING RIM HEIGHT ANALYSIS

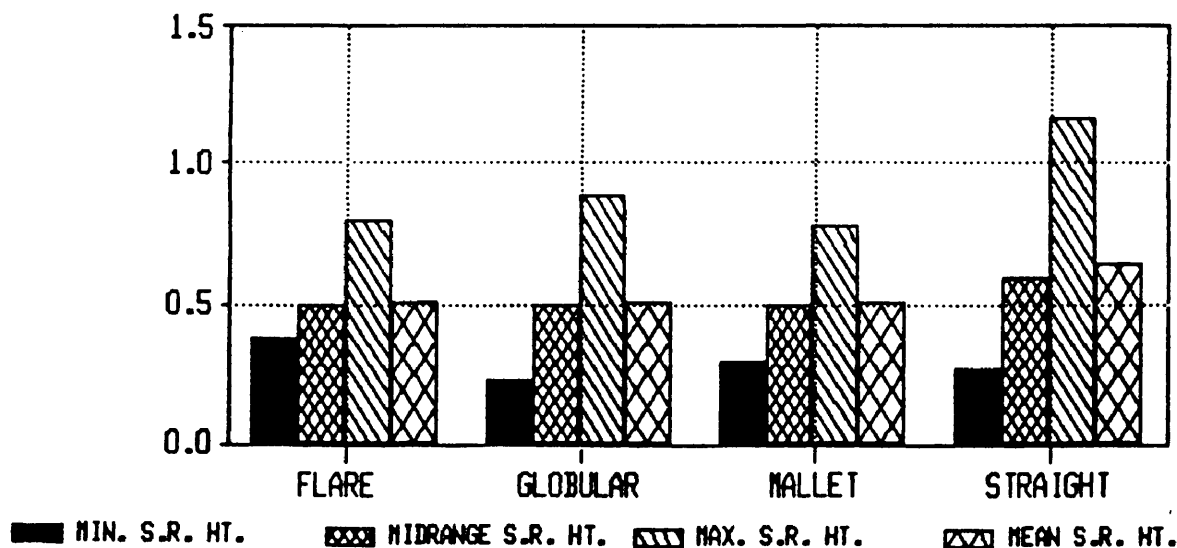
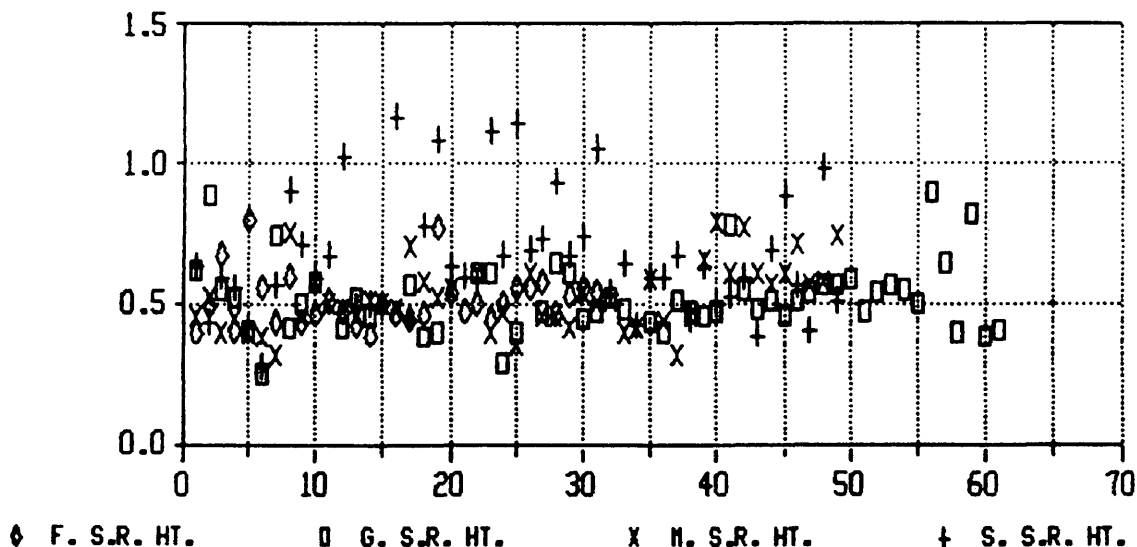


Figure 4.6

STRING RIM HEIGHT COMPARISON



and mallet shapes (sample size = 48). Table 4.3 lists the results of the computations which are illustrated in Figure 4.7.

Table 4.3

LIP HEIGHT ANALYSIS

SHAPE	MIN. LIP	MIDRANGE	MAX. LIP	MEAN LIP	VARIANCE	ST. DEV.
GLOBULAR	0.07	0.53	0.99	0.44774	0.03812	0.19524
FLARE	0.16	0.575	0.99	0.55567	0.03158	0.17772
MALLET	0.19	0.43	0.77	0.41146	0.02095	0.14476
STRAIGHT	0.15	0.56	1.52	0.56267	0.04004	0.2001

It is apparent that the lip heights of the globular and flare-sided forms are very consistent with identical maximum heights of 0.99 centimeters. The arithmetic means of these shapes do show minor variations. All of the

computed variances within the samples show very little

Figure 4.7 LIP HEIGHT ANALYSIS

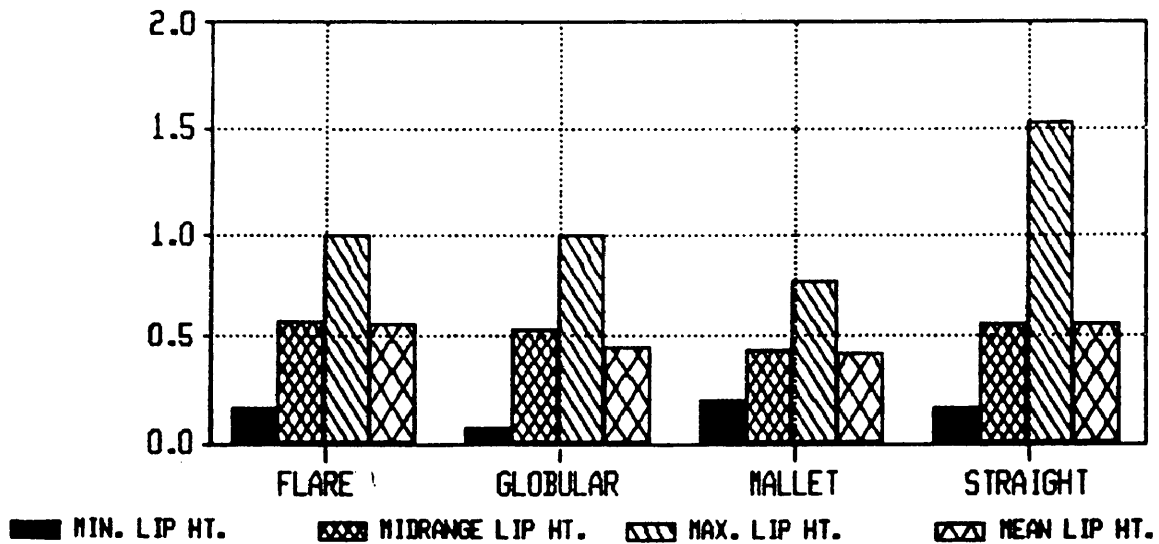
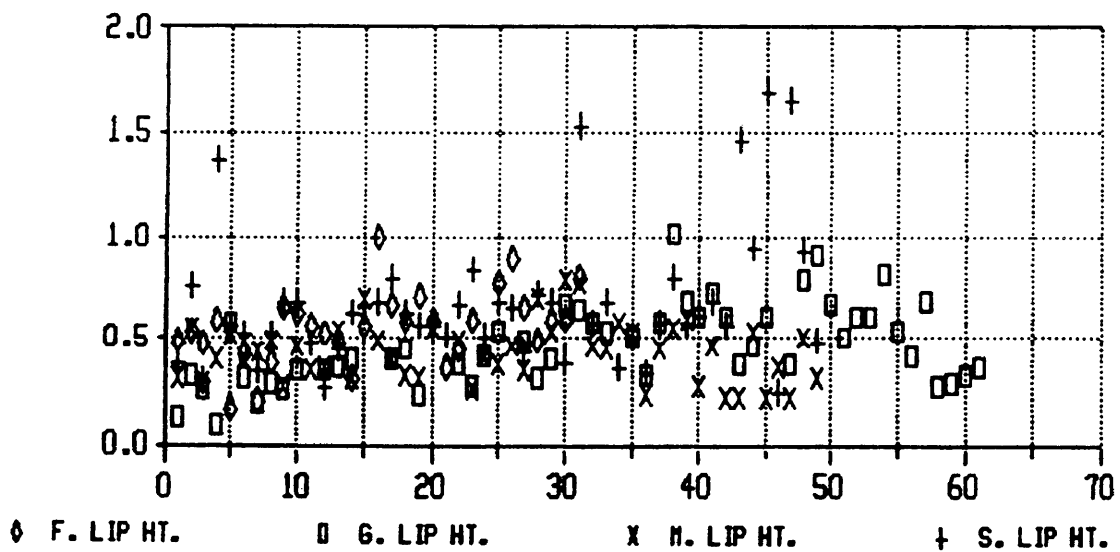


Figure 4.8 LIP HEIGHT COMPARISON



variation among any of the four forms. The only outstanding incongruity among these measurements appears in the maximum lip height for the straight-sided form which is nearly twice that of the mallet shape. Figure 4.8 shows

the distribution of the lip heights for all the form classes.

The finish heights were also analyzed with the same results as described for the lip and string rim heights. Minimal degrees of variance occurred in each sample with the most pronounced differences appearing in the finish heights of the straight-sided forms. In all four shape classes, the means and standard deviations were remarkably similar. See Table 4.4, Figures 4.9 and 4.10 for comparisons.

Table 4.4 FINISH HEIGHT ANALYSIS

SHAPE	MIN. FIN	MIDRANGE	MAX. FIN	MEAN FIN	VARIANCE	ST. DEV.
GLOBULAR	0.51	0.96	1.57	0.97453	0.04961	0.22272
FLARE	0.64	1.045	1.57	1.079	0.04096	0.20238
MALLET	0.59	0.92	1.29	0.91458	0.02572	0.16036
STRAIGHT	0.6	1.17	1.91	1.19759	0.0635	0.25199

Figure 4.9

FINISH HEIGHT ANALYSIS

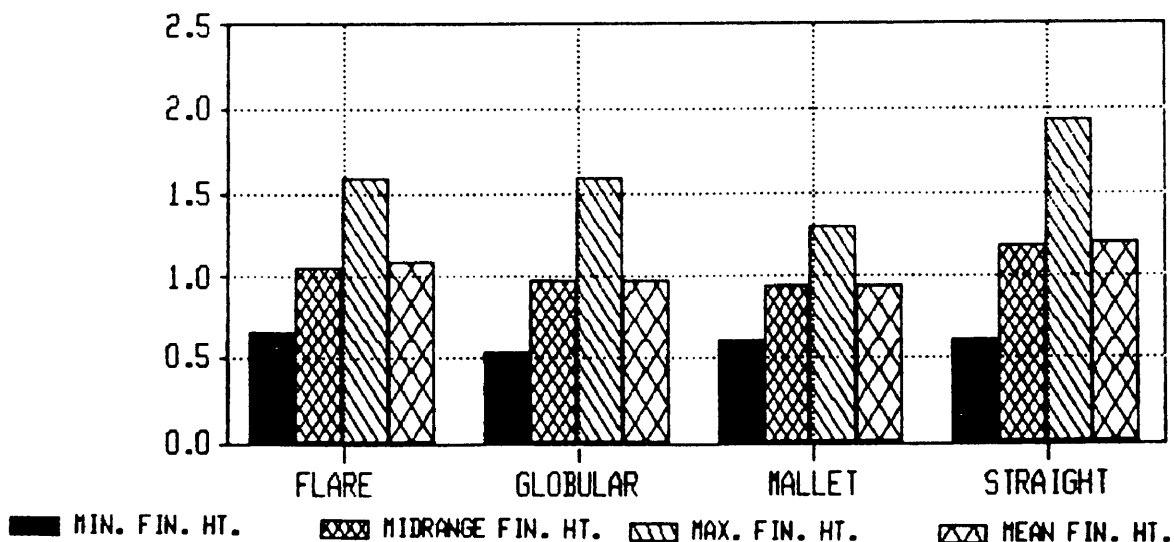
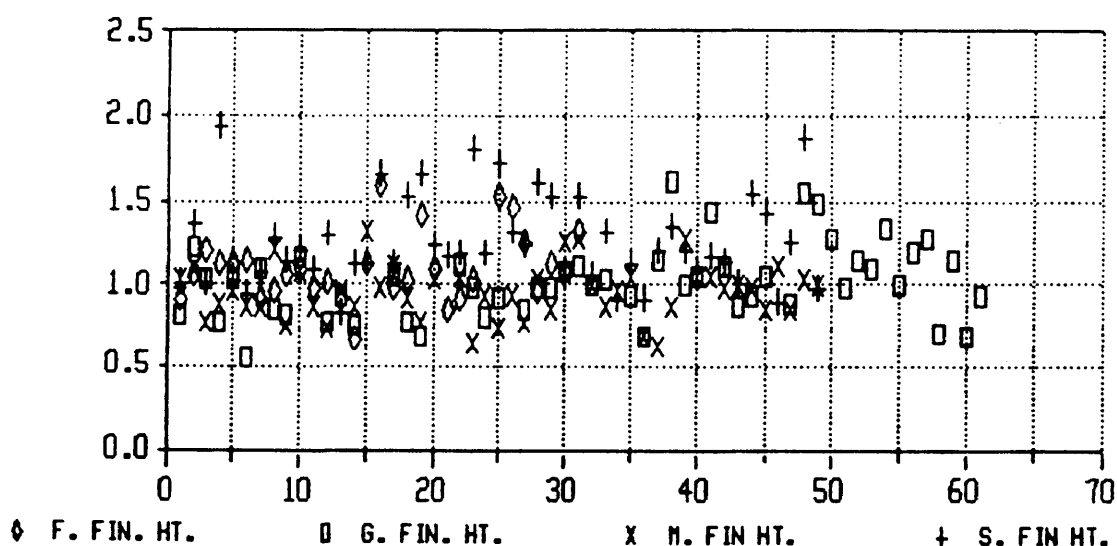


Figure 4.10 FINISH HEIGHT COMPARISON



External neck diameters were tested to determine if the diameter of the neck, one of the most easily measured bottle elements, would show any direct correlations to bottle shape. As expected, the maximum neck diameters for the flare-sided shape exceeded those of the other three shapes. This is to be expected because the flare-sided body and soft shoulder exhibited in these forms. Table 4.5 lists the results of the statistical manipulation of the raw data.

Table 4.5

NECK DIAMETER ANALYSIS

SHAPE	MIN. NEC	MIDRANGE	MAX. NEC	MEAN NEC	VARIANCE	ST. DEV.
GLOBULAR	1.45	2.56	2.25	1.8756	0.02214	0.14878
FLARE	2.3	2.735	3.89	2.75742	0.0688	0.2623
MALLET	2.3	2.65	3	2.65688	0.01795	0.13398
STRAIGHT	2.44	2.765	3.16	2.76944	0.02154	0.14678

The mean neck diameter for the short-necked globular forms (sample size = 58) was 1.87 centimeters which increased in the flare-sided and straight-sided forms (sample size = 31 and 126 respectively), but decreased slightly in the mallet shapes (sample size = 48). This may be accounted for considering the techniques employed in manufacturing these shapes. The globular forms were not marvered to the same degree as the flare-sided shapes. This resulted in a more rounded form, while the flare-sided forms, smaller at their bases than at any other point through their bodies, were purposefully shaped to have a distinct and prominent shoulder. The flare needed to accentuate this shoulder would naturally result in a proportionally greater neck diameter. The dip-molded, straight-sided forms would likewise have a more pronounced shoulder and correspondingly wider neck diameter. The mallet-shaped bottles were marvered with a reverse taper through their bodies. This form class, in which the base diameter is consistently greater than the shoulder diameter, had a correspondingly softer shoulder with a smaller neck diameter. Figure 4.11 illustrates that the mean neck diameters of the flare-sided, mallet, and straight-sided forms in this test sample were similar, while the mean neck diameter of the globular forms was somewhat smaller. All of the variances for this test sample were very small except the results for the flare-

sided forms which amounted to 0.06 with a standard deviation of 0.26. Figure 4.12 shows the remarkably tight distribution of the test sample.

Figure 4.11 NECK DIAMETER ANALYSIS

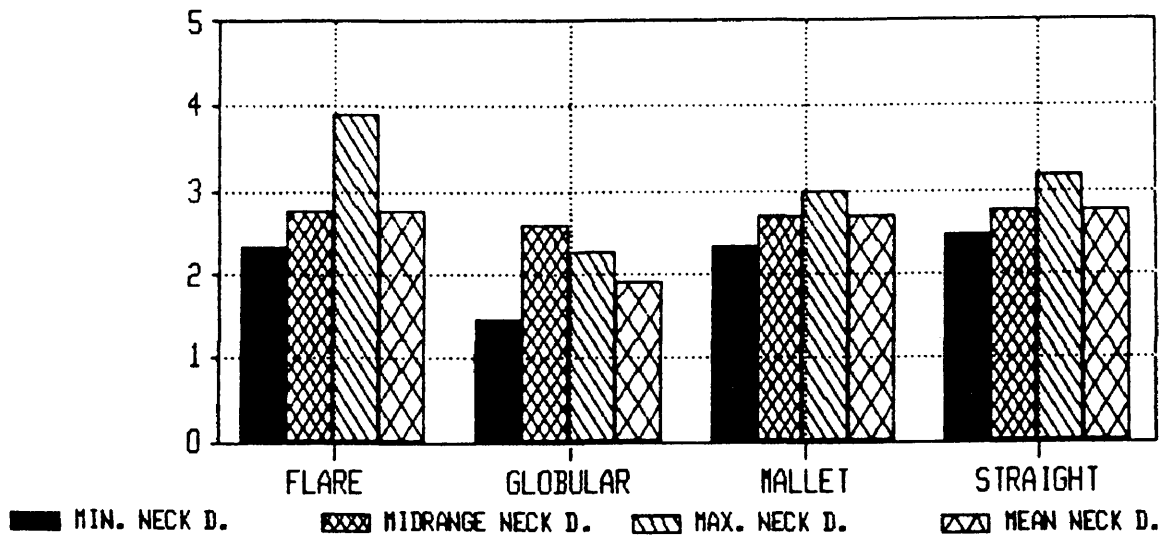
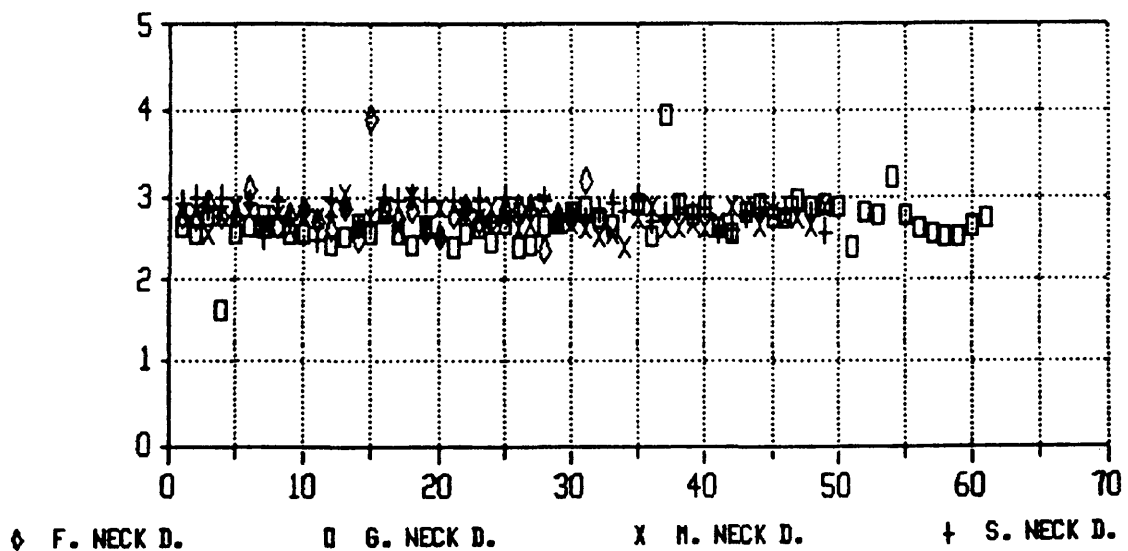


Figure 4.12

NECK DIAMETER COMPARISON



Along with the neck diameter, the neck-to-finish height was a bottle element largely controlled by techniques used in forming the bottles. The relative lengths of the necks in the sample showed a slight, but gradual increase through time as shown in Table 4.6.

Table 4.6

NECK TO FINISH ANALYSIS

SHAPE	MIN. NEC	MIDRANGE	MAX. NEC	MEAN NEC	VARIANCE	ST. DEV.
GLOBULAR	4.94	8.12	11.3	6.52483	1.05158	1.02547
FLARE	5.1	6.65	12.1	7.23387	3.31846	1.82166
MALLET	6.2	8.45	11.88	8.36021	1.12784	1.062
STRAIGHT	6.3	8.7	12.1	8.69394	0.96985	0.98481

The mean neck length for the globular forms (sample size = 58) was 6.52 centimeters while those of the flare-sided (sample size = 31), mallet (sample size = 48), and straight-sided forms (sample size = 127) increased steadily to 8.69 centimeters. Figures 4.13 and 4.14 illustrate the results shown in Table 4.6 and the distribution of these measurements from the raw data. The length of bottle necks should be considered along with the total height of the bottles in the sample. Table 4.7 and Figures 4.15 and 4.16 demonstrate the increase in bottle height through time. The heights of bottles (midrange values, means, and minimum and maximum observations) increased gradually in all of the bottle classes.

Figure 4.13 NECK TO FINISH HEIGHT ANALYSIS

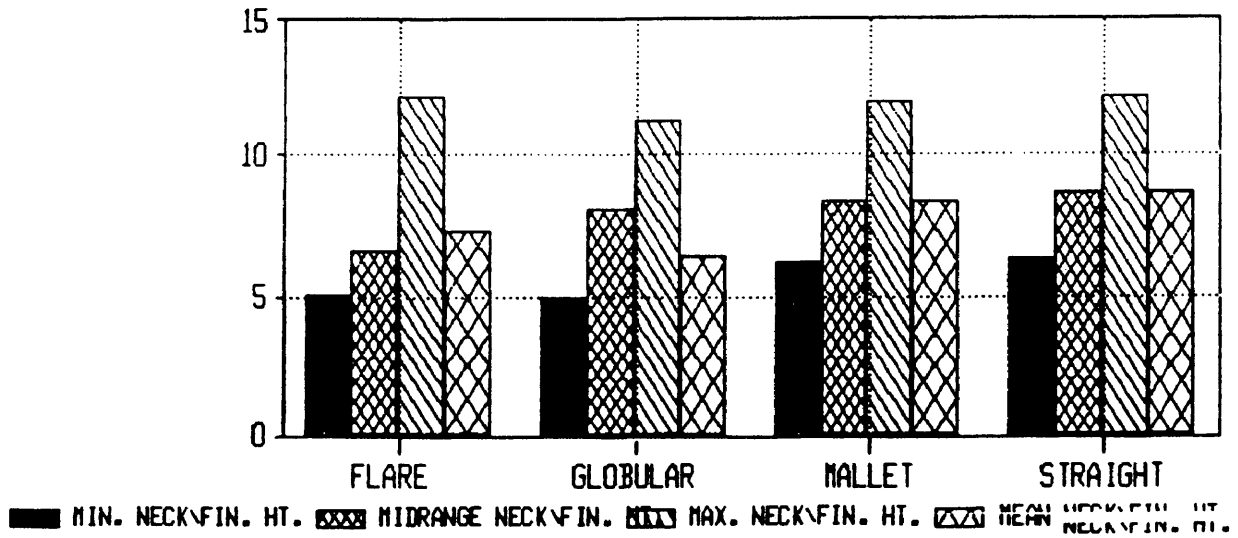


Figure 4.14 NECK TO FINISH HEIGHT COMPARISON

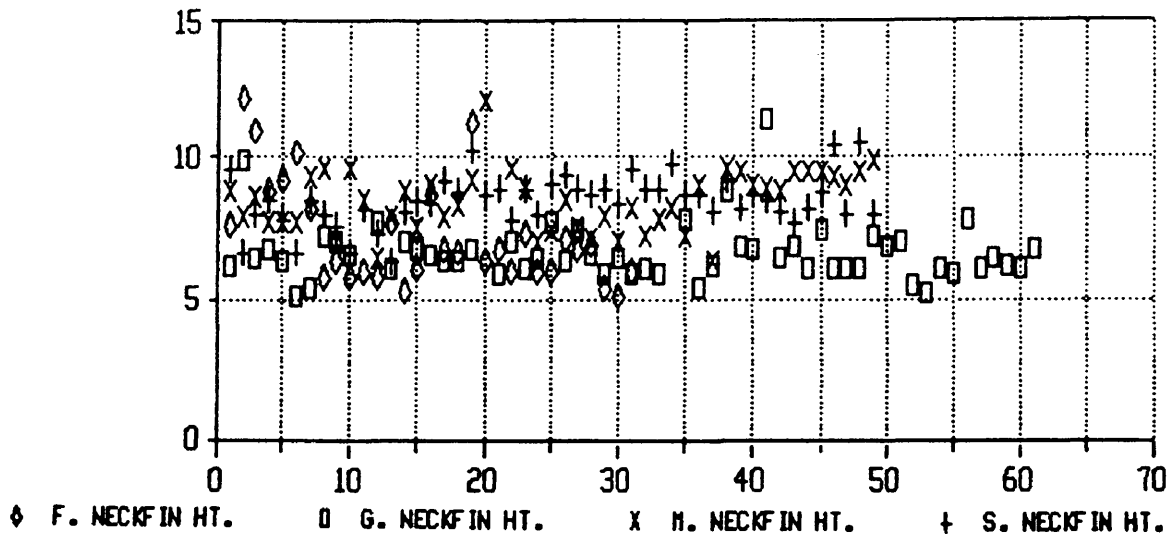


Table 4.7

BOTTLE HEIGHT ANALYSIS									
SHAPE	MIN	BOT	MIDRANGE	MAX	BOT	MEAN	BOT	VARIANCE	ST DEV
GLOBULAR	13.4		15	20.8		15.222		1.62307	1.274
FLARE	13.7		16.05	20.9		16.3839		3.20651	1.79067
MALLET	15		19.2	23.4		18.901		3.05755	1.7859
STRAIGHT	18.3		22.7	36.7		22.9575		8.22654	2.86819

Figure 4.15 BOTTLE HEIGHT ANALYSIS

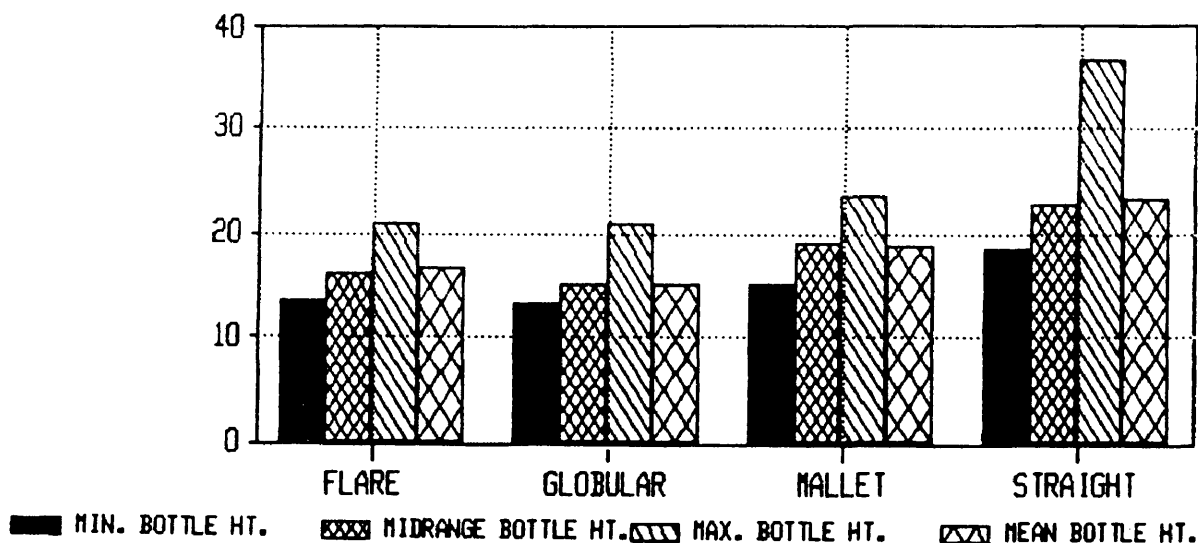
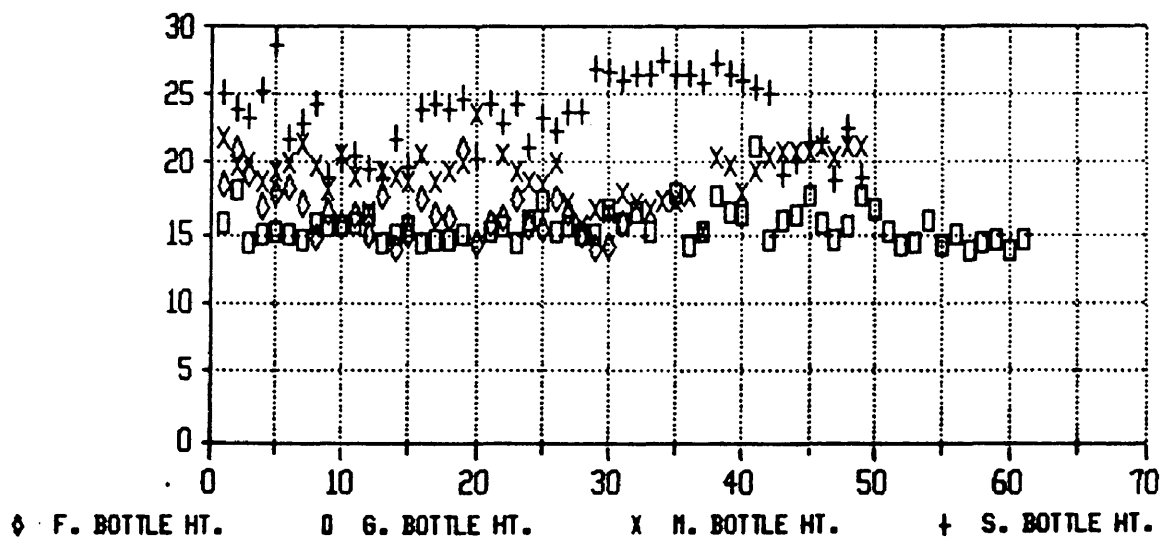


Figure 4.16 BOTTLE HEIGHT COMPARISON



The globular forms (sample size = 59) had a mean height of 15.22 centimeters, the flare-sided shapes (sample size = 31), a mean height of 16.38 centimeters, and the mallet shapes (sample size = 48), a mean height of 18.9 centimeters. The greatest jump in height occurred in the straight-sided bottles in this test sample (sample size =

127) which showed a mean height of 22.95 centimeters, 33% taller than the globular forms. The increase in height was predominantly in the bodies; however, a proportional amount of this total height was made up in elongated necks as shown in Figure 4.14. The greater difference between the observations in the straight-sided forms accounted for the increased variance of 8.22 in this sample.

The results of base diameter analysis in this test sample fall into predictable sequences. See Table 4.8. The globular forms (sample size = 61) provided a mean base measurement of 14.05 centimeters, which was the largest of any of the classes of shapes under investigation. The flare-sided forms (sample size = 31) with their broad shoulders and proportionally smaller bases, yielded a mean base measurement of 12.20 centimeters. The mallet-shaped bottles (sample size = 49) provided a mean basal diameter of 13.95 centimeters, and the straight-sided forms provided the smallest mean base diameter of 11.03 centimeters. The variances within the sample ranged from 0.28 in the mallet shapes to 5.39 in the globular forms. All of the standard deviations from the mean were within acceptable ranges of less than one unit.

A comparison of the base diameters of the globular shapes and a 50% sample of the straight-sided shapes revealed some unexpected similarities which are related to

manufacturing techniques in producing these two forms. It

Table 4.8

BASE DIAMETER ANALYSIS

SHAPE	MIN. BAS	MIDRANGE	MAX. BAS	MEAN BAS	VARIANCE	ST. DEV.
GLOBULAR	7	14.9	16.6	14.059	5.39914	2.32361
FLARE	7	13.1	14.8	12.2032	4.52354	2.12686
MALLET	13	14	15.5	13.9531	0.2829	0.53188
STRAIGHT	8.5	11	13.5	11.0302	2.00568	1.41622

was expected that the dip-molded, straight-sided forms would have very consistent basal measurements; however, when the base diameters for the free-blown globular forms were plotted with the straight-sided forms, it became apparent that there was considerable consistency in this bottle element in both form classes. Figure 4.19 shows Figure 4.17

BASE DIAMETER ANALYSIS

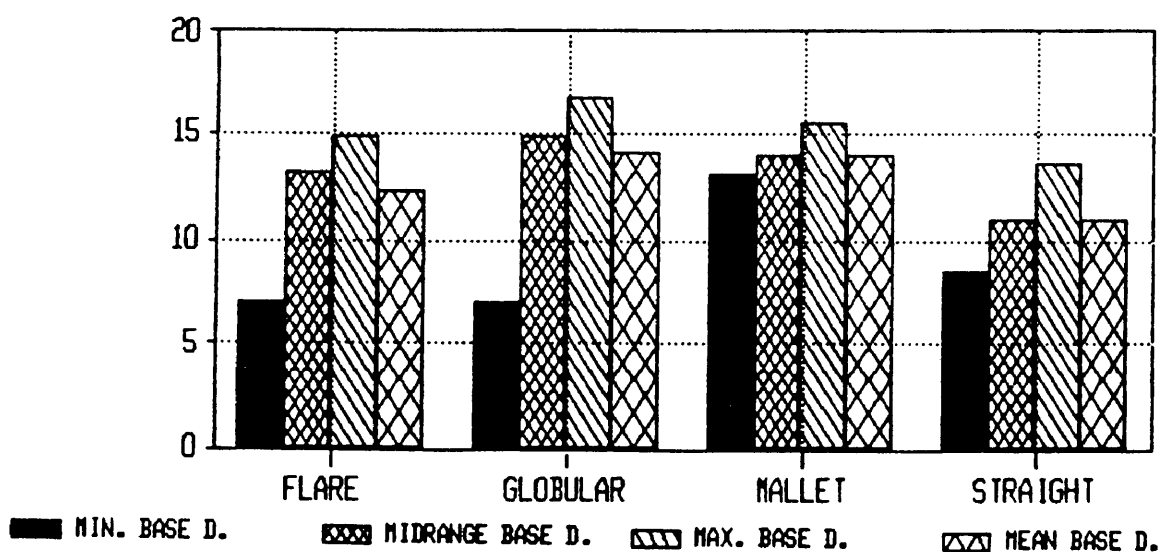
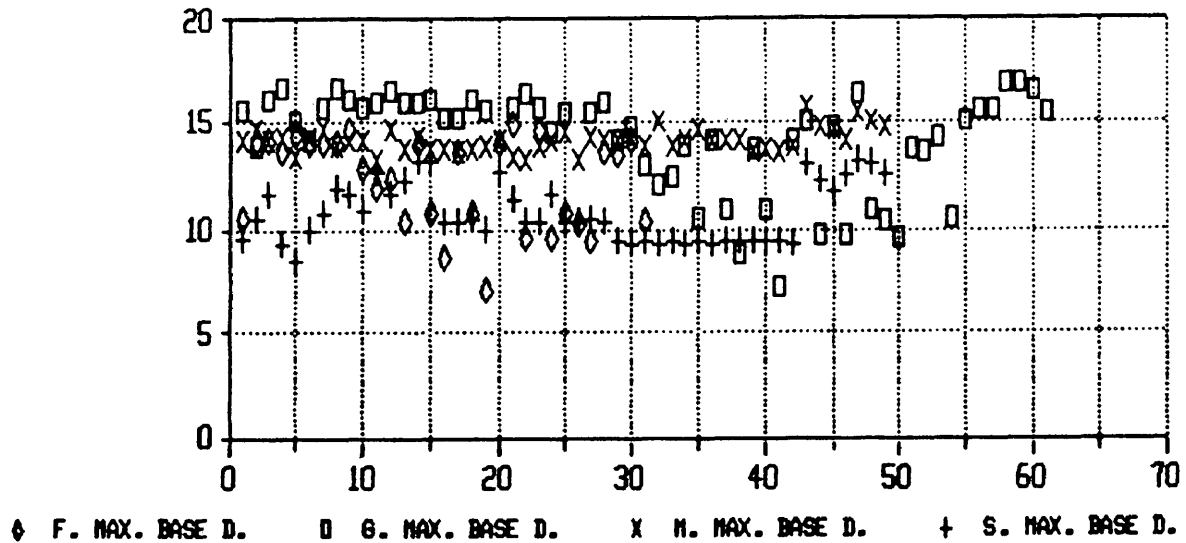


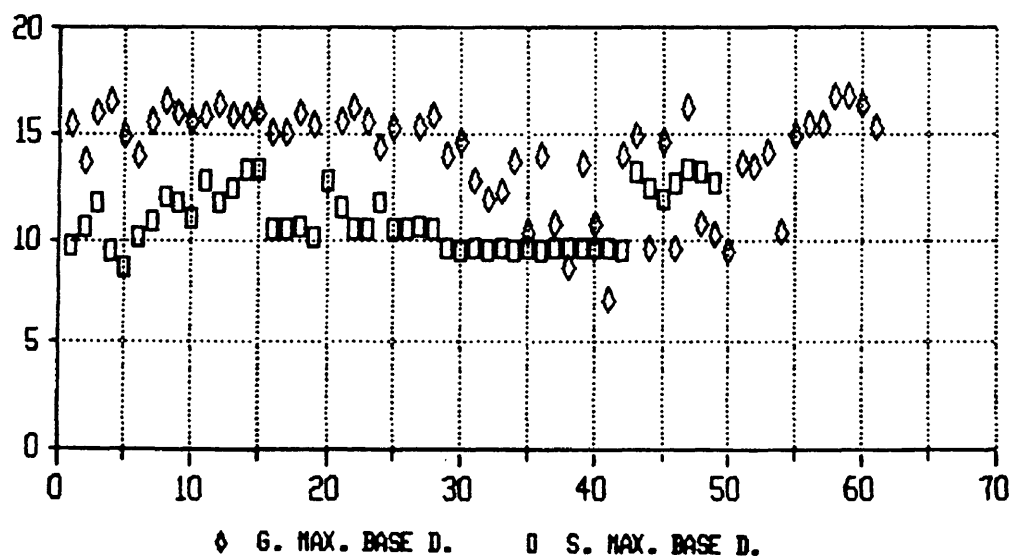
Figure 4.18 BASE DIAMETER COMPARISON



that the majority of the globular base measurements hover between 14 to 15 centimeters while the straight-sided forms concentrate on either side of 10 centimeters

Figure 4.19

GLOBULAR & STRAIGHT FORMS - BASE DIAMETERS



The resting point diameters which were largely controlled by the maximum base diameters in the four bottle shape classes, were analyzed with predictable results. Table 4.9 shows the results of the computations.

Table 4.9

RESTING POINT DIAMETER ANALYSIS

SHAPE	MIN. RES	MIDRANGE	MAX RES	MEAN RES	VARIANCE	ST. DEV.
GLOBULAR	5.1	11.25	14	10.6672	3.64417	1.90897
FLARE	5.1	9.05	11.8	9.24516	2.68441	1.63842
MALLET	9.5	11.2	12.5	11.2327	0.41322	0.64282
STRAIGHT	7.2	7.65	11.7	9.25969	1.60535	1.26702

The globular forms (sample size = 61) produced a mean resting point diameter reading of 10.66 centimeters. The flare-sided shapes (sample size = 31) yielded a mean resting point diameter of 9.24 centimeters. The mallet shapes (sample size = 49) had a mean resting point diameter of 11.23 centimeters. The smallest mean resting point diameter occurred in the straight-sided forms at 9.25 centimeters. A striking consistency appeared between the maximum basal diameter measurements discussed above and the resting point diameters. The obvious reason for this proportional similarity in the measurements lies in the technology used in manufacturing the bottles. The bases of all these bottles were pushed up prior to the attachment of the pontil rod. A study of the glass at the base, the resting point, and through the kick or push-up, may reveal

a similarity in thickness which may in part, account for the similarity in these measurements. Figure 4.20 shows the gradual decline in the resting point diameters which is reflected in the decline in base diameters documented in Figure 4.17. Figure 4.21 shows the distribution of resting point diameters of all the globular, flare-sided, and mallet shapes with a 50% sample of the straight-sided forms.

Use of the pontil rod to hold the hot glass bottle during the finishing procedures is evident in the "scars" left on the kicks or push-ups. Their relative size is directly related to the manufacturing technique, as are the maximum basal

Figure 4.20

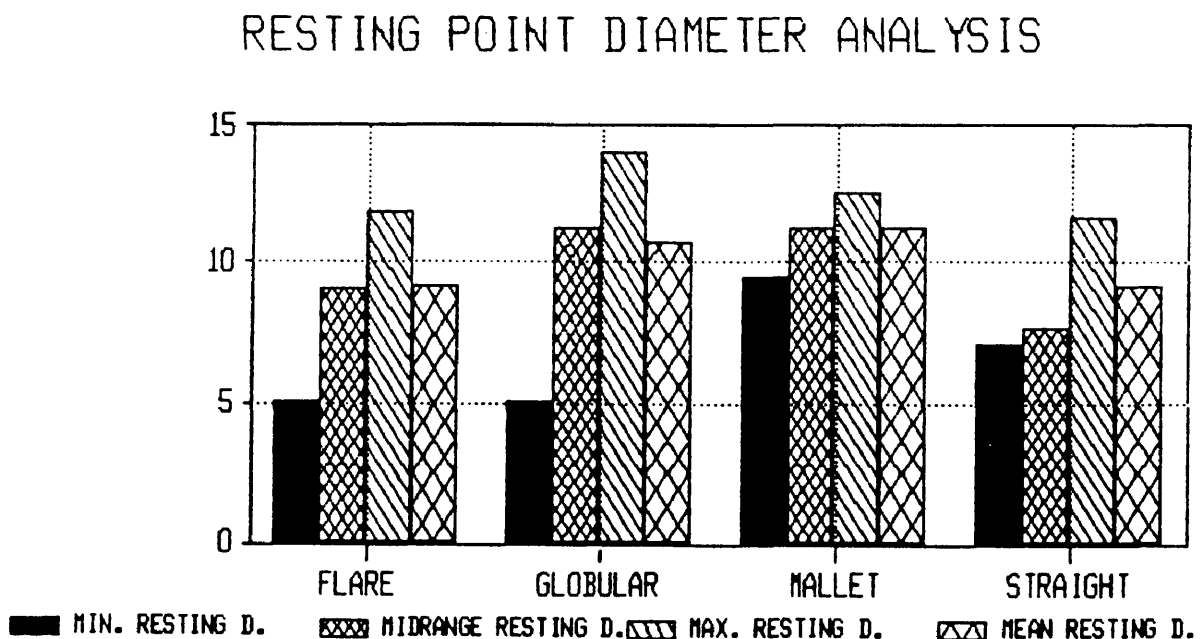
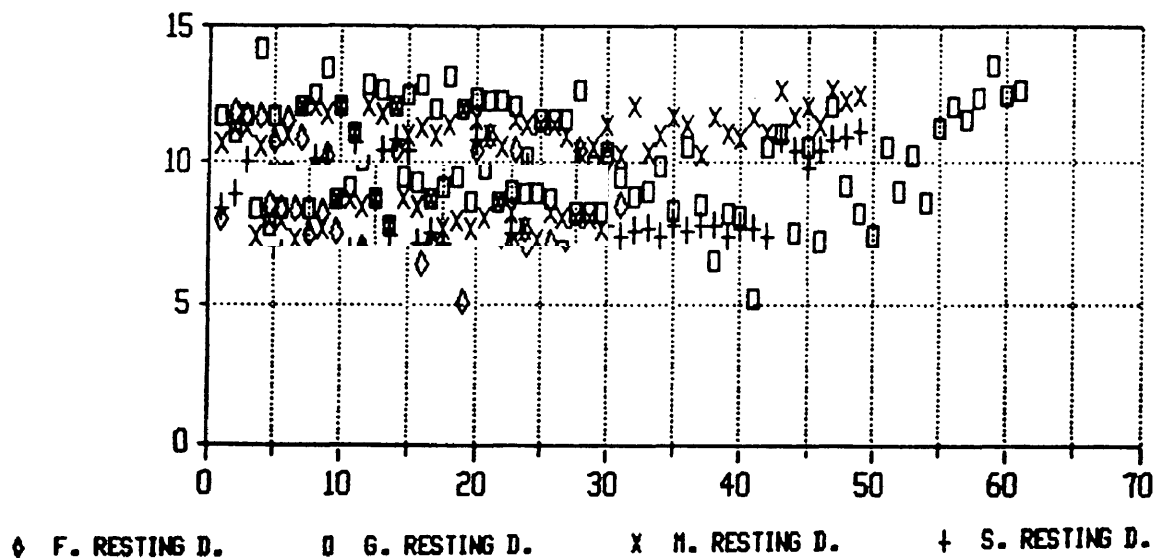


Figure 4.21

RESTING POINT DIAMETER COMPARISON



and resting point diameters. A comparison of this bottle element revealed the same gradual decline in diameter through time that has been shown in the maximum base diameter and in the resting point diameter analysis. Table 4.10 lists the analysis results.

Table 4.10

PONTIL SCAR DIAMETER ANALYSIS

SHAPE	MIN. PON	MIDRANGE	MAX. PON	MEAN PON	VARIANCE	ST. DEV.
GLOBULAR	2.6	5.5	7.8	5.31167	1.05728	1.02824
FLARE	2.5	4.25	5.5	4.07333	0.92996	0.96434
MALLET	2.8	5.45	7	5.47553	0.61041	0.78129
STRAIGHT	3	5.65	6.9	5.59032	0.44507	0.66713

The broad-based globular forms (sample size = 60) had a mean pontil scar diameter of 5.31 centimeters, while the small-based flare-sided forms (sample size = 30) had the

smallest pontil scar diameter of 4.07 centimeters. The mallet shapes (sample size = 47) yielded a mean measurement of 5.47 centimeters. Unexpectedly, the straight-sided forms (sample size = 124) had the largest pontil scars of any in the test sample, with a mean value of 5.59 centimeters. Variances within the samples were quite small, amounting to only 1.05 in the globular shapes and 0.44 in the straight-sided forms. The larger variance found among the free-blown bottles is attributable to less consistent methods of manufacture. All the standard deviations were 1.0 or less. Figure 4.22 graphically illustrates the differences between the four bottle classes. Figure 4.23 shows the distribution of all the globular, mallet, and flare-sided forms with a 50% sample of the straight-sided forms in the sample.

The measurements of the push-up or kick heights seem to have a greater similarity to the increase in total bottle height than to any other bottle element. Table 4.11 lists the results of the statistical computations while Figure 4.24 demonstrates these figures graphically.

Table 4.11

KICK HEIGHT ANALYSIS

SHAPE	MIN. KIC	MIDRANGE	MAX. KIC	MEAN KIC	VARIANCE	ST. DEV.
GLOBULAR	0.5	2.7	4.1	2.57869	0.59479	0.77123
FLARE	0.5	2.56	5.4	2.65806	1.18244	1.0874
MALLET	2.3	3.75	5.1	3.82708	0.45406	0.67384
STRAIGHT	1.2	3.95	6.4	3.75349	0.95101	0.9752

Figure 4.22

PONTIL SCAR DIAMETER ANALYSIS

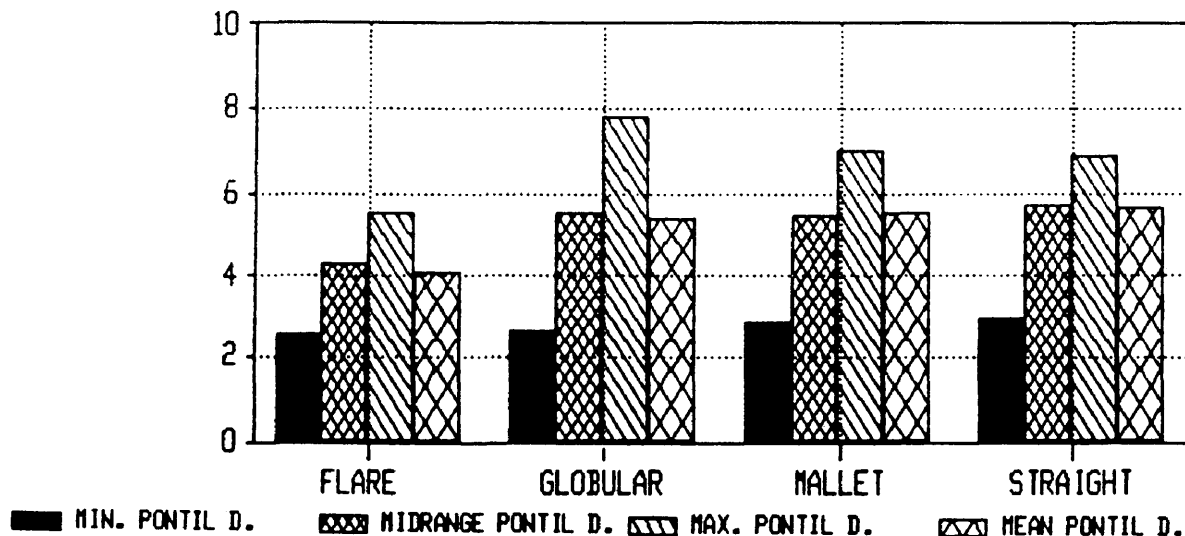
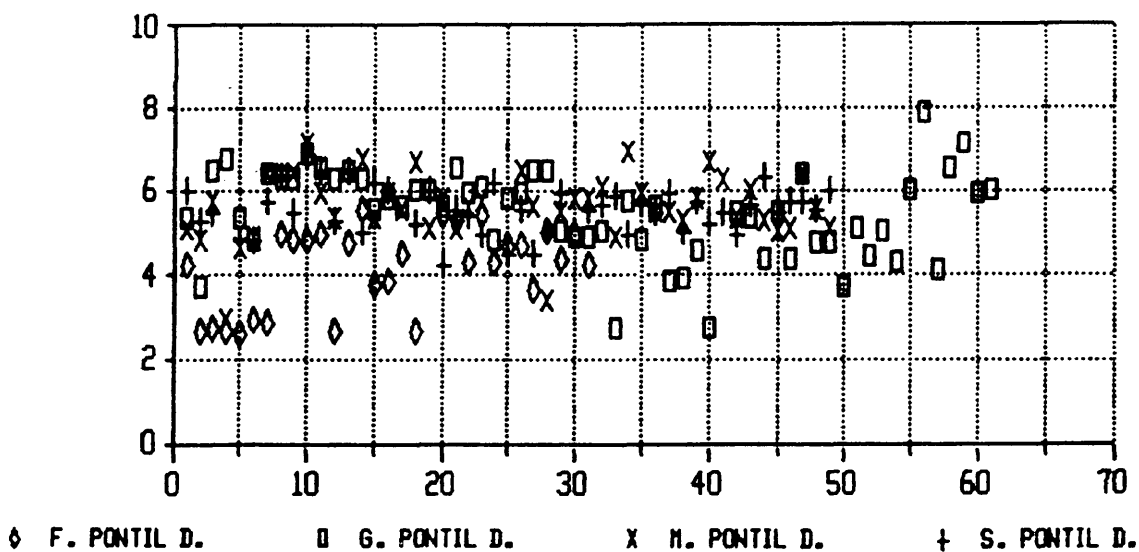


Figure 4.23

PONTIL SCAR DIAMETER COMPARISON



The height of the kick or push-up increased consistently over time from a mean measurement of 2.57 centimeters in the globular sample (sample size = 61) to a

mean height of 2.65 centimeters in the flare-sided forms (sample size = 31), to a mean height of 3.82 centimeters in the mallet shape (sample size = 48). The straight-sided bottles (sample size = 127) were very similar to the mallet forms with a mean kick height of 3.75 centimeters. The variances within the sample were all quite small with the exception of the flare-sided sample which had a variance of 1.18. The standard deviations from the mean were quite low, the smallest being in the mallet forms and the largest in the flare-sided shapes. Figure 4.25 shows the distribution of kick heights for the sample.

The study of bottle capacity was undertaken as part of the overall study of bottle morphology. A number of bottles in the test sample were complete enough to be measured, however, not all of the form classes were adequately represented. A sample of 34 globular forms, 9 flare-sided shapes, 27 mallet forms, and 99 straight-sided bottles were measured using water and a graduated beaker. The author does not believe, however, that a sample of only 9 flare-sided bottles was large enough to be an accurate reflection of the capacities of this form. The results of the capacity computations are, therefore, incomplete. The author hastens to note that this aspect of the analysis is by no means conclusive. Table 4.12 lists the results of statistical computations for capacity.

Table 4.12

BOTTLE CAPACITY ANALYSIS

SHAPE	MIN. CAP	MIDRANGE	MAX. CAP	MEAN CAP	VARIANCE	ST DEV.
GLOBULAR	650	800	980	795.441	6672.6	81.686
FLARE	690	800	880	786.667	3616.67	60.1387
MALLET	725	840	1150	883.704	11714.1	108.232
STRAIGHT	675	800	1200	826.212	6729.84	82.0356

Figure 4.24

KICK HEIGHT ANALYSIS

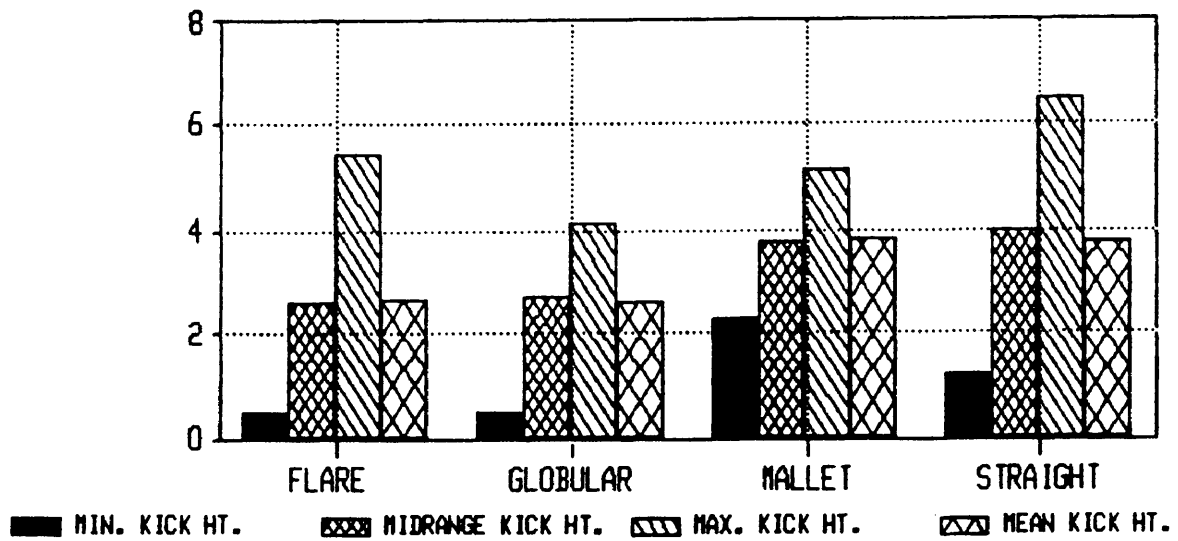
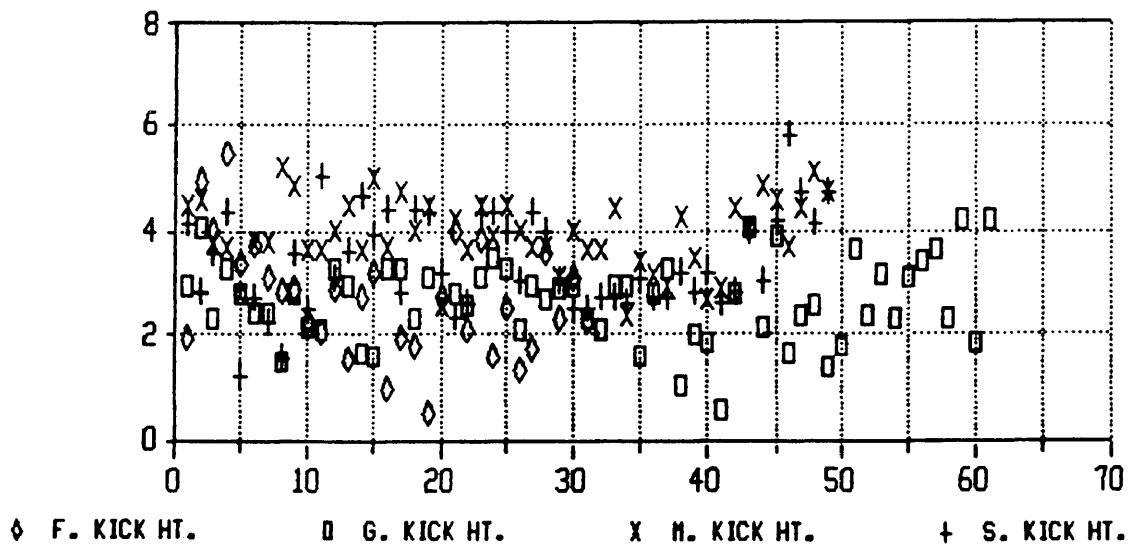


Figure 4.25

KICK HEIGHT COMPARISON



The midrange value of each of the form classes is 800 milliliters except for the mallet shape which is 40 milliliters more. This capacity is closest to the 757.04 milliliters which constituted the reputed quart of the Queen Anne Winchester Gallon system, in general use before 1707 (Ross 1983:45). The mean capacities did not display an obvious pattern until they were plotted, when a concentration along the upper 800 milliliter range was revealed. The mean capacity for the mallet shapes is unaccountably 97 milliliters larger than the flare-sided bottles. Any conclusions about this difference are suspect owing to the inadequacy of the sample size. Figure 4.26 shows the extremes of the observations, the midrange value, and the mean of the samples. It is significant that the arithmetic means of the four classes are fairly constant. It is not fully understood why the maximum observations in each class decline in the flare-sided shapes and increase again in the straight-sided forms. Figure 4.27 graphically illustrates the distribution of the capacity values in this test sample.

An analysis of the weight of the bottles reveals information about the amount of glass metal used in the manufacturing process in relation to the shapes of the glass vessels. This aspect of bottle manufacturing technology has not been investigated in previous studies and would answer many questions relating to the

manufacturing process. Little is known about how completely free-blown forms were produced in such large quantities and with such consistency. The study would inevitably lead to comparative studies between the manufacturing techniques used for marvered bottles and those formed in the dip mold.

Figure 4.26 BOTTLE CAPACITY ANALYSIS

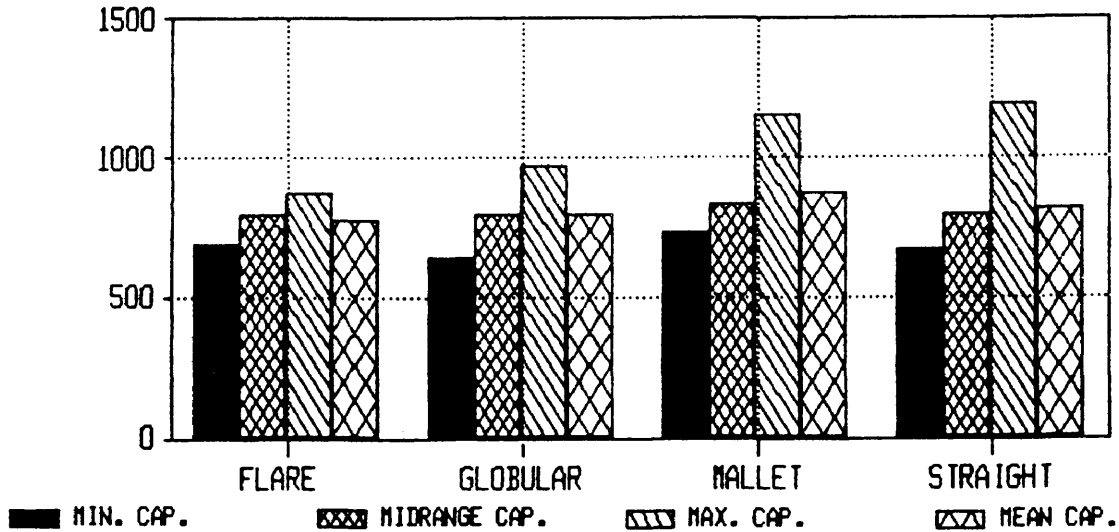
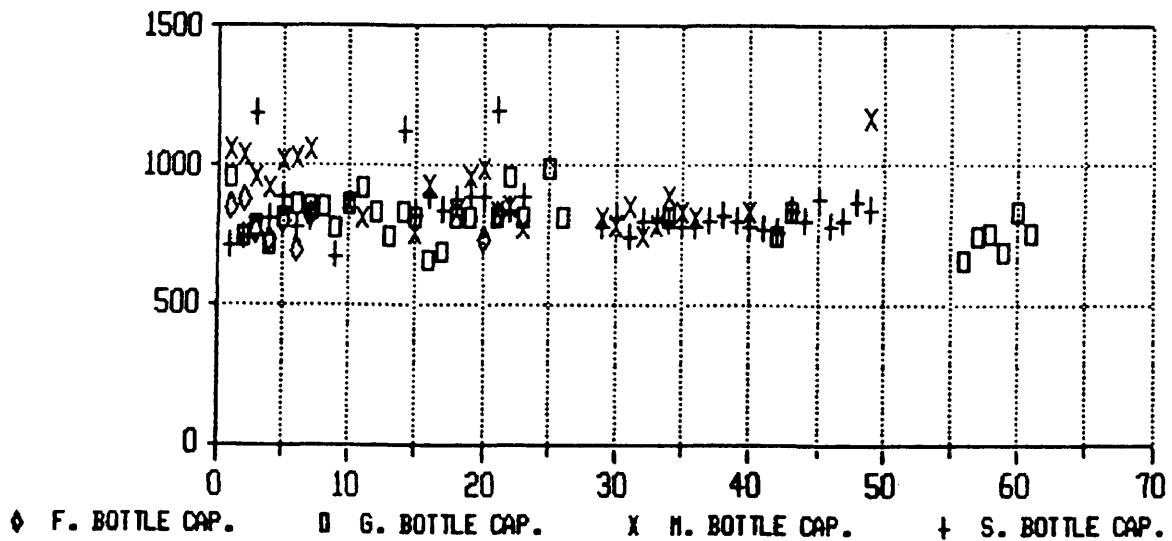


Figure 4.27

BOTTLE CAPACITY COMPARISON



In the course of the investigation a large number of each form class were weighed, but it was discovered that without a consistent method to account for missing portions of some of the archaeological specimens, their inclusion in the analysis could result in misleading information. Initially, 61 globular bottles, 31 flare-sided bottles, 27 mallet-shaped bottles, and 99 straight-sided bottles were weighed. The majority of these, however, were incomplete or had been "restored" using methods which could compromise accurate weight readings. Reluctantly, the analysis of bottle weight had to be omitted from this study. This aspect of English bottle morphology merits additional study when a sufficiently large and uncompromised test sample can be assembled.

CONCLUSIONS

The statistical analysis of twelve diagnostic bottle elements have lead to a number of objective conclusions about the morphological change that took place in English wine bottles of the late seventeenth and early eighteenth centuries. The earliest period of flare-sided glass bottles, which appeared during the late seventeenth century, can be described as a round bottle form with pronounced shoulders, standing approximately 16 centimeters in height on a resting surface approximately 3

centimeters diameter smaller than the maximum base diameter. The push-ups of these bottles exhibit a low, flattened dome shape averaging 2.6 centimeters in height with a correspondingly small pontil scar. The string rims of this period are usually applied, rounded bands of glass, positioned low on the bottle neck and devoid of tooling. The bores of these early forms are only slightly larger than the bores of later periods - averaging approximately 1.9 centimeters in diameter.

The wine bottles of the last years of the seventeenth century were shorter than those of the preceding decades, averaging 15.2 centimeters in height. These globular bottles were round, bulbous forms which had fairly large resting point diameters (averaging 10.6 centimeters) and maximum base diameters (averaging 14 centimeters). The finishes were still composed of an untooled, applied string rim, positioned nearer the lip, which was occasionally everted. The dome-shaped pushup was slightly lower than in the previous period - averaging 2.5 centimeters.

There was one seal-dated globular bottle in the analysis database which belonged to Thomas Southcott and carried the date 1711. See Appendix D for specific measurements. A comparison of the measurements from this specimen and the calculated mean measurements reveals striking similarities in a number of bottle elements. The bore diameter of the Southcott bottle is 1.84 cm while the

calculated mean for the sample is 1.87 cm. The string rim height for the Southcott bottle is 0.57 cm, compared to a mean height of 0.50 cm. The external neck diameter for the bottle is 2.5 cm and the calculated mean for the sample is 2.6 cm. The kick height is 2.1 cm as compared to the mean kick height of 2.57 cm.

By the turn of the eighteenth century, and lasting into the first quarter, mallet-shaped wine bottles developed. This form retained some of the roundness through the body, while the dome-shaped pushups were broad and higher in relation to the maximum body diameter. The bottle necks were taller than those found in globular forms - averaging 8.3 centimeters. The finish heights, averaging 1.0 centimeter, were lower, with the string rim tooled in a "V" shape, or with a pronounced downward slope. The pushups retained their dome-shape; however, they increased in height to an average of 3.8 centimeters. Pontil scars increased proportionally with the maximum base and resting point diameters which averaged 11.2 centimeters. The necks of this period increased in length as did the total vessel height averaging 18.9 centimeters.

There were eight bottles in the mallet form class which bore seals. A comparison of the measurements of these specimens with the calculated mean measurements shows strong correlations in a number of bottle elements. See Appendix D for specific measurements.

By the second quarter of the eighteenth century, wine bottles had lost most of their rotund shape through the body and were basically cylindrical due largely to use of the dip mold which formed the body of the vessels. The soft shoulders of the mallet shaped bottles had become more clearly defined and evolved into the straight-sided or cylindrical forms. The necks continued to increase slightly in length while the maximum body and base diameters showed less variance than in previous periods, again owing to dip mold-forming. The bottles continued to grow taller while the pushups maintained the height achieved in the mallet shapes. They became a rounded dome-shape usually with a pronounced pontil scar. The finishes were generally fire-polished with a "V" -tooled or down-tooled string rim.

There were two seal-dated bottles in this form class and an additional fifteen specimens from tightly-dated archaeological contexts of the mid-eighteenth century. A comparison of the mean measurements with the actual measurements for these specimens shows a strong correlation between various bottle elements. See Appendix D for specific measurements.

APPLICATIONS OF THIS STUDY IN MATERIAL CULTURE RESEARCH

The results achieved in this statistical analysis of English wine bottles provides a basis for comparison with

excavated fragments or bottles of unknown date. By using the minimum and maximum observations and the arithmetic means of the bottle elements investigated in this study, material culture researchers and archaeologists have an additional analytical tool which removes subjectivity in placing excavated or non-seal-dated bottle fragments into a date range.

Table 4.13

SUMMARY OF MINIMUM AND MAXIMUM OBSERVATIONS

Bottle Element	Flare	Globular	Mallet	Straight
Bore D.	1.60 - 2.25	1.45 - 2.25	1.47 - 2.49	1.58 - 2.71
S.R. Ht.	0.37 - 0.80	0.23 - 0.90	0.29 - 0.79	0.26 - 1.16
Lip Ht.	0.16 - 0.99	0.07 - 0.99	0.19 - 0.77	0.15 - 1.52
Fin. Ht.	0.64 - 1.57	0.51 - 1.57	0.59 - 1.29	0.60 - 1.91
Neck D.	2.30 - 3.89	1.45 - 2.25	2.30 - 3.00	2.44 - 3.16
Neck-Fin Height	5.10 - 12.1	4.94 - 11.3	6.20 - 11.8	6.30 - 12.1
Base D.	7.00 - 14.8	7.00 - 16.6	13.0 - 15.5	8.50 - 13.5
Rest Pt.	5.10 - 11.8	5.10 - 14.0	9.50 - 12.5	7.20 - 11.7
Pont. D.	2.50 - 5.50	2.60 - 7.80	2.80 - 7.00	3.00 - 6.90
Kick Ht.	0.50 - 5.40	0.50 - 4.10	2.30 - 5.10	1.20 - 6.40
Capacity	690 - 880	650 - 980	725 - 1150	675 - 1200

(all measurements are in centimeters with the exception of capacity figures which are in milliliters)

Table 4.14

**SUMMARY OF STATISTICAL RESULTS
ARITHMETIC MEANS**

Bottle Element	1660-1680 Flare	1680-1715 Globular	1715-1730 Mallet	1730-1750 Straight
Bore Dia.	1.90 cm	1.87 cm	1.94 cm	2.12 cm
Str. Rim Ht.	0.51 cm	0.50 cm	0.50 cm	0.64 cm
Lip Height	0.55 cm	0.44 cm	0.41 cm	0.56 cm
Finish Ht.	1.07 cm	0.97 cm	0.91 cm	1.19 cm
Neck Dia.	2.75 cm	1.87 cm	2.65 cm	2.76 cm
Neck-Finish	7.23 cm	6.52 cm	8.36 cm	8.69 cm
Bottle Ht.	16.38 cm	15.22 cm	18.90 cm	22.95 cm
Base Dia.	12.20 cm	14.05 cm	13.95 cm	11.03 cm
Resting D.	9.24 cm	10.66 cm	11.23 cm	9.25 cm
Pontil D.	4.07 cm	5.31 cm	5.47 cm	5.59 cm
Kick Ht.	2.65 cm	2.57 cm	3.82 cm	3.75 cm
Capacity	786.66 ml	795.44 ml	883.70 ml	826.21 ml

The measurement parameters and arithmetic means computed in this study allow the researcher to be objective in placing comparable samples of bottle fragments into date ranges. This analytical tool, when used in conjunction with existing bottle seriations, permits the archaeologist to overcome the subjectivity which hinders accurate use of existing bottle seriations. Tables 4.13 and 4.14 provide the basic comparative information needed to date English wine bottles. An archaeologist need only measure the bottle elements in his or her sample and compare the minimum and maximum observations shown in Table 4.13, and the arithmetic means shown in Table 4.14, to determine the corresponding form class and date range. The researcher using this analytical tool should consider as many of the bottle elements as possible in order to assign a date range. The effective use of this tool depends on a

comparison of as many diagnostic bottle elements as possible.

This study also provides a functional interpretation for the morphological evolution of English wine bottles. The shifts in wine consumption patterns in England and in her North American colony of Virginia coincided with the changes in glass bottle forms. As the consumption of wines which were aged in glass to enhance their flavor and value increased, the need for more efficient bottle forms emerged. The custom of binning wines in glass bottles and the techniques used in closing bottles contributed to the evolutionary changes in bottle form.

APPENDIX A

RETAIL PRICES FOR WINES ON THE ENGLISH MARKET

WHOLESALE AND RETAIL WINE PRICES FIXED - 1632

<u>Wine Types</u>	<u>Wholesale price per pipe & (tun)</u>	<u>Retail price per quart</u>
Canary, Muscadel, Alicant	£16/pipe (£32)	£-/-/12d.
Sack, Malaga	£13/pipe (£26)	£-/-/9d.
Gascony & other French wines	£9/ pipe (£18)	£-/-/6d.
Rochelle & inferior wines	£7.5/pipe (£15)	£-/-/6d.

WHOLESALE AND RETAIL WINE PRICES FIXED - 1635

<u>Wine Types</u>	<u>Wholesale price per pipe & (tun)</u>	<u>Retail price per quart</u>
Canary, Muscadel, Alicant	£17/pipe (£34)	£-/-/12d.
Sack, Malaga	£15/pipe (£30)	£-/-/10d.
Gascony & other French wines	£9/ pipe (£18)	£-/-/6d.
Rochelle & inferior wines	£7.5/pipe (£15)	£-/-/6d.

These prices were again reaffirmed in 1637, but the price for Rochelle wines was increased to £16 per tun while the retail price per quart remained unchanged.

WHOLESALE AND RETAIL WINE PRICES FIXED - 1638

<u>Wine Types</u>	<u>Wholesale price per pipe & (tun)</u>	<u>Retail price per quart</u>
Canary, Muscadel, Alicant	£18/pipe (£36)	£-/-/12d.
Sack, Malaga	£16/pipe (£32)	£-/-/10d.
Gascony & other French wines	£9/ pipe (£18)	£-/-/7d.
Rochelle & inferior wines	£7.5/pipe (£15)	£-/-/6d.

WHOLESALE AND RETAIL WINE PRICES FIXED - 1639

<u>Wine Types</u>	<u>Wholesale price per pipe & (tun)</u>	<u>Retail price per quart</u>
Canary, Muscadel, Alicant	£19/pipe (£38)	£-/-/13d.
Sack, Malaga	£17/pipe (£34)	£-/-/11d.
Gascony & other French wines	£9.5/pipe (£19)	£-/-/8d.
Rochelle & inferior wines	£8/ pipe (£16)	£-/-/7d.

RETAIL PRICES OF WINES - 1652

<u>Wine Types</u>	<u>Retail price per quart</u>
French Claret	£-/-/7d.
Spanish wines	£-/1/6d.
Rhenish wines	£-/-/12d.

RETAIL PRICES OF WINES - 1662

<u>Wine Type</u>	<u>Retail price per quart⁵²</u>
Canary, Muscadel, Alicant, Sack, and Malaga	£-/-/18d.
French and Gascony wines	£-/-/8d.
Rhenish wine	£-/-/12d.

There is clear evidence of windfall-profit-taking by the vintners of England during the mid-seventeenth century, as described in the following description of the variance between the wholesale and retail prices.

"...Whereas the merchants' price for Malligo and Sherry was then (Dec. 1637) set at £34 a tun, the Vintners retayle them at 14d. a quart, which amounts to £56 the tun, and is £22 profit; and then they buy these wines for the most part £6 and £8 under the set price. Canary and Sacke were set at £48 a tun, which they sell generally at 14d. the quart, and is £18 a tun cleare gaine; and some sell at 16d. a quart, which is £8 a tun more. French and Gascoinge wines were set at £19 a tun, and other smaller wines at £16, and the

⁵² It was further directed that the price per quart could be raised one penny per quart for each 30 miles that the beverages had to be transported overland.

retayling for all being 7d. a quart, is £28 a tun, which is £9 gained on the best, and £12 on the smaller; and the two first yeeres (1638 and 1639) they bought most of their French wines at £8 under the set price. So they gained by some of these wines £20 a tun, and on all £17...

As for the gain the Vintners have made by this corrupt project, it hath been shewne and proved before the Committee to amount to above £200,000, and the Vintners, being a considerable body, are well able to make great restitution or satisfaction to the Commonwealth (Simon 1964:Vol. 3:54-55).

APPENDIX B

QUANTITIES OF WINE IMPORTED INTO ENGLAND 1697-1703

The Board of Trade, established by William III, compiled the following figures illustrating the quantities of wine which were imported⁵³ between 1697 and 1703 (Simon 1964:Vol.3:131).

Official Board of Trade Figures for
Quantities of Wines Imported 1697 - 1703

	French	Portuguese	Spanish	Rhenish
year	tuns	tuns	tuns	tuns
1697	2	4,744	7,897	412
1698	272	4,057	7,851	792
1699	248	8,703	11,701	900
1700	664	7,757	13,649	1,430
1701	2,051	7,408	11,184	798
1702	1,624	5,924	7,482	693
1703	139	8,845	1,359	748
	5,000	47,438	61,123	5,773

⁵³ In 1697, by Stat. 7 & 8 Gul. et Mar. c 20, the duty on French wines was raised by as much as 132 per cent, bringing it to £47 2s 10d. per tun, or 4s 10d. per gallon, whilst the duty on all other wines was also raised, although not in the same proportion; Spanish and Portuguese wines were to pay £21 12s 5d. per tun and Rhenish wine £26 2s 10d. per tun. In the following year, by Stat. 9 & 10 Gul. et Mar. c. 23, the duty on French wines was further increased, reaching £51 2s 0d. per tun, or an advance of £49 2s 0d. per tun, in less than a century! (Simon 1964:Vol. 3:127).

Total Wine Imports per Year 1697 - 1703

Year	Total Imports
1697	13,085 tuns
1698	12,972 tuns
1699	21,552 tuns
1700	23,500 tuns
1701	21,441 tuns
1702	15,523 tuns
1703	11,091 tuns

APPENDIX C

York County Deeds, Orders, Wills XIII:61, 24 March 1706/07

It is ordered that Ordinary Keepers Rates within this County be as followeth Vizt:

each dyet for one person, one shilling	£	-.1.-	
Lodging for each person per night one Royall		-.-.7	1/2
Stable Roome & fother sufficient for each horse			
one Royall per night		-.-.7	1/2
ditto for day & night one Royall & half		-.-.11	
1/4			
Corn five shillings:per bussell			
Wines of Virginia product at five shillings:per quart			
Canary & Sherry seaven Royalls per qt.			
Red & white Lisbone [,] Claret and white wine five			
Royalls per qt			
western Islands wines three Royalls per qt			
French Brandy fower shills. per qt.			
French Brandy punch or french Brandy flip two Royalls per			
qt			
Rum & Virga. Brandy two shillings per qt:			
Rum Punch & Rum flip one Royall per qt.			
Virginia & Pensilvania beer & Syder half a Royall per qt			
English beer one shilling per qt.			

York County Deeds, Orders, Wills, XIII:211, 24 March 1708/09

A List of the Ordinary Rates (vizt)

Each Dyet for one person	£	0..1..0	
Lodging for each person per night		0..0..7	1/2
Stable Room & Fodder sufficient for each horse			
P night		0..0..7	1/2
Stable Room & Fodder sufficient for each Horse			
P Day & Night		0..0..11	1/4
Corn five shillings P Bushill		0..5..0	
Wine of Virginia produce P Quart		0..5..0	
Canary & Sherry P Quart		0..4..4	1/2
Red & White Lisbon P Quart		0..3..1	1/2

Western Islands Wines P Quart 1/2	0 . . 1 . . 1 0
French Brandy P Quart	0..4..0
French Brandy Punch or French Brandy Flip P Qt	0..1..3
Rum & Virginia Brandy P Quart	0..2..0
Rum Punch & Rum Flip P Quart	0..0..7 1/2
Virginia & Pensilvania Beer & Cyder P Quart	0..3..3 3/4
English Beer P Quart	0..1..0

It is ordered that the several & respective Ordinary keepers within this County sell according to the above mentioned list of Rates & that they do not presume to ask or demand any otherwise of any person Whatsoever on penalty of forfeiting as the Law Directs.

York County Deeds, Orders, Wills XIV:6-7, 24 March 1709/10

This Court do Sett & Rate for

Each Dyet	£ -..1..-
Lodging for Each person	-..-..7 1/2
Stable Room & Fodder Sufficient for Each Horse per Night	-..-..7 1/2
Stable Room & Fodder Sufficient for Each Horse 24 Hours	-..-..11 1/4
Each Gallon of Corn	-..-..7 1/2
Wine of Virginia produce per Quart	-..5..-
Canary & Sherry per Quart	-..4..4 1/2
Red & White Lisbon per Quart	-..3..1 1/2
Western Islands Wines per Quart	-..1..10 1/2
French Brandy per Quart	-..4..-
French Brandy Punch or French Brandy Flip per Quart	-..1..3
Rum & Virginia Brandy per Quart	-..2..-
Rum Punch & Rum Flip per Quart	-..-..7 1/2
Virginia Beer & Cyder per Quart	-..-..3 3/4
Pensilvania Beer per Quart	-..-..6
English Beer per Quart	-..1..-

York County Deeds, Orders, Wills XIV:71-72, 19 March 1710/11

each Dyet	£ -..1..-
lodging for each person	-..-..7 1/2
Stableroom & fodder for each horse per night	-..0..7 1/2
stableroom & fodder sufficient for each horse 24 hours	-..-..11 1/2
each gallon of corn	-..-..7 1/2

Wine of Va produce per quart	-..5..-
canary & sherry per quart	-..4..4 1/2
red & white Lisbon per quart	-..3..1 1/2
Western Island wine per quart 1/2	- . . 1 . . 1 0
French brandy per quart	-..4..-
French brandy punch or French brandy flip per quart	-..1..3
rum & Va brandy per quart	-..2..-
rum punch & rum flip per quart	-..-..7 1/2
Va Midling Bear (sic) & cyder per quart	-..-..3 3/4
Pa bear & Roger's best Virg aile per quart	-..-..6
English bear per quart	-..1..-

It is ordered that the severall & respective ordinary keepers within this county doe sell & take according to the rates before sett & that they do not presume to ask or demand of any person whatsoever on penalty of paying what the law directs-

York County Deeds, Orders, Wills XIV:142, 17 March 1711/12

The rates of licquors formerly sett by this is further contd without alteration

York County Deeds, Orders, Wills XIV:238, 16 March 1712/13

The rates of liquors formerly sett by this court are further contd without alteration -

York County Deeds, Orders, Wills XIV:321, 17 May 1714

The rates of licquors &c formerly set by this Ct are contd without alteration -

York County Deeds, Orders, Wills XIV:406, 22 March 1714/15

The former rates of licquors &c is contd with this addition to witt, rum punch made of wt sugar nine d per quart -

York County Deeds, Orders, Wills XIV:495, 19 March 1715/16

The former rates of liquors &c sett by this Ct are further contd-

York County Deeds, Orders, Wills XV:98, 18 March 1716/17

The former Rates of Liquors &c Sett by this Court are further continued with Addition of White apple Syder to be Sold by the Ordry. keepers in this County at 6 Pence per Quart.

York County Deeds, Orders, Wills XV:394, 16 March 1718/19

The former list of Rates of Liquors are further continued for the year 1719.

York County Deeds, Orders, Wills XV:571, 19 March 1719-20

This Court do Sett & Rate Liquors as followeth

Each diet	£	-.1.-
Lodging for each person		-.-.7 1/2
Stable Room & Fodder for each horse p night		-.-.7 1/2
Stable Room & fodder for each horse 24 hours		-. -. 1 1
1/4		
Each Gallon Corn		-.-.7 1/2
Wine of Virga produce p Quart		-.5.-
French Brandy p Quart		-.4.-
Sherry & Canary wine p Quart		-.4..4 1/2
Red & white Lisbon p Quart & Claret		-.3..1 1/2
Madera Wine p Quart		-. . 1 . . 1 0
1/2		
Fyall wine p Quart		-.1..3
French Brandy Punch & Flip p Quart		-.1..3
Rum & Virga Brandy p Quart		-.2.-
Rum punch & flip p Quart 7 1/2d made with white sugar		-.-.9
Virga midling Beer & Syder p Quart		-.-.3 3/4
Fine bottled Syder p Quart		-.-.6
London Beer bottled p Quart		-.1..3
Bristoll Beer Bottled		-.1.-
Arraik p Quart		-.10.-

York County Deeds, Orders, Wills XV:571, 22 March 1719/20

The Court set the rates for liquors.

York County Deeds, Orders, Wills XVI:198, 18 March 1722/23

The Court do Set and Rate Liquors &c as followeth vizt.

[] Diet	£ -..1..-
Lodging for each person	-..-..7 1/2
Stable Room & fodder for each horse p Night	-..-..7 1/2
Stable Room & fodder for each horse 24 hours	- . . - . . 1 1
1/2	
Each Gallon of Corn	-..-..7 1/2
Wine of Virginia produce p. qt.	-..5..-
French Brandy p. qt.	-..4..-
Sherry and Canary Wine p. qt.	-..4..4 1/2
Red and White Lisbon & Claret p. Qt.	-..3..1 1/2
Madera Wine p. Qt.	- . . 1 . . 1 0
1/2	
Fyal Wine p. Qt.	-..4..3
French brandy Punch and Flip p Qt.	-..4..3
Rum and Virginia Brandy p. Qt.	-..2..-
Rum punch and flip p. qt. 7 1/2 made with white sugar	-..-..9
Virginia middleing beer p. qt.	-..-..3 3/4
Virginia Cider p Qt	-..-..3 3/4
London and Bristol beer in Bottles p Qt	-..1..3
A Qt of Arrack in Punch	-..7..6
English Cyder p qt. bottle	-..1..-

It is ordered that the Several and Respective ordry. keepers within this County do sell and take according to the Rates above Set and that they do not presume to ask or demand more of any person whatsoever on penalty of paying what the Law in that case directs.

Additional Ordinary Rate Lists exist in the York County Deeds, Orders, Wills and may be found as follows:

20 March 1731/32

DOW XVII:266

15 March 1735/36

DOW XVIII:275-276

APPENDIX D

COMPARISON OF CALCULATED MEANS AND ACTUAL
BOTTLE MEASUREMENTS TAKEN FROM DATED SPECIMENS

GLOBULAR FORM

<u>Bottle Element</u>	<u>Specimen #26</u>	<u>Mean Measurement</u>
Bore diameter	1.84 cm	1.87 cm
String Rim Height	0.57 cm	0.50 cm
Lip Height	0.32 cm	0.44 cm
Finish Height	1.13 cm	0.97 cm
Neck Diameter	2.50 cm	1.87 cm
Neck to Finish Height	6.50 cm	6.52 cm
Bottle Height	15.1 cm	15.22 cm
Base Diameter	15.5 cm	14.05 cm
Resting Point Diameter	12.0 cm	10.66 cm
Pontil Scar Diameter	6.7 cm	5.31 cm
Kick Height	2.1 cm	2.57 cm
Capacity	855 ml	795.44 ml

Specimen #26 has a dated seal with the inscription "Tho Southcott 1711", C.W.F. accession #1936-495.

MALLETT FORMS

<u>Bottle Element</u>	<u>Spec. #265</u>	<u>Spec. #269</u>	<u>Spec. #270</u>	<u>Spec. #271</u>	<u>Spec. #273</u>
Bore D.	2.05 cm	1.94 cm	2.10 cm	2.00 cm	1.94 cm
S.R. Ht.	0.06 cm	0.59 cm	0.70 cm	0.55 cm	0.57 cm
Lip Ht.	0.19 cm	0.19 cm	0.34 cm	0.20 cm	0.48 cm
Fin. Ht.	0.96 cm	0.80 cm	1.07 cm	0.80 cm	1.00 cm
Nec-Fin.	9.40 cm	9.30 cm	9.20 cm	9.00 cm	9.30 cm
Neck D.	2.79 cm	2.74 cm	2.74 cm	2.65 cm	2.57 cm
Height	20.6 cm	20.6 cm	21.0 cm	20.0 cm	21.0 cm
Base D.	15.5 cm	14.5 cm	13.9 cm	15.2 cm	14.9 cm
Rest. D.	12.5 cm	12.0 cm	11.3 cm	12.5 cm	12.1 cm
Pont. D.	5.90 cm	4.90 cm	5.00 cm	6.20 cm	5.40 cm
Kick Ht.	4.00 cm	4.50 cm	3.60 cm	4.30 cm	5.00 cm

All the specimens listed above bear the identical impressed seal with the name "I Custis". All the bottles were made for John Custis before to his death in 1729 (Noël Hume 1961:113).

Bottle Element	Spec. #28 "1738"	Spec. #83 "1737"	Spec. #275 "1723"	Sample Mean
Bore D.	1.81 cm	1.81 cm	1.87 cm	1.94 cm
St.Rim Ht.	0.29 cm	0.51 cm	0.73 cm	0.50 cm
Lip Height	0.41 cm	0.29 cm	0.28 cm	0.41 cm
Finish Ht.	0.84 cm	0.75 cm	0.96 cm	0.91 cm
Neck-Finish	9.15 cm	9.01 cm	9.80 cm	8.36 cm
Neck Diameter	2.60 cm	2.53 cm	2.80 cm	2.65 cm
Bottle Height	21.2 cm	19.7 cm	21.0 cm	18.90 cm
Base Diameter	14.4 cm	13.8 cm	14.6 cm	13.95 cm
Resting D.	11.9 cm	11.8 cm	12.3 cm	11.23 cm
Pontil D.	6.20 cm	5.00 cm	5.00 cm	5.47 cm
Kick Height	3.70 cm	4.40 cm	4.60 cm	3.82 cm

The dates obtained from the seals of the three specimens listed above are indicated in quotes beneath the specimen numbers.

STRAIGHT-SIDED FORMS

Bottle Element	Spec. #225	Spec. #226	Spec. #227	Spec. #228	Spec. #229
Bore D.	2.45 cm	2.36 cm	2.37 cm	1.85 cm	2.15 cm
St.R. Ht.	0.93 cm	0.89 cm	0.82 cm	0.56 cm	0.86 cm
Lip Ht.	0.82 cm	0.69 cm	0.77 cm	0.22 cm	0.59 cm
Fin. Ht.	1.53 cm	1.43 cm	1.39 cm	0.88 cm	1.26 cm
Neck-Fin.	10.2 cm	8.80 cm	8.70 cm	10.4 cm	8.40 cm
Neck D.	3.20 cm	2.82 cm	2.75 cm	2.80 cm	2.95 cm
Height	22.2 cm	21.5 cm	19.7 cm	21.5 cm	21.0 cm
Base D.	12.1 cm	11.7 cm	12.1 cm	12.5 cm	12.0 cm
Rest. D.	10.0 cm	9.90 cm	9.90 cm	10.5 cm	9.80 cm
Pontil D.	6.30 cm	5.40 cm	5.70 cm	5.70 cm	5.20 cm
Kick Ht.	4.00 cm	4.20 cm	3.40 cm	5.80 cm	3.20 cm

The specimens listed above are a sample of the bottles excavated at Henry Wetherburn's Tavern from a sealed archaeological feature. All these bottles existed before their deposition in the feature, post-1750 (Noël Hume 1985).

Bottle Element	Specimen # 29 "1755"	Sample Mean
Bore Diameter	2.28 cm	2.12 cm
String Rim Height	0.64 cm	0.64 cm
Lip Height	0.38 cm	0.56 cm
Finish Height	1.00 cm	1.19 cm
Neck to Finish Height	9.57 cm	8.69 cm
Neck Diameter	2.87 cm	2.76 cm
Bottle Height	25.0 cm	22.95 cm
Maximum Base Diameter	9.50 cm	11.03 cm
Resting Point Diameter	8.40 cm	9.25 cm
Pontil Scar Diameter	6.00 cm	5.59 cm
Kick Height	4.10 cm	3.75 cm

Specimen # 29 is a complete bottle which has a seal with the inscription "James Oakebury 1755", C.W.F. accession #1947-543.

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VITA

William E. Pittman

Born in Petersburg, Virginia, October 20, 1949. Graduated from Tidewater Academy in Wakefield, Virginia, June, 1968; Virginia Commonwealth University, B.F.A., 1972. In September, 1984, the author entered The College of William and Mary as a graduate student in the Program in American Studies. The author is the Supervisor of Archaeological Collections Research for the Department of Archaeological Research, Colonial Williamsburg Foundation. In this capacity he is responsible for material culture research and analysis of Colonial Williamsburg's extensive archaeological collections.