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Kenneth E. Kidd

Abstract

The author describes bead-making in Venice and Murano in detail and outlines the history of glass beads in various European countries and America. A glossary of terms used in connection with bead-making is included, as is an appendix of dates of importance to bead history.

Submitted for publication 1974, Kenneth E. Kidd, Peterborough, Ontario.

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Introduction

The study of European trade goods among the Indians of northeastern North America was concerned essentially with the period between the first discovery of the region (ca. 1500) and the end of the French régime in Canada (1760). Glass beads quickly assumed an important position in this research because of their wide acceptance by the Indians and their subsequent far-flung distribution as determined archaeologically. Having an important ceremonial as well as decorative function in Indian cultures, these trinkets, of little worth in the eyes of Europeans, assumed great significance to the traders as well.

One of the results of this demand was the great increase in the volume of bead production which occurred in Venice after 1492, accompanied by a proliferation of types and varieties and by continued improvements and refinements in techniques of manufacture. Trade in beads greatly expanded in both the neighbouring European countries where the Venetian reputation was high and overseas in the recently discovered lands of the New World.

Until recently, glass beads and their manufacture have not been of any great interest to historians, and consequently there are few published sources devoted exclusively to the subject. So far as Venice is concerned, archival materials are known to exist and have been exploited to some extent by Zecchin and Pasquato. Only a few reports on bead production have come from Moravia, Germany, France, Spain, Belgium and England. In The Netherlands, the late Dr. W.G.N. van der Sleen did much to contribute to bead history by investigating the evidence for bead manufacture in his country. But so far there has been no attempt, as far as the author is aware, to produce an overall picture of bead production in western Europe beginning with the Renaissance.

Glass Manufacturing in Western Europe

The glass industry of western Europe today is large and important but, like so many other aspects of our civilization, originated in the Middle East several thousand years ago. Already a well-established craft before the Roman Empire, glass of great beauty, both utilitarian and artistic, was made by moulding, blowing and pressing techniques with many refinements in detail. Beads were one of the interesting forms of art glass which became a convenient and doubtless profitable article of trade in western Europe in pre-Christian times, as evidenced by finds in early tombs and tumuli.

In their conquest of western Europe, the Romans expanded trade and created new demands, one of which was for objects made of glass. As glass is a fragile substance, it would be more satisfactory to have a supply available locally than to depend on imports brought over long distances, and wherever the Roman standards went, there the remains of glasshouses have been found. Apart from the glasshouses established in Italy in the years following the birth of Christ, there were numerous examples in Gaul, Belgium, the Rhineland and Spain and apparently a few in Britain. Dillon, one of the most reliable of glass historians, comments that in the second and third centuries there was probably more glass made in Europe than at any other time until quite recently.[1]

After the Roman legions withdrew from western Europe the manufacturing of glass apparently suffered like most other arts and crafts, but the industry did not entirely disappear; a few itinerant and stationary glassworkers still made their wares although the results were mediocre by comparison with earlier products. Cut off from supplies of barilla (potash made from burned seaweed) from Mediterranean areas, these glassmen produced their potash by burning ferns and fired their furnaces with wood from the abundant forests. Fern ash made very impure potash and produced a characteristically greenish glass of rather poor quality known in France as verre de fougère. Though technically inferior, it was frequently of considerable beauty, establishing a tradition which found its apogee in the later art of Bohemia and gave rise to the thick-walled glassware

of Germany. Glass made in the forests where hardwood ash was frequently used was of somewhat better quality and was referred to as Waldglas.

Although archaeological investigations and historical research are now elucidating this dark period in the history of western glass, it is far from being well understood and the lacunae cannot at this time be filled. It may be stressed, however, that the Roman tradition of glassmaking lingered in eastern Europe as it did in the Balkans and southern Russia. Italy and France were among the more fortunate countries, probably because of their more cosmopolitan nature, while Britain and Germany were less favoured.[2] The craft did not die out completely, however, for it was carried forward into the Middle Ages, spreading into new territories on the fringes of the old Roman Empire and including the interior of Germany, Moravia and Bohemia. Medieval glassmaking continued into the beginning of the Renaissance when it was greatly stimulated and took on new life and purpose. Few if any new types of glass were introduced during these periods, and the principal techniques were still blowing and moulding. During the Renaissance, however, there was a proliferation of new modes and great refinements of the techniques already known. Only much later were entirely new methods introduced such as the pouring of glass for mirrors and windows.

The early glassmaking centres - Venice, Bohemia and Moravia - exceeded all others in quality and volume and dominated the industry until the 20th century. In addition there were many glasshouses in Italy, France, Switzerland, Spain, Belgium, Holland, England, Germany, Czechoslovakia and Poland where glass of various kinds was produced in Renaissance times, some of it rivalling the Venetian products in quality and artistic importance.

Glass and the Making of Beads

The term "glass" refers to a wide variety of materials having a number of characteristics in common. It is ordinarily a mixture of silicates, an alkali of soda or potash, lime or some other stabilizer and usually some colouring material. These constituents are heated to the point where they fuse into a homogeneous mass called "frit," which is ductile but not malleable. Upon cooling, the mass becomes solid. A large number of physical properties characterize virtually all kinds of glass. Not only is it rigid when cold, but also it is a low conductor of electricity, has a low coefficient of expansion, transmits and refracts light when translucent, and when cold possesses a characteristic conchoidal fracture pattern and generally shatters easily.

In the heated condition, glass may be drawn into rods or fine threads, or spun. It may also be blown to expand into a large bubble or "paraison" and this bubble may be manipulated in many ways. Glass may be poured into a mould or pressed while still molten. When it has cooled and become rigid, it may be cut, engraved, etched, enamelled, painted or ground. Great care must be exercised in cooling glass after removing it from the furnace. If it cools too quickly it becomes extremely brittle; if it cools too slowly it crystallizes and is equally useless. The correct rate of cooling is one part of the glassmaker's experience and skill.[1]

The raw materials which go into the making of glass are fairly abundant and easy to procure. The major constituent, silica (silicon oxide), is generally in the form of clean sand or crushed quartz. To the silica must be added two basic salts - usually the carbonates, nitrates or sulphates - of the elements sodium, potassium, calcium, magnesium, barium, aluminium, lead, boron or others. Each combination produces glass of slightly different quality. Lead glass, for example, is noted for its brilliance and weight and is thus widely used in producing objets d'art. If a colourless glass is desired, some substance must be added to the mixture which will produce this effect; such a substance is usually referred to as "glassmaker's soap" for which a small amount of manganese is used. If colour is required, it may

be obtained by the addition of one of the metallic oxides to the "batch" as the mixture of raw materials is called. Cobalt salts and cobalt oxide, for example, produce a blue glass. For opaque glass various materials have been used; during the period with which we are concerned here, ground bones produced the desired opacity. Finally, experience has shown that the batch reacts better in the furnace if a quantity of already-made glass is added to it. For this purpose the glassmaker saves his waste and broken glass (called "cullet") which he breaks up into small pieces and according to the colours he wants, adds it to the batch.[2]

Until the rise of the exact science of chemistry, it was not possible to control the purity of the raw materials; hence glass made under the somewhat primitive conditions of earlier times was less standardized, more variable and frequently more interesting than modern glass. Not only were the raw materials impure - and these impurities would affect the quality and the colour of the finished product - but also the quantities could not be properly controlled. A hundredweight of potash might yield somewhat less than 100 pounds of potassium carbonate, the difference being made up of useless or even detrimental materials and perhaps some pigments which would affect the colour. Modern glass is made to very precise specifications from highly purified materials, and the product made from two or more batches mixed at different times or run in different factories will have a predictable uniformity as to colour and other physical and chemical properties. The glass of the period under study, however, varied widely in all its aspects. Under such conditions it is futile to expect that the products of these centuries will be uniform except within a wide range of tolerance. Thus a blue bead may vary considerably in the intensity of the blue, and the glass may likewise vary greatly from that of another bead made in the same glasshouse the previous week and from a batch prepared according to the same formula. This caution is worth bearing in mind constantly when considering beads made previous to the middle of the 19th century.

In earlier centuries the frit was prepared by heating the basic elements until the mixture partly fused. It was then sprinkled with water and pulverized. In this step the heating was often done in a separate furnace used only for this purpose, or in the annealing oven. The frit and the cullet were then mixed together and placed in a crucible in the furnace where they were melted and underwent the surprising transformation from a drab, granular, opaque mixture of solids to a translucent, viscid liquid. To effect this transformation, the mass was heated to a high temperature for as long as 48 hours.

Obviously the furnace in which this change took place must be sturdy, and at least its interior must be made of

materials which could stand heat higher than that required to melt the batch. The material used was refractory brick, an earthenware product which would withstand an extremely high temperature before being adversely affected. One type of furnace consisted of a combustion chamber, and above it a chamber in which the glass material could be set apart for heating where it would not be subjected to the products of combustion. This inner chamber was usually provided with a broad bench called a "siege" which ran around the wall. Upon the siege were placed the crucibles or pots containing the batch. Each such chamber was usually supplied with several doors or ports through which the crucibles could be introduced and the molten glass removed.[3] The doors were always referred to as "glory holes," no doubt on account of the brilliant illumination of the interior and the noise of the bubbling molten glass. Surrounding the inner chamber was a space to allow for the circulation of the heated air. The air rising along the walls vented through a hole at the top, thus keeping an even heat all around the chamber. Frequently the gases were vented through a long chamber which led off from the furnace at one side. This long, narrow chamber was provided with a flat floor and numerous doors, and in it the artisans placed their finished glassware, thereby taking advantage of the cooling effect of the gases as they progressed the length of the chamber.

Like the furnaces, the crucibles had to be made of refractory material. In the 16th, 17th and 18th centuries they were difficult to construct, costly and frequently broken. Crucible breakage could result in the loss of an expensive quantity of batch and severely damaged the furnace. For this reason much care was given to the production and selection of the crucibles and their preservation. In the best of cases, however, neither furnace nor crucible was likely to last more than a year or two, at which time they had to be rebuilt or replaced.

The use of wood as fuel in early furnaces caused a serious problem for the large quantity required soon depleted the resources nearby. The less populous districts had a natural advantage in this respect, and the hardwood forests such as once existed in northern Germany and Czechoslovakia must have had a decided influence upon the history of glassmaking in these regions.

After the batch had remained in the furnace for a suitable length of time, the worker opened the door nearest the crucible and ladled off the scum or "gall" which had formed on the surface of the boiling mixture. He might then leave the batch to continue heating or he might ladle the molten glass or "metal" into pans of water, which cleared the glass of gas bubbles. The batch was then put into another crucible and remelted. Having cooled slowly again until viscid, it was ready for working.

The glassmaker possessed special tools permitting him to manipulate the glass without touching it with his hands or bringing it too close to his face. Such tools were perfected long ago and several of them are still made and used today almost unaltered in form. They are made of iron and those designed for handling the molten glass have wooden handles. Those tools used in bead-making were the gathering iron, the blowpipe and the marver. The gathering iron was a solid iron rod with a wooden handle that was thrust through the glory hole and rotated in a crucible until it had picked up a quantity of molten glass or "gather" on the end. The blowpipe, which also had a wooden handle, is a hollow tube used to blow into the gather to expand it or to blow it into a mould. The marver, a metal or marble block placed either on the floor or on a table, was used to shape the paraison to any desired form such as a square, oval, triangular or hexagonal cross-section, or to produce a corrugated surface.

The techniques of bead-making have changed little over the centuries. If beads were to be made, the gather was first shaped into a thick cylinder called a "paston." A rod or "pontil" was then attached to the end of the gather opposite the blowpipe. Each of these iron rods was then handed to a tirador and the two men moved quickly in opposite directions, often as much as 150 meters, drawing the gather out into a narrow rod before the glass cooled too much to pull. The newly formed glass rod was supported and cooled on a prepared bed consisting of short, parallel wooden slabs called cannelli. Such rods were destined for use in making the so-called wire-wound or suppialume beads as well as to decorate tube beads. If the shop master wished to make tube beads, he proceeded somewhat differently; instead of making a solid rod he produced a hollow tube. After he had made the paston, he made a hole in the centre with a large pair of spring pincers called a borsetta, thus creating a hollow cylinder. Or he could blow the glass into a bubble by means of the blowpipe. The pontil was then attached and the tiradori elongated the glass into a tube. The diameter of the bore remained constant throughout the length of the tube, no matter how thin it might be drawn, even though it might be only a fraction of a millimeter.[4]

Tubular beads thus produced would necessarily be of solid colour (or colourless). If beads of more than one colour were desired, they were made by one of two methods. The simplest technique was to make a gather and dip it into a crucible of molten glass of another colour. A much better method was called "casing." First a paraison was blown, a pontil was attached to the opposite end and the paraison was snipped off the blowpipe with shears. Then by means of tongs the paraison was opened up into a U-shape. This small hemisphere was set into a mould and another bubble of glass

of a different colour was blown into it. The outer casing was carefully pressed back over the inner one to cover it well; then the whole was reheated to ensure fusion of the two elements. If two colours only were required, the tube was drawn out at this stage; if three or more layers of colour were desired, the process was repeated as often as necessary before the drawing. Beads of five or six layers were not uncommon.[5]

If drawn beads with stripes of a contrasting colour were wanted, they might be produced in the following manner. First, rods of glass of the required colour were made by the method already described and cut into short, even lengths. Rods of yellow or blue glass, for example, could be produced in this way. These were arranged around the inside wall of a small bucket in the desired colour pattern. When the arrangement was completed, a paraison of glass still attached to the blowpipe was introduced into the bucket and expanded until it adhered firmly to the rods. On being withdrawn from the bucket, the complex was reheated sufficiently to ensure firm fusion and then drawn out. If the worker wished to ensure that the rods would be flush with the surface of the paraison and not stand out on it in ridges, he simply rolled the still molten mass on the marver, pressing the rods into the body of the material without damaging them. The coloured rods appeared as diminutive lines on the surface of the bead, in the same order and in the same relative proportions as on the original bubble.

As the canes and rods were being drawn by the tiradori, they might be twisted to give a spiral shape to the beads. Thus it was possible to produce one- or multi-coloured beads, round or square in section, and either twisted or untwisted. Further, a paraison, simple or composite, might be blown in a mould with corrugated sides to shape the so-called "star" or "chevron" beads. If the paraison were twisted slightly while in the mould, the tips of the star points took on a swirled or hooked effect called "dragging." The number of points in such cases were usually twelve. The range of variation possible in blown beads alone is thus seen to be considerable.

Beads produced from tubes by these methods will of course be tubular, and will bear all marks of the paraison from which they originated, only in miniature. They will be monochrome if they consist of one gather; duochrome or polychrome if they have been cased or dipped twice or more into crucibles of different coloured glass; striped if they have stripes added as described above, or be straight, twisted, rectangular or facetted. They will vary only slightly with regard to length, and scarcely at all with regard to colour, bore, decoration and so forth, provided they come from the same paraison or at least from the same batch. But even here there will be minute differences, for

they are in a sense hand- and not machine-made, and the differences between batches will be greater. Absolute uniformity is not to be expected.

Blown or cane beads could be further shaped. The beads were first rubbed by hand in a mixture of charcoal and lime until the cavities were filled. They were then cast into a drum along with a quantity of sand to prevent them from fusing together, and rotated over the fire or stirred by hand with an iron rod. When the beads had been tumbled for a sufficient length of time, the drum was taken from the fire and the contents were removed and sifted. To remove the plugs from the bores the beads were shaken up in a bag; they were then polished by placing them in sacks of bran and agitating them for a considerable length of time. Finally they were sorted by running them down an inclined table where the irregularly shaped and misformed specimens were eliminated by hand, and by sieving to grade them according to size. Every cane bead could, in theory at least, have its analogue in the tumbled category.

If it were not intended to make round beads, the finished tubes were left on the cannelli until they were sufficiently cooled. They were then broken into lengths of about one meter and passed to the operator of a machine which cut them into the desired lengths. The cut beads were collected in buckets or baskets below the machine and taken to sorting screens where they were graded according to size. From there they passed to rooms where women removed defective specimens and strung the remainder for despatch to the markets.

In addition to beads made from tubes and canes, there is an equally important class of beads called "wire-wound" or suppialume. Such beads were produced individually and entirely by hand from rods of solid coloured glass, and it would be even more futile to look for uniformity among them. The manufacture of wire-wound beads is a home craft, since no furnace is required, and furthermore the glass rods from which they are made are portable and can be used far from the glasshouse where they originated. Indeed during the 16th, 17th and 18th centuries wire-wound beads were made in Venice whereas tube-bead manufacture was confined to the island of Murano nearby. The beads produced depended on the glassman's skill in manipulating a simple stock of equipment. By holding the glass rod in the flame of a Bunsen-like burner until it began to melt and then winding it around a core provided by a piece of chalked wire, he could rather quickly build up a bead of almost any desired size or shape. Beads made in this way could be monochrome or polychrome; they could have insets of little bits of coloured glass; they could be built up in layers; they could be round, cylindrical, or indeed of any shape. The craftsman could add threads of contrasting colours, studs of

various colours, sizes and shapes, or he could press his new still soft bead into a tiny mould.

To make the studs[6] or "eyes" used in suppialume beads, a process similar to that described for making the striped beads was used. When the worker had decided upon the pattern of the stud he wished to use, he cut rods of glass of the desired colours and set them in a bucket, taking care that when seen from above the ends of the rods produced the required design. This design might take some simple form like a red cross on a yellow ground, a series of concentric circles, or some more elaborate pattern such as a representation of a flower. The rods were heated to the fusion point in the furnace, and while still semi-fluid, drawn out by the tiradori. This compound rod was allowed to cool and was then cut up into thin discs or studs, each of which showed on its cut surface the original arrangement in the bucket. Such discs were used to a limited extent to decorate suppialume beads by pressing them into the still viscid glass by rolling them on the marver.

When cold the canes were broken, sorted and cut in the usual way, but it was customary to give these beads further treatment not usually accorded others. The smaller specimens, often scarcely more than one-eighth of an inch long, were only slightly rounded on the ends by grinding on a wheel; larger beads, sometimes as much as two and one-half inches long and one inch in diameter, were ground so that the ends were pyramidal in shape or rounded, and the sides were often cut back to expose the layers. In some cases, most of the outer layer was cut away. Others were tumbled, polished and sold as round beads. By these finishing techniques these essentially identical objects were given a wide variety of appearance, which diversity was further increased by the great range in size.

Star or chevron beads are among the most complex of all kinds found in archaeological sites and despite their essential uniformity of design, show a great variety in size, shape and external appearance. Most star beads exhibit a uniform colour pattern; namely, a core of clear, translucent blue, overlaid with opaque white (clear light blue, opaque white), opaque red, and an outside layer of navy blue. Some have in addition inlaid stripes of various colours.

The Making of Glass and Beads in Venice and Murano

It would be gratifying to be able to trace the glass industry in Venice back to Roman times, but this is not possible since Venice was not founded until the sixth century. Some historians suggest that the Venetians learned the art from their neighbours in Aquileia, who presumably were the inheritors of the Roman tradition. Because of its maritime location, Venice tended to look to the east, with which in later centuries it had strong trade bonds. Since the east was a region where glassmaking flourished, Venice benefitted from its contacts there as well as from its Italian roots.[1] Cecchetti, historian of the glass industry in Venice, was of the opinion that his fellow countrymen made glass mosaics for the church of Santa Eufemia in Grado as early as A.D. 580,[2] while Gustavus Eisen says that the Venerable Bede mentioned that Venetian glass had been ordered in A.D. 674 for the Abbot of Wernemouth, and that the German monk Theophilus referred to Venetian glass in A.D. 1150.[3]

Marco Polo is said to have influenced the industry in Venice, particularly the manufacture of glass beads.[4] The assertion is that upon his return to Venice in 1295 after an absence of some 24 years in the Far East, he pointed out to businessmen of his native city the great demand for glass beads there was in the regions from which he had just come and the profits to be derived from such trade. Recent opinion, however, discredits Polo's influence in this respect because of the evidence that beadmaking was already part of the glass industry at Venice.

In 1432 Bertrendon de la Broquière, who had just returned from a visit to the Holy Land, wrote that Venice was renowned there for "its manufacturing of glass."[5] Another stimulus frequently credited was the fall of Constantinople in 1453. By that time glassmaking had reached a high point of development in that region and after the fall many artisans may have sought refuge or been induced to migrate to the west, bringing with them more effective methods for producing better glass in greater quantity.

Unfortunately, and particularly for centres other than Venice, extremely little attention has been paid to the

development of the manufacture and commerce of beads. While it is true that for several centuries Venice held such an outstanding position in this field that rivals had little chance of success, it was not able to enforce a real monopoly outside its own territory. Hence it was possible for small centres of bead production to exist, provided they could find a market for their goods. Apparently all parts of Europe provided such local markets; for example, the use of glass beads for rosaries became common in Czechoslovakia about the 14th century.[6]

On the development of the Venetian glass industry, Dillon wrote that "at an early date, long before they had acquired territory on the mainland," the Venetians "had established factories at Treviso, at Belluno, and along the upper course of the river Piave."[7] Even at the beginning of the industry the production and sale of beads seem to have been exceedingly important for

> the manufacture and export of beads have at all times formed the very backbone of the Venetian glass industry. We cannot trace this trade further back than the beginning of the fourteenth century - by means, that is, of definite documentary evidence - but by that time a fleet of galleys was yearly dispatched, on the one hand to the Black Sea, on the other to Flanders and the Thames; subsidiary centres for distribution were established at the principal ports, and these beads already formed an important element in the cargo.[8]

The competition most to be feared was that of the glassmakers of the Bohemian and Moravian forests, for glasshouses in those districts had the advantage of an abundance of fuel. The industry was already flourishing there in the 14th century; by the beginning of the 17th it was employing some Italian craftsmen,[9] and by 1725 was imitating Venetian beads. The Venetians, alarmed by this competition, sent Giuseppe Briati to Bohemia to learn the methods employed there, and on his return granted him permission to make "Bohemian glass" for the decade following 1736.[10]

A lesser problem which the Venetians faced was the selling of glass beads which resembled semi-precious stones, especially crystal. In 1445 a law was passed prohibiting such transactions, but it probably was not entirely successful and in 1592 the making of false jewels, as they were called, was permitted in Venice itself.[11] A century later a man named Bernardo del Pin perfected a hydraulic machine for polishing beads to make them resemble diamonds.

The extent of the glass trade to the Black Sea in the 14th century has already been noted, as well as that to the Muslim territories. Printed descriptions of this trade are

almost non-existent, but it is generally believed that it was the backbone of Venetian life from this time on and it is still one of the few industries of the city. The discovery and exploration of Africa and the western hemisphere in the opening years of the 16th century certainly gave a tremendous impetus to bead manufacturing for almost every explorer carried beads with him and beads subsequently became important articles of trade with non-European peoples. Almost certainly this fact would make the glass industry even more important to the city than it had ever been in the past, and it would be interesting to know in detail what encouragement the city government gave it thenceforth.

One of the guides as to volume of production which is available to us is the number of glasshouses in operation at various dates. In the first quarter of the 16th century a monk, Leandro Alberti, recorded the existence of 24 glasshouses at work in Murano.[12] In 1606, there were 251 bead and rosary firms in Venice, probably including the makers of wire-wound beads and dealers in small glasswares. The same authors who give the last-mentioned information write that about 70 years later there were only 11 first-rate bead and rosary firms, but whether this was due to a decrease in business or to amalgamation is not stated.[13] The wire-wound bead business alone had expanded by 1731 to the point where it required 800 pounds of oil daily to fuel the lamps, and by the end of the century was employing from 600 to 1,000 workmen.[14] Zanetti estimated six houses making fine beads and 26 making ordinary tube beads in 1746-47, with a total annual output of 3.9 million pounds.[15] For 1762, Morazzoni and Pasquato counted 15 furnaces in Venice employing 200 master workmen,[16] while Nesbitt stated that two years later Venetian factories were producing 44,000 pounds of beads a week at 22 furnaces.[17] Morrazoni and Pasaquato noted the presence of 30 houses in 1776. The heyday of the republic and of bead-making was coming to a close, for in 1784 unemployment was becoming severe,[18] but in the 1790s there were still between 600 and 1,000 Venetians engaged in making wire-wound beads alone.[19] When Napoleon's armies took Venice, however, they removed many Venetian workmen to France, and Berthier, an army officer, was instructed to obtain the formulae for making conterie to take to Paris. Although this mission failed, the Venetian industry underwent many severe stresses as a result of the fall of the republic. By 1836 the number of glasshouses operating on the island of Murano had dwindled to 12.[20]

> Regarding the bead trade, Dillon commented, It must be remembered that the Venetians, at least in later times, did not trade directly with inland and barbarous races. Their business was to deliver their merchandise at

> certain seaport towns where they had factories[21] or agencies. The goods then fell into the hands of local merchants who distributed them by caravans or sent them on coastways in their ships. So the Arab traders of Egypt, reshipping the Venetian wares at Suez or other ports of the Red Sea, would carry them in their dhows to Zanzibar or India; and so again in later days the merchants of Amsterdam and London, who held at times vast stores of Venetian beads, distributed them in Dutch or English ships to the very extremities of the world. The trade in beads was very active in the seventeenth and eighteenth centuries.[22]

The pattern lists of the 18th century carried 562 kinds of beads with a great number of sub-varieties, and the total number of different beads is to this day unknown. Shortly after the turn of the 19th century, a traveller named Burkhardt wrote, "400 to 500 chests of Venetian beads, each chest weighing half a ton, were sold in Cairo each year," and he found that in Nubia every district had its preference in beads. At Djedda at least a dozen varieties were sold, "each packet arranged with its sample bead outside, and each known by its special name, as The Renowned, King's Saddle, Whore's Eye, Hassan Beq, and so on."[23]

During the 19th century, after Venice had recovered from the Napoleonic Wars, vast quantities of beads were exported. Weeks reported to the United States government in the 1880s that Venetian production amounted at that time to 6 million pounds a year.[24]

The growth and proliferation of separate beadmakers' guilds, which occurrred within the framework of the much larger glass industry as a whole, is eloquent testimony of the importance of this craft. The glass historian, Alexander Nesbitt, tells us that

> distinct documentary evidence on the organization of the glass manufactures of Venice begins in the thirteenth century, and the earliest portion of the "mariegole" or code of trade regulations of the various sections of glass workers would appear to have been drawn up about the middle of that century.[25]

This growth of the guilds apparently did not mean that the republic relinquished its control, for in 1291 the Great Council ordered all glass furnaces within the city and diocese of Venice to be demolished; they might be rebuilt on the island of Murano nearby, which was considered safe so far as fire was concerned, and of course they were built there in large numbers. The unhappy results of such a total proscription were quickly realized and permission was given the next year for the makers of small glassware (<u>verizelli</u>) to return to the city provided they took certain precautions

against the spreading of fire.[26] But since these craftsmen did not require a large furnace, the danger was slight.

One of the oldest of the glassmakers' guilds at Venice was that of the friolari (vial makers or bottle makers). The cristallerai seem also to have been an ancient guild which had a beginning no doubt in the artisans who fashioned beads from crystal (i.e., quartz and other semi-precious stones); just how they came to be associated with the glassmakers, or when, is not clear. Other guilds involved in making articles of glass were the fornafieri (makers of glass in mass); the specchiai (makers of mirrors); the perlai (makers of glass beads) and finally the venitai or stazioneri (dealers in glassware).[27]

The cristallerai were split into two new guilds at an early date, the cristallerai and the perlai (large beads).[28] Evidently the first of these groups continued to work in stone, but the latter devoted themselves to making glass beads. The perlai were more especially makers of canes and paste for beads.[29] By 1318, the perlai were further subdivided into the perlai and the makers of conterie.[30] The former produced the canes for making marguerites and cakes of enamel; the latter made canes for making conterie, the ordinary large beads of commerce. The rules of all these guilds were set down as in the past in the register or mariegole.[31] After 1629, makers of suppialume beads were joined to the guild of the pasternostrerai or makers of paternosters (prayer beads), and the margariterai or makers of marguerites (small embroidery beads), but 20 years after this each group had its own council and president.[32] This basic organization endured until the fall of Venice in 1797.

Dillon stated that these suppialume-making guilds were confined to Murano, and were chiefly concerned with the preparation of the materials; he pointed out that "the actual makers of the beads lived for the most part under separate organization at Venice."[33]

An interesting concommitant of the rise of glassmaking was the practice which developed of ennobling master glass craftsmen with the title of "gentlemen glassworkers," which carried with it certain minor privileges not accorded more ordinary citizens, and which was hereditary in glassmaking families. Usually, in conformity with ancient custom, the son followed the father's trade or occupation, and even today it is said that some of the master glassworkers in Venice and Murano belong to families which have been connected with the industry for four or five hundred years. This custom of admitting glass masters to the ranks of the lesser nobility spread to other countries and we find it being done, for example, in France. It was not, however, the practice in England.[34]

The chief danger to maintenance of a monopoly of the glass industry by Venice lay in the exodus of skilled craftsmen, enticed away to ply their trade in foreign cities, and this the Council of Ten felt must be controlled. Their response to the problem was to rule that "if a workman of any kind should transport knowledge of his craft into a foreign country to the injury of the republic, and refuse to return, an emissary should be commissioned to put him to death," and this was effected on two occasions.[35] One of the earliest leaks of these secrets is said to have occurred in 1526 when Plenio del Sol obtained a license to set up a gilded glass manufactory in or near Paris, and this was followed by a spate of new glasshouses built by renegade Venetians in Nevers, Amsterdam, Rouen, London, Liège and other cities. The attractions of setting up an industry abroad were simply too strong for Venetian workers to resist, and in addition, many emigrants probably wished to escape from repressive laws.

The first author to describe the technological aspects of Venetian glassmaking was Antonio Neri, whose book, De arte vetraria, first appeared in 1612 and was reissued in several later editions.[36] The furnaces used in glassmaking are described in Merret's edition of Neri (1662). From his account, we may conclude that in early Renaissance times the more prosperous Venetian glassmakers owned three furnaces in the first of which they melted the batch. The first furnace was dome-shaped like an oven for baking bread, and the upper chamber where the glass was melted was six feet long, four feet wide and two feet high. The second furnace where the remelting occurred was so much larger, being ten feet wide and eight feet high, that it had to be buttressed with external blind arches one and one-half feet thick. It also contained two chambers. The third furnace was what we would now call a lear or cooling furnace. To this brief but important description very little can now be added. Gasparetto notes that in Gothic times the bottle makers used furnaces with four crucibles, three ports and three chambers.[37] Three chambers would seem, in fact, to be essential where the glassmaker was not in a position to own more than two furnaces.[38]

The art of building furnaces and the knowledge of refractory materials was well enough advanced to make possible the construction of a furnace which would last, and with great care, two years, but this was apparently the longest life of an active furnace.[39] The Venetian furnaces were stationary and not the portable type of earlier days used by itinerant glassmakers in the forested parts of Europe.

Fuel must have presented a serious problem to the Venetian glassmaker for the long and sustained temperatures required to make glass would consume enormous quantities, no matter what the source. Even one furnace would require very

considerable amounts to keep it in operation as long as one year, and when this is multiplied by the number of furnaces reported in Sabellico's time,[40] the requirement must have been staggering; yet the literature has almost nothing to say about sources of materials. Wood was undoubtedly the preferred fuel and must have been brought from the mainland and the adjacent Dalmatian coast. Gasparetto says that willow and alder wood were used,[41] which would suggest that these trees grew in abundance in the marshes not far from Venice, and it is interesting to speculate whether the Venetians "cropped" these trees for fuel. In any case, they were handicapped by the lack of beech, oak and other hardwoods of the northern and western forests which not only provided good fuel, but also ash for alkali. Later, after the lamp was introduced, liquid fuels were in demand. The first of these was oil obtained from rape seed, but later horse fat was employed and this was then replaced by whale oil. As much as 800 pounds of oil per day were used in the lamps in Venice in 1731.[42]

It must have been less of a problem to obtain the raw materials for making glass. The silica which forms the basis of all glass was derived from the beds of rivers in Venetia and Lombardy in the form either of sand or of pebbles and rocks.[43] Since the cost of bringing these from afar would have been high, Venice was fortunate in having this ingredient close at hand and certainly owes much of its fame and prosperity to this fact alone. The alkali is said to have been first obtained from Spain in the form of barilla.[44] Glassmaker's soap was imported from Germany or the Gard region of France, and cobalt from Bohemia.[45]

Since no satisfactory descriptions of beadmaking in the period from the 16th to the 18th century are available, we must rely on two articles written within the last 150 years. An American naval officer, writing in 1834, described beadmaking in some detail.[46]

> In the first [bead manufactory] to which they conducted us we found a large reverberatory furnace in the centre, with a basin of liquid vitreous matter. A workman put in the end of an iron rod and whirling it slowly around, until a sufficient quantity of matter had attached itself, he withdrew the rod and formed the mass into a rude hollow cone about six inches in diameter, the apex being attached to his rod. Another workman had been doing the same thing at an adjacent opening, and the bases of the two cones now being brought together and united, a quantity of air was thus enclosed. As soon as the junction was perfected, they carried the mass to one side of the chamber and here strips of wood were laid

cross-wise along a passage and each one holding his rod in hand they began to walk rapidly in opposite directions. As they did so, the glass drew out and in less than a minute we had a tube of uniform bore and about one hundred and fifty feet in length. This one was of about the thickness of a quill; for the smallest beads they increase the pace to a pretty rapid trot. When a sufficient number of these tubes are formed, they are broken into lengths of about twenty seven inches, and are then carried to an adjoining building called the assorting house. Here they are assorted, the workman being able from the feeling only, to arrange them in different boxes according to their thicknesses and colors. From this house they are now carried to another where the laborers are mostly women and boys. Each one is seated in front of a kind of little anvil, having in the right hand a thin plate of steel, nearly triangular in shape and with a blunt edge: in the left he takes as many of the tubes as will form a single layer between the thumb and fore finger, and advancing their ends against a measure on the anvil, by a dexterous use of the steel, breaks off from each tube a piece of sufficient length for a bead. The bits fall into a box and are about twice as long as the thickness of the bead (if a common one) is intended to be.

The next operation I thought the most interesting one. The boxes are carried into a large chamber with a furnace in the center of it. A substance which I took to be ashes is moistened and made into a paste, and the bits of tubes are worked about in it until the holes are completely filled; they are then put into a sheet iron cylinder about eighteen inches in length and a foot in width, with an iron handle to it, and about twice as much sand being added, the cylinder is thrust into the furnace and subjected to a rotatory motion. In a short time, the glass becomes soft and yielding: the paste in the holes keeps the bits from being compressed, and from an elongated they assume a spherical shape: when this is done, the paste is worked out by the sand, and the latter penetrating into the holes, the hard, sharp edges are rounded and smoothed, and the beads are soon brought to the shape in which we see them in the market. When cooled, the sand is sifted from them, and after being rubbed in a

> cloth for the purpose of brightening them, they are fit for use.

This description is of the processes at one bead factory in Murano, but since there has always been a great deal of secrecy surrounding the making of drawn beads, there is no assurance that contemporary factories were using exactly the same methods, and indeed we can be reasonably confident that there were slight variations in technique. It is also necessary to bear in mind that some details had most likely changed since the 1760s, even though the industry as a whole has been marked by conservatism.

In a 1919 description[47] of drawn beads at Murano and Venice it is evident that the techniques of manufacture had not changed appreciably in 80 years. The 20th-century writer reported that the making of drawn beads involved 15 distinct steps, each of which he described in some detail. Only those which have not already been discussed will be given below, since those omitted conform to descriptions already presented. His listing of the various steps is as follows:

> (1) Compounding the materials; (2) fusing the materials into the fondant[48] or molten glass; (3) cupping the fondant to prepare the orifice that will run through every cane and every bead; (4) pulling the fondant into long hollow tubes; (5) cutting the tubes into canes of about one yard in length; (6) sorting the canes according to diameter; (7) clipping the assorted canes into bead lengths and fanning out the powdered glass; (8) filling the orifices of the sharp-edged beads with a composition of charcoal and lime, mixing the beads thus filled with a quantity of sea sand, re-fusing in revolving crucibles to eliminate the sharp edges and round the beads, and cooling; (9) fanning out the sea sand and mechanically sorting the beads for size; (10) mechanical sorting for perfect perforation; (11) in some cases polishing or elucidation; (12) and (13) stringing or mechanical threading on fine metal wires; (14) sorting strung beads for colour; (15) packing for shipment.

This author stated that men did all of the work in connection with bead-making except operate the clipping machines, sorting, threading, bunching and packaging. He also noted that the formulae for preparing the batch were "more or less" secret, and that the heat required to melt them varied from 1000°C to 1600°C because they "must be exposed to a heat of 1000° before they fuse properly." Under heading 3, he mentioned that the gathering irons looked like sections of gas pipe 12 to 15 feet long, and when a gathering had been made it was removed from the

furnace to a metal table or anvil, where it began to "change in colour from white to red." On the anvil it was pounded till it became red and the mass on the end of the rod was then opened by another workman with a borsetta "and the fondant is scooped and pressed out as if it were a dumpling being prepared for an apple." It was this concavity which gave rise to the hollow later on when the mass was drawn out into a tube.

> This cupped mass is again thrust into the oven and heated to white heat and almost the consistency of glue without being allowed to collapse or lose its cupped form. It is again taken out of the crucible, and another workman, provided with an iron rod having a broad, blunt end, presses that end against the top of the fondant cup, to which the heat causes it to adhere.

At this stage (4), the tube was drawn out, sometimes for as much as 300 yards. No mention is made of the temperature of the room where the drawing was done and where the resultant canes were laid down to cool. The author remarked on this point that the fineness of the bore depended upon the character of the batch, the size of the mass on the gathering iron and the speed with which the two tiradori walked away from each other. The long tubes were now broken into canes about one yard long, and then gathered into "sheaves" of the same size (step 6). Nowadays these sheaves are cut by a machine which "bites" off the ends into sections whose diameter is about equal to the length. In the next step (8), the rounding of the beads was done very much as the American naval officer described the process. The 20th-century author mentioned, however, that the crucible was an egg-shaped one, set in a special furnace where the temperature was about 400°C, where the

> charcoal is consumed, the lime vanishes after having served to "fix" the aperture, the edges of the beads become smooth and rounded, the sand grinds and polishes them, and at the same time keeps them from coalescing with each other, and, finally, sand and beads together are dumped out into large shallow pans to cool.

In the next step (9) the beads were sorted by means of a series of mechanical hoppers with screens of graded mesh arranged one above the other. The hoppers were agitated to keep the contents moving, and the beads were collected from each hopper in baskets. Step 10 involved determination of the perfection of the threading holes for which purpose a cylinder or dum had been invented, apparently in 1894. Step 11 did not necessarily follow, but is described as being one in which "certain one-colour beads for America have the surfaces slightly ground by contact with emery paste or other grinding material, or even sawdust. This process

takes place outside the Murano factory and usually in Venice. It is called lucidation."

The author described next the processes of stringing beads, step 12 applying only to certain coarser grades used in funeral wreaths in France. Step 13 explained how the other beads were strung by Venetian women, often as they sat in the streets and chatted. They used long needles, somewhat like knitting needles but smaller in diameter and with an eye for a thread at the end. A good worker could operate as many as 24 needles at once by thrusting them into a large pan of loose beads until they were covered for almost their full length. The beads were then slipped down on the threads and the needles arranged to pick up more beads. The strands of beads were subsequently tied together in bunches (step 14). Some beads were bunched for weight and others for number. Many of the small beads were sold by number, in which case they were referred to as "count" beads, but those which were sold by weight were known as "pound" beads.

> The bunched beads are sorted for size and colour and in some cases according to country of destination and are stacked in shelf bins in the warehouse according to a chromatic scale. To look at the side of the warehouse is like looking at a rainbow where the shades insensible melt into each other.

The final and 15th step was packaging.

Neither of the above accounts describes the making of suppialume beads; however, this process is not in any way secret and visitors to Venice today - for this art is now practiced in Venice and not to any extent in Murano - may see wire-wound beads being made. It is all hand-work done by individuals and in none but the broadest sense are the beads mass produced. Consequently wire-wound beads show much wider variation than drawn beads.

In the case of glass beads, technological advances can be of interest to the archaeologist not only for their own sake but also for the possibility they provide of using them as dating devices. If the wire-winding process was invented in 1528 as claimed, it follows that no wire-wound bead can be older than this date, and that any site where such a bead is found must be later. Because of this value a review of some of the highlights of the technological history of Venetian beadmaking is given below.

Previous to 1528 all glass beads must have been produced by the drawing process unless the a speo method was employed. The drawing process was probably used steadily by Venetians for nearly 1,500 years. Early glass was soda glass and thus of rather poor quality and the range of colours was much more limited than in later times. Theophilus gave a few colour formulae for glass and Neri did the same for a later era, but in assessing such qualities as

content, it is often necessary to resort to chemical or spectrographic analysis, and unfortunately the comparative material for this is as yet lacking.

Perhaps the first name to be associated with beadmaking at Venice is that of Martin da Canale, who is said to have made glass beads and vessels.[49] A record of 1296 says that beads were then being used in embroidery work and that the colours in which they came were red, white and green.[50] In 1317 a bottle-maker named Giovanni made a great improvement in coloured glass and may have perfected the chevron bead.[51] If this is true, it would mean that the invention of star beads preceded the discovery of the Americas by more than a century, and would render them of little use in dating archaeological sites. Some time before the 16th century the process of making millefiori glass was discovered, and in 1443 a recipe was perfected for the making of imitation chalcedony.[52] Colourless glass was achieved between 1460 and 1463. In 1528 occurred the biggest single advance in the history of glass beads in modern times for in that year Andrea Vidaore is said to have developed the wire-winding process to the point where it was practicable.[53] Some authors assert that in 1530 Cristoforo Briani made the first avanturine glass and new coloured glasses with which to imitate certain precious stones.[54] Topaz-coloured glass beads were introduced at the end of the 16th century in Venice and in 1604 a hyacinth-coloured glass was perfected by Gerolamo Magagnati,[55] apparently the same craftsman who is credited with the introduction 22 years later of new processes whereby coloured glasses could be produced with no loss of transparency.[56] A lapse of about 40 years occurred before the next important development was recorded; that is, the process of making porcelain beads attributed to Bertolini in 1768.[57]

In keeping with the spirit of the Industrial Revolution, new processes were introduced into the beadmaking industry in the 19th century, but few descriptions of them are available. One of these is, however, of some interest to American archaeologists because of the very restricted time-span during which evidence for it is found. It is said that shortly after the turn of the century a process was developed for making extremely small seed beads. It was soon discovered that it was almost impossible for most native people to thread them because of the tiny bore, and they went out of circulation very quickly.

In Venice, where so many millions of pounds of beads were produced and which drew so much of its wealth from their sale, scarcely one is to be found on public display today, and very little reference is made to them in the museums.

Bead-Making in France

In view of the fact that France was one of the major colonizing powers in North America and had a reputation for pre-eminence in the arts during the ancien régime, it would be interesting to know if she produced beads for her American Indian subjects.

France was certainly exporting beads as early as 1608 to England, for we find in the London Port Books for that year that "1000 perpetical beads" were sent across the Channel.[1] A decade later 20,000 glass and 12,000 china beads as well as "9 chains of beads for children" were taken from France to England by foreign merchants and eight gross of glass beads by English merchants.[2] In the following years beads of "crystal" arrived in increasingly large numbers, 34,000 of them brought from France by English merchants in 1625-26 and 80,000 in 1629-30.[3] By the end of the century either the commerce in this commodity had dwindled or the records are lost; in any case only eight gross of beads are recorded for 1697-98 and 77 dozen glass necklaces; the following year the number of necklaces rose to 47 gross 4-5/13 dozen.[4] Quite possibly some of these imports to England eventually reached America, but shipments direct from France to the New World would probably have been much greater.

The old Roman tradition of glassmaking in Gaul persisted into the Middle Ages, giving rise to the magnificent stained glass windows of Saint-Chapelle and many other Gothic ecclesiastical buildings and churches. By the 16th century, glass production was at its height in France and French glassmakers were copying many of the more ornate Venetian forms and techniques.[5] Several regions in France, among them Lorraine, Darney and Normandy, where wood was abundant, were well-known for their glass products and in 1292 Paris already had a "Glassware Street."[6] The chief consumers of art glass were relatively few, the members of the court and the wealthy who had travelled in Italy or had family connections there.

The dukes of Nevers, allied to the ducal family of Altare in Italian Montferrat, were able to arrange for some of the glassmakers of that city to come to Nevers to make glass on French soil. The Altarists permitted their

craftsmen to settle in foreign ports and produce glass there provided they did not teach the craft to foreign apprentices. The first large-scale break from the old "foreign" tradition in France was hence due rather to the Altarists than to the Venetians.[7] By the end of the 17th century Venetian and Altarist craftsmen either made or supervised the making of glass in 17 French provinces.[8] It is interesting to note that one of these Italian glassmakers was Teseo Mutio, a Bolognese brought to France by Henry II in 1551 to set up a factory at Saint-Germain-en-Laye to make glass, mirrors and canons (canes) and other kinds of glassware in the Venetian style.[9]

Barrelet, the best authority at present on the history of fine French glassmaking, indicates the location of 193 glasshouses in France in the 17th century,[10] but admits that knowledge of what was made in them is not in every respect complete. Most of our information, he says, has to do with luxury goods made in the Venetian style. Thus the manufacture of glass beads can only be implied from rather oblique comments gathered here and there.

One such clue is to be found in the frequent reference to the "enamellers" at work in France in the 17th century. These craftsmen produced "enamel" and coloured glass in the form of rods and canes, of loaves or mailes and tubes or pipes for the use of goldsmiths, silversmiths and makers of prayer beads. One enameller, Vincent Saroldi, was authorized in 1600 to make all sorts of glass objects at Paris, Orleans, Rouen, Caen, Angers, Poitiers, Bordeaux, Toulouse, Lyons and Marseilles provided he did not use wood or charcoal; thus he must have done his work at the lamp or burette, which in those days burned horse fat. His tools were pincers, scissors, a file, iron wire and a few splinters of gunflint for cutting the glass; thus the canes and tubes he produced were wire-wound. In time, the enamellers began to use their own materials instead of selling them to make artificial eyes and the "fine beads" which Breton and Jaquin perfected in 1686.

Barrelet is of the opinion that the methods of working enamel-glass in the 17th century were much the same as those used in the 18th and 19th and if so, five may be distinguished: (1) a tube was blown to make such things as birds; (2) a lump of glass was worked into the desired shape with pincers; (3) an object might be modelled on a core of coarse, greenish glass built up around a copper or iron wire, then coated with a layer of coloured glass; (4) the specimen might be formed of different rods melted together in the lamp, and (5) the glass might be drawn out to make tufts, plumes and so on. Certain of these methods undoubtedly were used in beadmaking by the enamellers and possibly also by the paternoster-makers.[11]

So well advanced was glassmaking in France in the 17th century that its methods were set forth in an interesting volume called L'art de la verrerie by Haudicquer de Blancourt, first published in 1697. Blancourt describes not only the making of glass, the techniques of the enameller and the making of artificial pearls, but also gives detailed formulae for the preparation of glass of different colours and for the manufacture of looking glasses and burning glasses. The details of the various colour formulae and the recipes for the making of such imitation precious gems as carbuncles, rubies, sapphires and topaz would be of interest to the specialist wishing to use the spectrometer on beads. Glass in some of these colours was produced at Nevers.

In the 18th century the French glass industry continued to flourish and expand, and because it is more recent this period is better documented. Not only did the number of glasshouses increase - Barrelet estimates 421 - but the variety of products multiplied enormously. The range of colours was greatly extended and technicians were constantly seeking new methods. Venetian styles continued to be popular in the first half of the century, even if the reputation of the products of Venice itself had suffered a decline. The manufacture of porcelaine glass, begun in the preceding century, expanded in the 18th to still greater popularity. This branch of the industry was concerned with making opaque glass, particularly the milk-white variety: Neri had given formulae for it a century earlier. An interesting opalescent variety was made by adding oxide of tin to the frit, but oxides of arsenic and antimony were almost equally used, and calcined bones were also in favour. Phosphate of lime produced a slightly opalescent glass probably very like that seen in some beads.

In this vast industry which was catering to a well-developed and highly diversified society, verroterie or small glassware occupied a prominent place and generally included in verroterie were rassades or rocailles. These two last terms include, according to Barrelet, "glass beads for stringing, rosaries or collars." By the mid-18th century beads were made in many cities including Nevers, Dangu, Aubermesnil and Villers. It was indeed a well-established branch of the larger industry in which specialization had been carried so far that the paste was often made by experts in one city and shipped to another for final processing. The paternoster-makers at least had their own guild, with a body of regulations dating from 1593 to make rosaries, enamel and glass buttons, chains, collars and bracelets.

Under such circumstances it would be surprising not if beads of French manufacture were traded to the New World but if they were not so traded. The fact that Normandy, whence the greater portion of the Canadian settlers came, was one of the major centres for the final processing of beads seems

to suggest that there was in that province a good market for them. What better market than that afforded by the constant stream of adventurers and businessmen with interests in the New World? Barrelet in fact notes in his glossary that rassades or rocailles were sent in the 18th century to the Indies, Africa and Canada.[12] Certainly there is no cause for surprise in this, for we read that the Bayel glasshouse sold art glass in 1728 to Spain, Portugal, Mexico and the Indies.[13] Even in the preceding century, "several French artisans in 1686 accompanied a shipment of plate glass to Siam in order to silver and install the pieces in the King's palace."[14] The production and transportation of beads to America pales into insignificance by comparison. Yet to date we have found only one reference to an actual order: a request for "rassade blanc[he] et non d'autre co[u]leur" for use in Guiana in 1666.

Germany and Austria

Although none of those states which later united to form modern Germany had any colonies in the New World, some of them had near neighbours that did. In some of these German states glass was made in quantity, undoubtedly including beads. With their indirect access to American outlets, it is possible that some middlemen dealt in beads which found their way to America before the end of the 18th century. As usual, however, proof is difficult to find.

The manufacture of glass in Germany dates from medieval times, for there are records of its being made in Nuremberg and Mayen from the 7th century until 1340.[1] About a century later, Leipzig was the leader, notable chiefly for glass for church windows. It was not, however, until the 15th and 16th centuries when the centre had shifted back to Nuremberg that glass production became really important. This city's speciality now became mirror glass and it had eight factories engaged in its production. The prominence of Leipzig continued, its best period being said to be the 17th and 18th centuries when all kinds of glassware, both domestic and decorative, were made in abundance. A third district of importance was the Fichtelgebirge in Bavaria, not far from Bohemia, where beads and other small articles were made in the 15th and 16th centuries. In the ensuing century, thermometers were made in Bischofsgrun, and in the first half of the 17th century factories were set up in Beyreuth and other places.[2]

From about 1280 at least, it was the custom for some Bavarian communities to send men to Venice to buy glass canes. These the Germans took home and made into paternosters and polished by means of water-power derived from their abundant streams. They also learned how to make beads by using a "little copper pipe fixed over a burning lamp" (the wire-winding process) from one Abraham Fino who went from Amsterdam to Nuremberg in 1630. At about the same time Johann Kunkel von Lowenstjern was making glass beads at his works on the Pfauen-Insel near Potsdam for the Brandenberg African Company for export.[3]

Elsewhere, beads were made in the German states, particularly in the Bohemian-Bavarian sector, as early as 1305. In that year a village glassworks was operated by a

monastery of Niederaltaich for making beads and a property was acquired at Revenstein to be used for making paternosters.[4] In Thuringia one Hans Greiner and a Christopher Muller left Bohemia and set up a factory at Lauscha for the making of rods and tubing which were used chiefly for the manufacture of "doll's eyes, artificial eyes, beads and trinkets."[5] In Austria glass was made as early as 1142,[6] but the varieties and purposes for which it was destined are not indicated. It is not surprising in view of the long tradition in the country that Maria Theresa (reigning 1740-1780) initiated the making of beads at a factory in Innsbruck and another at Graz whose products were sold in London, Hamburg and Turkey, key points for the overseas trade to the east and west.[7]

One authority notes that at the beginning of the 18th century German bead manufacturers were competing with their opposite numbers in Venice. The phrase "Nuremberg ware" occurs frequently in early trading accounts and is said to have included all manner of minor products, doubtless including beads though one cannot be certain. Such wares found their way far afield, including northeastern North America where the dolls were particularly welcome. But no solid evidence for the export of German beads to America has been noted.

England, however, did import some, if we are to credit Houghton's report of 1696 that London imported in 1694 388 l. of bugle and 23 tuns 10 barrels of marbles.[8] Moreover the London port books indicate that in 1697-98, £168 worth of great bugle and 31 gross of glass necklaces arrived there from Germany.[9] One cannot disregard their possible re-shipment to the colonies.

Since The Netherlands were even nearer neighbours to Germany than Britain, it is natural that we should hope sources in that country would throw some light upon the trade in German beads to America, particularly as the Dutch companies were so well organized, so powerful and carried on commerce with so many parts of the world in the 16th and 17th centuries. A Dutch authority on these matters wrote,

> The Companies [the East and West India companies] bartered these beads [which they carried across the seas from Europe] with natives; in the records, however, these beads are not mentioned apart as a special merchandise, but taken as a whole together with other sorts of such-like things the so-called Nurenberger merchandise. The name indicates that these commodities were imported from Germany.[10]

Many of the records of the West India Company prior to 1674 have been lost, thus ending any hope that further light will ever be thrown on this subject.

In conclusion, it can only be said that beads were being made at various places in Germany and Austria during the period ending in 1760, notably at Nuremberg, Leipzig, the Fichtelgebirge region, Innsbruck and Graz, and possibly at Mayen. Doubtless some of these products passed into the overseas trade, but the details cannot be proven at present.

The Low Countries

In the 17th century the Low Countries enjoyed, in England at least, a reputation for first-class workmanship and high enterprise. When Sir Thomas Gresham built the Royal Exchange in London, Holinshed wrote that "he bargained for the whole mould and substance in his workmanship in Flanders," that he imported the wainscot, the glass and even some of the stone from that province.[1] When Benjamin Bonnel started his glassmaking venture in Gothenburg in 1628, he is thought to have procured his workmen in Holland.[2] In 1567, Jean Carré, a promoter of Flanders, went to England to establish glass manufactories.[3] One might mention other cases of much the same import.

Pholien states that in 1503 a factory in Flanders was already producing glass mirrors and that by 1567 there were glasshouses in Anvers, Brussels, Charleroi, Jumet and Lierre.[4] Another author relates that in the same century there were glasshouses at Antwerp, Liege, Mezières and Lille, and that at Amsterdam "some glass-works must have existed somewhere near The Maze which even employed two ovens, and where crystal-clear, delicate glasses were made delicately and finely as Venice had done."[5] Although these Venetian styles figured prominently in Dutch glass - so much so that it is said even experts could not distinguish between real Venetian ware and that made at Anvers and Liège about 1610 - it must not be supposed that all the glass made in the Low Countries was a straight imitation. On the contrary, glassmaking was already an old industry and the metal itself probably was similar to the German product. The ties with the west were manifested in other ways too: mirrors were first made in Germany, but a Flemish glasshouse was closely associated with the parent plant before the art was communicated to Venice or elsewhere.[6]

As for beadmaking in the Low Countries, there appear to be few official records although it is conceded by the Director of History of Business Archives at The Hague that Dutch factories may have produced some.[7] However, from other sources we learn that two Italians, Zuanne Gedolin and Pietro Sicca, took the secrets of the art from Venice to Amsterdam in 1730.[8] The artist Jacob Van Loo, who was

born near Ghent in 1614, painted an oil now hanging in the Royal Museum of Fine Arts in Copenhagen. This canvas is usually referred to as "The Glass and Coral Factory," but Bredius considers it to be the Italian glass factory at Amsterdam.[9] This painting shows some details of the procedures used at the time such as the grinding and mixing of frit or cullet, the furnace in the background with a man at the glory hole, and in the left foreground a young man cutting up rods into beads. The painting was obviously done with first-hand knowledge of the subject.

It is to a modern student of the subject, however, that we owe the almost certain proof that glass beads were made in Amsterdam during our period. The late Dr. W.G.N. van der Sleen of Naarden, The Netherlands, obtained numerous examples from vacant fields near the city which appear to have been used as a dump for the refuse from the factory, and some of these he had analysed. The analysis apparently indicated a different composition from Venetian beads, further strengthening the argument for a local manufacture.[10] There can now, thanks to van der Sleen, be no reasonable doubt of the production of beads in Amsterdam during the period of this study.

Evidence for the export of beads from Holland is available from several sources. The first are the London Port Books and customs records which frequently list the imported merchandise by value only, making it necessary to calculate the quantity. Between Michaelmas 1697 and Michaelmas 1698, London imported £464 worth of great bugle from Holland.[11] Between Christmas 1608 and Christmas 1609, "Alien Merchants" brought to London from Holland 42 gross of counterfeit amber beads, most likely of glass;[12] during a 10-month period in 1625-26, English merchants imported 59 gross of glass beads to that city,[13] and between Christmas 1633 and Christmas 1634, 42-1/2 gross of glass beads were brought from The Netherlands.[14] The reason for the sharp decline in imports toward mid-century is not clear; perhaps it is connected with changes in customs regulations, but more probably it is related to interruption of trade during the Thirty Years' War.

Unofficial evidence for the existence of a trade with the Low Countries in beads is to be found in one of the first newspapers to be published in England, Husbandry and Trade Improv'd, edited and printed by John Houghton. In his ninth volume for 2 May 1696 he wrote on glass imports to London for that year and noted that 769 glass pipes (for tobacco smoking), 8 gross of looking glasses, 175 gross of glass necklaces, 4 dozen "prospect glasses," 77 l. of smaltz (coloured glass for making millefiori, beads, etc.) and 5,626 l. of bugle were brought in from Holland. In the same year London imported from Flanders 675 pipes and 8 gross of

necklaces, but no beads, no smaltz, no looking glasses and no prospect glasses.[15]

Additional concrete evidence on production of beads in The Netherlands comes from another century when the Philadelphia merchant James Logan was importing goods for the Indian trade. In a letter to John Askew dated 18 January 1717/1718 he remarked, "I have them [beads] from Holl^{d} at 6 or 8 Stivers y^{e} highest y^{e} pound." In another letter about a month later to the same agent he repeats the same thoughts.

> I sent thee by Capt. Wayles 3 or 4 beads in a small box for a Sample. I wish thou would Search for Such and Send me about 100lbs. weight of each of the lesser and 50lbs. of y^{e} greater We had by Crawford from Holland at 6 Stivers the other I had from New York but be Sure to have them with y^{e} Drawback otherwise they will not answer.

In 1727 Logan once again ordered Askew to procure beads for him; this time he required

> Beads according to y^{e} Samples, 100 lbs. of y^{e} angular blue, but rather larger than less, & 50 lbs. of y^{e} Small white if possible to be procured. The larger ones must be of deeper blue mostly These come from Holland under 4 Stivers the lb.[16].

Logan found Holland a good buyer's market. "Beads are another Article of great [impor]tance in the Trade...I have been sometimes well supplied from Holland at 3 or 4 Stivers or less p lb."

While there is still much to be learned concerning the Dutch beadmaking industry, we have ample proof that it was already flourishing in the first half of the 17th century and that by the first quarter of the following century it was supplying beads of several types to traders in the Anglo-American colonies.

History of Beads in Czechoslovakia

Bohemia, one of the provinces of modern Czechoslovakia, has long been renowned for its manufacture of glassware. Other parts of Czechoslovakia share the distinction and have equally long histories of glassmaking. At the present time this nation is probably not exceeded by any other either in the quality or the quantity of its glass production, of which beads have always been a conspicuous part.

Because Bohemia's population was small, its forests escaped destruction until much more recent times than was the case with more populous parts of the continent; thus when the glass industry became important in Czechoslovakia, ample quantities of excellent hardwood fuel were at hand.

Dillon defines the area of Bohemian glass production as essentially that which lies

> on either side of the mountains which gird Bohemia to the north-east, the north-west, and the south-west, and divide that kingdom from Silesia, from Saxony and from Bavaria respectively. Of all these districts it may be said that wherever the pines and beeches of the wooded slopes provided fuel for the furnaces and (from their ashes) the indispensable potash, wherever, too, from the hillsides a pure white sand could be extracted, and finally, wherever in the mountain streams a source of power for cutting the wood or grinding the glass was at hand, there a glass furnace would sooner or later be established.[1]

Glass manufacture in Czechoslovakia was begun in the Middle Ages. One of the most authoritative modern writers on the history of glass in that region writes,

> There are many reasons for the belief that the production of glass jewels and buttons - at least in a certain form - existed even in...the cultures of the great Moravian empire of the 8th and 9th centuries.[2]

Archaeological investigations and archival research have in recent years thrown much light on the development of the industry. Excavations at Kroszwica have proven that

glass beads, vessels and other objects were being made there as early as the 10th century by preparing the batch in dome-shaped furnaces and making the glass "in crucibles above open fireplaces."[3] J. Bartas, investigating the history of glassmaking in the Hron valley, found that it had sheltered ten glasshouses, the oldest of which were at Skelne Teplice and Muran Huta and said to be 600 years old. Others were at Lucatin (dated to 1564), Banska Bystrica, Sliac and Zvolen. Bartas went on to say,

> The first German immigrants to Slovakia included miners who worked in the gold and silver mines, and they probably invited fellow countrymen to come to Slovakia to make for them the various glass vessels required in the smelting processes. A document dated 1550 stated that glasses used in the mining industry at Stiavnica and Kremnica had been made at Skelne Teplice for 200 years.[4]

He does not give a date for this German invasion, but Hettes mentioned one in the last half of the 13th century which he says swamped the original traditions of glassmaking and that the German tradition survived:[5] he is probably referring to the same event as Bartas.

Not only is the making of glass in Czechoslovakia of great antiquity, but also the production of beads is equally ancient. Many of the articles produced must have been of purely practical value, like the ones used in the smelting activities, but beads seem to have been made for a different reason. Hettes remarks of them,

> The production of glass beads for rosaries was also connected with ecclesiastical life. Due to the influence of the Dominican Order they began to be used during the 14th century. These glass beads were made in very small rosary furnaces which can still be found on the Czech-Bavarian border, mainly in the King's Wood; this production was the privilege of the freemen who guarded the frontier.[6]

In some sense Bohemia and Slovakia were at a disadvantage geographically for they were peripheral to the more populous and developed countries of Europe where their markets must be found. Beginning in the 17th century interactions between the Czech and Venetian industries began to occur, as was inevitable, and the secrets of the one were sought out by the other until there was much in common in the two industries. Despite the constantly increasing conversion toward similarity, there was much to differentiate them, for the Venetians continued to work in numerous small glasshouses and the products were still more lustrous and individual in character than those made in the more mechanised Czech works.

Producing far more glass than they needed for home consumption, the Czechs devised in the latter part of the 17th century an efficient organization for delivering and selling their wares abroad. Caravans of glassware driven by teamsters left the town of Ceska Lipa in Bohemia and, says Hettes, "ventured to Poland, the Baltic lands, penetrated even as far as Russia, Denmark, Sweden and the Netherlands, crossed Germany to France, England, Spain and Portugal, crossed through Moravia to Hungary, Transylvania and Constantinople."[7] Experience gained thus resulted in more sophisticated marketing mechanisms and by the latter half of the 18th century export companies were organized and had agents in 54 European cities and six centres overseas.[8] Under these circumstances it is reasonable to expect to find glass beads of Czech origin in the most distant parts of the world by the mid-18th century. The principal problem is to identify them as Czech.

During the past two centuries beadmaking has developed into a sub-industry which has, in its vigour and competence, rivalled the Venetian one and even threatened its supremacy.[9] Czech beads appear to be more uniform and by and large show more brilliant and often strident colours. In individual samples, however, these differences are not always easy to detect.

Glass Beads in England

Although glass was certainly known to Britons in the time of Caesar and probably long before his day (the very word is of Celtic origin, referring to the bluish-green dye with which the ancient inhabitants coloured their bodies),[1] there is no evidence of any extensive glass manufacture in the British Isles except for stained glass windows until the 13th century. Near the middle of that century, Lawrence Vitrearius built up a business in the Wealden district and got a large order to supply window panes, both clear and coloured, for Westminster Abbey. His son William le Verrir carried on the business at Chiddingfold until the end of the century when the industry passed into the hands of a French family, the Schurterres; then to the Peytowes.[2] The French succession was broken in 1567 when Jean Carré (or John Carry) of Arras and Antwerp moved in and brought with him members of four distinguished Lorraine glassmaking families, the Nennezels, the Thizacs, the Thiétrys (Titterys) and the Houx. English production had concentrated on window glass and it was therefore logical to bring in the Lorrainers who had always specialized in that branch of the industry and who, moreover, were now uneasy at home on account of the religious unrest there. Carré worked the Wealden shops, but also took out a licence to make crystal glass in London. His plant at Crutched Friars began operation in 1567 and continued after his death four years later. To it he brought seven or more Venetians with the intention, as Thorpe points out, of making Venetian-style glass in London using cheap Lorraine labour.[3]

The similarity between English and Dutch glass products was so close at this time that Thorpe remarked, "The two countries had one industry."[4] For Carré to bring in the Italians, however, was a direct breach with the tradition and inevitably led to trouble.

The break with the past had started in both Holland and England sometime previously. Dillon noted that in the 16th century "at Antwerp and at Liége the typical Venetian cristallo was more successfully imitated than elsewhere out of Italy,"[5] and in England the first mention of Italian glassmakers occurs in 1550 when eight Muranese were imprisoned in the Tower of London for failing to keep their

contracts.[6] The arrival of Giacomo Verzelini in England is usually taken to mark the begining of the modern era of English glassmaking for this man set the mould for much that was to follow. He came to London in 1571 to manage the Crutched Friars works for Carré and after the latter's death the next year was the dominant figure in the industry until his retirement in 1592.[7] By that time the Venetian tradition had taken root in England, enabling Dillon to observe that "before the death of Elizabeth the making of both hollow ware [e.g., blown glass] and window-glass by the new methods [of the Lorrainers] was firmly established in London and in the provinces."[8]

The fuel most commonly used in Europe for making glass in the 16th century was wood, but by the end of that century this commodity was becoming scarce and there was an outcry agaist its continued use on such a large scale. An ex-admiral with a keen business sense, Sir Robert Mansell, noted the possible profits to be made from glass and in the early decades of the 17th century bought up many of the English glasshouses. One of his first achievements was to introduce the use of coal in glass furnaces, a fuel destined in time to revolutionize the making of glass both at home and abroad, except at Venice. So far as beads are concerned, however, the main lines of development were by now laid down and were essentially Venetian in character.

England is the only great colonizing power with which we are concerned for which there is little documentation of trade in beads with the New World. It is true, of course, that there are abundant records of English traders who supplied beads to their American clients - John Askew immediately comes to mind - but there is no convincing proof as to where these agents obtained their stores; they may have gone to the continent for them. Nevertheless there is good circumstantial evidence that if they wished, they could have purchased them in England any time after the beginning of the 17th century, though perhaps in limited quantities in the early years. We must turn elsewhere for proof of the making of beads in England.

The existence since medieval times of the street called "Paternoster Row" in London is no evidence that glass beads were then being made, for jet, amber, coral, silver, gold and wood were the popular materials of the time.[9] Nor is it certain that glass is referred to in an ordinance of the Star Chamber in the 36th year of the reign of Henry VI (about 1457) where it was ruled that "no workers of counterfeit chaynes, beades, brooches, owches, rings, crops, and spoons silvered should be suffered" within the sanctuary of St. Martins-le-Grand in London.[10] Winbolt asserts that "Tubular coloured beads ("bugles") and enamelled glass were made at Northiam by Sebastian Orlanden, a Venetian, assisted by Lorrainers, towards the end of the sixteenth century" in the Surrey-Sussex district, and that he found

one blue bugle on the site of the factory.[11] In another paper on the Wealdon industry, Winbolt discovered that it appeared

> from a deposition taken in 1578-9, March 24, before the mayor of Rye, in a suit against Sebastian Orlanden, of Venice...that one Godfraye Delahaye has sold to John Smith "all the wares, stuffs and instruments which were at Beckly"; and Stephen Duvall, a Frenchman, of London, deposed that Sebastian Orlanden ought to have a third part with Godfraye Delahaye for making "Bugles"...at Beckley.[12]

They are known to have made bugles, enamel and glass in collars.[13] At Sidney Wood, also in the Wealden district, the same author found glass tubes "about the size of an ordinary lead pencil, or thinner" and "also solid glass rods or pencils, not quite circular in section,"[14] which may have been the raw materials for making beads.

The industrialist Mansell obtained letters patent from James I in 1623 giving him the right to

> use exercise practise sett up and putt in use the arte feate and misterie of melting and makeing of all manner of drinking glasses broade glasses windowe glasses looking glasses and all other kinds of glasses, bugles bottles violls or vessels whatsoever made of glass of any fashion stuff matter or metal whatsoever not being tymber or wood.[15]

Thorpe thinks it was Mansell's intention to supplement the native black bugle with coloured beads according to the formulae provided by Neri's recent work, but that he may not have got around to it before Sir Nicholas Crisp secured a patent "for the sole making and vending of Beads and Beaugles" from Charles I in 1635. Thorpe is also of the opinion that Crisp planned to use these commodities in his African business, since he had the sole right to trade in Guinea.[16] If this is correct, we probably have here the first reliable indication that English-made glass beads were available for trade with natives in remote new lands. Other merchant adventurers besides Sir Nicholas might also find uses for them.

In the New Book of Rates (import duties), appearing in the second year of James I (1603-04),[17] "Beads of Glass and Wood all sorts the great gros" were scheduled at the rate of 5 s.; "great bugle" at 2 s. a pound; small seed bugle at 3 s. 4d. a pound and "lace bugle" at 4s. a pound. In Cromwell's Book of Values published a half-century later, the same commodities are rated in the same order at 10s. the "great groce," bugles of glass at 2s. 6d. the pound; great bugle at 4s. 6d.; small or seed bugle at 6s. 8d. and large bugle at 8s. the pound, while in 1660, Charles II's Book of Rates laid down a duty of 4s. on "Bracelets or Necklaces of

Glasse the small groce containing 12 bundles or dickers."[18] Allowing for some fluctuation in currency values between 1604-05 and 1660, the duties must be considered to have risen, indicating a protectionist policy for the home industry. In 1664, a further restriction was put on the importation of looking glasses and other plate glass, spectacle glasses, burning glasses, tubes, and so on, because the Venetians were flooding the English market with wares at unremunerative prices with the object of crushing "a manufacture lately found and brought to perfection."[19] At about the same time (1668) a London dealer, John Greene, still had to import "bundells of Large Long pearle necklaces, fine," "fine midle pearl" and "fine seed pearle" from Allesio Morelli in Venice, but he was beginning to feel enough reliance on the native English production to be a bit demanding in his order of 1670-71 when he "desired" Morelli to send

> 50 Bunches or Masts of fine pearle neck Lacces or Bracelett but Indeed ye Last you sent cost one Liver a Bundle too much I hope you will send me the Largest and best for 7 Livers a Bundle. Mij ffrind Mr. Van Mildert complaines you use him hardlij in these neck laces you sent him for you charges 100 Mast at 6 Livers a Mast and ye other 100 at 7 Livers which he said were noe better.[20]

These would be strong words if Greene had no alternative to dealing with Venice.

We have already seen that in 1696 Houghton reported a considerable import trade in bugle from Germany and Holland,[21] and the trade was large enough for Houghton to sense that it deserved a joint stock company to carry it on. Nonetheless if trade in bugles was still primarily a mercantile rather than a manufacturing business, that in glass necklaces was apparently more firmly based, for Houghton said he was told that "we out-do our Neighbours, and are likely in short time to serve other Countries." Perhaps we will never know more of the facts surrounding the bead export trade in England at the end of the 17th century, but we will always wonder why John Tyzack, who belonged to one of the ancient Lorraine glassmaking families, advertised in Houghton's newspaper in 1694 that he

> who is very well acquainted with Pensylvania and parts adjacent, will be every Week-day at the Barbadoes Coffee-House in Exchange Ally...to assist in buying and selling Land or transact any other Matter relating to the Offices of above said Places.[22]

Did his glass interests first take him to Pennsylvania and did he still carry on a little business in that line there?

At the turn of the 17th century, the English glassmaking industry was securely based and in some respects

unexcelled. French glassmakers had by this time established a reputation for their window-glass and mirrors; English makers for the excellence of their lead crystal. No longer was there any need to depend on foreign sources although many small items were still being brought in - among them beads - either because there was not sufficient production at home or because of a desire for goods of foreign manufacture.

During the 18th century the industry continued to thrive and we may not be wrong in thinking that beadmaking continued as a branch. Numerous orders placed by merchants in the American colonies may have been filled by the home industry; the evidence, however, must still lie in manuscript sources. Francis Buckley, long a student of English decorative glass, combed the 18th-century newspapers for references to his chosen subject and recorded, more or less by the way, two references to beads. The first of these was to "Peter Saffree, London, Beadmaker," which he found in the London Gazette for 5 December 1706 and the other to a "Parcel of Beads for the Guinea trade" in the Post Boy for 7 June 1709.[23] The Guinea trade continued to loom large in the bead business for many years to come, well beyond the period covered in this paper. The Rev. Thomas Clarkson, inveighing against the slave trade in 1788, produced as part of his evidence that it was not as profitable to the mother country as it was made out to be. He pointed out that on great and small bugle the difference between the duty and the drawback was so small as hardly to pay the salaries of the officials who collected it. This fact suggests that the beads were imported and indeed Clarkson says nothing of any of English make.[24] Scant as it is, however, there is a bit of proof for the manufacture of beads in England at that time, found in the customs record of 1770 where it is said that 620 (pounds) of bugles, "the produce or manufacture of Great Britain and Ireland," were imported at Boston, 208 at Philadelphia and 304 in Charlestown (Charleston, S.C.).[25] This inconspicuous industry lingered on for another century in Bethnal Green and Shoreditch (London) but finally disappeared due, we are told, to the carelessness and lack of punctuality of the workers.[26] So ended one of the minor but more interesting of the English crafts.

Glass Beads in Sweden

If beads were made in Sweden during the period 1550-1750, they would most likely have been taken by Swedish travellers, particularly Swedish trading companies, to New Sweden during the first half of the century. There appears to be no documentary evidence that any beads of Swedish manufacture were taken to the New World, however.

Amandus Johnson affirms that one Benjamin Bonnell "went to Sweden in 1625, with the intention of founding a glass factory."[1] His first application for permission to do so was turned down by Gustavus Adolphus, and it was not until three years later that "The South Company," which had at the time a monopoly of trade with New Sweden, made an arrangement with him to establish a glass manufactory at Gothenburg. Bonnell is said to have brought equipment and some special instruments from England, and to have tried to bring in skilled workmen from Holland. He ran into difficulties, however, had to dismiss his help and was himself arrested for debt. Thus the hope which Usselinx, the director of the South Company, had entertained that the factory would produce glass beads for the African and American trade came to naught, so far as can be ascertained.

Bonnell's was not the first or the only attempt at glassmaking in Sweden in the two centuries in which we are interested.[2] The first glass to be made in that country was produced by two Italian craftsmen brought to Sweden by Gustavus Vasa in 1555, and several other factories were established in the following decades. One of these, Duke Karl's works in Nykopingshus, produced tableware in dark green glass after the German fashion. In the early years of the 17th century the Tristenshult works made flasks and jars, probably employing Dutch workers. The most ambitious project of that century, however, was that started in 1641 by Melchior Jung at Stockholm; Jung proposed to make "plain window glass, and flasks, as well as large drinking vessels of French and Dutch design," some of which he might export. A shortage of help held up production until the owner brought in Venetian workers; these in turn left to go to Scapitta's works, founded in 1676, and two years later Jung himself died.

Scapitta (or Guagnini, as he is better known) was a mendicant Italian friar who spent some time in Amsterdam with fellow-countrymen employed in running a glassworks there and who conceived the idea of starting his own manufactory. He went to Sweden and obtained the rights to make window glass, mirrors, drinking glasses and "rock crystal" in 1676. He got into production, but failing to keep accounts, had to flee the country two years later. His plant was moved to an island in the lagoon for greater safety, and continued in operation until 1815. Two more glasshouses were established in Sweden in 1700; two in the 1740s and ten more before the end of the century.

In view of the evidence at hand, all that can be said is that after 1676 conditions in Sweden were favourable to the production of beads; glass was becoming popular, glasshouses were being established throughout the nation, and there were plenty of craftsmen. Possibly beads were made in Sweden in the late 17th and 18th centuries. Before that time, it would appear that they were not made there and that we should not therefore expect to find beads of Swedish origin in New Sweden. The point cannot be proven from documents, however, since all those which might have helped have been lost; those which remain in the Royal Swedish Archives suggest that most, if not all, the merchandise used for American consumption was purchased in Holland.[3]

The Making of Glass Beads in America

The London customs books for 1696-98 contain reference to the importation to England in that year of £158.0.0 worth of "Great Bugle" from "Virginia & Maryland."[1] The significance of this is not at all clear; it seems, indeed, to run counter to all we know of the usual flow of trade between the Old World and the New at that time. Did these "Great Bugle" originate somewhere in Europe and were they being transhipped from the colonies for the purpose of reducing the customs duties, or were they truly of American origin? This could have been the case, for we read that glasshouses had been set up in Mexico by the Spaniards about 1535[2] and another on the River Plate in 1592. Again it is possible that small amounts of beads were made for export in the English colonies themselves.

Despite the theory that the functions of colonies was basically to supply raw materials to the mother country and, by corollary, a market for the finished products, certain manufactures were permitted in British America, partly to supply local needs and partly for export. The very first instance of this is a glasshouse built at Jamestown, Virginia, 90 years previous to the customs record cited above.

Captain John Smith, having succeeded in establishing a colony on the James River in 1606, attempted to start a glass factory. He worked through the official colonizing agency, the Virginia Company of London, which sent 70 settlers, among whom were eight Dutchmen and Poles, some of whom were glassworkers across the sea for the purpose in 1608.[3] The leading spirit in the undertaking, after Smith himself, was another Englishman, Captain Christopher Newport. Newport selected the location of the site which Smith described as being "in the woods neare a myle from James Towne," and supervised the erection of the glasshouse. Within a year it was in production and the management sent home "a tryal of glasse" for the financial backers to see. The good work was not destined to continue, however; starvation and disaster overtook the settlement and by spring only 60 of the original colonists were alive. The glassmaking venture had to be forgotten.

In 1621, one Captain William Norton petitioned the London Company to be allowed to "sett upp a Glass ffurnace and make all manner of Beads & Glasse." His request was granted, money was raised to finance the project and supplies collected. With them when they were sent out by ship was an open letter to the colonists advising them to give Norton their best assistance "and especially have a Care to seat him neare some well inhabited Place, that neither his Gange be subject to Surprise, nor the Commodities of Glasse and Beads be vilified by too common a Sale to the Indians" (italics in the original).[4] Six Italians, four of them glassmakers and the others servants, went to operate the proposed factory; a detail which did not escape the notice of the Venetian ambassador in London.[5]

The professed aim of the second establishment was set out in a letter from the Marmaduke to the Governor and Council in Virginia, dated August, 1621. He said in part;

> The making of beads is one of Capt. Nortons chiefe employments which being the money upon trade with the natives we would by no meanes have through too much abundance vilified or the Virginians at all permitted to see or understand the manufacture of them: we therefore pray you seriously to consider what proportion of beads can be vented and their worth not abated, and estimates the proportion to Capt. Norton and his Italians, and certifice the same to us in your next letters, that accordingly we may limit the quantity that shall from time to time be made."[6]

Misfortune dogged this venture, if not in such a sudden burst as the first, at least with equally disastrous results. No sooner was the house finished than a "tempest" blew off the "coverings"; of the produce of the first factory there is no record other than that two "tryals of glasse" were sent to England for inspection. Window glass and bottle glass were most likely the chief products.[7]

The site of the glasshouse was excavated recently by John L. Cotter and J.C. Harrington for the United States National Park Service, during which work a furnace and the annealing oven were found as well as the pot kiln and the cullet pile. Evidence was uncovered to show that "considerable glass was melted and fabricated," and all of it was common green glass.[8] There was nothing to support the legend that beads were made at the first glasshouse. But was Captain Norton's glasshouse on the same spot as the earlier one? Harrington sees no reason to doubt it, at least until further historical or archaeological evidence is discovered. If this is so, we must conclude that beads were not produced at Jamestown.[9]

In the final analysis, it is somewhat of an academic question whether beads were manufactured at Jamestown.

Historically it would be interesting to know the answer, but for the archaeologist it has no real significance. The beads, if any were made, would presumably have been indistinguishable from those made by Dutch, Bohemian, Polish or Muranese craftsmen elsewhere and for that reason would be of no special use in archaeological work. The production would certainly have been European in all respects, for all that it was physically based in the New World.

Several other attempts at glassmaking were made in the British colonies in the 17th and 18th centuries, but even less seems to be known about them than about the Jamestown venture. The first of these ventures was started at Salem, Massachusetts, in 1639, by Obadiah Holmes and Lawrence Southwick for the making of coarse glass, probably window panes, bottles and pans. The manufactory continued until about 1670 or 1680. Evert Duycking built a glasshouse in New Amsterdam about the same time as the Salem factory was opened and had the good fortune to have his work carried on for several generations.[10] In 1654, Johannes Smedes had a glasshouse on Glass-maker's Street in Manhattan, but sold it when the Dutch lost their American colonies in 1664.[11] Whether the Chester Creek Glass Works in Delaware County, Pennsylvania, were ever used is questionable; Knittle thinks they were not. On the other hand, Joshua Tittery, a member of one of the four great glassmaking families which emigrated to England in the late 16th century, came to Pennsylvania in 1682, the year these works are said to have been established; he came as a glassworker in the employ of the "Society of Traders" presumably the Chester Creek Works. In the 18th century, numerous glasshouses were started in the colonies, among them two in New York city in 1732, one in New Jersey operated by Caspar Wistar and his descendants (1739-81), one in Brooklyn in 1754 and one at Brown Pines, New Jersey, prior to 1776.

The existence of these factories speaks adequately for the importance of glass in the life not only of the mother countries but of the colonies as well. The home industry could not keep up with demand, and hence it was permitted to establish new plants across the sea, probably as much for supplying home as colonial markets. But no mention of beadmaking occurs in connection with any of these works so far as can be determined. It is indeed unlikely that any of them produced beads at all, for beads could be purchased in abundance in Venice and perhaps elsewhere in western Europe, and the great need of the settlers was for window glass, drinking glasses, bottles and such utilitarian items. If beads had been available for purchase locally, it would not have been necessary for Logan and other New York, Philadelphia and Boston merchants to order them from England and Holland.

The Nomenclature of Glass Beads

When something new is invented, a name must be found for it. Beads were no exception, and names have been attached to them for a very long time, doubtless almost as long as beads have been known. This paper is concerned with only those words by which beads have been designated in Italian, English, French and German, and is not concerned with those of antiquity, except insofar as Latin has had some direct or important influence.

It is probably a safe assumption that most of the terms used to designate beads in any of these languages have arisen from some practical need. A "paternoster" is, as its name signifies, used in telling the rosary. The origin of the word "bead" in English may be traced back to Old English where telling the rosary is implied. Or again, the origin of the Italian and French conterie is due simply to the use of certain kinds of beads as a sort of currency; that is, something which is "counted out."[1] The same might be said of the English names - always generic and referring to many individual varieties, as "pound," "seed," and "tube," terms which were, in practice, simple, direct ways of indicating for practical, usually commercial, purposes certain large categories of beads. For the most part, the names of individual varieties, if they existed at all, are are not now known to us except for those which came into use during the late 19th century.[2]

Readers of this paper will be most familiar with English usage and such terms as pound, seed, tube and pipe will not strike them as unusual. The word "bead" itself is commonplace, hardly requiring definition. Furthermore, most English readers will see in the above terms very practical meanings, which would be of great convenience in commercial transactions. They are, in fact, correctly used to describe bead merchandise on sample cards. Most of these terms are self-explanatory or appear to be at first glance.

The word "bead" is derived from Old English bidan (pronounced bī'dan), meaning something used to say one's prayers, but this connotation has long been lost and the word is now treated simply as a substantive noun.[3] In modern English, "bead" may refer to anything which is small, round, with a longitudinal or a transverse

perforation, made of some solid material such as stone, bone, ivory, glass, pottery, or even of seeds, wood or similar material. It usually also denotes an object used for personal adornment, but includes prayer beads and a few other types. This omnibus term is obviously insufficient for practical purposes and additional ones had to be invented. Little is known about the origin of these words, but in Italian some of the terms were in use at least as early as the 14th century. English, French and German usage may have lagged somewhat since they had no native bead industries, but once established the names have continued in use to the present.

One of the first of these names to appear in English was the word "bugle." According to Thorpe, these were "beads of black or green glass" which, he says, Autolycus cried (in the streets, as a vendor?) in 1611:

Bugle-bracelet, necklace-amber
Perfume for a lady's chamber[4]

Equivalent terms were "marguerites" or "seed pearls."[5] Bugles were small tubes of glass, usually black, used to ornament wearing apparel.

Other terms are difficult to define precisely, and they may have been used with considerable latitude. Seed beads are generally understood to be very small round beads made by the drawing process, measuring not more than 2 mm in either direction. Pound beads, according to modern usage, are likewise round beads, but may measure up to about 10 mm in diameter. Pipes, tubes, jais and macca are all tubular beads (as are the bugles) and the distinctions which the modern manufacturer makes between them are far from clear as there is a good deal of overlapping in sizes. Pipes may be fairly large, as much as 7 mm in diameter, but are distinguished by having both length and width approximately equal. Tube beads, by contrast, are several times as long as wide. Bugles are probably merely very small tubes, not over 2 mm thick. Modern jais have diameter and thickness approximately equal but are generally smaller than pipes, while macca are usually wider than they are long. Any of the above beads may be purchased in any of the colours produced in the factory, and names bear no relationship to the colour of the specimen.

The large, fancy beads, usually referred to by collectors as "candy" or "star" beads are an exception, for they have been sufficiently distinctive to have earned their own names. They are in fact large drawn beads built up of layers of glass of more than four colours and often ground at the ends. Other English names for this variety are "chevron" and "aggry" but the latter term is incorrectly applied here.[6]

It is noteworthy that in Italian there are two basic terms for beads, margariterai and perlai, and that both of these signify pearls. If the Italians had followed the

English practice, the usual word would have been a derivative of a word for prayer, probably paternoster, but this did not happen, and the paternostrerai never became a dominant group. Italian nomenclature is thus seen to be based in the first instance on an analogy with pearls, and in the second has reference to use and size, as denoted by conterie.

Bead nomenclature in French, unfortunately, is in little better case than the Italian. There was no old French bead industry which could give rise to a group of names, with the result that most terms were borrowed from Italian when beads became common. As in Italy, French paternoster-makers failed to leave an impression on the language in this respect and it remained for the French to borrow the two Italian words for beads, naturalizing them as marguerites and perles. These became the customary names for most beads, paternosters retaining their own special significance of prayer beads only. Conterie was likewise adopted from the Italian, but of course both the French and the Italian forms could be derived from Latin in any case and the words mean the same in both languages. The French do have certain words, however, which are peculiar to their language by means of which to designate beads in certain senses. Rocaille is sometimes applied to glass beads in general although more properly it refers to work in rock crystal; rassade is a term said by Cassell's French dictionary to refer to "Glass beads (for dealing with Negroes)." A few type names come to notice, but very few. Cornaline d'Aleppo was one of these and others were mentioned in connection with the Nubian trade. The French use the word verroterie to indicate a large number of items of glassware such as toys, marbles, small ornaments and beads, but it has no specific connotations.

The German language follows the Italian and French in having failed to develop any exclusive word for glass beads, Kügelchen (small glove) being the nearest. The usual word for glass beads is Perle (pearl) with Korallen (coral) having some currency connotations.

In the American trade, simple terms were used to designate beads, both in the reports of explorers and in merchants' records. The most common term of reference was to small, medium and large beads of a simple colour, as red, white, blue or black. From this one would get the impression that the variety was not great, yet we know that from very early times the Huron Indians were receiving many varieties in a great range of shapes, sizes, colours and colour combinations, including star beads. There appear to have been some which were even made especially for the Hurons in imitation of the red catlinite popular among the Indians of the Great Lakes area at that time.

The English traders in Canada likewise used simple terms, and the Hudson's Bay Company in the 1800s was still

referring to small, medium and large blue, red and white beads in its transactions.

The Indians who were supplied by dealers in the Thirteen Colonies were perhaps more fortunate, for in the accounts from this region we find references to several more interesting varieties of beads. John Mallefield, probably a merchant of Springfield, Massachusetts, who died there in 1711, left a stock of "amber beads" valued at 6d.[7] In Philadelphia, James Logan, a prominent Quaker merchant and citizen, ordered his agent in London, John Askew, in 1720 to send him

> 100lbs of small, coloured bright beads, some round some angular some of them white or pale as ye Smallest of these last sent some clear glass. All ye rest very lively colours in time that ye Drawback may be had otherwise some Jett some be Jett Black.[8]

Seven years later, Logan ordered "Beads of a good blue and cutt into 8 sides about ye size of a hazelnut or middling grape 40 or 50lbs;"[9] these were certainly the facetted type and probably of Dutch make. In another entry, for 1723, Logan ordered "Carnation according to ye Sample sent last fall 10lbs of ye common Small round Beads, white black blue & green about 50 or 60lbs. but most of the White about this sizeo."[10] No further designation of "carnation" is given, but they were a success with the Indians. Of them, Logan wrote another of his agents in England, Samuel Stork, saying, "The Carnation Beads are a small new fashion in little bunches of Strings not weighing above 2 oz. or thereabouts, they [a]re angular and their Colour very lively. T.L. had a parcel of them (I believe) from Holland. Very cheap and they sell dear."[11] Many citations of similar import could be given. In a "State of Presents Wanting to Compleat an Assortment for a Meeting proposed to be held with the Indians in 1766," a Colonial Office paper, mention is made of "White Barley Corn Beads, @ 5/-" and of "Black ditto @ 5/-;" "White Large Barley Corn Beads @ 5/-" and bunches of "white small round beads."[12]

Few sample books exist to show what range of choice was presented to middlemen. There is said to be in existence a tariff for Venetian beads dating to 1800 which gives the rates to be charged at various ports in Europe.[13] An early sample card is on display in Johnson Hall, in Johnstown, New York, which seems to date from about 1830 or 1840, and to be of Venetian origin.

In summary, the nomenclature of glass beads must be described as unsatisfactory from the archaeologist's point of view. Those nomenclatures which do exist are based essentially on size and on the analogy with pearls, and are not specific. They relate in some cases to manufacturing processes and then only vaguely. By way of commendation, it

can be said that there appears to have been a tendency during the past century or so toward some sort of standardization of terms although these terms are not usually very meaningful.

Terms used in Connection with Glass Beads

Alkali: Any one of the basic salts required to make glass, such as soda
A lume: At the lamp: see suppialume
Annealing: The process of cooling the glass to room temperature, thereby toughening it for use
Annealing Oven: See lear
Avanturine glass: Glass "in which numerous particles of copper (or of silicate of copper) are diffused through a transparent yellowish mass, and said to have been invented by a Miotti about the beginning of the 17th century." The secret was preserved in one family and in 1772 made only in one glasshouse, according to De La Lande.
Appliqué: The process of setting small ornaments of glass of another colour into a glass object
Barilla: "Alkali obtained by leaching the best ashes, filtering and evaporating, drying and calcining, and finally grinding to a powder"
Batch: The raw materials prepared for melting in the furnace, i.e., the mixture of frit and cullet
Blowing Iron: An iron tool used in the blowing of glass, about five feet long, hollow, and with the near end encased in wood for safe handling. Canna da soffio (Ital.).
Blown glass: Any glass object expanded by use of a blowing iron
Borsella: A rod for punching a hollow into the end of the gather while it is still on the rod
Bugle: A small coloured, tubular glass bead for sewing on dresses
Calcar: A furnace used for the preparation of glass metal by converting sand and potash to frit. Such furnaces were used by the more affluent beadmakers at Murano.
Cane: A solid rod of glass, often coloured
Canna: "Cane" in Italian
Canneri: Men who make canes of glass
Casing: The process of covering a glass object with glass of another colour, sometimes known as "flashing"
Cernatrici: Women who sort beads into various sizes
Charlottes: Same as marguerites

Chevron: See Star
Conradore: The maker of a batch (Ital.)
Conterie: Large beads of glass: a common kind of bead: the ordinary beads of commerce
Coperta: A layer of glass on glass (Ital.)
Cornaline: A bead having an opaque white enamel core covered by or "cased" in ruby enamel
Cullet: Broken and waste glass used to mix with the frit to make a batch
Enamel: Opaque glass with colouring matter in it. Term usually indicates raw material for making enamelled glasses or beads
Ferri da canna: Gathering irons 12 to 15 ft. long used to collect glass from the crucibles (Ital.). See Gathering iron.
Fining: The process of removing bubbles from glass by throwing the hot mass into cold water
Flashing: See casing
Fondant: Same as paston; the gathering of glass after it has been "punched" to make a concavity
Frit: The mixture of silica, salts of alkalis and colouring matter, heated sufficiently to cause it to fuse slightly
Furnace: The apparatus used to heat the batch to the melting point and keep it there for as much as 48 to 60 hours
Gall or scum: Impurities which rise to the top of the pot as the batch is heated and made to boil. It is waste and must be skimmed off.
Gather: The molten glass collected on the end of the gathering iron from the pot
Gathering iron: A solid iron rod with a wooden handle used to gather the molten glass from the pot and bring it out of the furnace
Glory hole: The port in a furnace through which the molten glass is extracted, or through which the partly finished object is thrust for re-heating
Jais: The same as bugle, q.v.
Lear, leer, lehr: A heated chamber used to cool glass gradually, i.e., to anneal it. Originally part of the furnace, but for the past two centuries or thereabouts a separate furnace has been used to anneal the finished glass.
Lucidation: (Lucidazione, Ital.) polishing
Macca: A small faceted bead of drawn type about 3 mm in diameter and 4 or 5 mm long
Marguerite: A small tubular bead formerly used for embroidery work (margharita, Ital.)
Marver: An iron slab (originally marble) used to roll the paraison and which may be smooth, corrugated, etc.
Metal: The raw materials for glassmaking, when fused: the final material of glass, whether in the molten or solid form

Millefiori: (Ital. "thousand flowers") A type of glass built up by using many small cross sections of compound glass rods made up of different colours, usually in a pattern of some sort and imbedded in usually colourless glass

Minio: Oxide of lead used in colouring glass at Venice

Paraison: A bubble of molten glass formed at the distal end of the blowing iron when air is blown through it. The paraison is then worked further into vessel, tube, etc.

Paste: A glass material used for re-melting and fabricating objects of glass

Perle: A common term for a glass bead in German, French and Italian: a rosette bead same as star or chevron

Pipiotto: Same as macca, a small drawn bead 3 mm in diameter and 4 or 5 mm long

Pontil: A solid rod of iron used in several ways to perform certain functions. One of these uses is to attach it to the end of a paraison to draw it out into a cane. There are several variations of the word, as punty, puntee and ponty (consaura, Ital.).

Pot: The vessel or crucible of refractory material into which the batch is put for melting

Pound bead: A bead small enough to make measuring by pound weight a convenient form of measurement

Rassade: A common French term for any kind of bead (in gross)

Rocaille: French term for large beads in general

Rod: See cane

Rosetta: See star, chevron, or perle à rosette

Scagner: The master of the bead works

Scontro: A semi-cylindrical block of iron or steel set beneath the chisel to regulate the lengths of glass as they are cut

Seed: Very small drawn beads resembling seeds in size. Always of the drawn type.

Siege: The bench running around the inside of the furnace melting chamber upon which the pots or crucibles are set for firing

Siribiti: A mixture of lime and charcoal for filling the holes in beads before rounding them in the furnace

Smalt: The dark glass resulting from fusing calcined cobalt mixed with sand and potash, then ground between very hard stones

Star: A kind of bead, varying in size from very small to as much as an inch in diameter, built up by layers of coloured glass (usually red, white and blue), and often ground at the end to show the layers. The same as chevron, perle à rosette.

Supplialumi: Beadworkers who worked at the lamp

Tirador: The man who runs with the iron rod to which the end of the paraison is attached to draw it into a cane or a tube

Tube: A hollow rod of glass

Verixelli: Small glassware (Ital.) and the beads they made
Verre de fougère: Glass made with fern ash; it is characteristically milky-green, semi-opaque, and of roughish surface. It is equated by some with Wald glass, and in Italian with vetro di foresta.
Verrerie: Glass vessels and glassware in general (Fr.)
Verroterie: French word for small glassware, including beads
Vetro di foresta: See verre de fougère
Vitrail: Window glass (Fr.)
Wald glass: Glass made in the forests of western Europe, usually by the use of hardwood (beech) ash
Wire-wound: A bead made by the process of melting a strand or strands of glass and winding them around a piece of wire. The equivalent of beads made a lume; suppialume.

Appendix A. Important Dates in the History of Glass Beads.

A.D.	
580	Glass mosaics for Santa Euphemia in Grado probably made at Venice.[1]
586	Venice founded by Lombards.
674	Venerable Bede records glass ordered for windows of Wernemouth from Venice.[2]
700-800s	Glass jewels and beads of various colours believed to have been produced in Bohemia.[3]
800-950	Glassmaking almost ceases at Venice.[4]
982	Venetian *fiolari* mentioned as working in monasteries.[5]
1000	Glassmaking at Altare begun by a group of Frenchmen.[6] Theophilus Regulus wrote a book containing four chapters on glass. Honey says W. Theobald has proven Theophilus lived about 1000 and not 1100.[7]
1063	Document of 20 December 982 is copied. It is the oldest in existence which refers to Venetian glass. (*See* n. for 1308.)
1082-1090	Venetian *fiolari* referred to again.[8]
1100	Glass first made in Venice before 1100.[9]
1200-1300	Beadmaking begins its upsurge in Venice.[10]
1204	Conquest of Constantinople by western powers, including Venice.
1226	House in Chiddingfold, England, making glass.[11]
1226-40	Lawrence Vitrarius made window glass for Westminster Abbey.[12]
1255	Furnaces probably operating in Venice.[13]
1268	Beads and glass vessels are said to have been made at Murano by Martin da Canale.[14]
1271	Venetian *fiolari* produce document called the *Capitulare* which contains some technical procedures.[15]
1279	German pedlars restricted to carrying from Venice ten *lire*'s worth of glass rods for making beads.[16]
1282	Venetian products begin to be exported by German itinerant merchants.[17]

1285	A glass house may have been in operation in Murano at this time. A fiolario of Murano was a judge then.[18]
1285	Spectacles invented at Venice.[19]
1291	All glass furnaces in Venice were ordered to be extinguished and removed to Murano.[20]
1292	Laws concerning glassmaking in Venice relaxed provided certain rules are observed.[21]
1295	Marco Polo returned to Venice and encouraged bead trade to the East.[22]
1296	Beads first used in embroidery; early colors were red, white and green.
1299	Spectacles first mentioned as being made of glass. Attributed to Salvino d'Armento of Florence. First made of rock crystal but soon after of glass.[23]
1300-1400	Glass coloured in the mass first made at Venice.[24] Sometime during this century emery introduced from Asia Minor. Glass beads for rosaries began to be used in Czechoslovakia under the influence of the Dominicans.[25]
1300	William Le Verrir ends his business at Chiddingfold.[26]
1303	Venetian government takes steps to prevent expatriation of its glassmakers.[27]
1305	Village glassworks at Niederaltaich in Bohemian forests making glass.[28]
1308 & 1318	Documents make explicit reference to the making of glass for mosaics and windows for the first time.[29]
1317	Mirrors made at Venice are mentioned in documents, but still uncommon.[30] Giovanni, the "fioler," made great improvements in coloured glass; probably invented star beads.[31]
1318	Venetian glassmakers divided into four guilds.[32]
1326	Fabrication of false gems prohibited.
1340	Evidence of glass factories near Nuremberg.[33]
1342	Church windows made at Leipzig.
1394-1399	Glassware, very likely Venetian, is exported to Flanders and London.[34]
1400-1500	Elegant vessels being exported from Venice to rest of Europe. Millefiori process invented or re-invented.[35]
1421	Paternoster factory land acquired at Revenstein (presumably for glass beads).[36]
1432	Leipzig already prominent in glassmaking. Church windows made and painted there. Vertrendon de la Broxquière says Venice renowned for its glass in the Holy Land.[37]

1436-1448	Glass houses in operation at Momignies, Belgium.[38]
1443	Recipe for making imitation chalcedony or schmaltz.[39]
1445	Law introduced at Venice prohibiting the sale of glass beads as precious stones.[40]
1450	No "works" on Venetian glassmaking exist prior to the middle of the 15th century.[41]
1453	Constantinople captured by the Turks.[42]
1454	Strict rules enacted about carrying information outside the Republic. Death penalty imposed.[43]
1460-63	Pure uncoloured glass perfected in Venice.[44]
1463	Industries of paternosters and false pearls greatly increased.[45]
1471	William Teele of York is paid 12d. for 40 pairs of beads of yellow glass for the making of window glass for the minister.[46]
1480	Statute of Fournai says that no one but a master may make glass "soit à la canne soit en pot et en table."[47]
1486	Making of paternosters used as a test for admission to rank of master.
1490	Glassmakers at Venice placed under jurisdiction of the Council of Ten, thus removing them from the lesser authorities.[48]
1500-25	Evidence that ruby and cobalt blue used in English glass, if only experimentally.[49] Leandro Alberti reports 24 glasshouses at work in Venice.[50]
1503	A mirror factory functioning in Flanders.[51] Andrea and Domenico de Angelo del Gallo invent new processes for making mirrors.[52]
1506	Glass factory at Hainault, Belgium, for making fern glass and enamelled ware.
1507	Donzale del Gallo brothers petition Council of Ten at Venice for permission to make glass mirrors according to the Flemish formula.[53]
1526	First leak of glass secrets from Venice occurred when Plenio del Sol got licence to set up gilded glass factory in Paris.
1528	Andrea Vidaore invented process of suppialume making for beads. "Andrea Vidaore appointed supervisor of the manufacture of enamelled pearls of a type called 'Suppialume' or flame-thrown. Star beads in use."[54]
1530	The popularity of Venetian glass so great that it led to the founding of glasshouses in The Netherlands.[55] Avanturine glass invented by Christoforo Briani. Also coloured glass in imitation of precious stones.[56]

1547 The Council of Ten decreed the death penalty for anyone taking information on the making of glass to a foreign country.[57]

1548 Large emigration of Altarists from Italy to France.[58]

1550 Wood for fuel becoming scarce in England.[59]

1551 Henri II tries to establish a glassworks at Saint-Germain-en-Laye.[60]

1551 Teseo Mutio of Bologna obtained from Henri II permission to set up factories to make glass, enamels, etc. in all parts of France.[61]

1564 Venetian mirror-makers form a trade syndicate.[62]

1570 Italian glassmakers working in Prague.[63]

1557 Glass made in England at Crutched Friars in London. (This must mean glass in the Venetian fashion for glass was made long before this in England by other means.)[64]

1567 Carré licensed to make window glass in England at Alford and probably London. Crutched Friars plant working 1575. In 1571 he employed seven Venetians.[65]
A glass house operating at Anvers.[66]

1579 Sebastian Orlanden, a Venetian, makes glass in England, including glass bugles.[67]
Bugle beads made at Buckley (near Rye) in England by Sebastian Orlanden, Godefroy Delahaye and Mr. Okes.[68]

1592 Fabricate di Conterie (beads, false stones and glass jewels) permitted again in Venice itself.[69]

1593 Statutes at Venice recognize the right of the makers of paternosters to make paternosters and buttons of glass and enamel.[70]

1594 Vincenzo Bussoni d'Altare and the Mantuan Tomaso Bartoli built furnaces at Rouen to make enamels and other things produced in Venice in 1594.[71]

1595 Thuringian glass industry founded by Hans Greiner and Christopher Muller at Lauschaw. Much of the production consisted of materials for making dolls' eyes, beads, etc.[72]

1595 Glass bead of topaz colour introduced at Venice.[73]

1598 Two glassmakers from Altare (Italy) get permission to rebuild a glasshouse at Rouen, France.[74]

1599 Bernardo del Pin invented a hydraulic polishing machine which allowed him to make imitation diamonds. Law passed in 1445 against anyone selling them as genuine.

1600 Italian glassmakers employed in Bohemia after about 1600. They were working in Prague in 1570.[75]

1600 Vencent Saroldo obtained permission to make all sorts of glassware at Paris, Orleans, Rouen, Caen, Angers, Poitiers, Bordeaux, Toulouse, Lyons, Marseilles and elsewhere.[76]

1604 Topaz and hyacinth-coloured glass patented (?) by Giralamo Magagnati.[77]

1606 There were 251 bead and rosary firms in Venice.[78]

1607 Jamestown, Virginia, glassworks set up.

1608 The glass furnaces in Kent, Surrey and Sussex have already consumed most of the surrounding forests.

1610 Glass rods (canes) found on site of a glasshouse at Sidney Wood.[79]
Glass made at Anvers and Liège cannot be distinguished from that made at Venice.[80]
Glass first made in Scotland, so far as is known.[81]

1611 Bugle beads were being hawked in London.[82]

1612 Neri's Arte Vitraria published - many colour formulae included in it.[83]

1616 Thermometers first made in Bischfigein (?) by S. Green.[84]

1620 Subscription list started in Jamestown, Virginia, to begin a glasshouse and in 1621 the London Company sent workers to make it.[85]
Bohemian and English makers flood Europe with their cut glass.[86]

1621 Captain Norton charged with ruining the glasshouses at Jamestown, Virginia.[87]

1622 Giralamo Landa reports that the English have sent "Muranese from London to Virginia and the West Indies for glasswork."[88]

1626 New processes for making coloured glasses while still retaining their transparency discovered at Venice by Giralamo Magagnati.[89]

1629 Suppialume makers inscribed in sciola of paternostreri and margariteri.[90]

1630 Abraham Fino taught suppialume method in Nuremberg. He came there from Amsterdam.[91]

1631 Venetian suppialume workers receive their own council and president.[92]

1635 Sir Nicholas Cripps obtains patent for making glass and "vending of beads" from Charles I.[93]

1639 Glassworks set up at Salem, Massachusetts, for making coarse bottles.

1643 Duke of Buckingham sent for Venetian glassworkers, glass polishers and glass grinders.[94]

1648 Suppialume workers obtain a separate council and president.[95]

1662 Merret's edition of Neri's work on glass appeared.[96]

1673 First plate glass made in England, for use in looking glasses and coarse windows, at Lambeth.[97]

1674 There were 11 first-rate bead and rosary firms in Venice.[98]

1677 An especially brilliant enamel was found, called L'Aventurine which was particularly popular in the mid-18th century.[99]

1679 Haudicquer de Blancourt's book L'art de la verrerie appeared.[100]
Kunckel translated Neri's book on glass into German.[101]

1680s Czech glassmakers sent teamster caravans from Ceska Lipa to Poland, the Baltic lands, Russia, Denmark, Sweden, The Netherlands, Germany, France, Spain, Hungary, Transylvania and Constantinople.[102]

1685 French artisans silver and install glass mirrors in palace of the king of Siam.[103]

1687 Advertisement in London Gazette for "Black glass buttons."[104]

1690 English glassmakers at work in Hamburg.

1696 Importation of "bugle" into England amounted to 20,855 pounds.[105]

1700 Glassmakers of Nevers, France, produce glass in topaz, emerald, hyacinth and aquamarine colours.[106]

1705 Laws prohibiting giving information on glass secrets outside Venice enacted.[107]

1706 Advertisement of Peter Gaffere, beadmaker, appears in London Gazette.[108]

1717 The Miottis given permission to make "Bohemian" glass in Venice.[109]

1718 The making of artificial pearls was invented by Janin, a paternoster and coral worker.[110]

1720 Nuremberg had eight mirror glass factories.[111]

1725 First imitations of conterie appeared at Prague and Nuremberg.[112]

1725 At Chaillot, France, Dupin and Drumgold were permitted to make "glass and all sorts of enamels," the materials for making necklaces imitating pearls and other kinds of vitreous matter.[113]

1727	Glassworks at Bayel, France, were making glassware for export to Spain, Portugal, Mexico and the Indies.[114]
1730	Zuanne Cedolin and Pietro Sicca took art of beadmaking to Amsterdam, and at about same time it was taken to Florence and Pisa by Battelo and Milani (to Pisa).[115]
1730s	Czech exporters of glass were using export companies and setting up permanent warehouses abroad, in important towns of Europe and overseas.[116]
1731	Suppialume process consumes 800 lbs. of oil daily in Venice.[117]
1732	Glassworkers making glass in Connecticut and New York.
1736	Guiseppe Briatti (?) receives ten-year patent to make "Bohemian" glass in Venice.[118] Jacobus Buseneollo given privilege of making "Bohemian" glass in Venice.[119] Venice had an estimated 30 first-rate glasshouses.[120]
1738	There were 30 firms dealing in beads in Venice.[121] Caspar Wistar imports glassworkers from Holland.
1740	Bohemian exporters set up permanent warehouses in all important ports and inland cities of Europe.[122]
1745	Coloured glass became very popular in England.[123]
1746-47	Venice had 6 glasshouses using 33 pots for fine and 26 for ordinary tube beads, and produced an estimated 3,900,000 pounds per year.[124]
1750-1800	Czech glassmakers had agents in 54 European cities and six centres overseas.[125]
1754	Bead factories established at Florence by Gioven Antonio Gazabin and three brothers.[126] Glassworkers at work in Brooklyn, New York.
1755	There were 52 bead and rosary firms in Venice.[127]
1762	There were 15 firms in Venice employing 200 master workers.[128]
1764	Venetian factories turn out an estimated 44,000 pounds of beads per week.[129] Twenty-two furnaces making glass beads in Murano, producing ca. 44,000 pounds of beads per week.[130]
1765-66	De Lande reported 15 glasshouses working at Murano.[131]
1768	The Bertolinis discover a process to imitate polychrome porcelain. Polychrome porcelain bead introduced at Venice.[132]

1772	Avanturine glass made in one glasshouse only.[133]
1773	Bead factory set up at Rome by Battista Zanoni. Quite successful.
1775	Dutch smugglers bring large amounts of beads from Prague and Nuremberg to London and undersell Venice.
1784	Unemployment in Venetian glass industry.[134]
1788	False pearls made in Paris.[135]
1789	Beads were imitated in Birmingham, or perhaps only finished there.
1790-99	An estimated 600 to 1,000 workmen employed at Venice in making suppialume beads alone.[136]
1797	Venetian workmen taken to France (to vitalise the French industry?).[137]
1799	Fall of Venice to Napoleon and end of the old regime.[138] Napoleon instructs officer (Berthier) to find the formula for conterie and bring it to Paris. Berthier writes that he did not succeed, 5 Nivose.
1800	A bead tariff lists 562 "species" of beads and a "grandissimo" number of "sub-species."[139]
1806	The privileges as well as the corporations relative to glass are abolished (at Venice) in favour of French industry, with the result that in 1836 the fifty establishments for the making of glass in Murano had dwindled to 12.[140] Freedom restored to the arts and crafts of Venice and the old corporations abolished.[141]
1817	Machine introduced which makes perfectly round beads.[142]
1838	Glassmaking revived at Venice.[143] Ancient processes of making glass revived in Venice by D. Bujolin.[144]
1843	Use of gas in blow pipes introduced.[145]
1880	Venice produced in this year 6,000,000 pounds of glass beads.[146]

Endnotes

Glass Manufacturing in Western Europe

1 Edward Dillon, Glass (London: Methuen, 1907), p. 3.

2 See G.H. Kenyon, "Some Comments on the Medieval Glass Industry in France and England," News and Reviews of the Society of Glass Technology, Vol. 43, No. 18 (1959), 17n, where he notes that there were 168 glasshouses in France up to 1500, but that in England up to 1066 only three glasshouses are known to have existed. See also James Barrelet, La verrerie en France de l'époque gallo-romaine à nos jours (Paris: Larousse, 1953).

Glass and the Making of Glass

1 This extremely brief and cryptic characterization of glass should be amplified by consulting one or more of the excellent books and articles available on the physics of this substance, as G.O. Jones, Glass (London: Methuen, 1956); R.J. Charles, "The Nature of Glasses," Scientific American, Vol. 217, No. 3 (September 1967), pp. 127-36, and Robert H. Brill, "A Note on the Scientists' Definition of Glass," Journal of Glass Studies, Vol. 4 (1962), pp. 127-38. Brill notes that on cooling the molecules in any substance take on a natural arrangement called a "lattice" characteristic for that substance. In glass the lattice is highly irregular.

2 It should be emphasized that these were merely the materials most commonly used in the 16th, 17th and 18th centuries. No attempt is made to discuss the complex formulae developed and used in the modern glass industry which result in the amazing array of glass products now available from beautiful lead crystal creations to heat-resistant ovenware. Readers interested in these matters are referred to any good periodical on glass manufacture, such as the Journal of the Society of Glass Technology where ample details will be found.

3 Furnaces in the 15th to 18th centuries generally had four ports.

4 See Apsley Pellat, Curiosities of Glass Making: With Details of the Processes and Productions of Ancient and

Modern Ornamental Glass Manufacture (London: D. Bogue, 1849), p. 108; "Bead-making in Murano and Venice," Journal of the Royal Society of Arts (August 1919), p. 607.

5 See Apsley Pellat, op. cit., p. 115.

6 Used in making bowls and bases, the studs were often representations of flowers, and as dozens or even hundreds were used in the fabrication of a single object, the ware came to be known as "millefiori," and by extension the word is sometimes applied to the process of making them. Antonio Neri, Art de la verrerie de Neri, Merret et Kunckel... (Paris: Durand, 1752), p. 429.

The Making of Glass and Beads at Venice and Murano

1 For a discussion of the several theses of the beginning of the industry in Venice, see Astone Gasparetto, "Aspects de la verrerie venétienne antérieure à la renaissance," Cahiers de la Céramique, du Verre et des Arts du Feu, No. 17, pp. 9-10.

2 Bartolomeo Cecchetti, Delle origini e dello Svolgimenti dell'arte vetraria Muranese (Venice: Alti Inst., 1872).

3 Theophilus' work is generally assigned now to around A.D. 1100. See Robert Hendrie, trans., An Essay upon Various Arts...by Theophilus... (n.p., 1847) and later works by this monk.

4 Jules Labarte, Handbook of the Arts of the Middle Ages and Renaissance, as Applied to the Decoration of Furniture, Arms, Jewels, etc. (London: J. Murray, 1855), p. 340; Gustav A. Eisen, Glass, its Origin, Chronology, Technic and Classification to the Sixteenth Century (New York: W.E. Rudge, 1927), Vol. 2, p. 719; Pieter d'Hondt, Venise. L'art de la verrerie, histoire et fabrication (Paris: Librairie Centrale des Beaux-Arts, 1893), p. 9 and Edouard Gerspach, L'art de la verrerie (Paris: A. Quantin, 1885), pp. 144-46. This author related that a Muslim potentate ordered 900 mosque lamps from Murano in 1569 (p. 170).

5 Alexander Nesbitt, Glass (London: Chapman and Hall, 1878), p. 69.

6 Karel Hettes, Glass in Czechoslovakia (Prague: SNTL, 1958), p. 11. This observation applies only to Czechoslovakia but may hold for other countries as well.

7 Edward Dillon, op. cit., p. 185.

8 Ibid., p. 183.

9 Karel Hettes, op. cit., p. 17.

10 Guiseppe Morrazoni and Michelangelo Pasquato, Le conterie veneziane (Venice: Società Veneziana Conterie e Cristallerie, 1953), pp. 39-40.

11 Jules Labarte, op. cit., p. 339.

12 Alexander Nesbitt, op. cit., p. 73.

13 Guiseppe Morrazoni and Michelangelo Pasquato, op. cit., p. 7.
14 Alexander Nesbitt, op. cit., p. 93.
15 Vincenzo Zanetti, Guida di Murano e delle celebri sue Fornaci vetrarie (Venice: Antonelli, 1866), pp. 254-6. It is uncertain whether Zanetti is referring to 1746 or to 1846 here, but more likely the latter.
16 Guiseppe Morazoni and Michelangelo Pasquato, loc. cit.
17 Alexander Nesbitt, loc. cit. He says that De Lande reported only 15 glasshouses at Murano in 1765-66 (p. 85).
18 Guiseppe Morrazoni and Michelangelo Pasquato, loc. cit.
19 Alexander Nesbitt, loc. cit.
20 Gustav A. Eisen, op. cit., p. 720.
21 Edward Dillon, op. cit., p. 190, means by this, trading posts, not manufacturing establishments.
22 Alexander Nesbitt, loc. cit., noted that about 1764, "one house at Liverpool bought beads to the value of 30,000 ducats annually."
23 M.A. Wallace-Dunlop, Glass in the Old World (London: Field and Tuer, 1882), p. 154; --- Warren, "Venetian Glass," The House Beautiful, Vol. 4 (November 1898), p. 211. According to a press report in the Christian Science Monitor for 21 October 1952, the Venetians recently opened a plant to make glass beads in Johannesburg for native South Africans, the value of which trade they estimated at $280,000 annually.
24 Joseph D. Weeks, Report on the Manufacture of Glass (addressed to the Hon. C.W. Seaton, Superintendent of Census from Pittsburg, Pa., on March 21, 1883) (N.p.: n.p., n.d.), p. 70.
25 Alexander Nesbitt, op. cit., p. 67. Dillon notes that the organization into guilds did not occur until the 14th century (Edward Dillon, op. cit., p. 181).
26 Alexander Nesbitt, op. cit., p. 68. This author notes here that glass furnaces may have been operating in Murano before 1291.
27 Edward Dillon, op. cit., pp. 182-3; Alexander Nesbitt, op. cit., pp. 67, 91-2. Nesbitt took his details from Cecchetti.
28 Cecchetti is said to have believed that the cristallerai changed to making rosaries from ornamental glass.
29 Edward Dillon, op. cit., p. 183.
30 Florent Pholien, Les verreries au pays de Liège. Etude retrospective (Liège: Aug. Bénard, 1889), p. 39; see also Edward Dillon, op. cit., p. 183.
31 Alexander Nesbitt, op. cit., p. 67.
32 Ibid., p. 93.
33 Edward Dillon, op. cit., p. 183. He is referring in the latter quotation to the makers of suppialume beads who did not work to any extent in Murano.

34 For a discussion of the ennoblement of glassmakers at Venice see Alexander Nesbitt, op. cit., p. 73.

35 Ibid. Other authorities give 1547 (Florent Pholien, op. cit., p. 41) and 1705 (Gustave A. Eisen, op. cit., p. 720), but these dates may have reference rather to a reaffirmation of this law.

36 Two of these are especially important. A translation into English by Christopher Merret was published in 1662; another, in German, was edited by Johann Kunckel, and later translated into French in 1752. Kunckel's book is significant for its annotations and comments. Later descriptions of glassmaking based of necessity on these earlier works were given by such writers as Haudicquer de Blancourt, Hondt, Nesbitt, Zanetti and Gasparetto. Most of the later authors benefited from archival research, thus introducing some improvements on the work of Neri. For the 19th century, one of the best works is an eye-witness description of an anonymous American naval officer who described the various steps in the process of beadmaking in 1835. Assuming that the basic processes had not changed appreciably in the past three or four centuries, we can accept his account as applicable to 16th, 17th and 18th century Venetian and Murano processes. Another, almost equally good account was published anonymously in the Journal of the Royal Society of Arts in 1919 under the title "Bead-making at Murano and Venice."

37 Astone Gasparetto, op. cit., p. 41.

38 The question arises whether bead-makers would require a complement of three furnaces because beads from canes seem not to have been cooled in a lear but in a large, very warm room where the men worked. However, there has always been a great deal of secrecy about the making of drawn beads, and this point is not clear.

39 Vincenzo Zanetti, op. cit., p. 23.

40 Leandro Alberti says there were 24 glasshouses operating in 1500-25 (Alexander Nesbitt, op. cit., p. 73), while in 1606 there were 251 bead rosary firms in Venice (Guiseppe Morrazoni and Michelangelo Pasquato, op. cit., p. 7.).

41 Astone Gasparetto, op. cit., p. 41.

42 Alexander Nesbitt, op. cit., p. 93.

43 Astone Gasparetto, op. cit., p. 41.

44 Reginald George Haggar, Glass and Glassmakers (London: Methuen, 1961), p. 73.

45 Astone Gasparetto, loc. cit.; Vincenzo Zanetti, op. cit., pp. 24-5, says that soda was obtained from Catania, natron from Egypt and that many other materials such as lead, arsenic and antimony were used.

46 "Miscellaneous Communications from an American Naval Officer Travelling in Europe; Forwarded from the

Mediterranean, May, 1834," American Journal of Science and Arts, Vol. 27 (January 1935).

47 "Bead-making at Murano and Venice," Journal of the Royal Society of Arts, Vol. 67 (August 1919), pp. 605-9.

48 The term "fondant" corresponds to "metal" here.

49 William Bowyer Honey, English Glass (London: Collins, 1946), p. 55.

50 Guiseppe Morrazoni and Michelangelo Pasquato, op. cit., pp. 20-21. This statement is confusing because it is not clear whether no beads were made in any other colours at that time, or simply that only these colours were used in embroidery.

51 Gustav A. Eisen, op. cit., p. 719.

52 Alexander Nesbitt, op. cit., p. 74. More correctly, one should say "rediscovered" for the process had been used in antiquity.

53 This event was just 36 years after Columbus discovered the New World; thus wire-wound beads will have little chronological value for the archaeology of the Americas.

54 Guiseppe Morrazoni and Michelangelo Pasquato, op. cit., p. 23 give the date as 1677; Gustav A. Eisen, loc. cit.

55 Gustav A. Eisen, loc. cit.

56 Florent Pholien, op. cit., p. 72.

57 Guiseppe Morrazoni and Michelangelo Pasquato, op. cit., p. 23.

Bead-Making in France

1 London. Public Record Office, E190/14/5, "Imported by Alien Merchants to London 1697-98."

2 Ibid., E190/26/2, "Imported by Alien Merchants to London 1621-1622;" E/190/24/4, "Imported by English Merchants to London, 1620-1621."

3 Ibid., E190/31/3, "Imported by English Merchants to London, 1625-1626;" E190/34/2.

4 Ibid., Customs 3, 1 Part 1; Customs 3, 1 Part 1, outports.

5 James Barrelet, op. cit., p. 64. Much of this present chapter is based on Barrelet's excellent work.

6 James Barrelet, op. cit., pp. 43, 44. At this time, Lorraine was preeminent in the making of window glass, which she exported to The Netherlands, England and Switzerland (James Barrelet, op. cit., p. 66).

7 James Barrelet, op. cit., pp. 64-66, 89; Warren C. Scoville, Capitalism and French Glassmaking, 1640-1789 (Berkeley: Univ. of Cal. Press, 1950), p. 21; Frances Rogers and Alice Beard, 5000 Years of Glass (New York: Frederick A. Stokes, 1937), p. 6; William Arnold Thorpe, op. cit., p. 124; Florent Pholien, op. cit., p. 33 and Edward Dillon, op. cit., pp. 222-34.

8 Warren C. Scoville, op. cit., p. 22.

9 James Barrelet, op. cit., p. 65; Florent Pholien, op. cit., p. 15, and Edward Dillon, op. cit., p. 236.
10 James Barrelet, op. cit., pp. 85-118; see pp. 91-4 for description of enamelling in France at this period.
11 Albert Parent, La bouton à travers les âges (Paris: Alepée & Cie, 1935), pp. 20, 21; James Barrelet, op. cit., pp. 154, 166. Parent says that included in the rights of the paternoster makers were those of making rosary beads, enamel buttons, gilding on glass, earrings, belts, chains, collars, bracelets, string beads, and all kinds of glassware.
12 James Barrelet, op. cit., p. 105.
13 Warren C. Scoville, op. cit., quoting Archives Nationales F^{12}, 1486.
14 Jules Labarte, op. cit.

Germany and Austria

1 Florent Pholien, op. cit., p. 13.
2 P. Martell, "On the History of the Glass Industry and Pottery Trade in (of&) Thuringia" (abstract), Journal of the Society of Glass Technology, Vol. 18 (1934), "Abstracts and Reviews," p. 453. Original in Glashütts, Vol. 64 (1934).
3 Edward Dillon, op. cit., pp. 177, 184, 292.
4 Josef Blau, "Bead Makers and Bead Glasshouses in the Bohemian Forest," Glastechnische berichte, Vol. 19, No. 3 (March 1923), pp. 89-98.
5 P. Martel, op. cit.
6 William A. Rublee, "Report on the Manufacture of Plate Glass," in Joseph D. Weeks, op. cit., pp. 240, 263.
7 Edward Dillon, op. cit., pp. 184-5; see also Erich Egg, Die Glashütten zu Hall und Innsbruck im 16. Jahrhundert (Innsbruck: Universitätsverlag Wagner, 1962).
8 John Houghton, Husbandry and Trade Improved... (London: Woodman and Lyon, 1727) Vol. 9, No. 196, 2 May 1696 and Vol. 8, No. 189, 13 March 1695/96.
9 London. Public Record Office, Customs 3, 1 Part 1.
10 Pers. com., Dr. Van Lutterwelt, (6) keeper of the First Section, Algemeen Rijhsarchief, Stravenhage, 8 September 1956.

The Low Countries

1 Ephraim Lipson, The Economic History of England (London: A. & C. Black, 1915-31), Vol. 3, p. 56.
2 Amandus Johnson, The Swedish Settlements on the Delaware; Their History and Relation to the Indians, Dutch and English, 1638-1664, with an Account of the South, New Sweden, and the American Colonies, and the Efforts of Sweden to Regain the Colony (Philadelphia: D. Appleton and Co., 1911) Vol. 1, p. 34.

3 Jules Houdoy, Verreries à la façon de Venise: la fabrication flamande, d'après des documents inédits (Paris: A. Aubry, 1873), p. 5.
4 Florent Pholien, op. cit., p. 16.
5 Frans Coenen, Essays on Glass, China, Silver, etc. in Connection with the Willet-Holthuysen Museum Collection, Amsterdam (London: T.W. Laurie, 1907), p. 17n.
6 In 1507 a Venetian firm asked permission to imitate Flemish mirrors; see Florent Pholien, op. cit., p. 33.
7 L.J. Brugmans, pers. comm., 17 May 1957.
8 Guiseppe Morrazoni and Michelangelo Pasquato, op. cit., p. 42. "nel 1730 Zuanne Gedolin e Pietro Sicca portano l'Arte del Margarietero ad Amsterdam." It would seem that the art was known in Amsterdam earlier than this "theft" would indicate.
9 Michael Bryan, Bryan's Dictionary of Painters and Engravers (London: G. Bell and Sons, 1903-05), pp. 3, 45; see also Kunstmuseets Arrsskrift I, 1914, 150, and A. von Schnieder, Zeitschrift fur Bolt. Kunst., Vol. 59 (1925), pp. 71-4, as well as the catalogue of the Royal Museum of Fine Arts (Copenhagen), No. 398. Many of the above details have been supplied through the courtesy of Dr. Paul Gammelco of the Royal Museum of Fine Arts (Copenhagen). Gustav Edmund Pazaurek, Glasperlen und perlenarbeiten in alter und neuer zeit (Darmstadt: A. Koch, 1911), p. 4 seems to be of the opinion that Van Loo showed the interior of a Venetian shop. He says, "Einen sehr instruktiven Einblick in eine alte venezianische Glasperlenwerkstatt gewährt uns das Gemälde von Van Loo."
10 W.G.N. van der Sleen, "Ancient Glass Beads, with Special Reference to the Beads of East and Central Africa and the Indian Ocean," Journal of the Royal Anthropological Society, Vol. 88, Pt. 2 (1958), pp. 203-16; "De wetenschap van de asbelt," Panorama, Vol. 48, No. 10 (March 1961), pp. 40-3; Glaskralen. Bussum. De Circel. (In Dutch with English summary) 1962; M. Tornati and W.G.N. van der Sleen, "L'analisi chimica aiuta l'archeologia," Vetro e Silicati, Vol. 4, No. 3 (1960), pp. 19-24.
11 London. Public Record Office, Customs 3, 1 Part 1.
12 Ibid., E190/14/5.
13 Ibid., E190/14/3.
14 Ibid., E190/14/5.
15 John Houghton, op. cit., Vol. 9, No. 196, 2 May 1696.
16 Pennsylvania Historical and Museum Commission, Logan Parchment letter Book 1717-28, pp. 8, 13, 504.

History of Beads in Czechoslovakia

1 Edward Dillon, op. cit., p. 259.
2 Karel Hettes, op. cit., p. 6.

3 --- Cofta-Broncewiska, "Some Observations on the Early Medieval Glass Manufacture at Kroszwica" (review). Sklo i Ceramika, Vol. 13, No. 1 (1962); Reviewed in Journal of the Society of Glass Technology, Vol. 4, No. 3 (1963), p. 40A, No. 325.
4 Jan Barta, "History of the Hron Valley Glassworks" (review). Czechoslovakian Glass Review, Vol. 5 (1950), pp. 7-11; reviewed in Journal of the Society of Glass Technology, Vol. 35 (1951), pp. 51-52.
5 Karel Hettes, op. cit., p. 9.
6 Ibid., p. 11.
7 Ibid., p. 20.
8 Ibid., p. 31; see also Edmund Schebek, Böhmens Glasindustrie und Glashandel. Quellen zu ihrer Geschichte (Prague: Handels und Gewerbekammer, 1878) where prices of some beads are given. One minor author says the Bohemians had an office in Mexico (Jaroslav Raimund Vavra, 5000 Years of Glass-making; The History of Glass (Prague: Artia, 1954), p. 154.
9 See also Josef Blau, op. cit.; --- Stulik, "The Harrachov Glassworks," Czechoslovak Glass Review, Vol. 2, No. 3 (1947), pp. 7-9. Reviewed in Journal of the Society of Glass Technology, Vol. 32 (1948), p. 157, and P. Martell, op. cit.

Glass Beads in England

1 William Ramsey, The Worshipful Company of Glass Sellers of London (London: Printed for the Company, 1898), p. 24.
2 William Arnold Thorpe, English Glass (London: A. & C. Black, 1935), pp. 81-2.
3 Ibid., pp. 87, 95.
4 Ibid., pp. 92, 134. Samuel Edward Winbolt, "Wealdon Glass. The old Surrey-Sussex Industry," Journal of the Society of Glass Technology, Vol. 16 (1932) (hereafter cited as "Wealden Glass"), p. 259 remarks to the same effect.
5 Edward Dillon, op. cit., p. 221.
6 Ibid., p. 307.
7 William Arnold Thorpe, op. cit., pp. 99-100.
8 Edward Dillon, op. cit, p. 308.
9 Frederick W. Burgess, Antique Jewelry and Trinkets (London: Routledge & Sons, 1919), pp. 244-5.
10 F. Cohen, unnamed article in Archaeologia, Vol. 18, p. 55. These are the "false St. Martins' beads" referred to in 1668 in Samuel Butler's Hudibras (1905).
11 Samuel Edward Winbolt, "Wealden Glass," p. 270, corroborated in letter of G.H. Kenyon to the writer, 9 December 1956.

12 Samuel Edward Winbolt, "The Surrey-Sussex Glass Industry," The Sussex County Magazine (1934 or 1940), p. 830.
13 William Arnold Thorpe, op. cit., p. 120.
14 Samuel Edward Winbolt, "Wealden Glass," p. 37.
15 William Arnold Thorpe, op. cit., pp. 115-6.
16 William Arnold Thorpe, op. cit., p. 120. The Journal of the House of Commons, Vol. 2, 16 Car. I, p. 33, records the petition of the Venetians and the Company of Merchant Adventurers to the Committee of Grievances where "It is ordered. That Sir Nicholas Crisp attend the Committee for Grievances: And that he bring forthwith to this House the Patent he hath for the sole Trade to Guinea and Binney: and the sole Importing of Red-Wood, and the Patent concerning Copris Stone: and the Patent for the sole Making, and Venting of Beads and Beaugles" (21 November 1640).
17 London. Public Record Office, Customs 173/3, 2 Jac. I.
18 Francis Buckley, The Glass Trade in England in the Seventeenth Century (London: Stevens and Sons, 1914), p. 19.
19 Joseph Kenworthy, "Glassmaking at Bolsterstone, near Sheffield, from about A.D. 1650 to 1750," Journal of the Society of Glass Technology, Vol. 2 (1918), p. 5; Harry James Powell, Glass-making in England (Cambridge: University Press, 1923), p. 37.
20 British Museum, London, 1714-15, Sloane MSS No. 847, pp. 61-70.
21 The total recorded exports are difficult to estimate on the same terms, but the value of bugle of foreign manufacture exported by certificate from London in 1697-98 was set by the officials at £1347.0.0 John Houghton, op. cit., Vol. 9, No. 196, 8 May 1696.
22 Cited by Francis Buckley, op. cit., p. 48.
23 Francis Buckley, "Old English Glass: Glass Bottles and Jewelry," Glass, Vol. 10 (n.d.), p. 322.
24 Thomas Clarkson, An Essay on the Impolicy of the African Slave Trade. 2 Parts in 1. (London: Phillips, 1788), p. 105.
25 London. Public Record Office, Customs 16, "An Account of the Produce or Manufacture of Great Britain and Ireland Imported into the several ports of North America...1769 to...1770," pp. 75-6.
26 Albert Hartshorne, Old English Glasses. An Account of Glass Drinking Vessels in England, from Early Times to the End of the Eighteenth Century (London: E. Arnold, 1897), p. 106.

Glass Beads in Sweden

1 Amandus Johnson, op. cit., p. 63.

2 Eliza Hald-Steenberg, Swedish Glass (New York: Barron, 1950), see especially Ch. 1, pp. 13-51.
3 Pers. com., Royal Swedish Archives, Kommerskollegium, letters dated 13 January 1655 and 17 February 1655; and "Handel och sjofart # 3 and 4, 1637-40 and 1643."

The Making of Glass Beads in America

1 London. Public Record Office, Customs 3, 1 Part 1. "London. Importations from Michaelmas 1697 to Michaelmas 1698."
2 John H. Harrington, Glassmaking at Jamestown: America's First Industry (Richmond: Dietz Press, 1952), p. 3n.
3 Ibid., p. 6; Mr. J.H. Harrington, an authority on Jamestown where the works were set up, is of the opinion that the Dutch were really Germans, for the term was then used loosely.
4 Ibid., pp. 9-10; also cited in Rhea Mansfield Knittle, Early American Glass (New York: The Century Company, 1927), p. 59.
5 London. Public Record Office, Calendar of State Papers (Venice), 17, No. 424. Cited by Francis Buckley, The Glass Trade in England in the Seventeenth Century (London: Stevens and Sons, 1914), p. 31.
6 Virginia Company of London, The Records of the Virginia Company of London... (Washington, D.C.: USGPO, 1906-35), Vol. 4, p. 565.
7 Ibid., Vol. 4, p. 23, George Sandys to Mr. Farrar, March 1622-23.
8 John H. Harrington, op. cit., pp. 28-32.
9 Virginia Company of London, op. cit., Vol. 2, p. 495. This is corroborated in a "Note on the Shipping...for Virginia, 1621" where it is said, "Persons Italian and others have been provided, and sent for the making of Beads for trade in the Countrey with the Natives and for making Glasse of all sorts" (p. 16).
10 Rhea Mansfield Knittle, op. cit., pp. 63-76.
11 Ibid.

The Nomenclature of Glass Beads

1 Awnsham Churchill, comp., A Collection of Voyages and Travels, some now first Printed from Original Manuscripts... (London: H. Lintot, 1744-46), Vol. 5, p. 44.
2 Mainly for this reason my wife and I have developed a nomenclature for the use of archaeologists, published in Canadian Historic Sites: Occasional Papers in Archaeology and History No. 1.
3 See Oxford English Dictionary for a synopsis of the etymology of this word.
4 William Arnold Thorpe, op. cit., pp. 119-20.

5 Shorter Oxford English Dictionary.
6 See also Edward Dillon, op. cit., p. 183, for a discussion of names in English.
7 Charles E. Forbes Library, Northampton, Massachusetts, Judd MSS, Prices and Accounts, p. 331.
8 Pennsylvania Historical and Museum Commission, Logan Parchment Letter Book, 1717-28, p. 167, List of Goods for J. Logan, 10th 1720, to be shipped J. Askew.
9 Ibid., p. 504.
10 Ibid., p. 645.
11 Ibid., p. 656.
12 London. Public Record Office, Colonial Office 5, 540-49, reel 1337-1.
13 Vincenzo Zanetti, op. cit., p. 224.

Appendix A. Important Dates in the History of Glass Beads.
1 Gustav A. Eisen, op. cit., p. 718.
2 Ibid.; Hondt, op. cit., p. 66; Dominique Bussolin, Les célèbres verreries de Venise et de Murano; description historique, technologique et statistique de cette industrie... (Venice: H.F. Münster, 1847), p. 47.
3 Karel Hettes, op. cit., p. 6.
4 Florent Pholien, op. cit., p. 9.
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9 From a label in Corning Museum of Glass, 1962.
10 Florent Pholien, op. cit., p. 38.
11 Samuel Edward Winbolt, "Wealden Glass," p. 255.
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17 Astone Gasparetto, loc. cit.
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20 Alexander Nesbitt, loc. cit.; Gustav A. Eisen, op. cit., p. 719; Jules Labarte, op. cit., p. 339; Astone Gasparetto, loc. cit.
21 Edward Dillon, loc. cit.; Alexander Nesbitt, loc. cit.; Jules Labarte, loc. cit.
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25 Karel Hettes, op. cit., p. 11.

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29 Astone Gasparetto, loc. cit.
30 Florent Pholien, op. cit., p. 35; Astone Gasparetto, loc. cit.
31 Gustav A. Eisen, op. cit., p. 719.
32 Florent Pholien, op. cit., p. 39; cf. Edward Dillon, op. cit., p. 182; Astone Gasparetto, loc. cit.; Pieter d'Hondt, op. cit., p. 10.
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52 Gustav A. Eisen, loc. cit.
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54 Gustav A. Eisen, loc. cit.; Alexander Nesbitt, op. cit., p. 93, disputes this.
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Illustrations

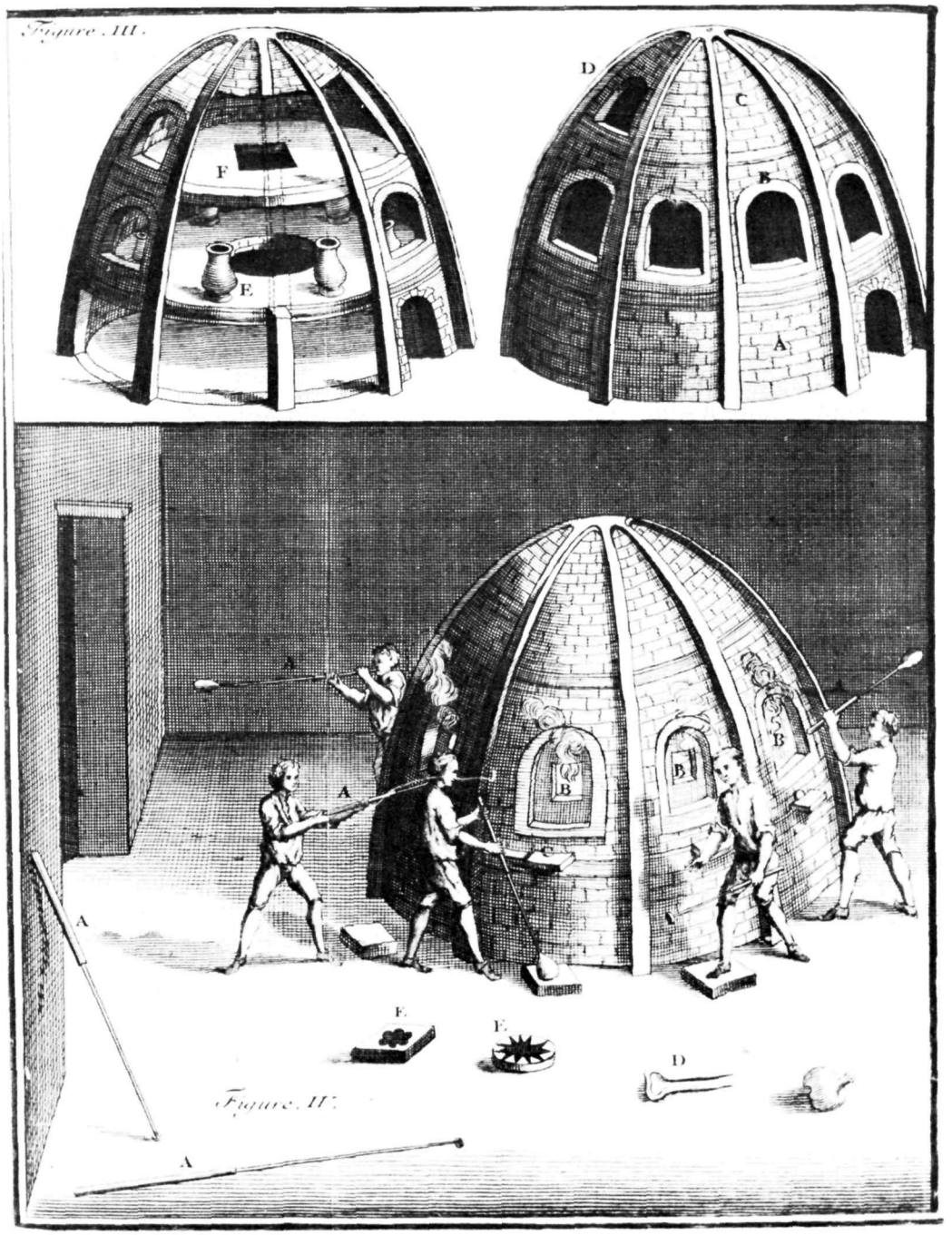


Figure 1. A furnace in operation. The top cut shows the interior arrangements on the left, and on the right the exterior. The bottom cut shows, at A, men taking up glass on the blowing iron, blowing the paraison (in the background), working the paraison on the marver (in front of window B), blowing irons, moulds and other tools in the foreground. (Antonio Neri, Art de la verrerie, de Neri, Merret et Kunckel... [Paris: Durand, 1752].)

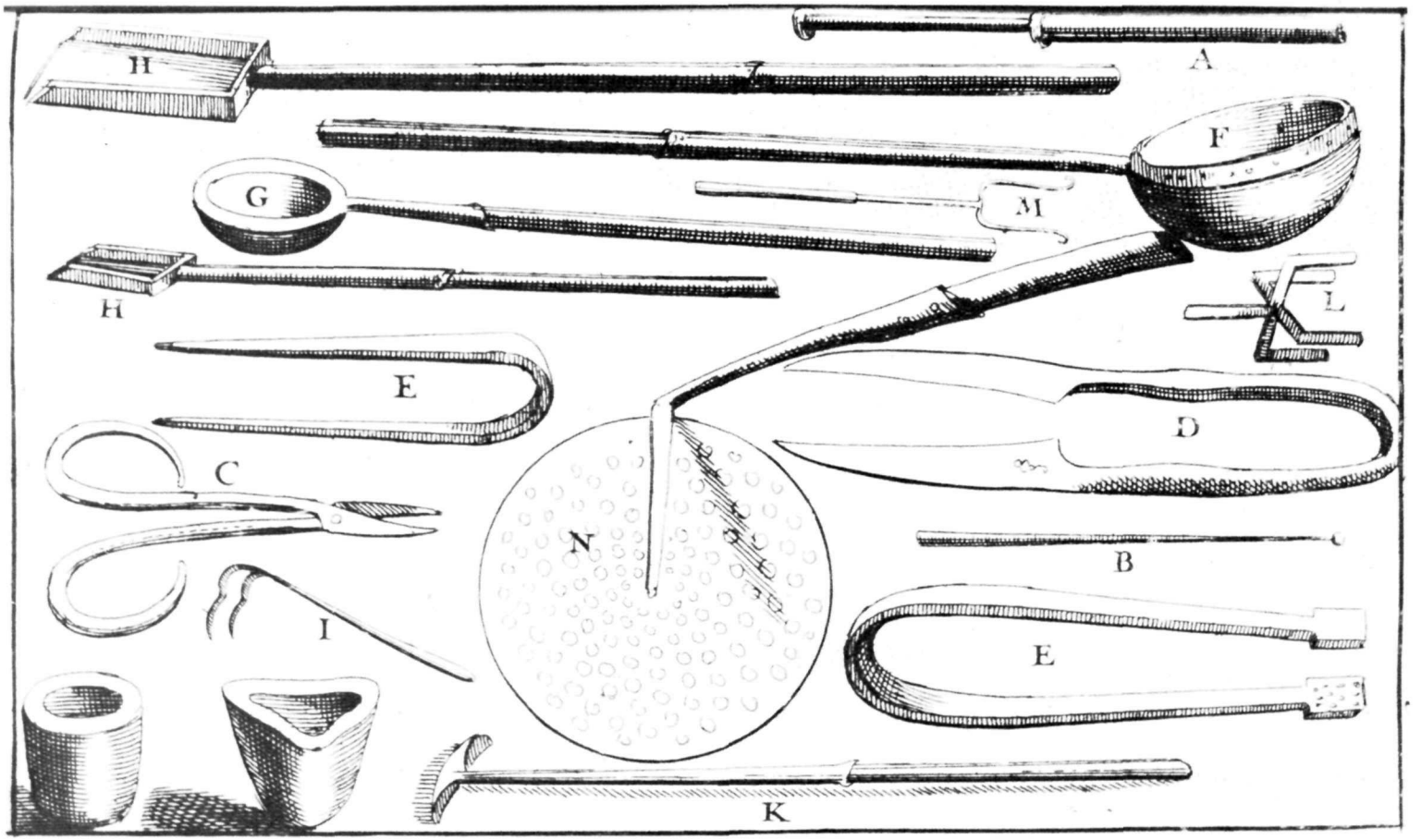


Figure 2. Glassmakers' tools. (Jean Haudicquer de Blancourt, The Art of Glass, Shewing How to Make all Sorts of Glass, Crystal and Enamels... [London: Printed for Dan Brown, 1699], p. 48.)

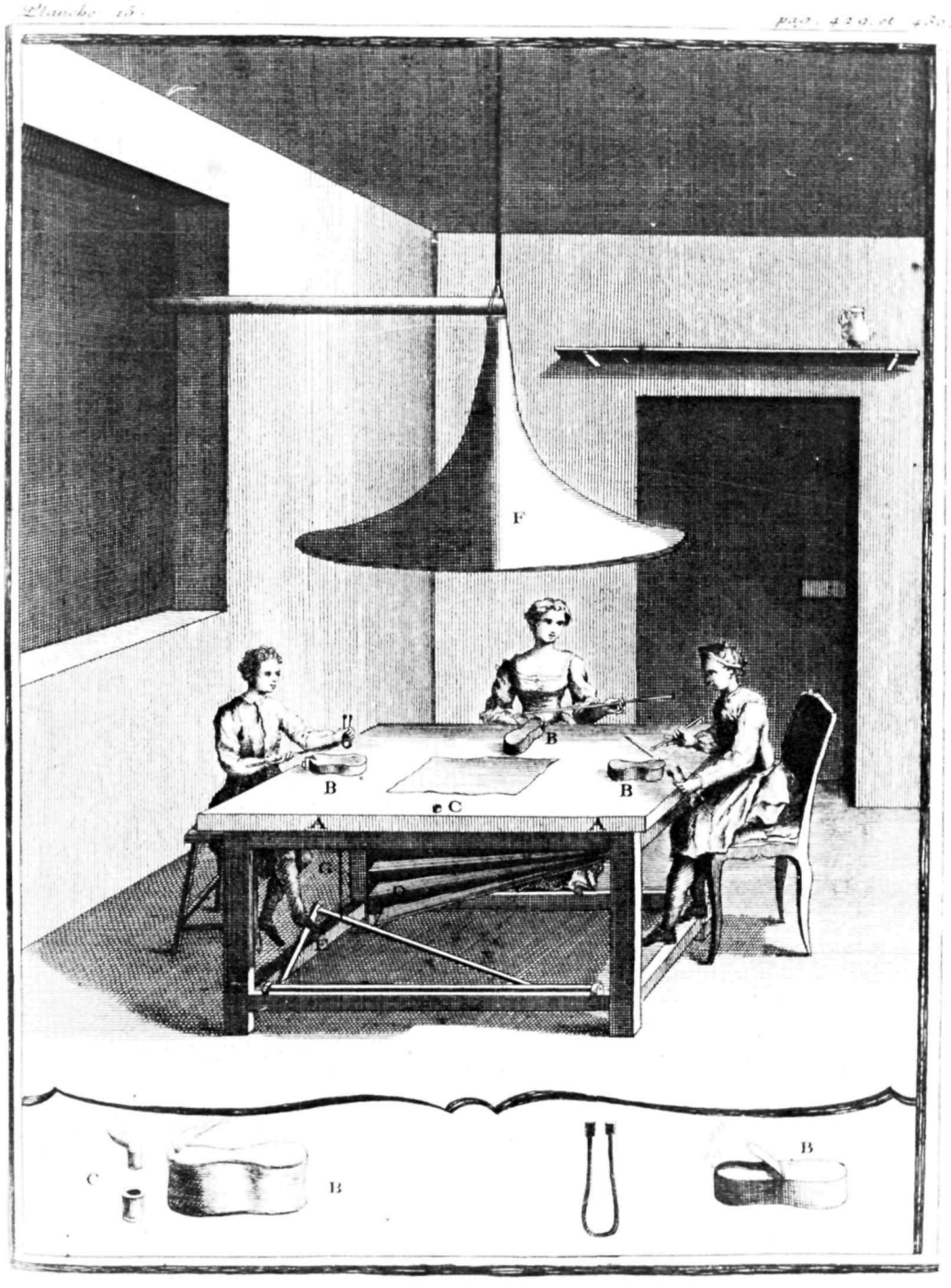
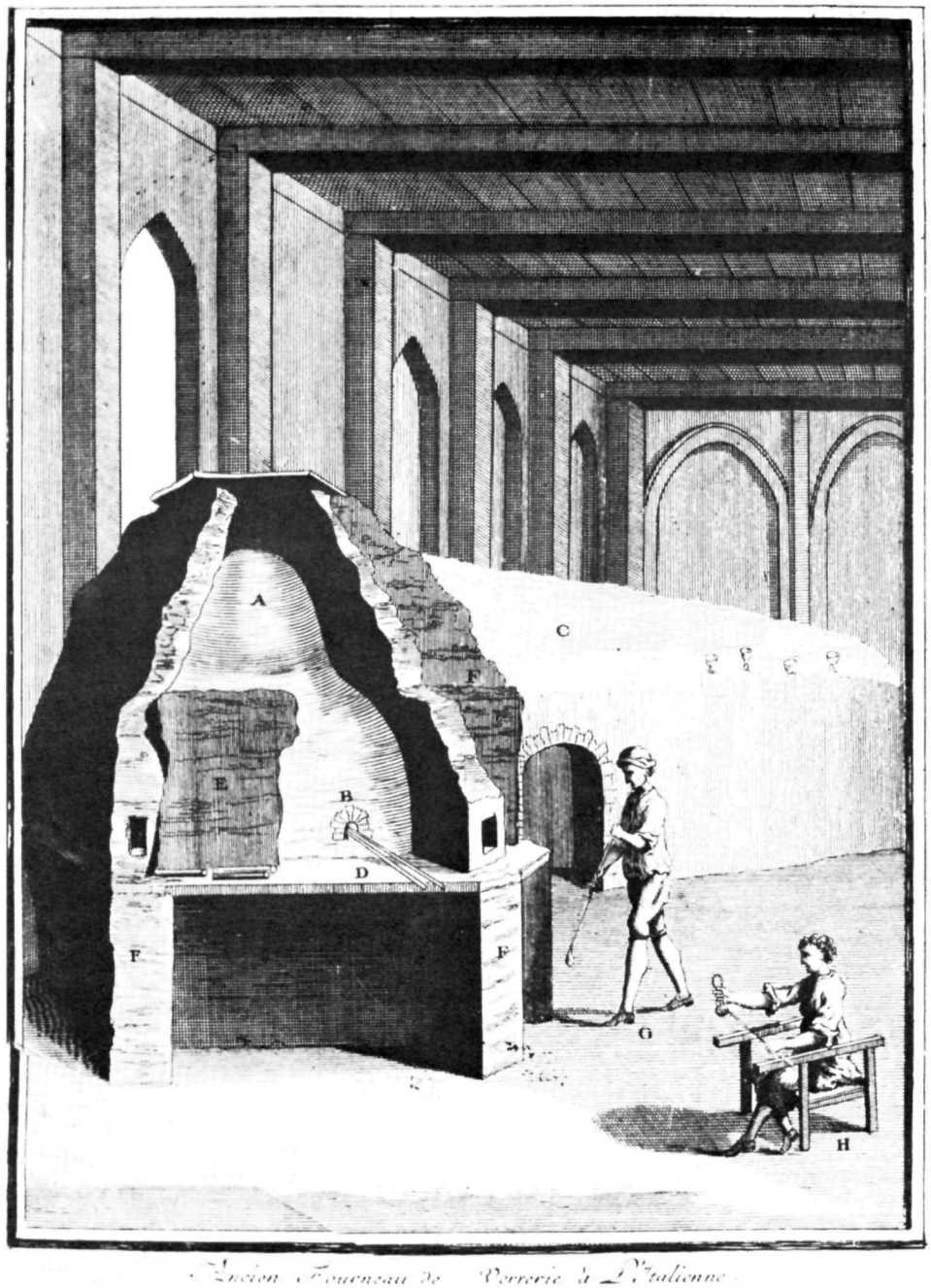


Figure 3. Working glass at the lamp (suppialume process). Note the rods of glass being held in the flame of the lamps, the bellows below the table to produce the air current for the lamps, with the exhaust flue above the table. (Antonio Neri, op. cit.)



Ancien Fourneau de Verrerie à l'Italienne

Figure 4. An old Italian glass furnace. (Antonio Neri, op. cit.)

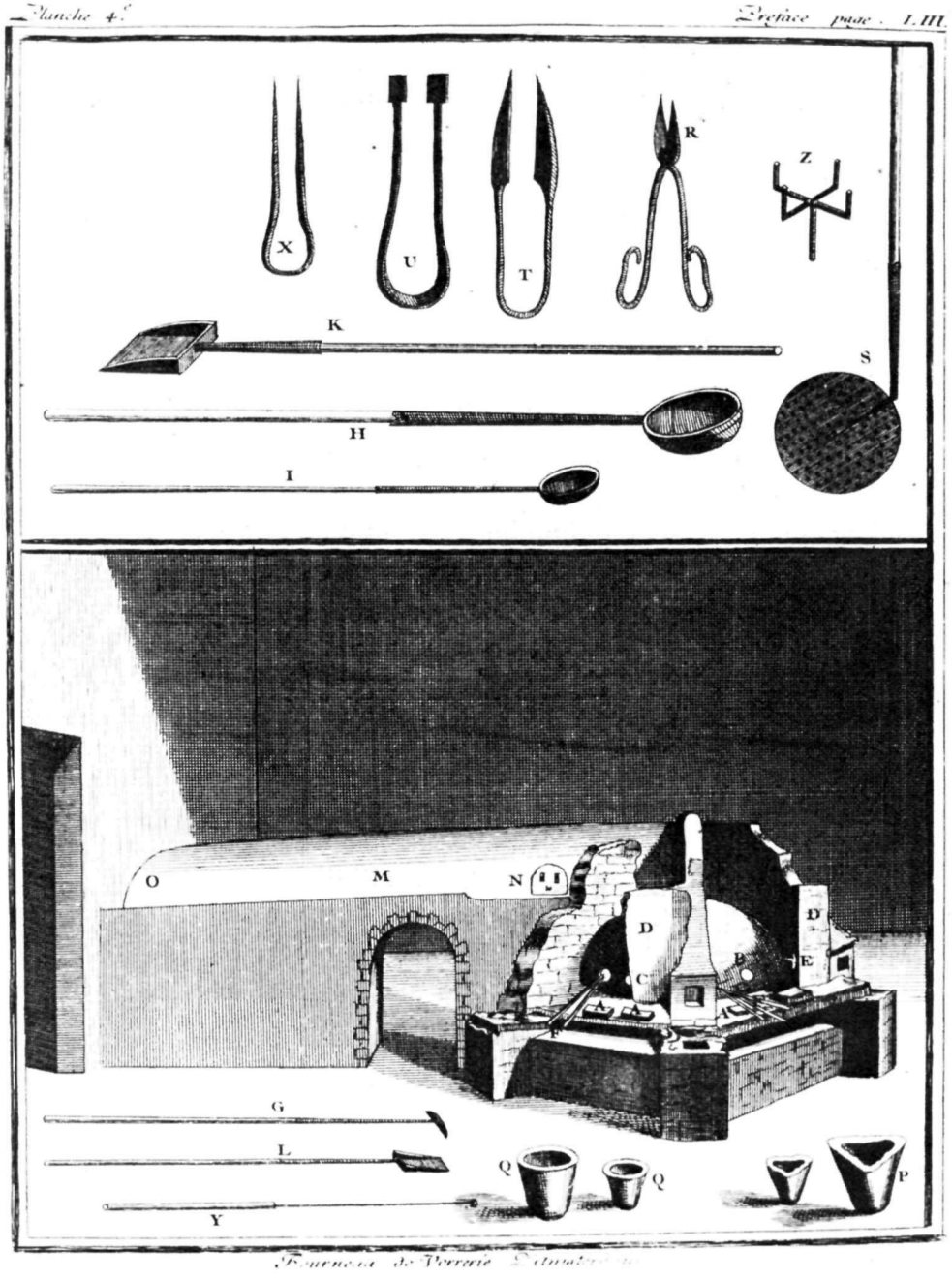


Figure 5. Glassmakers' tools. Rake for drawing ashes is seen at G; large and small shovels at K and L; lear at M; door to the lear at N; far end of the lear where the glasses are withdrawn after cooling at O; crucibles or pots at P and Q; scissors at R; sieve at S; instrument for spreading the glass after cutting at T; instrument for decorating glass at U; instrument for folding and spreading glass in preparation for turning it cord-fashion at X, and blowing iron at Y. (Antonio Neri, op. cit.)

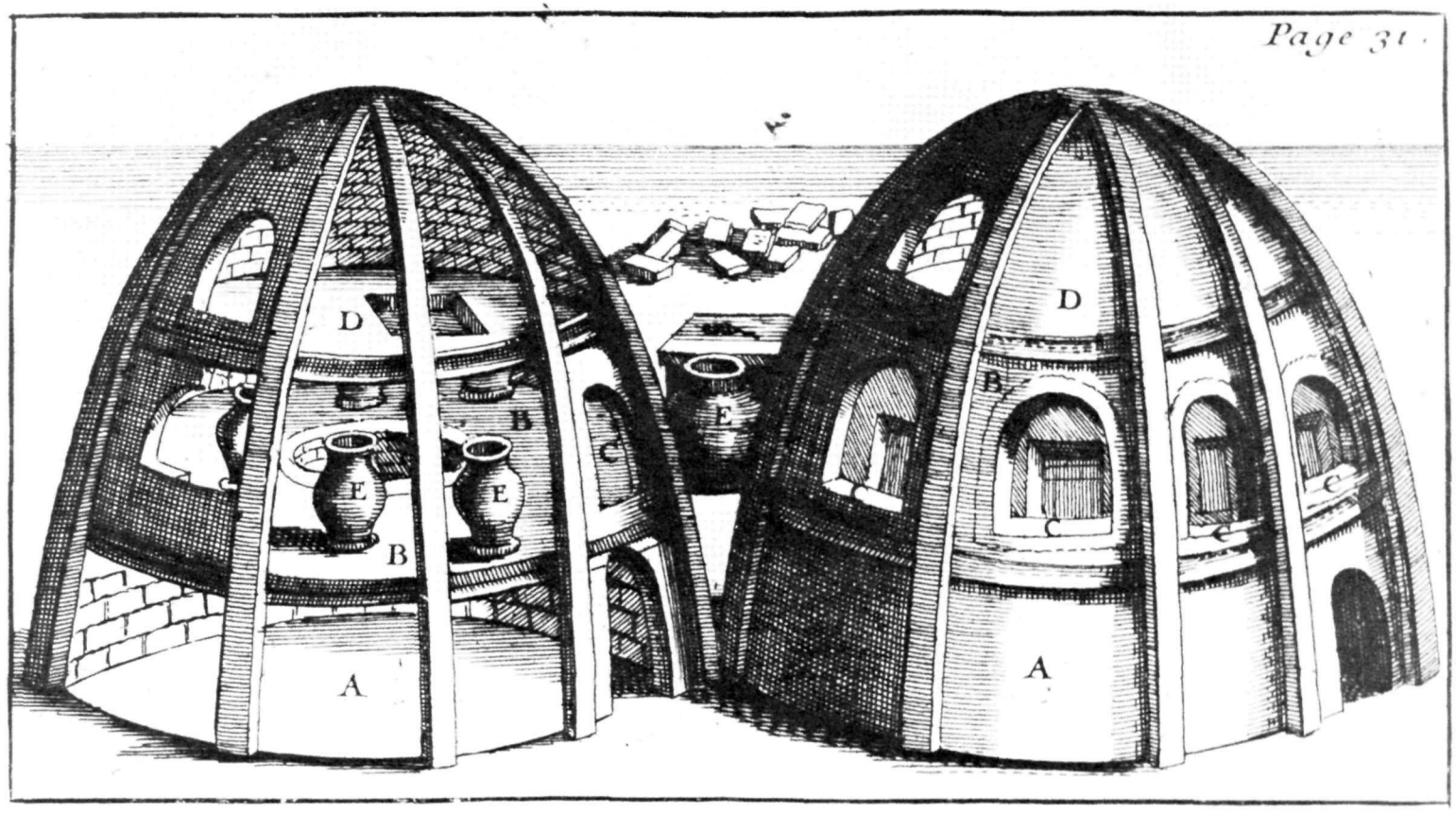


Figure 6. A cutaway of an old furnace showing the interior arrangements. (Jean Haudicquer de Blancourt, op. cit., p. 31.)

Figure 7. A fritting furnace. (Jean Haudicquer de Blancourt, op. cit., p. 28.)

Figure 8. An oil painting by Jacob Van Loo showing the making of beads, presumably in Amsterdam in the 17th century. (Statens Museum for Kunst, Kobenhavn.)

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