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National Historic Parks and Sites Branch
Parks Canada
Environment Canada
1979
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Abstract

A survey of table glass at Louisbourg reveals that the French used table wares made of at least five different metals (in addition to such English pieces as might have been owned by French inhabitants). The five classes of metal found were: common green or verre fougère metal; common clear or cristallin glass; a crizzled metal; a clear potash-lime or Bohemian-style metal, and a clear metal with significant lead content - demi-lead crystal. Stylistically, forms found in the first two metals and the demi-lead crystal seem largely Venetian, while the forms in crizzled metal compare closely to Germanic forms in the Bohemian crystal metal. All the metals except demi-lead crystal were quite probably manufactured in France in the early to mid-18th century.

Submitted for publication 1974, by Paul McNally, Queen's University, Kingston.
Acknowledgements

I wish to thank the archaeological staff of the Fortress of Louisbourg National Historic Park for their interest in and assistance with this study: Don Harris, Don Steer, now with Parks Canada, Western Region, Calgary, and Jason Henderson, now with National Historic Parks and Sites Branch, Ottawa. Particular debts are due John Dunton, then conservator, Fortress of Louisbourg, for discussions of the glass and the site and for perceptive comments on the original draft, and Jane Harris, then artifact analyst, Fortress of Louisbourg, for helpful conversations and ideas as well as more laborious aid with illustrative material. Olive Jones, glass analyst, National Historic Parks and Sites Branch, Ottawa, made shrewd suggestions towards revision of the first draft, and Jean-Pierre Cloutier, a researcher in material culture in St. Isidore de Prescott, Ontario, contributed useful manuscript references.
Introduction

This report identifies and classifies much of the 18th-century French table glass, especially drinking glasses, in the Fortress of Louisbourg archaeological collection. Time has not permitted a systematic analysis of the collection in correlation with excavation contexts, for the collection and the site are very large. However, an attempt has been made to identify the glass which was in use in the French occupation periods (1713-45 and 1750-58); to determine its technological and stylistic origin, and to establish classifications which suggest hypotheses of chronology and attribution to be tested in further analysis of the collection. Offering as it does a large and various number of objects representative of different social classes in the 18th-century fortified town, the Louisbourg collection provides an excellent opportunity for the intensive study of 18th-century glass products made in France or imported to be used in French households.

The table glass artifacts recovered in the course of excavations at Louisbourg are not only numerous but also diverse in style and origin. English glass from the second and third quarters of the 18th century is well represented and there is a considerable sampling of Bohemian and German glass from about the same period, although mostly of export quality. A number of other items may be of Belgian or Spanish origin and there is a large quantity of French wares, dating from the second decade of the 18th century up until 1758.

Just how large is the collection of French glass is hard to determine because there are several critical difficulties in identification. Literature on the subject is scanty, probably because collectors and antiquarians have never taken much interest in 18th-century French glass, perhaps taking their cue from the early authority on European glass, Robert Schmidt, who wrote that France was entirely dependent on imports for fine glass during the 18th century (Schmidt 1912: 376). This implies two features of any collection of French glass from the period: first, that there is little distinction to the domestic products, which tended to be imitative of the styles and techniques of other nations, and second, that it will be difficult to
distinguish between imports and domestic products. The French industry certainly was derivative, for it copied styles, techniques and glass formulae first from Venice and later from the Bohemian and English industries. At times the state actively encouraged recruitment of skilled workers from other nations, or favoured patentees who promised to duplicate foreign crystal (Scoville 1968: 127). Of course, the degree and the kind of active imitation varied from time to time and from region to region. For example, in the 17th century the only major foreign influence was Venetian and in the 18th century this influence apparently remained strongest in the south of France, while the industry of the northeast was increasingly oriented toward Bohemian styles and technology (Scoville 1968: 22). Also, there were certainly imports, from Germany and England especially (Bosc d'Antic 1780: 60-1). Louisbourg itself traded with New England. Thus it cannot be assumed that glass found in French excavation contexts is French, but nor can it be assumed that an object of, say, Bohemian style is in fact Bohemian.

If such difficulties of attribution raise problems for the archaeologist at Louisbourg, the Louisbourg collection is of considerable assistance in any effort to solve the difficulties themselves. Since the English had no reason to bring considerable quantities of non-English glass to Louisbourg during their two periods of occupation (1745-48 and 1758-68), it is clear that almost all of the non-English glass recovered in the course of archaeological investigations belonged to French inhabitants (along with goodly quantities of the English glass). (Excavations at contemporary English sites, such as Fort Beauséjour in New Brunswick and Fort Amherst in Prince Edward Island, have disclosed that the English used English table glass more or less exclusively.) In consequence, it is possible to outline in some detail the styles, forms and even the quantities of the glass used by an assortment of French people in the periods 1713-45 and 1749-58. The years represented are of particular and considerable importance if we are to address the difficulty of French attribution of glass in the 18th century, for they include the tail end of the Venetian style's popularity; the brief ascendancy of an indigenous tradition, so-called "verre fougère"; and the beginning of large-scale importation of both German-Bohemian and English glass, with subsequent establishment of crystal manufactories designed to duplicate these imported products. In short, the Louisbourg collection provides evidence for a fairly thorough classification of, if not French glass, glass used by the French in the four decades preceding the collapse of New France, and for tentative definition of the chronological progression of the phases just described.

Before embarking on a discussion of the Louisbourg glass, it is necessary briefly to review the main crystal
glass traditions in Europe and briefly to survey both modern scholarship and historic treatises on the subject of 18th-century French glass.
Glass Compositions

Glasses are formed by the fusion of silica with a fluxing oxide - sodium oxide or potassium oxide - and at least one stabilizing oxide - such as lime (calcium oxide), lead oxide, magnesium oxide or aluminium oxide (Peddle 1927: 74-5). The fluxing oxide is needed because it drastically reduces the fusing temperature of the silicate. A stabilizing oxide is necessary because unless one is included the resulting glass is soluble in water and very unstable, and stabilizing oxides enhance the working properties of glass by lowering its melting temperature still further and extending its viscosity range (or working time) by varying amounts. Modern glasses are normally classified according to their primary stabilizing oxide, so that one simply speaks of lime glass or lead glass, or other of the many different glasses with different properties for different applications (Peddle 1927: 75).

Historically, the majority of glass has been lime glass, of alkali-lime-silica composition. Until a chemical process of deriving soda from common salt was developed in 1787 (the LeBlanc process) (Douglas and Frank 1972: 23), the alkali was normally in carbonate form, soda or potash obtained from the sea or the forest: in some glassmaking areas, the industry would rely on soda from the lixiviated ashes of seaweed; in regions where forest was plentiful, wood and bracken ashes provided potash (Hodkin and Cousen 1925: 5). Soda and potash could be used in combination as a flux. The stabilizing agent, excepting fortuitous impurities which fortunately acted as stabilizers, was almost always lime until the late 17th century, after which some glass was made using lead oxide.

With crudely refined batch materials, the simple mixing and firing of alkali, lime and sand allowed fabrication of common or bottle glass, normally discoloured green because of the presence of iron. It was desirable to make clear glass as an imitation of rock crystal: indeed, clear glass was and is called "crystal" (Perrot 1962). Making clear glass, however, was a much more deliberate and complicated procedure than making common glass. The batch ingredients had to be carefully selected and refined for purity and an appropriate quantity of decolouriser had to be added. The
decolouriser was a metallic oxide, usually manganese, which coloured the glass toward the red end of the spectrum, simply cancelling out the green tint which was normally present because of iron oxide (Peddle 1927: 153).

Although glassmakers were not chemically very sophisticated until the 19th century, it is possible to discuss the properties of certain different metals because historic glassmakers tended to adhere closely to whatever formula was successful for them (see Bosc d'Antic 1780: 122; Angus-Butterworth 1948: 43): in consequence, entire national industries produced crystal of as nearly uniform composition as the consistency of batch materials permitted. The first post-medieval clear glass, Italian crystal, was perfected in Venice and used soda for its alkali, presumably because seaweed, such as Spanish barilla, was more readily available to Venice and Altare than forest products. By the 17th century, Italian crystal was imitated in various European countries. In Bohemia, rock crystal engravers at the beginning of the 17th century tried their hand at artificial crystal: although these efforts were successful, it was found that the material was not suitable for thick-walled vessels which gave liberty to the engraver and cutter. Consequently a new potash-lime-silica crystal, using the forest products near to hand, was perfected about 1670 (Hettes 1958: 18) and this became the standard crystal of the Bohemian and then an imitative Bohemian-style industry during the 18th century. Just slightly later - probably perfected during the late 1670s - was the Englishman Ravenscroft's glass of lead (Thorpe 1969: 116ff), a crystal of potash-lead-silica composition. This metal was the usual medium for English table glass during the 18th century and in the course of the 19th century came to be accepted as the standard of crystal ware for the bourgeois table.

These three crystal metals, two lime glasses and one lead glass, had different properties which either caused or made possible the most fundamental stylistic distinctions in 18th-century glass. The different virtues of the metals are sometimes described with patriotic ebullience, but their properties can be empirically recited, at least on a comparative basis. The major contrast is between the properties of lead glasses and lime glasses. Substituting lead for lime lowers the melting point of the metal about 200° F, and since a very hot mass dissipates heat at a greater rate than a relatively cooler one, this change means a longer viscosity range for lead glass (Elville 1951: 37). Substituting lead for lime sharply increases the specific weight of the metal and the refractive power is accordingly increased (Angus-Butterworth 1948: 37). Finally, lead glass is "softer than lime glass and can be cut and polished more readily" (Hodkin and Cousen 1925: 103).

The differences between glasses utilizing different fluxing alkalis are more subtle, but most investigators
agree that potash makes a more colourless glass than soda because it reduces the effectiveness of colouring oxides (Angus-Butterworth 1948: 35; Hodkin and Cousen 1925: 103). This of course pertains to both lime and lead glasses: English lead crystal used a potash flux, as did Bohemian lime crystal, while Italian crystal was fluxed with soda. In comparing the two main species of lime glass, viscosity seems to be the main feature of further interest. The viscosity range of all lime glasses tends to be short (as compared to lead glasses), and both alkaline oxides increase fluidity and extend the viscosity range, but sodium more so than potassium oxides: hence, the viscosity of potash glasses is generally higher than that of soda glasses (Morey 1936: 551). The property of greater viscosity leads to a thick-walled vessel, an essential feature of Bohemian crystal (Vavra 1954: 137). However, the effect is variable since the proportion of lime to alkali can be varied: a reduction in alkali and corresponding increase in lime not only decreases viscosity range but also creates a glass which stiffens rapidly when it chills, a useful attribute in extensive hand manipulation (Hodkin and Cousen 1925: 100). Comparisons of the hardnesses of soda-lime and potash-lime glasses seem inconclusive and contradictory, but on the whole potash glass is apparently harder and also lower in density and refractive index than soda glass (Hodkin and Cousen 1925: 25, 94, 96).

While the glass industries of the three major glassmaking nations adhered quite consistently to these different kinds of crystal metal, the French industry made much common, green-tinted glass and much glass imitating the popular and famous foreign crystals. This topic is best introduced by surveying the literature of modern scholarship on 18th-century French glass.
The most complete and rewarding classification of 18th-century French drinking glasses is James Barrelet's "La verre à boire en France au XVIIIe siècle" (1957; see also 1953). Barrelet defines two major categories of drinking glasses based on style and metal. Using 18th-century paintings for the bulk of his evidence, he notes that during the first half of the century, thinly blown glasses, in metal which is always coloured, usually green, are not only common but quite exclusively in vogue. These are indigenous verre fougère wares, the name implying that they were made from a mixture of sand and potash derived from the ashes of ferns. These were blown in simplified Venetian styles. Elsewhere Barrelet (1953: 97) has distinguished between "la gobeleterie de luxe et la gobeleterie commune," and suggested that the former, the makers of fine wares, were virtually incapacitated by indecision in the first half of the 18th century, torn between the waning fashion for Venetian glass and the divisive, growing influences of Bohemian and English metal and styles. Into the vacuum came the common and formerly disdained fougère glasses and they captured the market for all social classes until the middle of the century (Barrelet 1957: 103-4). While the Venetian-style industry in France had lost its importance by the 18th century, so that its products are rarely seen in paintings, its logical successor, a Bohemian-style industry, did not really gain a foothold in France until quite late, the second half of the 18th century (Barrelet 1953: 103, 105). The second major classification of glasses defined by Barrelet, then, is restricted to the second half of the century. He calls these "verres blancs massifs" and they are made of clear glass, more thickly blown than verre fougère and in forms imitated from the English and the Bohemians (Barrelet 1957). (Actual English lead crystal was not successfully manufactured in France until at least the 1770s [Charleston 1959: 159; Barrelet 1953: 107-9; Scoville 1968: 23].)

Applying these fundamental distinctions of form and material to available glasses, Barrelet is able to establish a neat chronological division at mid-century for all but a few glasses which demonstrate characteristics of both
styles. To accommodate these, he turns to a manuscript of the second half of the 18th century which describes the French glass industry and which states that two different qualities of drinking glasses were made (Barrelet 1957: 113): one in clear class, composed with "salin," potash derived from vegetable ashes; the other made with Spanish soda. Conjecturing that the second kind of glass, which the document names "pivette," is the descendant of the fougère tradition, Barrelet defines a third class of French glasses, chronologically limited to the second half of the 18th century, entitled "verres fougère ou pivette."

A second work of essential interest is Warren Scoville's Capitalism and French Glassmaking, 1640-1789 (1968). Scoville has not related his study to the extant products of the glassworks, but nonetheless he suggests important distinctions between different manufactories, important trends in the technical evolution of the industry, and also significant ways in which differentiations cannot be made because of the nature of the industry. Thus it is possible loosely to categorize "grosses" and "petites verreries": the former made coarse glass for windowpanes and bottles while the latter made drinking glasses and other objects for table use; however, a so-called petite verrerie probably made its drinking glasses in both common and crystal metal (Scoville 1968: 8, 14, n. 1; 18). Scoville agrees that Venetian crystal rapidly lost popularity, but finds the strong influence of Bohemian glass much earlier than Barrelet suggests:

Most entrepreneurs who set up furnaces for white glass after 1700 used German and Bohemian techniques....There is reason to believe that nearly all the fine glass melted in Northeastern France in the early seventeenth and throughout the eighteenth centuries resembled other crystal more closely than it did Italian. Manufacturers there mixed potash with their sand instead of soda, and copied the techniques employed in German and Bohemian glasshouses (Scoville 1968: 22-3).

Obviously, such suggestions have implications for any typology of French glass based on the quality of metal and its effect on style. If common and crystal glass might be made in the same glasshouse by the same artisans, it is not reasonable to expect the styles and forms to be different, except inasmuch as the material being worked demanded differences - and Scoville (1968: 18) contends that the metal differed only in the purity of constituents and the introduction of decolourisers. Again, if glassmakers emulated Bohemian technology, it is probable that they emulated Bohemian styles as well.

Finally, on at least one major point of categorization we are indebted to Robert Charleston's work (1952a, 1952b,
1952c). He distinguished a crizzled metal "which takes on an increasingly pinkish tinge as the decay grows worse" as one of the features of a characteristically French glass originating in central or western France in the middle of the 18th century (1952c: 16-7). In addition, Charleston reinforces Scoville's observation that glasshouses in the north of France tended to make German or English styles of glass, adding that there was a close correspondence between glass styles from southern France and from Northern Spain, almost always in emerald-green metal (1952a: 253).

The studies thus summarized are unanimous in their suggestion that correspondence between metal types and vessel forms - in general between material and style - has either chronological or regional significance, or possibly both, and will of necessity be the basis for any classification of French glass of the 18th century. These features may best be approached by examining the names and descriptions used for different kinds of glass during the period itself.
Classifications of glass were provided in two major contemporary French documents which discuss the state of the art, at least one of which addresses itself candidly to the shortcomings of the French industry. The latter was Paul Bosc d'Antic's prize-winning 1760 memorial to the Académie Royale des Sciences (published in the 1780 Oeuvres). The Academy had offered a prize to the memorialist who could best outline ways to bring the French glass industry to perfection. The other important contemporary text is Diderot and d'Alembert's famous Encyclopédie, ou Dictionnaire raisonné, which appeared over the years 1751-80, with articles of particular relevance to glass falling in Volumes 4, 7 and 17, published in 1754, 1757 and 1765 respectively. The dates of these works are happily coincident with the end of the last French occupation at Louisbourg and suggest that we may gain a useful view of the advances and retardations of the industry during the crucial middle years of the century. A third document, which will be useful in providing a non-expert, mercantile view of the glass products available in France in 1731, is a list compiled by the Chambre de Commerce de la Rochelle entitled "Etat des marchandise dont on demande le prix actuele" (Canada. Public Archives [hereafter cited as PAC], MG6, B3, p. 7360).

In 1760 Bosc d'Antic wrote (1780: 62-3) that there were four kinds of glass made in France: bottle glass, common green glass called "chambourin," fine clear glass and crystal; however, fine clear glass from France would scarcely pass for common glass from Germany and French crystal would scarcely pass for foreign clear glass. The same distinction between crystal and clear glass is found in 1765 in Diderot (Encyclopédie 1966, 17: 155), where there is suggested a composition which would not give a beautiful crystal, but would give a beautiful clear glass. The La Rochelle price list suggests that most specialized objects - from candlesticks to water jugs, from holy-water basins to table buckets (wineglass coolers?) - along with carafes and drinking glasses, were available in crystal. Listed entirely separately, however, are drinking glasses of two
other sorts of metal: "verres à boire blanc" and "verres des fougère [sic] communs" (PAC, MG6, B3, p. 7360).

What is the middle range of glasses, the verres blancs, neither fougère (chambourin) nor crystal, in all these documents? Chambon (1955: 300) has suggested that there was a category of glass in the 18th century which he calls "cristal ordinaire" which was merely Venetian-style soda-lime crystal in the decline of its popularity, rendered common or ordinary by contrast to the fashionable English and Bohemian crystals.

The formulae for common clear glass in Diderot (Encyclopédie 1966, 17: 155) and Bosc d'Antic (1780: 125) are as follows: Diderot suggests 200 livres of Alicante soda, 50 livres of "sel de nitre," and 275 livres of sand, along with some manganese; Bosc d'Antic's recipe is for equal parts of soda, sand or sandstone, and cullet, along with some manganese. The recipes are particularly interesting not only because they suggest that Chambon is correct in identifying common clear glass as soda glass, but also because they do not include a stabilizing oxide. The use of soda connects this kind of glass with the Venetian tradition. Bosc d'Antic remarked that although potash was the only flux used in Germany, Italy and France continued to use soda and saltpetre (1780: 101). Of course the lack of a stabilizing oxide would produce a metal which would not last long, but in the verre fougère manufactories, no stabilizing oxide was added, simply because the batch materials contained enough impurities, particularly magnesium and aluminum oxides, to make the glass workable and stable (Chambon 1952: 793). Obviously, if glassmakers strove to get pure constituents and to refine them, such fortunate impurities would be lost and an unstable glass would result. It seems likely that some glassmakers worked at the margin between a common glass and a clear but unstable glass: Bosc d'Antic (1780: 117) was able to claim that few people were even aware that it was necessary to add to the sand and alkaline salt of a glass batch "une terre alkaline" (presumably chalk or other source of lime) in order to fuse a stable and workable glass. Some alkali-rich glass was so unstable it decomposed on the merchant's shelf:

Le verre...étoit peu clair, peu brillant, peu solide, très susceptible d'humidité, ressoit le sel, se decomposoit à la longue, & le pied creux des verres à boire se remplis soin dans le magasin, & sans communication sensible avec l'air extérieur d'une liqueur saline ou dissolution de sel, partie alkali fixe, partie neutre (Bosc d'Antic 1780: 123-4).

This must have been something very like water glass - an alkali-silica composition without stabilizing oxide. Less severe cases would doubtless be subject only to crizzling in humid environments and so it is possible that a transition
of common green glass into crystal glass, neglecting the need for stabilizing oxide, had resulted in the familiar crizzled glass of French provenience. More important, it is very likely that failure to understand the need for stabilizing oxides kept many glassmakers from choosing and refining pure alkali and sand, and hence made necessary the production of a substandard clear glass. As the Diderot author of an article on "Crystal Factice" remarks, crystal glass is nothing more than beautiful clear glass (Encyclopédie 1966, 4: 526).

As for chronology, the contemporary texts cited provide some useful comments. Certainly crystal, less perfect clear glass, and common fougère glass were all available by 1731 (PAC, MG6, B3, p. 7360). A 1757 article on fougère in Diderot's encyclopaedia (1966, 7: 219) refers to the green glasses which take their name from ferns as very common in Europe, but, in the segment of his Oeuvres written for their 1780 publication, Bosc d'Antic (1780: 165) states that chambourin glass was no longer made in France except as medicinal phials, so that it is apparent that there had been a drastic reduction in the manufacture of such glasses since his 1760 memorial.

Having reviewed modern scholarship and some historic texts, it is possible to turn to the glass of the Louisbourg collection to attempt to relate the objects themselves to the documentary evidence. I will begin with a discussion of the analytic techniques employed in studying and classifying the glass found at the site.
The salient characteristics examined in the study of 18th-century table glass are functional form, stylistic form and decoration, and the composition of the metal. Functional form is of course fundamental and straightforward, the difference between, for instance, a stemmed drinking glass and a serving jug.

Style and composition are somewhat interdependent, as the discussion of different 18th-century crystal metals has indicated. To define the style of a stemmed glass, one attempts to divide it into its defining features. Stem types are the most usual basis of classifications. Barrelet (1957) has suggested some terminology toward a classification of French stems and other terms may be borrowed from the excellent nomenclature of E.B. Haynes (1959: 193-208) even though most of his terms are devised for the description of English types. In some cases, coinages or original translations are unavoidable, but in this paper these will be as descriptive as possible. The essential research technique in identification of style, notwithstanding efforts to achieve objectivity, is strictly comparative. Glasses are compared with other glasses in the Louisbourg collection, in other collections whether archaeological or museum, or in published sources. Occasionally a comparison to contemporary paintings is of some use, but in every case the identification entails a judgement, especially when, as with French glass, stylistic features are often not so much copied from other glassmakers as adapted.

It is possible to be more precise with the characteristics of the metal. Certain compositions - lead glass, for instance - are readily identified by chemical test or ultraviolet light fluorescence (see Elville 1951: 256-66). In the examination of the Louisbourg glass, extensive use has been made of ultraviolet light and it has been possible to group some recurring forms of glasses under apparently homogeneous metal types. Of course, 18th-century glass compositions were subject to variations because of the inconsistency of materials, so that observations are only diagnostic in general terms. But in such terms the ultraviolet light seems an adequate tool, with the further
advantage of permitting efficient study of a very large collection. It ought to be noted that the ultraviolet fluorescence described here is essentially relative and that it may be misleading to examine single objects without the control of different kinds of glass. The ultraviolet lamp used was a Mineralight UVSL-25, with two available wavelengths: 2537 a.u. and 3660 a.u., hereafter referred to as short- and long-wave uv. Of course the appearance of the metal under natural light is noted with care as well. Where applicable, colour is measured on the Nickerson Color Fan (Munsell Color Company) under white fluorescent light.

Subsequent to the categorizing study recorded in this report, a small number of glasses have been analysed by means of atomic absorption spectroscopy. Appendix A summarizes the findings of that analysis as they reflect upon hypotheses and identifications advanced in this report.

Time has not permitted tabulation of the total number of examples of each form discussed. In consequence, the frequency of occurrence is approximated: "rare" means three or fewer examples, "infrequent" means fewer than ten, "frequent" means more than ten but fewer than 25, and more than 25 examples is considered "abundant."
Classification

The establishment of significant categories for the glass at Louisbourg depends, as I have argued, on the identification of stylistic attributes and composition of the metal. A classification of 18th-century French glass necessarily yields a minimum of four categories, all of which are represented in some degree at Louisbourg: Venetian-style glass, verre fougère, Bohemian-style glass, and English-style glass. Venetian-style glass in France was not so exuberant a tradition as it was in, for instance, the Netherlands (Thorpe 1969: 174), and consequently by the 18th century was stylistically very subdued. At Louisbourg there are no serpent stems or bird knops. The verre fougère tradition was also a repository of many sobered Venetian forms, including hollow, thin-blown stems, and indeed a repository of thin-blowing itself as a way of shaping glass (Barrelet 1957). This kinship blurs the stylistic distinctions between Venetian-style glass and fougère glass. Bohemian-style glassmaking in France is even more elusive because it was in imitation of an industry which manufactured large quantities of inexpensive wares to be exported. Such commonplace products of the Bohemian houses are only recently being studied by experts on central European glass (Vydrova 1972: 205), though Charleston suggested some time ago that most of the engraved or cut glass found in France was actually of Bohemian origin (Charleston 1952b: 254). Yet there is documentary evidence that French glassmakers did make table wares after Bohemian methods (Scoville 1968). How to separate the imitation from the original is a question never satisfactorily answered for the more vulgar of 18th-century Continental table glass. At a glance, English-style glass ought to be much easier to identify. Since the English made lead crystal while the French did not, at least until after the last French occupation at Louisbourg, French imitations of English forms in a different metal should stand out distinctly. But that is not quite the case, since the English continued to make some non-lead glass tablewares throughout the century (Haynes 1959: 163), since there is reason to believe (Charleston 1960) that other European glassmakers had succeeded with full lead crystal by the middle of the
century, after having dabbled with it for decades (Charleston 1957), and since the English themselves adapted forms from Venice and Germany (Thorpe 1969: 164-74).

From this rather confusing picture I turn to the often more decisive classification of objects by metal type. To visual inspection, an initial division between common glass and clear glass is obvious. Common glass is always greenish in natural light and though clear glass necessarily includes everything from verre blanc commun through fine crystal, it cannot be mistaken in contrast with common glass. The division is supported by examination under ultraviolet light where common glass shows no fluorescence at all. All clear glass in the Louisbourg collection fluoresces to a greater or lesser extent. This difference presumably indicates that in common glass no decolouriser was used in the glass batch (Elville 1951: 266). Scoville (1968: 18) suggests that the absence or presence of decolouriser defines the difference between common and crystal glass (but see Appendix A).

Apart from containers - phials, etc. - common glass is restricted to stemware forms (Figs. 1-6). It is apparently fougère glass such as had been made for many years before the settlement of Louisbourg, but which lasted well into the 18th century. The green tint is quite variable, from the top of the Y range to the top of the G range and even into the B range on the Nickerson Color Fan (Munsell Color Company). The glass is often bubbled, but not consistently so. As the drawings indicate, it is often amazingly thin in cross-section.

There are distinct divisions to be made in the metal properties of objects in clear glass. Amongst the objects for which there is some evidence of French attribution (on the basis of contextual or scholarly identification), two fairly distinct groups of clear glass stand out. Under ultraviolet light examination these are reinforced and the remainder of the clear glass is divided into two further categories, for a total of four.

A first category of French clear glass is found in very thinly blown, delicate forms of stemware (Figs. 7-11). It is normally quite clear but with a tendency to a brown or yellow tint in spite of its thinness. Examples are abundant at Louisbourg though in the main excavators found them in concentrations on the site and in a strictly limited range of forms. When examined under ultraviolet light, the metal is still more distinctive in comparison to other clear glasses. Under short-wave uv, it responds only very slightly with a green fluorescence or not at all, though surface patination sometimes glows like a dusting of purplish-white powder; under long-wave uv, it emits a dull pea green quite unlike long-wave fluorescence of any other glass from the site. This appears to be verre blanc commun in style, a sober and delicate continuation of the Venetian-style fashion.
The second group is crizzled glass, often discoloured brown or rust or pinkish brown in the process of its devitrification, and is apparently the metal which Charleston has described (1952c: 18-9; see above) and attributed to central and western France in the mid-18th century. Tumblers are especially numerous in this metal, along with some stemware (Figs. 13-15). Examples are abundant at Louisbourg and in tumbler form the metal is familiar at all Canadian historic sites with mid-18th-century occupations. Doubtless there would be even more common finds but for the advanced decay of many examples, which often makes excavation and preservation quite impossible (Dunton: pers. com.). Under short-wave uv, crizzled glass emits a very slight, dull green fluorescence; under long-wave uv, the fluorescence is a very bright yellow-green. The composition of this metal is presumably alkali-rich and hence unstable. This allows us to suggest that it resulted from the transition of common glasses into crystal glasses, for common glass was made of alkali and sand with no stabilizing oxide deliberately added and was stable on account of impurities (see above).

The remaining clear glass tends to aspire to the quality of crystal as we now know it - relative to the Venetian styles at least, it is thickly blown and clear. Apart from stylistic differences, there is not a great deal to distinguish between different objects under natural light. However, the glass immediately subdivides into yellow-fluorescing and blue-fluorescing metals under short-wave uv light. The latter metal has a significant lead content.

The lead-content crystal glass is largely confined to specialized forms - wineglass coolers, serving jugs, and even small hanging holy water basins (bénitiers) - rather than mainly to drinking glasses as most of the objects in other metals are, and the objects show close stylistic kinship to each other (Figs. 28-33). In addition to the ultraviolet light test, the lead content has been tested in two ways: by the displacement-density test (Elville 1951: 258-9) and by the chemical spot test. (Subsequently the results of this testing have been confirmed by atomic absorption spectroscopy [see Appendix A].) Both tests substantiated the presence of lead. Of four fragments tested by displacement (Table 1), three had a density of 2.96 or 2.97, indicating a lead content of approximately 23 per cent (Elville 1951: 258-9). The fourth, which was from a sealed excavation context of French occupation in the early to mid-1750s, had a density of 3.16, indicating a lead content of about 32 per cent (Elville 1951: 258-9) even though it is stylistically identical to other fragments with less lead. Elville (1951: 259-60) has demonstrated that "the lead content of the [English] glass has not been less than 30 per cent since the potash-lead formula was
established in the Ravenscroft period." This observation has been borne out in the tests on 18th-century English glass in the National Historic Parks and Sites table glass class collection and does not seem to admit of exceptions even for the most utilitarian and humble wares. The demi-lead crystal at Louisbourg must have been made on the Continent or made in England especially for export to the Continent: the former conjecture seems more plausible.

The remaining clear table glass objects are in good metal, more thick-walled than either the common glass or the Venetian-style clear glass. It subsumes many tumblers and stemware, the majority of which are of recognizable German-Bohemian form or decoration though some have close English counterparts (Figs. 16-27). The metal is presumably Bohemian crystal, that is, potash-lime glass. Under short-wave uv, response is a weak yellow-green; under long-wave uv, bright yellow is emitted but often tends toward either a bright yellow-green or a duller copper-tinted yellow. This variation is probably indicative of differences in the molecular state of the manganese declouriser (Elville 1951: 265) and, although the extremes tend to align themselves with certain vessel forms, I emphasize again that the variations in fluorescence within groups of glasses are recorded as relatives. Examination under ultraviolet light helps suggest distinctions, but can neither provide nor verify identification of different lime glasses (see Appendix A).

It is now possible to establish categories which integrate the objective differentiations of metal properties and the subjective attributes of style. In the interest of objectivity, metal type must remain the essential determinant, but, happily, the metal types distinguished correspond in most cases with forms and styles. In most cases a given object form occurs in only one type of metal and distinctive combinations of decorative attributes tend to be limited to one metal as well. There are, naturally, exceptions to these generalizations, some significant and some simply puzzling, but these are few and will be treated as they arise in the detailed discussion of each class of artifacts to which the remainder of this paper is devoted. The classes of table glass associated with the French at Louisbourg are designated as follows: common green glass, common clear glass, crizzled glass, demi-lead crystal, and Bohemian crystal.
Common green glass, to recapitulate, was called a variety of names in 18th-century France: verre fougère, verre commun and chambourin. Pivette may refer to the same metal, according to Barrelet (1953: 166). This glass is always green, although the actual hue varies from blue-green to yellow-green. Originally, the colour was fortuitous; in time it became fashionable for a while (Barrelet 1957: 103-4; and see Appendix A). Bubbles are present to some degree in most examples. Common green table glass was found only in stemware forms at Louisbourg, though phials, jars and bottles in similar metal were abundant.

On the basis of stem formation it is possible to differentiate two groups of common green glass stemware, spindle stems (Figs. 1-2) and hollow-blown stems (Figs. 3-6). The spindle stems normally contain tears, so that they may be technically hollow, but the tears are enclosures of air rather than expanded shapes.

Some spindle-stemmed common green glass stemware have tiny inverted balusters, usually with a cushion knop (Figs. 1a, b, 2a, b). Others have one or more small knops on a cylindrical but thin stem (Figs. 1c, 2c). Striations on irregularly knopped spindle stems (Figs. 1d, e, 2d, e) may be intentional or may be incidental to the formation of the stem. Apparently, spindle stems are never without knopping of a sort, however rudimentary or irregular. Metal colour and transparency are variable and the metal is frequently seed bubbled. The workmanship demonstrated by the shaping of the glass is more primitive than on other glasses at Louisbourg. Because they are so rudimentary in conception and manufacture, the spindle stems cannot be positively identified with any of the national traditions, but their frailty and lightness would suggest Venetian heritage. Taken together, spindle stems are abundant at Louisbourg, but no single form, closely defined, is more than infrequent.

Of more uniform metal and better workmanship are the hollow-blown stems in common green glass. These stems are of two general shapes - an inverted baluster (Figs. 3, 4) and a cigar shape (Fig. 6) - though there are variants of each.
The inverted baluster may or may not be quatrefoil, as Figure 3 (four vertical indentations are found on the sides of the baluster so that the horizontal cross-section is quatrefoil). The baluster is surmounted on Louisbourg examples by a hollow cylindrical neck, a collar or merese apparently shaped by folding out the top of the stem, and a conical bowl. Occasionally faint spiral ribbing is found on the whole stem, as Figure 4. The normal forms, examples of which are shown in Figures 3 and 4, are frequent at Louisbourg, but a number of stems, all rare, apparently share some of the features while lacking or altering others (Fig. 5). The glass in Figure 5a, b has no collar; the stem in Figure 5c, d is squat and foreshortened; the inverted baluster in Figure 5e, f has become a nondescript bulge. Figure 5g, h shows a common green glass stem which, though still related to the glasses just discussed, has adopted the general form of a stemware normally found in crizzled glass and Bohemian crystal metal (cf. Figs. 14, 15, 16c, 16d).

The cigar-shaped hollow-blown common green glass stem (Fig. 6) is very distinctive, especially in manufacturing technique. The stemware was evidently formed - stem, bowl and foot - from a single gather of metal. Thus it is a one-piece glass (most stemware, of course, is of either two- or three-piece manufacture, at least the foot and often the stem being added in a separate process). The stemware in Figure 6 was evidently shaped from a thinly blown parison: the parison was pushed up from a point opposite the blowpipe until the top of the push-up became the base of the bowl - or top of the stem, if you like. The stem and the foot were then tooled to shape from the lower, doubled-inwards portion of the parison. Entrapped air was usually confined to a large bead around the foot rim, which looks at a glance rather like a folded foot rim. Other blisters of air often evidence the double thickness of glass on the stem and especially the foot: on the latter, blisters sometimes seem to be intentionally arranged in regular spacing. The top of the stem sometimes bulges irregularly into the bowl. Other evidence of the manufacturing technique is the fact that the bottom of the stem was usually left open or only partially covered by the excess glass which the pontil deposited at that point. The normal cigar shape sometimes has a shoulder, so that it becomes a hollow inverted baluster shape (see Frothingham 1963: Pl. 39, A) though its profile would still be quite unlike the inverted balusters of Figures 3 and 4. These thin and delicate glasses are abundant at Louisbourg.

We have already seen, in brief surveys of modern and historic literature of 18th-century French glassmaking, that the so-called fougère glass ceased to be made during the 18th century in France, but there is some difficulty in defining the regional and chronological parameters of the style's demise. There is even more difficulty when we come
to actual artifacts, for literary sources yield little
evidence of the fashionability of particular shapes within
the general manufacturing tradition.

It would appear, on the basis of archaeological
evidence, that virtually all the forms of common green glass
found at Louisbourg had existed at the end of the 17th
century. At Place Royale in Quebec City, for instance,
a glass closely parallel to that in Figure 4, along with
other related common green glass stems, spindle and
hollow-blown, was found in a sealed context of the late 17th
and early 18th century (Lafrenière and Gagnon 1971: 71);
another Place Royale glass, comparable to that in Figure 3,
has been similarly dated (Genêt, Décarrière-Audet and Vermette
1974: 257, 293). At Castle Hill, in Newfoundland, which was
occupied by the French between 1694 and 1713, common green
glass stemware fragments excavated included a stem very like
the one illustrated in Figure 5c, d, and a spindle stem also
(Grange 1971, 7: Fig. 110).

Common green glass stemware is frequently found in
paintings in the first half of the 18th century (as Barrelet
[1957] has noted) and only a few of many instances can be
noted here, but these reinforce the argument for French
attribution. Spindle stems in J.-F. de Troy's 1737 Le
Dejeuner aux huitres (Barrelet 1953: Pl. XLVIII, A) have
inverted balusters and cushion knops as Figures 1a, b, and
2a, b. Quatrefoil inverted balusters in common green glass
are found in Chardin's 1728 Le Buffet (Barrelet 1957: Pl.
13, C) and in André Bouys's (b. 1656 d. 1740) La Collation
aux pêches (Faré 1962: No. 303).

As for extant specimens, all the Louisbourg common
green glass stemware have at least loose correspondants in
Barrelet (1957), who categorically dates all verre fougère
to the first half of the 18th century. A spindle stem
illustrated by Barrelet (1957: Pl. 13, A) is very similar to
those in Figures 1a, b and 2a, b from Louisbourg; another
(1957: Pl. 13, B) compares closely with the stem in Figures
1d and 2d. Other variants of the spindle stem are
illustrated by Barrelet (1957: Pl. 15). In hollow-blown
inverted balusters, Barrelet's quatrefoil example (1957: Pl.
13, C) lacks a neck and collar below the bowl and he does
not show a ribbed example although one glass he shows
(1957: Pl. 14, C) is otherwise equivalent to Figure 4.
Barrelet concurs (1957: Pl. 14, A, B) that the hollow
inverted baluster variant shown in Figure 5g, h is a verre
fougère form in spite of its resemblance to a Bohemian
crystal form (see Fig. 16c, d). Identifying the hollow
cigar-stem one-piece glass in the literature is not so
simple. Barrelet has an example (1957: Pl. 14, D) of an
inverted baluster shape which may be made in the same
fashion as the Louisbourg glasses, but the only certain
parallels (that is, certainly made by the same technique)
that I have found are some glasses from Cataluna.
(northeastern Spain) illustrated in Frothingham (1963: Pl. 39). Frothingham erroneously suggests (1963: 49) that these are after an English model and that the bowl was "set on" the stem, but her attribution to 18th-century Spain is plausible.

In general, there is no reason to deny French attribution for the majority of the common green glass stemware found at Louisbourg. Because it is not fine glass and because it probably was too delicate to travel well, common green glass stemware is an unlikely import item. The exception to this argument is the one-piece style with its Spanish kinship, but Charleston's suggestion that the glass industries of southern France and northern Spain were close kin in the 18th century may be recalled (Charleston 1952b: 253).

As for chronology, it is probably safe to say that the verre fougère tradition, as Barrelet (1957) defined it, is continuous at least until the middle of the 18th century in France and that certain forms are probably continual. Doubtless, however, the variant on the hollow inverted baluster shown in Figure 5g, h is a late development, that is, after about 1720. For the tradition as a whole, how hard and fast the mid-century end-date can be applied is a question which cannot be simply answered. There is substantial evidence that in certain areas the tradition survived longer than in others (Scoville 1968: 22-3). Archaeological evidence seems to support the argument that consumers in northern regions of France were accustomed to either Bohemian or Bohemian-style wares before mid-century: excavations at the site of the Roma settlement venture in Prince Edward Island, mounted by a Paris-Rouen partnership and dating between 1732 and 1745, yielded a number of Bohemian-style engraved tumblers and no other table glass at all (McNally 1972b). Yet, we have the evidence of the Diderot Encyclopédie and the Bosc d'Antic memorial that common green glass table vessels were familiar enough in 1754 and 1760 respectively. It is apparent that an arbitrary dating of the end of the manufacture of common green glass drinking glasses would be ill-advised. Further research might address itself to a collation of demographic knowledge of the population of the town of Louisbourg with recovered artifacts in order to ascertain whether there is any correspondence between the region of France from which a householder came and the objects on his table.

Green glass was common not only because it was familiar, but also because it was cheap. The La Rochelle price list referred to above does not provide a basis for comparison between drinking glass prices in crystal and common green glass because the crystal prices are given only for hundredweight quantities. However, fougère drinking glasses cost just less than half as much as "verres à boire blancs" (PAC, MG6, B3, p. 7360). A 1770 inventory in New
France indicates that a glass of crystal was worth nearly four times what a fougère glass was (Genêt, Décarrie-Audet and Vermette 1974: 257, 270n.), but fashion had probably depressed the price of common green glasses by that time.
Common clear glass (verre blanc commun) was also called, during the 18th century, simply verre blanc; Chambon (1955: 300) calls it cristal ordinaire, and it is probably the last of the Venetian-style glass. The metal is substantially the same as Venetian soda-lime glass, especially in terms of working properties. The consistently thin sections of common clear glass stemware at Louisbourg suggest a highly fluid but quick-setting metal, as Venetian crystal was. The glass is free from bubbles and from green tint, but usually has a slight yellow or yellow-brown tint in spite of its thinness.

Classified by stem formation, common clear glass may be represented almost entirely by three forms. These are a thin plain stem; a tall, hollow inverted baluster once again either plain or quatrefoil, and a hollow writhen cigar stem. Barrelet classifies a drawn plain stem with a moulded bowl (1957: Pl. 17, A) as "verre fougère ou pivette" and the other styles as verre fougère. The argument for rejecting Barrelet's assimilation of these styles into the verre fougère, or common green glass, classification is twofold: first, the metal of the common clear glass is substantially different from that of common green glass, as are the stem formations; second, unequivocal and repeated references to a kind of glass normally termed verre blanc commun in 18th-century documents make it perfectly clear that glassmakers, merchants and consumers were quite aware of a distinction between common green glass and a common clear glass (in turn distinct from crystal). If anything, the classification I have established for common clear glass is too exclusive and might include some of the poorer quality pieces of Bohemian crystal (see Fig. 16c, d). However, the standard of division by metal type upon which I have relied in defining the category is substantiated by style, for the common clear glass group certainly has its main ancestry in the thin-blowing tradition of Venetian crystal, while the styles of the Bohemian crystal glass are akin to Bohemian and English products.

The extremely austere plain stem, thinly formed, is abundant at Louisbourg (Figs. 7, 8). Not many examples are preserved intact and it is consequently difficult to compare
size and minor variations of proportion, but the glasses seem to vary little. The prototype for these drawn stems is Venetian (Thorpe 1969: Pl. XLV), but the presumably French examples at Louisbourg have straightened out the trumpet-bowl profile of the Venetian form, so that the bowl is conical. According to Barrelet (1953: 90), French taste characteristically gave Italian models more simple lines.

The illustrated inverted baluster in common clear glass (Figs. 9, 10) is about as numerous as an otherwise identical glass with four indentations on the baluster which give it a quatrefoil section. Taken together, the two types are abundant at Louisbourg. Apart from the clarity of the metal, these glasses are readily distinguished from common green glasses with the same stem elements because the stems are much taller and less wide at the shoulder of the baluster. While most of the thin bowls are fragmentary, the light double-ogee shape of the illustrated example appears to be typical.

The writhen hollow cigar stems are abundant and are found with a variety of bowls; more important and unusual is the fact that they are found in a variety of metals. The illustrated example (Fig. 11) has a round funnel bowl with rib-and-dimple pattern moulding. Other bowls are plain or moulded with vertical ribbing only. The metal variations are greater with this than with any other glass form found at Louisbourg: there is a single example in crizzled metal and many examples, perhaps half the total, in demi-lead crystal. The illustrated example of the stem formation is distinctive and typical even of the demi-lead crystal specimens, whose greater thickness is evident on the bowls rather than on the stems. The stem is probably formed by drawing a small gather of glass through a serrated aperture before final shaping of the stem.

Some few additional and rare artifacts are also formed of common clear glass. These are the two unique stems in Figure 12 and a few small pattern-moulded tumblers. The stem in Figure 12a, b is evidently an elaboration of the hollow writhen cigar stem, perhaps under the influence of the double-knopped striated stems which are found in Bohemian crystal (Fig. 18a, b). The stem in Figure 12c, d is a squat variant of a stem which is transitional between Venetian and Bohemian styles and which, though most common in Bohemian crystal, also occurs in both common clear glass and crizzled metal (Fig. 16c, d). The infrequent tumbler bases, small and rudimentary, in common clear glass, include a glass from a well with an archaeological dating of 1722-24 (Steer: pers. com.). It is pattern moulded for optic effect; that is, it was blown in an undersized pattern mould to impart widely spaced ribs or panels, then blown again in another, plain mould, so that the panels are retained only on the interior surface of the vessel. Most of the non-lead
glass tumblers at Louisbourg are in either crizzled glass or Bohemian crystal.

As I have mentioned, the plain drawn stem came from a Venetian prototype, but it was a staple for many glassmakers, in one variation or another. Honey (Victoria and Albert Museum 1946: Pl. 36, B), for instance, suggests a Low Country origin for a glass similar to that in Figures 7 and 8 though with a flaring bowl profile, and Chambon (1955: Pl. XXXIII, 110) counts another such glass among those made in Belgium after Venetian styles. I have mentioned Barrelet's example (1957: Pl. 17, A) which he ascribes to France in the second half of the 18th century and Thorpe's (1969: Pl. XLV), called "continental, probably Venetian" and dated to the 17th century. The plain stem was obviously a ubiquitous and long-lived form and also a form which adapted itself to the taste and the material of different traditions (see Thorpe 1969: Pls. XLV, XLVII), so that it has its expression in English lead glass and on the Continent in Bohemian crystal (Fig. 19).

The elongated inverted baluster also exemplifies the ubiquity of Venetian influence: Haynes (1959: Pl. 59a, b) conjectures a third-quarter 17th-century English origin for two examples; Charleston (1952c: Fig. 23a) calls an example with a moulded (rib-and-dimple) bowl "perhaps French; late 17th or early 18th century," and Barrelet (1957: Pl. 6, 16, A, B) calls them verre fougère, French, first half 18th century. By the time of the first occupation of Louisbourg, an English attribution is out of the question for so light a glass and French origin is quite plausible.

The third major stem category, the hollow writhen cigar stem, seems to be a technically cheap and efficient adaptation of the familiar Venetian cigar stem with enamel spiral threads (for example, Victoria and Albert Museum 1946: Pl. 26, A). Once more the form is long-lived. Barrelet finds it in paintings of 1704 and 1755 (1957: Pl. 4; 1953: Pl. XLVIII, B) and it is to be found in the still lifes of Vallayer-Coster well into the second half of the 18th century (Roland Michel 1970). Once again, Barrelet denominates the style as verre fougère (1957: Pl. 12). Other examples in the literature are in Charleston (1952c: Pl. 19, left) and Honey (Victoria and Albert Museum 1946: Pl. 35, B), the former identified as from 18th-century Normandy, the latter considered to be from the Low Countries or even England in the 17th century. Belgian attribution is argued, below, for the demi-lead crystal hollow writhen cigar stems. It seems that vestiges of the Venetian-style were very strong in the Low Countries (Thorpe 1969: 174) and the possibility of Low Country origin for all these common clear glass stemware cannot be ruled out. On the whole, however, French attribution seems perfectly plausible.

In 1731 a hundredweight of drinking glasses in common clear glass wholesaled in France at 75 sols, compared with
60 sols for a hundredweight of crystal drinking glasses (PAC, MG6, B3, p. 7360). Of course, there were more vessels to a given weight of thin, lightly made glasses than to the same weight of heavy-walled glasses which might even contain lead (see Chambon 1952: 798).
Crizzled Glass

Crizzled glass was of course not intentionally crizzled and so had no title in the 18th century (unlike crackling on Venetian glass [Haynes 1959: 66], crizzling was a fault and an accident). As I have argued above, it evidently resulted from glassmakers' attempts to make a crystal glass without using sufficient stabilizing oxide and so may well be evidence of the evolution of _verre fougère_ (in which no stabilizing oxide was necessary because of the presence of impurities) into crystal. It is also likely that an excessive quantity of manganese decolouriser was employed and that this is indicated both by the pinkish tint much of the glass has taken on (Toulouse 1969: 434) and also by the strong fluorescence under long-wave uv (see Elville 1951: 265-6). In the 18th century, the glass was presumably marketed as crystal and certainly the styles are identical or very similar to styles in Bohemian crystal though without engraving.

The crizzled glass group is composed of stemware and tumblers in strictly limited variety: the tumblers are virtually all pattern moulded with vertical ribs, sometimes remoulded for optical effect, and the stemware - excepting only the unique hollow writhen cigar stem mentioned above - have corrugated conical stems and conical bowls with one or two small collars near the base of the bowl.

The typical crizzled glass tumbler is small and without ornament other than its pattern moulding (Fig. 13). The ribbing is sometimes transferred to the interior surface by optic-effect moulding. There is considerable archaeological evidence that these crizzled tumblers were the most universal, if the most humble, drinking vessel during the 1750s at French sites in North America. They are the single common denominator in French table glass collections from Michilimackinac (Brown 1971: 122-3); Forts Beauséjour (McNally 1971: 30-1) and Gaspereau (Harris 1974: 81-2); the Acadian village of Beaubassin (Harris 1971: 19), and the 1760 wreck of the Machault in Chaleur Bay (McNally 1972a: 9-10). At Michilimackinac and Beaubassin were found single fragments with traces of enamelling and at Fort Gaspereau there was a finished (ground) pontil mark on a base: either
embellishment is rare on these vessels. Crizzled glass tumblers are abundant at Louisbourg.

The crizzled glass stems are similar to hollow inverted balusters, but these stems (Fig. 14) are so abruptly shouldered and straight-sided that "conical" seems a rather more descriptive term. The stem is corrugated vertically, not by moulding but apparently in consequence of creases formed in the walls of the hollow stem as it was narrowed down toward the foot. The crizzled glass corrugated conical stems, frequent at Louisbourg, have exact counterparts in both common clear glass and Bohemian crystal (see Fig. 16c, d) and there is certainly kinship with a rare form of common green glass (see Fig. 5g, h). In the 18th century the most common German-Bohemian stem form was an inverted baluster employed as a field for cutting, usually with a circuit of six to eight flutes on the sides surmounted by facets around the shoulder: the prototype of the so-called Silesian stem (Vydrova 1972: 214, Figs. 4, 5). The corrugations on the French corrugated conical stems approximate the flutes on the Silesian stem and suggest a transitional stage in the development of the Venetian-influenced hollow baluster of verre fougère (Figs. 3-5) into the moulded Silesian or bouton carré French stem in Bohemian crystal (Fig. 17; see Barrelet 1957: 114). This evolution of style, it seems to me, is further evidence that crizzled glass manifests the experimental evolution of common green glass into crystal on the Bohemian model.

Tumblers such as those in crizzled glass do not normally figure in collectors' histories of glass. A close parallel to the tumbler in Figure 13 is to be found in a 1760-61 Chardin still life (Chardin [1963]: Pl. 46). Barrelet (1957: Pl. 19, B) denotes corrugated conical stems "verre fougère ou pivette," dating them to the second half of the 18th century. Other writers who illustrate the form are Bickerton (1971: Pl. 4), who seems to suggest an improbable English attribution; Haynes (1959: Pl. 20a), who attributes it to France, early 18th century, and Charleston (1952c: Pl. 17b), who also considers it French, about the middle of the 18th century. There are excellent portrayals in two Chardin still lifes, both dated 1760 (Chardin [1963]: Pls. 42, 44), one of which, Un Bocal d'abricots, dit Un Dessert, is reproduced in Figure 15. There is no reason to deny that Charleston's dating (mid-18th century) and attributions (central and western France) for crizzled glass are accurate (Charleston 1952c: 18-19).
Bohemian Crystal

Bohemian crystal is the least well defined metal category of the five found in French contexts at Louisbourg. It is clear, non-lead metal, unbubbled and uncrizzled, and blown with thicker walls than common clear glass. The forms are often ones which were made promiscuously throughout Europe, but most of them are at base German and Bohemian in origin or conception. There are, however, a couple of stemware forms which are very similar to well-known English shapes of the 18th century. The stemware forms correspond to Barrelet's "verres blanc massifs" and "fougère ou pivette" classifications, both of which are dated to the second half of the 18th century by Barrelet (1957: Pl. 18-22).

I have already discussed, in regard to crizzled glass examples, the derivation of corrugated conical stems, which are abundant in Bohemian crystal and also show up in common clear (soda) glass (Fig. 16c, d). A rare variant is a plain conical stem (Fig. 16a, b).

The moulded-pedestal Silesian or bouton carré stem (Fig. 17) is one of the forms which was adopted from Bohemian glassmakers (Barrelet 1957: 114) although the Bohemian original was cut rather than moulded. Such stemware are abundant at Louisbourg. They were apparently a commonplace in many parts of Europe: Chambon (1955: 116-7) England). The cargo of the 1760 wreck of the Machault included a very large consignment of bouton carré glasses (McNally 1972a: 10-1). The glass illustrated in Figure 17 has a knop between the moulded stem and the thick base of the bowl; this is an unusual feature, but the piece is otherwise typical of both the Machault and Louisbourg examples. The stem is six-sided and formed in a two-piece contact mould, with the mould lines visible on the shoulder of the hollow stem.

Rather more puzzling in origin are the knopped stem forms in Figure 18. Barrelet illustrates two examples similar to the glass in Figure 18a, b (1957: Pl. 18, B, C) and dates them to the second half of the 18th century. This form is frequent at Louisbourg. The second stem (Fig. 18c, d) is possibly just an anomalous variant and is rare at Louisbourg.
The remaining stemware of Bohemian crystal metal are distinctly English in style. They are equivalent to the English plain stem and the English firing glass respectively (Fig. 19, 20) and might pass as such except that they are made of lime metal. Having noticed a difference in the metal, one remarks unusual (for English glass) formal characteristics. Both these non-lead glasses widen towards the lip rim from the stem-foot joint, while in most English counterparts the stems are just about cylindrical until they begin to trumpet at or just below the base of the bowl. Thus the profile of the lime glass examples from Louisbourg is conical, while the English glasses are normally convex-sided (that is, trumpet-shaped). In a 1763 Norwegian pattern book a plain stem with conical profile similar to the Louisbourg lime-metal glasses bears a German name and the firing glass is also illustrated (Polak 1969: Figs. 42, 49). A plain stem found in Schmidt (1912: 344), given an 18th-century German attribution, is also straight-sided. Since these are simple, two-piece glasses, they may be regarded as international, but since English origin is unlikely, a French attribution is as possible as any other. Barrelet (1957: Pl. 21, A) illustrates a straight-sided plain-stemmed glass as a foreign-influenced French ware of the second half of the 18th century. Both the plain stem and the firing glass are frequent at Louisbourg.

Tumblers in Bohemian crystal are of several varieties, with several modes of decoration, and are not necessarily French - engraved, cut, and gilded wares were imported from Bohemia and other Germanic centres. Most abundant are pattern-moulded tumblers, often with engraving in addition to the moulding. Finer pieces, probably imported, but not necessarily so, are engraved and cut, or cut and gilded. A unique piece to Louisbourg is contact moulded in a two-piece mould and may possibly be French. A final group, of uncertain origin, is made up of footed tumblers.

Pattern-moulded tumblers, in good metal with thick bases and well-defined moulding, often employ patterns familiar from the bowls of Venetian-style stemware, such as vertical ribbing and honeycombing (Fig. 21). Pontils are often finished on these tumblers although the ground surface is invariably rough and opaque. These tumblers are frequent at Louisbourg.

For other pattern-moulded tumblers, of which that shown in Figure 22 is typical, the moulds used were apparently only slightly undersized and of a two-piece open-and-shut variety, for the moulded ribs, or flutes, while showing a convex-convex external-internal surface relationship, are nearly as sharply defined as they would be from a contact mould and a mould line is occasionally perceptible on the base. Such tumblers are sometimes ornamented with engraving (Fig. 23). The engraving is normally confined to the lip area, but might extend to rows of nicks down the moulded
ribs. The engraved motifs - ovals of cross-hatching and stylised foliate sprays - shown in Figure 23 are standard with infinite minor variations on so-called peasant engraved wares, common throughout much of Europe in the 18th century, whether exported from Bohemia and Germany or imitated in other countries. They often have cursorily finished pontils. Tumblers like those shown in Figures 22 and 23 are abundant at Louisbourg.

Also represented, though infrequently, are finer Bohemian engraved pieces, usually combining cut facets or ovals with engraved motifs similar to those of peasant wares but more elaborate and more carefully executed (Fig. 24). There is a possibility that such tumblers could have been made outside of Germany-Bohemia, but it is on the whole more likely that they were imports to France rather than native products (Charleston 1952b: 254). The same holds for the rare cut and gilded tumbler illustrated in Figure 25. As shown by a decanter in a 1763 Chardin, La Brioche (Chardin [1963]: Pl. 49), and a tumbler in another of his canvasses, Le Déjeuner (Barrelet 1953: Pl. XLIX), the style was familiar to French tables but not necessarily made in France.

A unique piece at Louisbourg is a contact-moulded tumbler made in a two-piece mould. The moulded pattern shows embossed figures: an extant panel shows a human figure holding a staff and there seem to be four such figures in four panels, each different, but the tumbler is incomplete (Fig. 26). The style, shape and moulding technique (though not the figures in the panels) appear identical to those of a tumbler which Barrelet (1953: 96, Pl. XLI, C) attributes to the French inventor Perrot in the late 17th century.

Finally, footed tumblers (Fig. 27) are frequent at Louisbourg in Bohemian crystal, usually plain but occasionally with pattern-moulded ribs. Barrelet (1957: Pl. 23, A) illustrates a footed tumbler, which he dates as early 18th century, but it is in enamelled milk glass, a metal relatively rare at Louisbourg; in fact, only a few small fragments have been found and no vessels identified. Once again, similar footed tumblers found in the 1763 Norwegian catalogue mentioned above (Polak 1969: Fig. 48) bear a German name. Also, silver drinking vessels of the same shape as the glass footed tumblers may be seen in some 18th-century French paintings, such as Chardin's 1756 Un Orange, un gobelet d'argent et divers objets (Chardin [1963]: Pl. 39). It is not unusual for glass forms to follow silver forms.

By the beginning of the 18th century, Bohemian glass was marketed internationally on a rather prodigious scale (Hetteš 1958: 20, 26). Scoville (1968: 22-3) has emphasized that Bohemian influence, at least in the north and northeast regions of France, was such that any new manufactories set up after 1700 would be on the Bohemian model. Thus it is
necessary to be somewhat chary of Barrelet's statement (1957) that the import and imitation of Bohemian glass in France only began a little before mid-18th century. Doubtless the disagreement hinges to some extent on the regionalization of the French industry, on whether, for instance, the Lorraine industry is considered German or French. In the 1731 La Rochelle price list, for instance, window glass is listed under two headings: "Verre blanc dit verre de Loraine [sic]," and "Verre commun dit Verre de France" (PAC, MG6, B3, p. 7360). Of course window glass is not table glass and the analogy cannot be stretched, but it is obvious that northern France, with its German technology, was known for finer glass than other parts of France.

Any quarrel with Barrelet's chronology must be at least partly methodological. The evidence for his neat mid-century demarcation line between indigenous verre fougère and foreign imported/imitated wares is mainly from contemporary paintings. A survey of French paintings undertaken to help identify Louisbourg artifacts has not demonstrated any great variance with Barrelet's conclusions, but has suggested a few interesting minor differences. For example, Barrelet noted (1957: 104) that tumblers do not appear in French paintings until about the middle of the century and we have noticed that tumblers are far more common in Bohemian crystal than in common green or common clear glass, but in a 1731-33 Chardin (Chardin [1963]: Pl. 6) is a plain glass tumbler containing soapy water with which a young man is blowing soap bubbles. It is interesting that this is a genre painting, rather than a still life. Gobelets of crystal are specified in the La Rochelle list (PAC, MG6, B3, p. 7360) as "Cabarets Gobelets," that is, tavern tumblers, so that we may conjecture that they were familiar, but not domestic objects at that date. A 1725 inventory of imports from Holland to La Rochelle indicates a quantity of "verres et gobelets à boire" (PAC, MG6, B3, p. 9392). Be this as it may, the point that has to be made about dating antiquities from still life and genre paintings is this: while occurrence in a dated painting argues that a style must date at least as early as the painting, the converse, that it cannot be much earlier than its first appearance in any paintings, is not necessarily true. It seems quite possible that a painter chose objects for reasons other than their domestic currency and it is also possible that genre and still life attitudes are slightly nostalgic and hence anachronistic.

A corrugated conical stem of Bohemian crystal was found at Louisbourg in a 1722-24 context in a well (Steer: pers. com.). Many engraved Bohemian export tumblers were found at the Roma site in Prince Edward Island (which was closely connected with Louisbourg) in an excavation context dated 1732-45 (McNally 1972b). Yet the apparent concentration of crizzled glass (evidence of the transition of common-metal
glasshouses into crystal-metal glasshouses) around the middle of the century suggests that some regions - central and western France, to follow Charleston - were recent initiates to the technology of Bohemian crystal, a view substantiated by Bosc d'Antic's 1760 memorial. The inevitable conclusion to be drawn is that while the beginnings of Bohemian crystal, either imported or made in France, stretch back at least to the 1720s, Bohemian crystal coexisted with common metals for at least a quarter of a century before gaining absolute precedence in the French glass trade.
Demi-Lead Crystal

Demi-lead crystal is a clear metal worked with fairly thick walls. The forms found in this metal include only one kind of stemware - the hollow writhen cigar stem - which is found just as frequently in common clear glass as in demi-lead crystal. The other forms are of miscellaneous function, including frequent brocs (jugs with matching, loose fitted stoppers); infrequent wineglass coolers; infrequent bénitiers (holy water basins), and rare cruets. Stylistically, the vessels are of a kind and all markedly Venetian. They share a propinquity to wide pattern-moulded ribs, trailed rims which are often rigareed, and hollow handles.

Barrelet (1953: Pl. LI, A) illustrates a jug, which he calls a broc, that is very similar to the Louisbourg examples (Fig. 28). He considers it to be verre fougère. Pairs of jugs of similar form, but apparently smaller, are frequent occurrences in 18th-century French still lifes, usually in stands which seem to be silver. In the paintings, they must be cruets, used perhaps for oil and vinegar, but the Louisbourg brocs are easily as capacious as a wine bottle (see Chardin's 1763 Les Débris d'un déjeuner [Chardin (1963): Pl. 50], Anne Valayer-Coster's 1775 Still Life [London. Royal Academy of Arts 1968: Fig. 201], or André Bouys's [b. 1656 d. 1740] La Collation au melon [Faré 1962: No. 301].) The examples in contemporary paintings often have matching stoppers like that in Figure 29, from Louisbourg. The Louisbourg brocs were sometimes found in groups of two or more, notably in the Bigot latrine (2L12H) where they must have been deposited between 1750 and 1754.

The bowls which are now normally called wineglass coolers are found in 18th-century French paintings with stemware up-ended in them. A good example is Chardin's 1758-59 Pêches, dit Le Bol de cristal (Chardin [1963]: Figs. 131, 132) which shows a particularly close parallel to the straight-sided Louisbourg bowls (Fig. 30b; see also, for instance, Verlet 1966: Pl. 7, or Barrelet 1957: Pl. 9). Bowls shaped similarly to the Louisbourg wineglass coolers were found in faience at Louisbourg, with a small semicircular indent in the rim, which may have been for the stem of a wineglass. It is not clear whether the purpose of
the bowls was primarily to cool the stemware, to rinse the stemware between refillings, or both. If the wineglass coolers were used for rinsing, the companion bowl (Fig. 30a) in which the wineglass cooler stands neatly and to which it is obviously closely related by style, may have functioned as a saucer to catch spills. Both pieces were found in the same latrine as the brocs just mentioned. One very close parallel to the Louisbourg wineglass coolers is a bowl with the raven's head crest of early (1680s) English lead glass (Wills 1968: Signature 5, Fig. 1): it has the same rigaree base rim and wide-spaced pattern-moulded ribs though the sides flare and the rim is folded rather than applied. It is apparent that Venetian styles evolved through similar stages in the 17th-century English lead glass and again in the demi-lead glass of the Continent in mid-18th century. Charleston (1952c: Fig. 22) illustrates a wineglass cooler or bottle stand which he considers French.

Closely related to the wineglass coolers is the cruet stand pictured in Figure 31 and reconstructed in Figure 32. It had four cylindrical cups in which small cruet bottles stood, or perhaps the two smaller cups functioned as salt cellars. Its handles - one at either side - are similar to those on the brocs, with thumb pads at the top. A related cruet stand, for only two bottles, is illustrated by Savage (1973: 93) and identified as 18th-century French in origin, but it is evidently of crizzled glass.

Bénitiers, like the conjecturally reconstructed one illustrated in Figure 33, were favourite fields for Venetian ornamentation in 18th-century French glass (see Barrelet 1953: Pl. LIII).

A Liège glassmaker succeeded in making "le véritable 'cristal anglais'" during the 1750s, after having added limited amounts of lead to his batch for several years (Chambon 1952). Haynes (1959: 88-9) states that hollow writhen cigar stems, often with some lead content, were a common product of Liège area glassmakers in the second quarter of the 18th century. Thorpe (1969: 174) states that the Venetian style was a stronger tradition in the Low Countries than elsewhere in Europe. It has been shown that as early as the late 17th century small amounts of lead were introduced into glass made in the Low Countries (Charleston 1957). And in 1722 a Belgian glassmaker boasted of his products that "leur beauté et leur blancheur égalent en tout le verre d'Angleterre, et on renonce à ce dernier dont on fait des imitations parfaites." To substantiate the contemporary claim, Chambon has pointed out that the glassworks in question enjoyed a good reputation and "exportait non seulement dans les Provinces-Unies mais aussi en France" (1955: 121). Since no other attribution has presented itself, I am inclined to consider the demi-lead crystal artifacts at Louisbourg to have a Low Countries origin, probably in the middle decades of the 18th century.
Appendix A. Atomic Absorption Spectroscopic Analysis of Selected Glass Samples.

An analysis of thirteen glasses from the Fortress of Louisbourg using atomic absorption spectroscopy was done by Charles Costain of the Conservation Division, National Historic Parks and Sites Branch, Parks Canada. The glasses analysed were: 2L.51B2.1 (resembles the glass in Figure 3), 4L.8L1.3 (Figs. 1a, 2a), 2L.50D3.1 (resembles the glass in Figure 9), 2L.12H7.11 (not illustrated), 2L.6C1.1 (Fig. 16c, d), 1B.1J44.53 (Fig. 11), 16L.4A8.4 (Fig. 5g, h), 2L.18D3.9 (Fig. 13), 17L.23G9.2 (Fig. 19), 2L.18D3.4 (Fig. 27), 1B.16F6.125 (Fig. 24), 2L.12H8.3 (Fig. 28) and 2L.80S11.1 (not illustrated). Quantitative analysis for sodium, potassium, calcium, magnesium, lead, iron, manganese and arsenic revealed four categories of glass composition: soda lime, potash lime, lead and demi-lead.

The results of the analysis include the following:
1) Common green glass, at least in the two examples tested, proves to be a soda-lime glass and not, as the name "verre fougère" implies, potash-lime glass. Moreover, while spectroscopy shows a high proportion of iron, it also shows a quantity of manganese high enough to indicate that glassmakers deliberately controlled the colours of common green glass. Evidently, then, glassmakers made common green drinking glasses even after technology released them from the necessity of doing so; it follows that Barrelet is right in finding verre fougère fashionable, and not merely exigent, in 18th-century France.
2) Spectroscopy verifies the composition of demi-lead metal, indicating 20.3 per cent lead in an example tested. Moreover, spectroscopy confirms the accuracy of the ultraviolet light test for significant lead content; even some five per cent of lead in the glass does not render the familiar blue fluorescence under ultraviolet light.
3) Doubts about the efficacy of ultraviolet light for distinguishing between lime glasses are underlined by the analysis. Style of vessel remains the best determinant, and one style, the corrugated conical stem, proved current in soda glass as well as potash (or Bohemian) crystal.
4) Crizzled glass did prove to be low in calcium, that is, deficient in lime stabilizer, and its contents of manganese
and iron were higher than in other colourless glasses. These findings support the hypothesis that crizzled metal marks an effort, inadequately sustained by technical knowledge, to refine common glass into clear glass.

The results of the analysis have indicated that more work in this area will contribute significantly to the knowledge of French glassmaking traditions in the first half of the 18th century. Staff at Parks Canada anticipate doing additional testing and will publish the results as they become available.
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Table 1. Summary of Results of Displacement Test on Demi-Crystal from the Fortress of Louisbourg

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>wt. out of water</th>
<th>wt. in water</th>
<th>Volume</th>
<th>Density</th>
<th>Per cent PbO (from Elville 1951)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2L53G2</td>
<td>rim fragment, possibly from wine cooler.</td>
<td>15.75 g</td>
<td>10.43 g</td>
<td>5.32 cm³</td>
<td>2.97</td>
<td>appr. 23%</td>
</tr>
<tr>
<td>2L.38M2-2</td>
<td>stopper, from broc.</td>
<td>33.00 g</td>
<td>21.85 g</td>
<td>11.15 cm³</td>
<td>2.96</td>
<td>appr. 23%</td>
</tr>
<tr>
<td>3L.6E2</td>
<td>stopper, from broc.</td>
<td>17.95 g</td>
<td>11.85 g</td>
<td>6.10 cm³</td>
<td>2.96</td>
<td>appr. 23%</td>
</tr>
<tr>
<td>2L.12H7</td>
<td>broc lip fragment.</td>
<td>19.9 g</td>
<td>13.6 g</td>
<td>6.3 cm³</td>
<td>3.16</td>
<td>appr. 32%</td>
</tr>
</tbody>
</table>
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1 Common green glass spindle stems: a, inverted baluster with cushion knop, 7.5GY (4L.8L1.3); b, inverted baluster with cushion knop, 2.5G (provenience unknown); c, knopped, 5G (17L.21B2.2); d, knopped and striated, 7.5GY (4L.22F3.9), and e, knopped variation with collar, 7.5Y (2L.15P3.8). French, 18th century. Archaeological context for ld is probably pre-1751. (Drawing by P. McNally.)
2 Common green glass spindle stems: a, inverted baluster with cushion knop, 7.5GY (4L.8L1.3); b, inverted baluster with cushion knop, 2.5G (provenience unknown); c, knopped, 5G (17L.21B.2); d, knopped and striated, 7.5GY (4L.22F3.9), and e, knopped variation with collar, 7.5Y (2L.15P3.8). French 18th century. Archaeological context for 2d is probably pre-1751. (Photo by J.D. Crawford.)
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4 Common green glass stemware (16L.2A15.1). Hollow-blown stem, inverted baluster, 7.5G; French, 18th century. (Drawing by P. McNally; photo by J.D. Crawford.)
Common green glass stems: a, b, hollow-blown stem, inverted baluster, 2.5G° (4L.22F6.2); c, d, hollow-blown stem, inverted baluster, 7.5Y (17L.28E2.5); e, f, hollow-blown stem, variant, 5GY (4L.19B9.1), and g, h, hollow-blown stem, inverted baluster variant, 5Y (16L.4A8.4). French, 18th century. 5a, b has a pre-1751 archaeological context. (Photo by J.D. Crawford; drawing by P. McNally.)
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14 Crizzled glass stem (1B.18H4.29). Corrugated conical stem; French, mid-18th century. (Photo by A. MacNeil.)
Un Bocal d'abricots, dit Un Dessert, dated 175(6/8?) by Jean-Baptiste-Siméon Chardin (French, 1699-1779). Oil on canvas, 57.2 cm by 50.8 cm (oval). Art Gallery of Ontario, purchase, 1962. (Corrugated conical stem wineglasses at left.) (Photo by Brigdens, Toronto.)
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24 Bohemian crystal tumbler (1B.16F6.126, 1B.16F6.125). Wheel engraved and cut, clear; possibly French, probably Bohemian or German, 18th century. (Photo by A. MacNeil.)
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Bohemian crystal tumbler (2L.10D2.2). Contact moulded, clear; possibly French, 18th century. (Drawing by J. Harris.)
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(Drawing by T.M. Smith.)
Conjectural reconstruction of a demi-lead crystal bénétier, based on fragments (4L.53E3.4, 16L.3A6.5, 16L4A4.12, 52L.8A1.1). Venetian ornament; possibly Low Countries, mid-18th century. (Drawing by T.M. Smith.)
Eighteenth-Century French Blue-Green Bottles from the Fortress of Louisbourg, Nova Scotia
by Jane E. Harris

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Abstract

A large portion of the glassware excavated at the Fortress of Louisbourg consists of blue-green bottles of 18th-century French origin. Distinctions in bottle terminology occurred consistently in the Louisbourg inventories of the period and were applied to the blue-green glass containers in the Louisbourg archaeological collection, resulting in the establishment of a typology consisting of four bottle forms: fioles, flacons, bouteilles and dames-jeannes. Fioles are small bottles of only a few ounces which primarily seem to have contained medicines; flacons are multipurpose containers, narrow- or wide-mouthed, with capacities from a few ounces to several quarts; bouteilles are blue-green examples of typical French flowerpot-shaped "wine" or beverage bottles, and dames-jeannes are very large multipurpose containers.

The containers related to both periods of the French occupation of the site, 1713-45 and 1749-58, and bore no apparent stylistic distinctions pertaining to date of manufacture.

Acknowledgements

There are several people I would like to thank for their professional assistance. Clarence Saulnier, assistant conservator of the Fortress of Louisbourg National Historic Park, conducted the analysis of deposits on container push-ups. Charles Costain of the Conservation Division, National Historic Parks and Sites Branch, Parks Canada, Ottawa, conducted an analysis of French glass in the collection of the Research Division, National Historic Parks and Sites Branch, Parks Canada, Ottawa. From Paris, James Barrelet offered helpful comments on blue-green bottle fragments and drawings sent to him from the Fortress of Louisbourg collection, and provided information about his own collection.
Introduction

This report is primarily a descriptive analysis of 18th-century French blue-green glass containers found in the extensive Fortress of Louisbourg archaeological collection. Artifacts from the excavations are only partially mended or restored, but on the evidence of necks, bases and complete bottles (in this report the word "bottle" is used generically to refer to a glass container and "jar," more specifically, to a wide-mouthed glass container), four distinctive container forms, one of which occurs in nine distinct types, could be isolated. The forms vary in size, ranging from a few ounces to several gallons, and many of the types share identical features such as neck, body or base shapes, implying a relationship at the manufacturing level. By isolating the various forms and types and then using available literature, inventories, contemporary art and the evidence from blue-green bottles found on other French historic sites in North America, it became possible to discuss the physical relationships between the groups, the closures used, their possible functions, their social significance and their cultural origins.

The bottles occurred in contexts from both French occupation periods (1713-45 and 1749-58) with no apparent stylistic differences pertaining to date of manufacture. This lack of variation is consistent with observations made by both Scoville (1968: 20) and Barrelet (1953: 110), who stated that there were essentially no technological changes in the common glass industry nor did its products give any indications of regional distinctions during these periods.
A mixture of sand, calcium and an alkali flux, potash or soda, to which no decolourizer has been added, results in a greenish and sometimes yellow or brownish glass due to iron impurities in the sand. Such glass produced in wood-fired furnaces has been called waldglas, forest glass, verre fougère or verre commun, depending on its country of origin. The latter two French terms usually refer to lightly tinted tablewares which were produced in the petites verreries or verreries communes of France. These were generally small glasshouses which often produced a wide variety of products including more utilitarian items such as bottles (Barrelet 1953: 71). Besides the glass used for the clearer tablewares, a "common green" glass or verre vert was produced in the petites verreries for bottles (Scoville 1968), its blue tint being more noticeable according to Barrelet (1953: 103) among the bottles produced in the forest areas of Grésigne in Languedoc.

The petites verreries used wood-burning furnaces and were located throughout the forests of France. They usually had only one furnace and four to six pots in which to melt glass (Encyclopédie 1751-65, 17: 113; Scoville 1968: 72). They commonly employed no more than 20 people including part-time workers such as basket weavers and packers (Scoville 1968: 72). Some petites verreries made only bottles while others specialized in tablewares or window glass and made bottles as a sideline (Scoville 1968: 14n., 150-1). Bottle production was separate from that of tablewares or other items on two levels. First, there would have been a separate pot for bottle glass, usually one of green and sometimes one of brown glass (Encyclopédie 1772a: Pl. III). Second, there were workers who specialized in bottle blowing, for goblet and drinking-glass blowers apparently would rarely make bottles (Scoville 1968: 71).

The petite verrerie industry neither flourished nor declined throughout the 18th century for the number of factories, employment rates, and output increased in some areas, decreased in others, and stayed the same in still others (Scoville 1968: 13, 21, 72, 147). The demand for wine bottles had increased greatly with the new practice of storing wine in bottles and with the growing export trade in
bottled wines (Barrelet 1953: 100; Scoville 1968: 11, 111). This demand was largely met by the heavy dark glass bottles being made in the new or converted coal-fired furnaces introduced from England early in the century and by the heavy green bottles from grosses verreries (Scoville 1968: 11, 41). Further to the detriment of the petite verrerie industry, wood was scarce in France, which meant many factories were unable by law to keep their furnaces lit year round. This forced some entrepreneurs to close down for as many as six months or more of the year, having an obvious effect on production (Scoville 1968: 13, 21, 149). On the positive side, the petite verrerie industry already had a considerable market, built up in the 16th and 17th centuries, for their cheap and useful common bottles whose domestic use in France was traditional and so widespread that it involved "members of all social classes" (Scoville 1968: 111, 167).

For their domestic market the petites verreries made "large and small bottles" as well as "bowls, condiment containers, decanters, tumblers, goblets, ink wells, lamps and lamp chimneys, pitchers, plates, urinals, vases and other similar [useful] items" (Scoville 1968: 111). This list would presumably include items in clear and blue-green glass. They may have also supplied the perfumeries of southern France as well as the needs of the growing export trade in toilet waters (Scoville 1968: 112). Then, too, a variety of other items were packed in glass to be shipped to the colonies: olives, anchovies, capers, marinated tuna, olive oil, vinegar, liqueurs, eau de vie and toilet water (Barrelet 1953: 103).

Bottles were also made in the grosses verreries of Normandy and northeastern France, but in a "coarse, heavy" green glass or gros verre favoured by those in the mineral water, liquor and wine trades (Scoville 1968: 8, 11). These verreries also burned wood, but specialized in window glass, either crown or sheet (Scoville 1968: 8). The crown glass factories of Normandy normally reserved one of six pots for bottles alone (Scoville 1968: 11). Owned and operated by the gentilshommes verriers, a minor nobility who considered bottle blowing unbefitting to their rank, they employed common workers to manufacture bottles (Scoville 1968: 71, 84). According to Scoville (1968: 147-8), a typical Normandy factory in 1740 would produce 70 tons of common green glass for every 150 to 200 tons of window glass. Whether the bottles they produced resembled those of the petites verreries in form or colour is difficult to say, but there seems to have been a definite distinction in weight. Scoville (1968: 19, 41) referred to bottles from crown glasshouses as coarse and heavy and those from the petites verreries as light. Barrelet (1953: 99) cited a Bosc d'Antic description of Norman windowglass: "Il n'y a pas, je crois, de verre à vitre plus imparfait que celui de nos
grosses verreries; il est rempli de défauts, de 'bouillasses', 'filandres', de 'larmes', de 'pierre'; mal recuit, se plombe très promptement, et il est coloré au point d'être peu transparent, quoique fort mince."

Presumably their bottle glass was no better and if so, Bosc d'Antic's statement accurately describes most of the 18th-century glass bottles found at Louisbourg.

French bottle glass composition in the 18th century is a generally neglected area of study. Both soda and potash were being used as flux. Preliminary analysis of a blue-green bottle fragment (Costain 1978: pers. com.) indicates a glass of soda-lime composition. Soda was more easily available in the coastal regions of France where it was produced from the ashes of various seaweeds (Scoville 1968: 49). Potash was more accessible in the interior and urban areas of France in the form of bracken and wood ash, and it therefore seems likely that the small glasshouses, particularly in northeastern France, would find the use of potash more economical than soda.
Enough has been written about bottle manufacture that it is only necessary here to stress the techniques and tools that help to distinguish French bottles from others. Diderot, who maintained that items were made in the same manner whether in wood- or coal-fired furnaces, gave the following description of bottle-making using coal (Encyclopédie 1751-65, 17: 109, 112, 113; 1772b: Pls. III-VI). After the parison was marvered and blown, the bottle was placed in a copper dip mould having a truncated cone shape. It was blown, removed from the mould and up-ended in preparation to pushing up the base. A molette, or shaping tool, was used for this function. It was a short piece of flat metal, one foot long, with a pointed end used to push the base up while the bottle was continuously turned. The bottle was again marvered to correct any bulges or distortions that might have occurred when the base was pushed up. The base was then empontilled with a glass-tipped rod or with the meule; that is, with the portion of the glass that remained on the blowpipe after it was cracked off the neck. The bottle rested on its side during this operation. The lip was then reheated or fire-polished and finished as desired. It was at this point that a string rim could have been added. The bottle was then complete except for annealing.

Ducasse (1970: 393) discovered in a Panckoucke edition of the Encyclopédie that terre à pot moulds in several sizes were used in the petites verreries, rather than the lone copper mould Diderot had ascribed (Encyclopédie 1751-65, 17: 109; 1772b: Pls. III, IV) to each bottle blower. It is conceivable that clay moulds could impart a less smooth texture to the surface of a glass bottle than would a copper mould. The presence of many sizes of moulds is to be expected given the variety of vessels known to have been produced in petites verreries.
Blue-Green Bottles in the Inventories

It was customary in Louisbourg that an inventory was made of the possessions of a deceased person immediately following his death, usually for reasons of settling the estate (Adams 1972: 1). The inventories varied from a simple list of the contents of a fisherman's trunk to lengthy documentation of the contents of a house and often included appraisals of the values of the items listed. After the items were inventoried they were often sold at public auction and the item listed along with its sale price. These lists frequently mentioned both filled and empty bottles and their values. (The information used in this section was drawn from inventories found in France, Archives Nationales, Section Outre-Mer, Series G², Vols. 181, 182, 197, 199, 201-3, 205 and 209.)

Blue-green bottles are a difficult group to subdivide for discussion due to the lack of a consistent relationship between shape and function of the bottles, but a preliminary study of these records indicated that a general distinction was made between flacons, bouteilles, fioles and dame-jeannes.

Flacon was the term used for containers filled with "huille," "huille dolive," "huille de palma," "citron confits," "fruit à l'eau de vie," "enchois," "liqueur," "sirop de capilaire," "d'orgea," "capres," "sirop" and, infrequently, wine. Filled or empty flacons were often found in boxes or baskets: "canevettes," "paniers," "caves" and "caisses." There were "petits flacons," "flacons de pinte" (approximately 32 oz. or 909 ml) and "flacons de cinq chopines" (approximately 80 oz. or 2273 ml).

In the same documents bouteilles were almost invariably referred to as containers for wine and spirits (although in one instance a bouteille held tobacco) and were seldom found in canevettes. The distinction between flacon and bouteille has led to the belief that flacon generally referred to blue-green glass multipurpose containers and bouteille commonly referred to the dark green or black glass flowerpot-shaped bottles now popularly known as French "wine" bottles. Bouteille could also have been used to refer to English black glass "wine" bottles.

Fioles (phials) and dames-jeannes (demijohns), whose approximate sizes and general forms are implicit in the
definitions of the terms themselves, may also refer to vessels with other than French origins. Both forms occur only rarely in the inventories. Fioles, when mentioned with their contents, contain "elixir," "Sirop de Capilaire" or "eau de lavande." Only one dame-jeanne was mentioned with its contents, six pots (approximately three gallons, or 14 L) of eau de vie. Fioles and dames-jeannes were likely blue-green, but could have occurred in other colours as well.

The above indicates that the French flacon in Louisbourg was a multipurpose bottle which would have had to exist in a variety of shapes and sizes in order to accommodate such a variety of liquids and solids. Fioles and dames-jeannes were restricted by their sizes to more specific functions while bouteilles would have contained wine or spirits.
Blue-Green Bottles from the Excavations

Archaeological excavations conducted at Louisbourg since 1960 frequently unearthed glass containers distinguished by their blue-green bubbled glass. Most examples fall into the 10BG to 2.5G Munsell colour range, but some continue through the GY hues, several are as yellow as 10Y, and a few as brown as 10YR. Bubbling in the glass varies from light to very dense and is sometimes so close to the vessel's surface as to have caused elongated surface pitting. Some of the glass is glossy and new-looking while some is subject to a heavy, chalky white or gold iridescent patina.

Rather than construct an arbitrary typology, it seemed more significant to adhere to the nomenclature established in the inventories. Therefore the bottles were divided into four categories pertaining to form: fioles, flacons, bouteilles and dames-jeannes. There are one fiole type, nine flacon types, one bouteille type and one dame-jeanne type, all often occurring in several sizes. With one exception, all seem to have been mouthblown into plain cylindrical or square dip moulds. The flacon types are often only distinguished from one another by their particular neck shapes. For example, a square-bodied flacon could have a short thin neck, tall slim neck, or a short very wide mouth. For this reason the total blue-green sample of 1,200 vessels and resulting percentages of each form and type in the following descriptions are based on neck counts rather than on bases.

Volumes are included for purposes of comparison only and it is to be understood that they are at best approximate. A dry measure was obtained with rice as the medium for most of the bottles are too fragile to measure with a liquid. The volumes of less complete cylindrical bottles were measured geometrically using the formula $V=\pi r^2 h$, where $r$ is the average of the radii of base and shoulder, and $h$ is the distance from the top of the push-up to the base of the neck. The formula $V=lwh$ was used similarly for square-bodied bottles. Volumes were then expressed in British imperial and metric measures.

Other bottle measurements were taken, most of which are self-evident, but it may help to explain that "lip diameter"
and "lip height" indicate outer dimensions of the lip, whereas "bore diameter" indicates the inner lip diameter.

Fioles
Twenty per cent of the total blue-green sample consists of small bottles or fioles, making them, with 239 necks, 254 bases and one complete bottle, one of the most common blue-green bottle forms found at Louisbourg. They are characterized primarily by their small cylindrical bodies which taper towards the shoulder, and their tall, slim, concave necks which often bulge at the base. The bases have conical, domed, truncated-conical or rounded-conical push-ups which display glass-tipped pontil marks. The lips were usually thickened, apparently by applying pressure to the top of the lip after it was cracked off and reheated, a process which occasionally left a crease encircling the bore.

Definite size and shape variations among base diameters can be seen in Figure 1. The smallest bases, those less than 38 mm in diameter, tend to be distinctive (Fig. 2). They have proportionally heavy bases with shallow, dome-shaped push-ups, distinct basal sag, and proportionally large glass-tipped pontil marks (14 mm to 23 mm in diameter). Only one of these heavier bases varies by having a higher, rounded-conical push-up.

Of the bases with diameters from 38 mm to 40 mm, two-thirds are yellow-coloured with slightly higher push-ups in truncated cone or dome shapes. They also have slightly lighter bases with less evidence of basal sag. It is into this base size and colour range the one complete bottle falls (Fig. 3). It has an overall height of 118 mm and an approximate volume of 2 oz. or 56 ml.

Seventy-one per cent of all the fiole bases have diameters from 47 mm to 61 mm and push-ups in the shape of cones, truncated cones or rounded cones. Glass is generally very thin, approximately 1.0 mm thick, blue green, and distributed evenly throughout each bottle with usually no evidence of basal sag (Fig. 4). Pontil marks for this large group are proportionally small (10 mm to 29 mm in diameter) when compared to those of the smallest fiole bases. Many of the push-ups have faint swirling impressions in the glass, possibly caused when the bases were pushed up by the molette.

Fiole body heights do not appear to have varied much with base size. Body heights on two bases less than 38 mm in diameter are extant to heights of 70 mm and 74 mm, while the one complete body height (Fig. 3) is 67 mm and the conjectural body height on the large base in Figure 4 is less than 80 mm.

Neck dimensions vary more in height than diameter. Yellow neck heights vary from 40 mm to 50 mm, but 81 per
cent of all the fiole necks are taller than 50 mm, the tallest being 69 mm, and only two are shorter than 40 mm. On the whole, bore diameters vary from 10 mm to 18 mm with 88 per cent between 12 mm and 15 mm, and lip diameters have a normal distribution from 15 mm to 24 mm.

The taper which occurs from base to shoulder on each of the restorable bottles is not a feature consistent with dip moulding, but one that might be explained by the process of marvering after the base was pushed up and emportilled. During marvering such thin-glassed bottles could easily be changed from cylindrical to tapered. Another possibility is that the bottles were freeblown, the bases pushed up, and the bodies then marvered into a roughly cylindrical shape.

The Dictionnaire universel (1743: 257) defined fiole as a little glass bottle used particularly by the apothecaries in dispensing their medicines, potions and syrups to the ill. Governor Duquesnel's inventory (Adams 1971: 181, 176, 190) tells us he had among his possessions "une boette" in which there were four "fioles delixir nommé garrus" in his wardrobe; two "petites Fioles d'eau de lavande" in his office, and five "fioles de Sirop de Capilaire" in storage, but generally references to fioles in the inventories were rare. Perhaps they were too common for mention and those in Duquesnel's inventory were only important for their contents. No fioles were mentioned in conjunction with administered medicines in selected Louisbourg surgeon's bills (Hoad 1972: lll-5), but various medicines and mixtures such as "cordialles," "ptisannes pectoiralles," "sudorifiques," and "carminatives" were dispensed in "portions," "dragmes" and "bouteilles." Perhaps it may be assumed that portions and dragmes of a particular medicine were administered in small bottles or fioles, and that bouteilles indicated a larger amount.

The use of fioles and wineglasses together was implied in two sources and may indicate a further use for fioles. The inventory of Pierre Lorant, cabaretier (Proulx 1972: 107), listed six fioles with six gobelets, and a painting of Leonard de France (Faré 1962: 437) depicts a wineglass and small bottle sitting together on a plate, the aftermath of a meal. Perhaps fioles were used on the buffet or table filled with oil, vinegar or wine when more expensive burettes or cruetes were not available.

Fioles used as containers for medicines and toiletries necessitated some sort of closure and McKearin (1971: 121) illustrated the use of a "spill of paper" for stopping small bottles. Whether this was the initial means of closure or merely a temporary one while the contents were being used is uncertain and the use of corks as closures is just as likely.
Flacons occur in a variety of shapes and constitute 70 per cent of the total sample. They have been divided into nine types based on combinations of shape elements. This section ends with a description of bases from cylindrical bottles which could not be assigned to a particular flacon type, yet which do present additional information.

Closures are not dealt with at the end of each type discussion as those for types 1 to 7 were identical and are described once at the end of the discussion of short-necked square "case" flacons (type 1). Closures for types 8 and 9 were more varied and are discussed individually at the ends of those sections.

1. Short-Necked Square "Case" Flacons
The square-bodied, short-necked "case" bottles (Fig. 5) comprise 31 per cent of the total blue-green bottle glass sample. There are 357 necks, 342 bases and 13 complete bottles. These bottles usually have cracked-off and fire-polished lips, plain tubular necks and horizontal shoulders. Occasionally the lips were thickened as on the flacon in Figure 14. The bodies generally widen 2 mm to 6 mm towards the shoulders and sometimes have vertical ridges left by the dip mould. The bases are not always true squares, are slightly arched and, as the texture of the bases equals that of the bodies, would seem to have been formed in the mould. They usually bear glass-tipped pontil marks, but sometimes the glass adhered so lightly as to leave no mark at all. Glass distribution is quite even throughout these bottles, perhaps offsetting the inherent weakness in their square shape.

Embossed on some bases are very distinct letters or figures (Fig. 6) that appear to have been part of the initial moulding process. A lower case "b" is the most common letter found, occurring on at least 40 bases, often with a dot below its stem. The letter, usually placed to one side of the basal surface, was occasionally centred on the base, but was then only slightly distorted by empointilling (Fig. 5). The lack of distortion is unusual and seems to indicate careful use of a glass-tipped pontil.

Short-necked square flacons appear to have been made in several sizes and four possibilities are suggested in Figure 7. They have respective base widths of 75 mm, 55 mm, 45 mm, and 35 mm, dimensions about which type 1 basal widths (which vary from 33 mm to 88 mm) tend to cluster (Fig. 8). A base of approximately 65 mm was omitted from the size categories for only nine bases are spread over the 60 mm to 69 mm range; no short necks are attached to shoulders of a corresponding width, and the one complete bottle of this base width has a different finish (Fig. 13); however, bases
falling into this uncertain range have been included in the
following description.

By far the most common size of square flacon is
represented by 270 bases (79 per cent of square bases) in a
range from 70 mm to 79 mm. This number includes 13 almost
complete bottles whose measurements are given in Table 1.
Their volumes vary from 19 oz. to 30 oz. or from 549 ml to
852 ml. On the basis of the complete bottles and 30 other
necks with extant shoulders wider than 70 mm, it was
determined that neck heights for bottles of this size range
from 32 mm to 47 mm, lip diameters from 22 mm to 32 mm, and
bore diameters from 16 mm to 25 mm. There are only ten
necks with extant shoulders less than 60 mm wide and these
present respective neck height and lip and bore diameter
ranges of 20 mm to 39 mm, 15 mm to 22 mm, and 9 mm to
15 mm.

Pontil marks on square bases are distinct from those on
cylindrical bases, being generally applied in a manner so as
to leave the least amount of glass on the base. Pontil
marks on bases wider than 70 mm have a 17 mm to 40 mm
diameter range and a mean diameter of 33 mm. Marks on bases
narrower than 70 mm wide have the same diameter range but a
mean diameter of only 28 mm.

As can be seen in Table 1, variations due to hand
manufacture are ordinarily those of height, widths being
controlled by the mould. There are only occasional
deliberate variations among the square flacons and these
have been illustrated. Figure 9a depicts the only
square-bodied bottle with a string rim and Figure 9b
illustrates an unusually short body which has begun to curve
into the shoulder at a point only 40 mm above the base.

Aside from those flacons filled with food or
condiments, most references to flacons in the inventories
were to empty vessels and the next most common references
were to those filled with oil (flacons d'huile). Flacons
were very often found in canevettes or caves containing from
two to 44 flacons, but most canevettes held 12 bottles.
Barrelet (1953: 103) mentioned the export of oil in "caves"
and "cavelettes [sic]" containing six, nine or 12 flacons
which he said were often squared. The frequency of flacons
d'huile in the inventories and Barrelet's reference would
imply that many of these square bottles did originally
contain oil and the frequency of the reference to canevettes
of empty flacons suggests as well their worth and reuse.
Their large numbers from the excavations indicate their use
for a variety of liquids other than oil, such as toilet
water, vinegar and occasionally spirits. Barrelet
(1975: pers. com.) has found blue-green bottles with labels
indicating their use as containers for laboratory,
apothecary and household products as well as wine, oil and
perfumes.
Square flacons were most likely stoppered with plain corks. Corks have been found in situ in necks of square flacons and occur in large numbers in the inventories. Governor Duquesnel alone had over 1,200 bouchons de bouteilles (Adams 1972: 187). Closures for other narrow-necked flacons (types 2-7) would have been the same.

2. Cylindrical "Case" Flacon
The cylindrical bottle type when depicted two-dimensionally is essentially very similar to the previous square flacon. It has a plain cylindrical neck, horizontal shoulder, relatively straight-sided body, slightly indented base, and fairly uniform glass distribution; however, the neck is consistently longer by approximately 20 mm than type 1 flacons. There is one almost complete bottle in this group (Fig. 10) as well as 11 necks and 11 bases. They constitute approximately one per cent of the blue-green bottle sample.

The base of the nearly complete bottle is slightly ovoid - as though it had lain on its side for too long while still in its plastic state - and the resulting base diameter is 79 mm to 83 mm. From the base the body rises 158 mm to the shoulder, widening only to a diameter of 83 mm to 85 mm at that point. Only the base of the neck remains and it is extant to a height of 48 mm. The neck height and finish are conjectural, based on dimensions of the other necks of this type. The bottle has a capacity of approximately 24 oz. or 680 ml.

The 11 necks are distinguished from necks of other types by their true cylindrical shape, by their heights (47 mm to 60 mm) and plain, cracked-off and fire-polished lips (20 mm to 27 mm in diameter). The bore diameters range from 16 mm to 20 mm.

Bases vary from 79 mm to 83 mm in diameter, bear glass-tipped pontil marks 31 mm to 33 mm in diameter and can be distinguished by their shallow push-ups only 7 mm to 14 mm high. It would seem from the shallowness and surface texture of these bases that they were formed during dip moulding and pushed up only slightly during empointilling. Perhaps the pontil was just pressed lightly to the base so as not to push it up any higher than necessary. This might account for the fact that so little glass adheres to the base in the case of both these bottles and the square flacons.

The relatively straight sides of this bottle type suggest it would fit snugly and securely into a case or canevette. Its shape also suggests modelling after the square flacons and its function would not vary from theirs.

3. Tall Cylindrical Flacon
A type 3 flacon is defined primarily by its tall, slightly
flaring neck and long thin body. The only complete example (Fig. 11) is 317 mm high with a base diameter of only 60 mm and a capacity of approximately 23 oz. or 654 ml. In addition to the one complete bottle, there are 99 necks and three bases, eight per cent of the blue-green sample. The disparity between the number of necks and bases is explained by the fact that bases of these bottles are identical to bases from two other types of flacons: cylindrical jars and short-necked cylindrical bottles (types 8 and 5). Bases of these three containers can only be differentiated from each other when most of the body is attached to them.

The container in Figure 11 has a neck 73 mm tall finished with a lip 27 mm in diameter and a bore 18 mm in diameter. The body narrows 8 mm over its height of 178 mm to a diameter of 52 mm at the shoulder. The smooth conical push-up has a glass-tipped pontil mark 23 mm in diameter completely covering the push-up tip.

With the exception of neck heights, which varied from 57 mm to 84 mm, there is little variation in size or shape in this group of necks. Lips are usually thick, approximately 5 mm, and 90 per cent of their diameters vary from only 25 mm to 30 mm; 93 per cent of the bore diameters vary from 15 mm to 20 mm. Glass thins considerably towards the bases of the necks and tooling marks are often visible as horizontal impressions in those areas. The neck-shoulder junctions are usually distinct and the shoulders begin to curve immediately. The two necks in Figure 12 illustrate the few variations that did occur. The neck in Figure 12a is excessively thick while the neck in Figure 12b has been indented below its lip. There were two examples of the latter variation.

The three bases range in diameter from 65 mm to 70 mm and exhibit push-up profiles in two shapes: rounded-conical and dome-shaped. Push-up heights vary from 15 mm to 18 mm and the glass-tipped pontil used in each case left a mark varying in diameter from 21 mm to 25 mm.

Barrelet (1975: pers. com.) included this bottle shape with those having varied functions as containers of spirits, oils, toiletries or household products. The almost complete bottle (Fig. 11) pours well and is a convenient size to hold, but with such a small base would seem impractical for everyday use. It seems possible that these bottles were placed in cases or canevettes.

4. Tall-Necked Square Flacons
One complete bottle, puzzling by its singularity and completeness, was found to represent another blue-green flacon shape. It combines the neck and body shape of two common flacon types for its neck belongs to the type 3 tall-necked cylinder and its body is identical to those of the type 1 short-necked squares. The bottle (Fig. 13) has
a base width of 60 mm to 61 mm and bears a glass-tipped pontil mark 22 mm in diameter. There is a tiny circular impression in the centre of the basal area that indicates that a sharp instrument had been used to push the base up additionally after moulding. The basal depression is only 8 mm high. The body is 184 mm high, a height similar to those of some of the large square flacons in Table 1. The shoulder is 64 mm square topped by a neck 60 mm high with a lip diameter of 24 mm and a bore diameter of 16 mm. The bottle's total height is 247 mm and it has an approximate capacity of 16 oz. or 455 ml.

No other necks of this type were found with even the suggestion of a horizontal shoulder, but many were found with part of an unquestionably round shoulder attached, identifying them as type 3 flacons. Furthermore, among the short-necked squares are no shoulders in the 60-mm range attached to necks. It is surprising that only one example of this bottle type occurs since its individual shape elements are both common. The fact that this bottle was excavated from the King's Bastion, even though from the end opposite that of the governor's wing, becomes interesting in the light of the bottle's uniqueness, for Governor Duquesnel's inventory (Adams 1971: 176-91) included over 1,000 bottles containing a wide variety of liquids and solids. A flacon in an unusual type from this area is, therefore, less surprising.

5. Short-Necked Cylindrical Flacons

Short tubular necks, either plain or thickened, are not limited to square-bodied flacons, but occur as well on round-shouldered cylindrical bottles (Fig. 14). There are five necks (less than one-half of one per cent of the total sample) with round shoulders attached. Two are plain cylinders as occur on most square flacons, and three are tapered from lip to shoulder with a narrow bore (Fig. 14). The two tubular necks have lip diameters of 30 mm and bore diameters of 22 mm. The three thicker necks have lip diameters of 31 mm to 32 mm and bores of only 17 mm to 20 mm. Neck heights of all five are comparable at 30 mm to 32 mm. Shoulder diameters could only be estimated as varying from 70 mm to 90 mm.

Only two bases can be definitely associated with the necks. The smaller one (Fig. 14), 54 mm in diameter, has a truncated cone-shaped push-up profile with a glass-tipped pontil mark 23 mm in diameter securely placed in the tip. The larger base, 68 mm in diameter, exhibits a dome-shaped profile and a pontil mark 31 mm in diameter. These bases are identical to those associated with types 3, 6 and 8.

A similar bottle, corked and filled with a reddish liquid, is illustrated in a circa 1756 Chardin still life entitled Une orange, un gobelet d'argent et divers objects
(Chardin 1969: Pl. 39). This bottle has straighter sides than do the Louisbourg examples which expand towards the shoulder. Other similar short-necked bottles were found in a 17th-century archaeological context in Quebec City. One bottle was intact and contained wine (Lafrenière and Gagnon 1971: 22, 68). In the 18th century these bottles would have likely had other functions, similar to those of any of the narrow-necked flacons already discussed, as well as being containers for wine.

6. Tall-Necked Cylindrical Flacons
Having a narrow body similar to flacon type 5 but a distinctive neck wider at its base than lip is the tall-necked round-shouldered cylindrical bottle illustrated in Figure 15. There are one nearly complete bottle of this type, 23 necks and two bases, comprising two per cent of the blue-green sample. Few bases could be associated with this type because of their similarity to bases of flacon types 3, 5 and 8.

The bottle in Figure 15 is 269 mm high and would have held approximately 24 oz. or 680 ml. It has a dome-shaped push-up 13 mm high with a pontil mark 30 mm in diameter. The diameter of the body widens to approximately 85 mm at the shoulder. The neck is a plain cylinder 40 mm wide at its base and 30 mm wide at its lip. The bore is 20 mm in diameter.

The base of this bottle is interesting for the area of the basal surface within the pontil mark is faintly corrugated as though the base had been pushed up with a rough flat-tipped tool rather than a molette. The pontil mark, a circle of glass chips, closely resembles that of a sand pontil (Jones 1971: 69), but evidence from similar bases indicates that the mark is probably from a lightly applied glass-tipped pontil.

The only other base is domed, 68 mm in diameter and had been pushed up 9 mm before the application of a glass-tipped pontil. The pontil mark is 35 mm in diameter.

The other 23 necks range in height from 45 mm to 64 mm, but 18 of these are in the 50 mm to 60 mm range. Lip diameters range from 24 mm to 31 mm, bores from 15 mm to 21 mm.

There are no examples of similar bottles in contemporary art or excavated from other sites with which to compare this flacon shape. It is likely that its function would not have varied from the other narrow-necked containers.

7. Large Storage Flacons
Bottles of the large storage type are unique among examples of blue-green bottles from the fortress for they have
distinct protruding lips (Figs. 16, 17). The bottle in Figure 16 is quite typical of the type, having a thick rounded lip; tall, slightly concave neck; broad rounded shoulder; tapered body, and high conical push-up. Among the fragments are 76 necks (six per cent of the total sample) and a possible 24 bases as well as one complete but fragile bottle with an overall height of 355 mm and an approximate capacity of 80 oz. or 2273 ml.

There may have been two or more sizes of this bottle type, but the most common are set on bases 100 mm to 112 mm in diameter. Only two bases exceed these dimensions: one 127 mm in diameter and the other 160 mm in diameter. The latter is associated with the top portion of a large neck with a lip diameter of 50 mm and a lip height of 10 mm. This base and neck would appear to be representative of a deliberately larger size. Lip diameters range from 34 mm to 55 mm with 77 per cent falling into a narrower range of 35 mm to 40 mm. Overall, lip heights range from 6 mm to 10 mm and bore diameters from 17 mm to 28 mm. Necks are from 90 mm to 120 mm tall.

Only two shoulder diameters are extant and they are 146 mm and 155 mm associated with bases 102 mm and 108 mm in diameter respectively. Their respective extant body heights are 192 mm and 206 mm.

Conical push-ups of the 24 bases are high, 22 mm to 37 mm, and bear relatively small (22 mm to 33 mm in diameter) glass-tipped pontil marks at or near the tips, often filling the tips or closing them over. Often a push-up mark could be seen as a flat circular impression in the tip about 8 mm in diameter. The marks appear to have occurred while the bottles were in the dip moulds or when the bases were being pushed up.

There is the possibility of confusion as the shape of these bottle bases could not be distinguished from those of large cylindrical jars (type 8). To date the largest jar reconstructed at Louisbourg has a base diameter of 94 mm and for this reason it was decided to describe any larger conical bases of this style as large storage flacon bases. However, it should be kept in mind that jars with bases as large as 100 mm in diameter do occur on other French historic sites, such as the Roma site in Prince Edward Island, occupied from 1732-45 (Alyluia 1975). It appears likely, too, that jars this size did occur at Louisbourg, even though their large bases are not extant, on the evidence of the presence of jar necks which exceed 100 mm in diameter.

The protruding lips of large storage flacons seem to have been formed by tooling the cracked-off lip down and out, often leaving a crease around the bore. This is particularly evident on the neck in Figure 17b, one of the wider lips found. The finish would then be smoothed inside the bore and the lip given its final definition and
distinctive shape: rounded (Fig. 17b), slightly uptooled (Fig. 16), or V-shaped (Fig. 17a). Figure 17c illustrates how little the lip protrudes on some examples.

Its size, relatively thin-glassed body and heavy neck would seem to make this flacon type less practical as a container that would see daily or frequent use and the likelihood of its use as a storage container for a variety of liquids seems more probable. One inventory (MacLean 1974: 139) listed a canevette containing six flacons of five chopines, or approximately 80 oz. (2273 ml) each. A 60-oz. (1705 ml) large storage flacon was excavated at Fort Michilimackinac (Brown 1971: 109) and a possible 48-oz. (1364 ml) size is cited in a 1684 Quebec inventory (Séguin 1973: 525-6) which lists "une cave de douse flacons de Trois chopines chacun plaine de Rossosel."

8. Wide-Mouthed Cylindrical Flacons
At least 20 per cent of the blue-green bottle sample consists of wide-mouthed cylindrical flacons or jars, which are, in effect, a horizontally expanded version of type 3 flacons. In all there are 234 necks and ten bases as well as six complete bottles whose dimensions are given in Table 2.

Commonly cylindrical jars have thick lips, tapered necks, very short rounded shoulders, tall tapered bodies and conical push-ups. Figure 18 illustrates a typical example, a jar 304 mm high with an approximate capacity of 24 oz. or 680 ml. They occur most often in blue-green glass and occasionally in yellow or brown.

Significant variations from the norm do occur - in blue-green only - and the most extreme is illustrated by the jar in Figure 19a: it has straight sides, a shorter straight neck, relatively thin lip and a shallow dome-shaped push-up. Occasionally the necks bulge slightly (Fig. 19b). The illustrated example (Fig. 19a) is 307 mm high with an approximate capacity of 32 oz. or 909 ml.

Diameters of 240 lips were taken and include those of the six complete bottles. The lip diameters cover a very wide range from approximately 35 mm to 110 mm (Fig. 20), with bores from 30 mm to 97 mm, and tend to bunch at 5-mm intervals due to the rounding off of measurements which is inevitable when using a concentric semi-circle gauge. By using the clusters as the centre of each 5-mm interval, the distribution illustrated in Figure 21 occurs.

Of the 240 lips with diameters extant, 61 have complete neck heights; however, the diameter to height relationship is not always as expected. The narrowest lip diameters, from 40 mm to 70 mm, are associated with neck heights ranging from 22 mm to 80 mm (51 examples); in contrast, middle-sized diameters, from 76 mm to 84 mm, are associated with neck heights ranging from 74 mm to 82 mm
(seven examples), and the widest diameters, from 90 mm to 110 mm, with neck heights ranging from 23 mm to 39 mm (three examples).

Including the bases from the complete bottles, there are only 16 definite cylindrical jar bases. Their numbers are low because of the usual confusion due to the similarity between these bases and those of types 3, 5, 6 and 7. The jar bases vary in diameter from 47 mm to 94 mm and all, with one domed exception (Fig. 19a), have conical or rounded-conical push-ups. Glass-tipped pontil marks vary in diameter from 20 mm to 31 mm, the diameter of the bases not always being determining factors in pontil diameter sizes.

The function of these jars was certainly to contain various foods, mainly fruits and condiments, for storage and shipping. Governor Duquesnel had in storage two "petits flacons de Citrons confits," 12 "flacons d'Enchois," five "flacons de Capres," and a case containing six "flacons de capres" and four "d'Enchois" (Adams 1971: 189-90). The merchant Castaing had among his merchandise three cases of "fruit à l'eau de vie" containing 36 flacons each and a case "danschoix" (anchovies) containing 72 flacons (Thibault 1972: 303). Chardin illustrates a jar of olives in his 1760 still life Bocal d'olives (Chardin 1969); Anne Vallayer-Coster, in the tapestry La brioche ou le déjeuner, modelled after a 1766 painting, includes a large jar of gherkins (Roland Michel 1970: No. 218), and de la Porte (Fig. 22) in his still life Une vielle et des fruits illustrates a jar of what could be apricots.

Narrow-necked flacons were stopped with corks, but wide-mouthed jars, by their size and the prohibitive cost of corks, necessitated a different means of closure. While the narrower jar necks could and did use corks, as illustrated by Chardin (Fig. 23), the wider jars appear to have been usually closed by means of some sort of cloth tied over the neck with string. McKearin (1971: 120-1) cited 16th-century references to wax covered with leather or parchment, or sized cloth as covers. References in contemporary art to this practice are numerous; however, only one is illustrated here (Fig. 22). A closure of this type would also provide a convenient space on which to note the contents, but the only illustrated example of this practice is from the first half of the 19th century (Richter and Härlin 1974: Fig. 6). Labels could have been placed on the bodies of jars and such a practice is illustrated in a painting of the Ecole Française (Faré 1962: Fig. 381).

9. Wide-Mouthed Square Flacons

Wide-mouthed square flacons make up only two per cent of the blue-green sample with 25 necks, two bases and four whole bottles. It is most likely that their numbers are somewhat larger as, like square type 4 flacon, they are a composite
of parts of two other flacon types: square bottles (type 1) and cylindrical jars (type 8). As percentages are based on neck counts, should the percentage of square jars grow, the percentage of cylindrical jars would drop. In either case, over 20 per cent of the blue-green sample consists of jars.

The jar in Figure 24 is typical in size and shape except that its lip is slightly everted. Most lips are quite straight, the necks narrowing slightly towards the shoulder. The illustrated jar is 235 mm high and has an approximate capacity of 27 oz. or 767 ml. The base is 78 mm square with a slight arch 11 mm in height. The pontil has hardly marked the base, merely leaving a faint circle of chips and gouges 34 mm in diameter. The body has widened unevenly and measures 81 mm on one side and 85 mm on the other. The neck, 52 mm high with a lip 60 mm in diameter and a bore 53 mm in diameter, narrows to 51 mm at the shoulder.

From the remaining fragments it could be determined that the neck heights are quite variable (32 mm to 69 mm) as are their lip and bore diameters (46 mm to 90 mm and 39 mm to 60 mm respectively). All necks with diameters over 70 mm have virtually no shoulders, as in Figure 25b, and the neck diameters are roughly equal to the body widths. Only one neck has a diameter as large as 90 mm and a correspondingly large shoulder. The remaining shoulders are from 70 mm to 80 mm in width independent of their neck diameters which range from 47 mm to 60 mm.

Bases coincide in shape and style with those of the common type 1 flacon, but are limited to a width range of 72 mm to 78 mm. One base is embossed with a capital "B." Of the six bases, all have glass-tipped pontil marks varying slightly in diameter from 26 mm to 34 mm. Volumes of the other three complete jars are approximately 25 oz., 25 oz., and 28 oz., or 710 ml, 710 ml and 796 ml.

Even though there are no pictorial or written references to square jars, their functions and closures should, understandably, parallel those of cylindrical jars. They contained various foods and were stopped with large corks, or in the case of the wider mouths, possibly waxed and covered with cloth.

Bases from Cylindrical Bottles
There are 242 bases from cylindrical bottles ranging in diameter from 41 mm to 98 mm which could not be definitely assigned to one particular flacon type, but could belong to types 2, 3, 5, 6, and 8 and even possibly to type 7 or to the fioles or bouteilles. Since function was determined primarily by neck shape and since the enumeration of types was based on necks, the type attribution of these bases is unimportant; however, the bases do present interesting features pertaining to their manufacture.
Forty-seven bases have dark ferric oxide (Saulnier 1974: pers. com.) deposits in the shape of a circle or a ring on the pontil marks, while many others show traces of the oxide. From this we can imply two things: 1) that the tips of the pontil rods used varied in diameter from 10 mm to 19 mm, and 2) that blowpipes were sometimes used as pontil rods. The iron oxide circles from the pipes vary in their outside diameters from 12 mm to 17 mm.

The base in Figure 26c has a flat ring-shaped ferric oxide deposit with respective outside and inside diameters of 15 mm and 8 mm. In the same figure, bases b and d have flat circular ferric oxide deposits with respective diameters of 16 mm and 10 mm. Base a in the same figure has what at first appeared to be double empontilling, but what more likely is an example of over-zealous application of a glass-tipped pontil. This base has a circular slightly impressed area with traces of an iron oxide deposit covering an area 14 mm in diameter. Much lower on the push-up is a circle of adhering glass chips forming a rough circle 32 mm in diameter. It appears that the rod broke through the excess glass of the pontil, not stopping until it reached the tip of the push-up. The tip had then been slightly extended by the force of the rod.

By comparison, deposits of any sort on square-bodied flacon bases are rare. Usually the pontil appears to have been so lightly applied as to leave only the faintest trace of a pontil mark, other times leaving a circular area of excess glass and torn-out areas. It seems that ferric oxide deposits from the pontil rod or blowpipe could appear on any of the cylindrical flacon, fiole or bouteille bases, but to date none have appeared on dame-jeanne bases.

Common occurrences on many bases are swirling striations or impressions from the base of the push-up towards the tip. These marks may have been left by the molette when the bases were formed. They are most noticeable on conical and rounded-conical push-ups and less evident on shallow domed push-ups which often have exceptionally smooth surfaces, possibly because the marks were obliterated by the pontil and possibly because the pontil may have been used in these cases as a push-up tool as well as a pontil. If the pontil was used to push the base up farther after being shaped by the molette, the glass in the push-up would be extended and subsequently smoothed.

Bouteilles
Wine or spirits bottles in the typical French flowerpot shape in blue-green glass make up seven per cent of the total blue-green sample. There are 87 necks and 18 bases, but no complete bottles. Overall these bottles seem to be strong and while the glass is heaviest in their bases and necks, it is generally evenly distributed through their
bodies, having a consistent thickness from 2 mm to 3 mm throughout the bodies and shoulders. The bottle in Figure 27, over 226 mm in height, has an approximate capacity of 26 oz. or 740 ml. The base, 93 mm in diameter, has a rounded conical push-up 27 mm high. A glass-tipped pontil mark 28 mm in diameter is situated in the tip. The neck is extant to a height of 93 mm and bears a downtooled string rim 35 mm in diameter and 8 mm high. The lip is 13 mm high with a diameter of 24 mm and a bore diameter of 16 mm.

The necks generally present quite an elegant profile - tall and slim, gradually widening into broad rounded shoulders - and for this reason it is difficult to distinguish where the shoulders end and necks and bodies begin. All of the necks are finished with plain cracked-off and lightly fire-polished lips varying only slightly in outer diameter from 23 mm to 30 mm and bore diameter from 15 mm to 22 mm. A string rim from 3 mm to 9 mm in height was placed 1.0 mm to 18 mm below the lip. Almost 50 per cent of the string rims are rounded, 33 per cent had been tooled into a V-shape and 20 per cent had been downtooled (Fig. 28a-c). Many of the rounded string rims have some tooling above and below them to make them more uniform, but some are plain, laid-on rings. Neck heights are often difficult to ascertain, but vary approximately from 85 mm to 120 mm.

Only five other bases have enough body extant to indicate flowerpot-shaped bodies, but 12 more could be tentatively attributed to the bouteille shape on the basis of their push-up shape and pontil mark diameters. Bouteille bases have push-ups that tend to be in the shape of a short broad-tipped cone, the pontil placed right in the tip and in some cases pushed up, causing the profile to become higher and almost bell-shaped. This action also resulted in push-up heights of considerable variety from 16 mm to 54 mm. The 18 bouteille bases (82 mm to 103 mm in diameter) have a mean diameter of 96 mm. Pontil marks range from 23 mm to 39 mm with a mean pontil diameter of 30 mm. By comparison the bases of large storage bottles (type 7 flacons) and cylindrical jars (type 8 flacons) which could be included in this base diameter range generally have sharp conical push-ups and, as well, large storage bottles have a proportionally smaller mean pontil mark diameter (27 mm) on a proportionally larger base (mean diameter: 105 mm).

Occasional push-up marks and possible molette marks occur on these bases, but most interesting are the two bases with a wide rectangular impression in the tip of each push-up. The marks appear to have been made by an implement in the shape of a 20-mm-wide slice through the centre of a hemispherical object. They are both on slightly bell-shaped push-ups, implying that the tool was used to extend the height of the push-up before empointilling.
Barrelet (1975: pers. com.) felt that these bottles were undoubtedly used for wine and Chardin included one half full and corked in a still life circa 1726-28 entitled Les apprêts d'un déjeuner (Chardin 1969: Pl. 2). A short-necked example with a label on its body is also depicted by Chardin in La théiére blanche avec fruits, circa 1756 (Chardin 1969: Fig. 246). Anne Vallayer-Coster shows an addition to the usual cork and wire closure in Fruits et bouteilles (Roland Michel 1970: 40) where cloth of some sort has been placed over the cork and tied down.

It is difficult to say whether these bouteilles are petite verrerie attempts at copying black glass bottles or whether French black glass factories copied this already established wine bottle style.

Dames-Jeannes
Only in one style in blue-green glass, the extremely large fragile bottles comprise approximately two per cent of the blue-green sample with 24 necks, 21 bases and no complete examples. The bottles are quite plain and apparently freeblown and flattened into a flat onion or gourd shape. The necks are plain with slightly concave profiles and cracked-off, slightly everted lips (Fig. 29). The lip on the illustrated example is 54 mm in diameter with a bore diameter of 42 mm on a neck 171 mm high. The base is decidedly ovoid and pushed up into a broad, almost bell shape. At the tip of the push-up is a circular protrusion or mamelon approximately 20 mm in diameter surrounded by a circle of glass chips 42 mm in diameter left by the pontil. Although the diameter of the base could not be taken, the distance across the resting point is 184 mm.

The remaining 20 bases have glass-tipped pontil marks although all that remains on each is a thin circle of glass. They vary in diameter from 34 mm to 49 mm with one extra large one of 59 mm. Only three of the bases are complete enough to measure the push-up height and these vary from 42 mm to 56 mm. Twelve of the bases each have a mamelon approximately in the centre of the tip of the push-up.

Lip diameters vary from 43 mm to 57 mm, but the most common size is 50 mm, a size which five lips fall into. Bores vary from 34 mm to 42 mm in diameter. The five necks having complete heights vary from 131 mm to 171 mm.

It is impossible to estimate the volumes of any of these bottles but we know that Governor Duquesnel had one which contained at least six pots, approximately three gallons or 14 L, which he had filled with eau de vie (Adams 1971: 189). Another dame-jeanne with a funnel (Thibault 1972: 308) was inventoried among merchant Castaing's goods, which would suggest that that vessel was used to carry smaller amounts of a liquid from storage to the house. Barrelet (1953: 88) mentioned the use of
demijohns in the 17th century as containers for oil. Scoville (1968: 95) recorded that "appreciable quantities" of empty dames-jeannes were exported from France to the colonies. As with the other blue-green bottles, dames-jeannes seem to have been multipurpose containers.

Although there is no specific evidence pertaining to closures for dames-jeannes, the use of large corks, as used on narrow-mouthed flacons (type 8), as stoppers seems most probable.
Conclusions

The study of blue-green bottles from Louisbourg has led to a definition of French 18th-century blue-green bottle forms, has provided additional manufacturing information, and can suggest possible uses and closures for the bottles. Only tentative statements concerning the economic and social significance of the bottles can be presented in advance of the results of chemical analysis and studies of the archaeological contexts in which the bottles were found.

The sample of 1,200 blue-green bottles was divided for study into four distinct bottle forms based on terms used consistently in the inventories of the period - fioles, flacons, bouteilles and dames-jeannes.

Fioles are small bottles, limited in size to a few ounces and comprising 20 per cent of the total sample. They were used primarily to contain medicines and toiletries, but may also have appeared on the buffet filled with oil, vinegar or individual servings of wine.

Flacons, both narrow- and wide-mouthed, comprise 70 per cent of the sample and occur in at least nine different types and several sizes. Wide-mouthed flacons held a variety of condiments such as preserved and pickled fruits, vegetables and fish, and constitute 25 per cent of the total sample. The primary purpose of narrow-necked flacons seems to have changed in the early 18th century with the advent of the black glass "wine" bottle, from primarily containers for spirits to containers for a variety of liquids such as oil, toilet water and, less often, spirits.

The flowerpot-shaped bouteille is the only bottle form in blue-green glass finished with a string rim. These bottles comprise seven per cent of the sample and were used for the storage or transport of wines and spirits.

Dames-jeannes, capable of containing several gallons of a liquid, are the least common blue-green bottle form, comprising only two percent of the sample. They probably functioned as containers for a variety of liquids.

The usual form of closure, used on all the bottle forms above, was a cork, tied down with string or wire when practical. The very large-mouthed flacons, because of the size of their openings, were not corked, but covered with paper or cloth tied down with string. These covers and
corks could be retained while the bottles were in use, but occasionally sprays of paper stuffed into the necks served the same purpose.

The study of blue-green bottles from Louisbourg has revealed some evidence of the techniques used in the manufacture of these vessels and also evidence that the techniques used around wood-fired furnaces were not identical to those used around coal-fired furnaces.

According to Diderot (Encyclopédie 1751-65, 17: 112; 1772a: Pl. XVIII), there were two common empontilling techniques used in the manufacture of black glass "wine" bottles; one used a glass-tipped pontil rod and the other used the meule or cylinder of glass left on the blowpipe after cracking-off. Both of these techniques are evident on common French black glass "wine" bottles from Louisbourg; however, in the case of blue-green glass from Louisbourg, the former method, using the glass-tipped pontil, was by far the more frequently used and there are no examples of the characteristic ring-shaped pontil marks associated with the latter method. There is evidence of use of the blowpipe during empontilling, but in a manner rather different from that described by Diderot. This evidence is in the form of an occasional, iron-oxide-darkened, ring-shaped impression which occurs on the pontil mark itself, indicating the blowpipe had been cleaned off, a new gather added, and then the pipe pressed to the base of the bottle. With the exception of the incidental occurrence of this imprinted ring shape, the pontil marks left by this method of empontilling are identical to those of a glass-tipped pontil.

The pontil marks left on all the blue-green bottles are typically small (Jones 1971: 68) in relation to the sizes of the bases on which they were placed, not exceeding 29 mm in diameter on fiole bases, 40 mm in diameter on flacon and bouteille bases, and not usually exceeding 50 mm on the huge dames-jeannes. Pontil marks are also generally much more prominent on cylindrical bottles than on square bottles, the pontil often appearing to have been more firmly attached to the former; however, in both cases, the pontil frequently adhered so lightly as to give the appearance of sand pontil marks.

In addition to the differences in the type and general appearance of pontil marks, there seems to be a difference in the formation of the bases of cylindrical and square bottles. Cylindrical bottles appear to have had their bases pushed up with a molette or other push-up tool after being removed from the dip mould, in the manner described by Diderot (Encyclopédie 1751-65, 17: 112; 1772b: Pl. V). Square bases, on the other hand, appear to have been formed in the mould, their usually slight basal concavity appearing to have been the result of empontilling.
The large number and variety of blue-green bottles in the Louisbourg collection are evidence that in the 18th century the petites verreries continued to play a significant role in the French glass industry by producing a wide variety of "large and small bottles" (Scoville 1968: 111), many of which were being exported to the colonies throughout the French occupation periods at Louisbourg. Time has not allowed for a chemical analysis of the blue-green bottle sample; however, its future use, by determining the presence of significant quantities of either soda or potash in the glass, could help localize the origins of the containers to particular parts of France. At the very least this type of analysis could indicate whether a bottle is of a coastal or inland origin. Unfortunately, further precision in attribution is unlikely since both Scoville and Barrelet have noted the difficulty of identifying regional distinctions in form or shape among the wares of the petites verreries.

The significance of blue-green bottles in more specific socio-economic terms is also difficult to establish at this stage in advance of the results of a current research program designed to systematically analyze material from archaeological contexts excavated at Louisbourg; however, certain general observations pertaining to the use and value of bottles in Louisbourg can be made.

King's officers, merchants, habitant-pecheurs, innkeepers and other middle and upper class members of Louisbourg society generally had the greatest variety and quantity of bottles in their inventories, while among those of the less well-to-do members of the community, such as the fishermen employed by the habitant-pecheurs, there was seldom any mention of glass items. This information, coupled with the knowledge of the kinds of luxury items often contained in bottles, bears out the contrast between the quality of life of the upper and lower classes. The apparent lack of blue-green bottles among the lower classes in Louisbourg is also in contrast to the situation in France where, according to Scoville, the use of common glass was widespread and included the lower classes. Transportation costs may have greatly increased the values of glass containers and their contents, making them less accessible to the poorer residents of Louisbourg.

The commercial value placed on glass containers and their contents in Louisbourg is indicated by their very mention in the inventories and, while a systematic evaluation of prices for bottles and their contents has been excluded from this report, it may be of interest to include some examples. Among the estimated values from a 1756 merchant's inventory (Thibault 1972: 299-310), a flacon of brandied fruit was worth 50 sols; a flacon of anchovies, 15 sols; a "bouteille de frontignan," 40 sols; a flacon of oil, 30 sols; a dame-jeanne and funnel, 100 sols, and 100 empty
bouteilles were worth 20 livres. It is interesting, but not surprising in light of the less than ideal growing conditions in Louisbourg that the fruit was valued above both the wine and oil, and much above the anchovies.

Since very little has been published concerning this large group of glass containers, the scope of the study has been mainly restricted to attempting to organize the blue-green bottles into a meaningful typology based on an interpretation of the historic inventories; however, this is just a beginning, based mainly on one collection, although a large one. Modifications are to be expected, especially should other collections of similar French bottles be analysed and compared to this one.
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TABLES
Table 1. Dimensions (in mm) of Complete Short-Necked Square (Type 1) Flacons

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*Two sides were measured due to the asymmetry of these flacons.
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*RRC: rounded cibell C: cone; D: dome.
ILLUSTRATIONS
1 Percentage distribution of fiolle base diameters. Total sample: 254 bases. (Drawing by T.M. Smith.)
2 Small fiole base.  
(Drawing by J. Harris; photo by J.D. Crawford.)

3 Middle-sized yellow fiole, approximate capacity of 2 oz. or 56 ml.  
(Drawing by T.M. Smith.)
4 Neck and base of a common fiole. (Drawing by T.M. Smith; photo by J.D. Crawford.)
5 Type 1 flacon, approximate capacity 26 oz. or 740 ml. (Photo by J.D. Crawford; drawing by T.M. Smith.)
Type 1 flacon bases showing various embossed figures. (Drawing by J. Harris.)
7 Type 1 flacon sizes. (Drawing by T.M. Smith.)
8 Percentage distribution of type 1 flacon base widths. Total sample: 342 bases. (Drawing by T.M. Smith.)
Occasional variations among type 1 flacons: a, string rim attached; b, extremely short body. (Drawing by T.M. Smith.)
Type 2 flacon, cylindrical, approximate capacity 24 oz. or 680 ml. (Drawing by T.M. Smith; photo by J.D. Crawford.)
Type 3 flacon, approximate capacity 23 oz. or 654 ml. (Photo by J.D. Crawford; drawing by T.M. Smith.)
12 Occasional variations on type 3 flacon necks:
a, flared lip; b, constricted lip. (Drawing by T.M. Smith.)
13 Type 4 flacon, approximate capacity 16 oz. or 455 ml. (Photo by J.D. Crawford; drawing by T.M. Smith.)
14 Type 5 flacon. (Photo by J.D. Crawford; drawing by T.M. Smith.)
15 Type 6 flacon, approximate capacity of 24 oz. or 680 ml. (Drawing by T.M. Smith; photo by J.D. Crawford.)
16 Type 7 flacon having a capacity of over 60 oz. or more than 2273 ml. (Photo by J.D. Crawford; drawing by J. Harris.)
Lip variations which occurred on type 7 flacons: a, v-shaped lip; b, rounded lip, and c, slightly protruding lip. (Drawing by T.M. Smith.)
18 Type 8 flacon, approximate capacity 24 oz. or 680 ml. (Photo by J.D. Crawford; drawing by T.M. Smith.)
19 Variation of type 8 flacons: a, complete bottle (approximate capacity 32 oz. or 909 ml) illustrating variations in overall shape; b, neck illustrating occasional bulging. (Drawing by T.M. Smith.)
20 Size variations of type 8 flacons. (Drawing by T.M. Smith.)
Percentage distribution of type 8 flacon lip diameters.

Total sample: 240 lips. (Drawing by T.M. Smith.)
22 Une vieille et des fruits or Nature morte à la vielle, still life by Henri Roland de la Porte. (Musée des Beaux-Arts, Bordeaux.)
23 Canard sauvage avec divers objets or Rafraîchissements, still life by Jean Baptiste Simeon Chardin, 1764. (Museum of Fine Arts, Springfield, Massachusetts, The James Philip Gray Collection [photo by Irving E. Bloomstrann].)
24 Type 9 flacon, approximate capacity 27 oz. or 973 ml. (Photo by J.D. Crawford; drawing by T.M. Smith.)
Variations in neck diameters of type 9 flacons: a, profile and cross-section (upper) and top view (lower) of a narrow neck; b, profile and cross-section (upper) and top view (lower) of a wide neck. (Drawing by T.M. Smith.)
26 Pontil marks: a, glass-tipped; b, glass-tipped with iron oxide deposit; c, glass-tipped blowpipe with iron oxide deposit; d, glass-tipped with iron oxide deposit. (Photo by J.D. Crawford.)
27 Blue-green bouteille, approximate capacity 26 oz. or 740 ml. (Photo by J.D. Crawford; drawing by T.M. Smith.)
28 Bouteille string rim variations: a, rounded; b, v-shaped; c, downtooled. (Drawing by T.M. Smith.)
29 Dame-jeanne neck and base. This bottle may have had a capacity of a few gallons or several decalitres. (Photo by J. D. Crawford; drawing by J. Harris.)
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