To give these longish beads their proper rounded form, a third person places them in a mixture of ash and sand, and agitates them in this mixture until their holes are filled and thus cannot collapse when heated. A fourth worker then puts the beads into a pan with a very long handle and adds some more of the sand-and-ash mixture. He then places the vessel over a charcoal fire, stirring the contents continuously with an instrument shaped like a hoe with a rounded end[6] until the beads have become rounded. The pan is then removed from the fire and the sand/ash mixture is removed by sieving. The beads themselves are subsequently sorted into uniform sizes by passing them through sieves of different fineness. They are then strung on thread and gathered into hanks or bunches.[7]

The quantity of beads produced in this factory, up to now the only one in the world to perform this sort of work,[8] is incredible. Several hundredweight were packed in casks, awaiting shipment to all parts of the world, especially Spain, the Barbary Coast, etc. But so far they have not made their way to America.[9] The Kaiser, during his recent visit to Venice, also visited this factory and presented the owner with the Order of Merit, a civilian medal.

The travelers, as well as two merchants from Aachen, bought a considerable quantity of beads to take to their relatives back home. They were also given several tube samples and a sample card which exhibited no less than 64 different kinds of beads.

### Endnotes

1. Hoppe and Hornschuch use the verb *laufen* which generally means "to run." However, it can also mean "to go" or "to walk" (dialectical). Based on other historical accounts and Karklins' personal observation of the drawing process in Murano, it is likely that a very fast walk is indicated.

2. In the 1825 translation, the length is incorrectly given as 150 feet.

3. The 1825 translation erroneously states that the two glasses are twisted together.

4. The German text specifies *lange* (length), but diameter or "thickness" (as used in the 1825 translation) is doubtless being referred to as the tubes have already been described as being of equal length. The accounts of Bussolin (1847:16) and others support this interpretation.

5. A good portion of the information presented in this paragraph is missing in the 1825 translation. Furthermore, the latter, by using the singular form "pipe," implies that the tubes were chopped up one by one rather than by the handful.

6. The 1825 translation describes this tool (*Hacke*) as "a spatula, resembling a hatchet with a round end." However, *Hacke* also denotes a hoe or mattock. Considering the activity that is being performed, a hoe-shaped tool would seem to make more sense.

7. The term *Bunde* may be translated as bundles, bunches, or hanks. Based on Bussolin (1847:25), the two latter terms would be the most appropriate here.

8-9. These two statements are obviously incorrect. One can only wonder what inspired the second one.

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## 50. GLASS BEADMAKING IN THE FICHTELGEBIRGE REGION OF BAVARIA IN THE MID-NINETEENTH CENTURY, by Ian Kenyon, Susan Kenyon, Susan Aufreiter, and Ron Hancock (1996, 28:12-19)

In the 19th century, two important centers of European beadmaking were Venice/Murano and northern Bohemia. Yet, at the same time, a significant bead industry also existed in a mountainous region of northern Bavaria (Franconia) called the Fichtelgebirge (Fig. 1). Since details about the Bavarian industry are scarce in the English-language literature, we offer a digest of two contemporary German-


**Figure 1.** Central Europe with political boundaries as of 1871: ▲ = some 19th-century glass-beadmaking centers; • = cities mentioned in text (drawing: Ian Kenyon).

language accounts below (Lobmeyr 1874:248, 253, 256, 262; Sackur 1861). Note that a German-language article on Fichtelgebirge glass beads was published in 1926, but we have only been able to find a very brief English abstract of this (Hohenberger 1927).

## Introduction

Rich in raw materials, the Fichtelgebirge region was one of the early centers of German glassmaking: a glassworks in Bischofsgrün was recorded as early as A.D. 1340 (Weiss 1971:337). By the 19th century, however, the scale of glassmaking had changed in Germany. The large factories needed to supply an ever-growing demand for tableware, bottles, and window glass were becoming concentrated in industrial centers like those in the Rhineland, Saxony, and Silesia.

Even so, Bavaria was still noted for certain glass products: blown mirrors and, from the Fichtelgebirge region, beads. A speciality of the Fichtelgebirge industry was the manufacture of large-sized wound glass beads (*massive Glasperlen*), known as *Paterles*. In addition, some bead houses made a related product–glass-ball buttons (*Kugelknöpfe*). The heart of the Fichtelgebirge bead industry was the village of Oberwarmensteinach. Other factories, no more than 30 km distant, were located in Fichtelberg, Bischofsgrün, Grünberg, and Altenstadt.

Lobmeyr's 1874 survey of the glass industry provides a detailed appendix listing over 300 German glassworks and their products. With but two exceptions in the entire German Reich, only Fichtelgebirge glass houses were reported as making beads. The exceptions were two glassworks in Thuringia, but since their speciality was glass tubing, it is probable that their beads would have been of the drawn or blown types rather than wound as in Bavaria. In view of this concentration of bead factories in northern Bavaria, any glass bead described in the mid-19th century as being from "Germany" or "Bavaria," especially if wound, is likely to have been a product of the Fichtelgebirge industry.

## Chronology

The Fichtelgebirge is said to have been a beadmaking center in the 15th and 16th centuries (Kidd 1979:33) with this industry declining after 1700, when many workers moved to Bohemia (Dubin 1987:113). Yet, in contradiction, a late-19th-century article (Anonymous 1884:819) attributes the introduction of beadmaking to Bavaria about 200 years previously (say ca. 1680); and Dillon (1907:292) is even more specific:

> ... that the use of "a little copper pipe fixed over a burning lamp" for making small objects of glass was first taught at Nuremberg by one Abraham Fino, who came from Amsterdam in 1630. The Dutch... had been taught the art by a Venetian.

Whatever the case, by the mid-19th century, a number of bead houses were reported as being long established: Lobmeyr recorded that a factory at Oberwarmensteinach, then owned by Michael Trassl, had been founded in 1756, and further noted that eight other beadworks dated back to the l8th century. By Lobmeyr's time (1874), however, the Fichtelgebirge industry seems to have gone into decline– of the 15 bead houses then in existence, only eight were actually in operation.

## Manufacturing Techniques

Most bead factories had one or two furnaces, stoked with the firewood so abundant in the Fichtelgebirge (literally

"spruce mountains"). A furnace contained about 7-8 melting pots (*Schmelztiegel*). In turn, each melting pot supplied molten glass to several working pots (*Arbeitstiegel*) from which the beadmakers drew their glass. At the Michael Trassl beadworks, for example, there were two furnaces, 14 melting pots, and 36 working pots, furnishing molten glass to a total of 80 workers.

Two tools were used in making beads: a pointed iron rod (*Spisse des Eisens*) and a "key" or "wrench" (*Schlüssel*). The rod, or gathering iron, was around three feet long, about 1/2 inch in diameter, and tapered towards the bottom. At the tip or working end of the rod was a precisely centered point. The "key," used in forming beads, was not described, but presumably it must have had a working end shaped something like this: ⊓ or ⊣= . Alternatively, the key may have been an open-faced mold.

The manufacturing technique was a variant of the wound method termed "furnace-winding" by Francis (1983:194) and "winding from the pot" by Neuwirth (1994:267). This differs from the lamp- or wire-winding technique–the "suppialume" process of the Venetians–mentioned by Dillon. Dr. Sackur (1861) described the beadmaking process as follows:

> Each worker has a working-pot before him, kept filled to the brim with glass. He takes a little ball of glass out of the working-pot with the point of the iron, pushes the iron deeper into it, that is, the more deeply the bigger the bead, and turns the little glass ball with great speed around the iron. Then he pulls the iron out and by rocking and pushing from above and below with the "key" gives the soft bead the required shape. Each worker has two irons. As the bead cools on one iron, he turns a new bead on the other iron.... In each workshop, there is also, on the gallery floor, a thin-walled small clay vessel, warmed by the furnace, and which the glass beads are brushed into by gradual cooling of the points [of the gathering irons]. [Translated from the German.]

Hohenberger (1927:A 113-114) gave a similar account of beadmaking in the Fichtelgebirge:

> To-day round wood-heated furnaces were used for beads, having twenty gathering openings in each. Each workman had two tapering gathering irons and eight or ten pearls were made in half a minute. These were allowed to cool on the iron whilst the second iron was used, after which they were shaken into a neighbouring jar.

Sackur attributed the invention of this distinctive way of manufacturing beads to the inhabitants of the Fichtelgebirge, although an anonymous report implies that the Venetians introduced the making of "turned massive beads" to the area (Anonymous 1884:819). Regardless, it seems to have been an adaptation of a technique dating back to the Middle Ages: Benrath (1880:351) noted that in the 12th century, Theophilus described a very similar method, also using a pointed rod, for making glass finger rings (Hawthorne and Smith 1963:73-74). The winding technique is still used in making glass beads in certain parts of the world. For example, Küçükeman (1988) describes and illustrates the gathering irons and variety of shaping tools used by modern-day Turkish beadmakers.

Not all beads were made by the winding technique. In the latter part of the 19th century, there was some manufacture of molded beads, including faceted varieties, apparently under the influence of the Bohemian industry (Peek 1995: pers. comm.). In 1885, J. Trassl of Oberwarmensteinach patented a mold for the mass production of glass beads and buttons (Anonymous 1886). Cane beads may also have been made in the Fichtelgebirge (Peek 1995: pers. comm.).

## The Product

After cooling, the beads were threaded on a string or line, which consisted of a hundred beads. While not directly stated, it is likely that the usual bead was round, since variant shapes were specifically noted as oval and ring. Beads varied in size: Lobmeyr reported that at the Schinner works at Grünberg, near Kemnath, the 100-bead strings ranged in weight from 1 *Loth* to 3 *Pfund*; that is, between about 16 g and 1,500 g. Therefore, the beads–based on this weight range (and assuming they were round)–would have varied from roughly 0.5 to 2.0 cm in diameter.

Beads came in a variety of colors including blue, green, black, yellow, and white. While base composition of the glass is not stated, it was possibly lead glass, since Sackur reports that a substantial amount of arsenic was added to the melt to produce opacity in white beads (arsenic has this opacifying effect only in lead-rich glass). If so, this stands in contrast with the contemporaneous Bohemian glass industry where phosphates (bone ash) were used to opacify potash-lime glass (Debette 1843:597-598).

## Scale of Production

According to Lobmeyr (1874), a typical bead factory employed about 32 to 36 bead makers who had 12-hour shifts. A good worker could make as many as 5,000 beads a day. For instance, the 40 workers at the Pschörer factory in Fichtelberg produced 960,000 strings of beads per year (i.e., 96 million beads). In 1861, Sackur estimated that the

12 bead houses then operating in the Fichtelgebirge made a total of six million beads a week.

How important was the Fichtelgebirge bead industry compared to that of Venice/Murano? Dr. Sakur stated that a single Bavarian glass house could make 8 to 12 *Centners* (1 *Centner* = 50 kg) of beads per week. At this rate, the 12 factories, if operating 52 weeks a year, could have produced roughly 250,000 to 375,000 kg of glass beads annually. However, if, as suggested by Hohenberger (1927: A 113), the bead houses were mostly shut down from Easter until August while the workers cut firewood, then these production estimates should be reduced by one-third. For the Venetian/Murano bead industry in 1847, Domenico Bussolin reported a total production of over 2 million kg of finished beads, almost ten times that of the Fichtelgebirge (Karklins and Adams 1990:80). But much of the Venetian product consisted of drawn beads. For wound beads only, Bussolin recorded a total output of 320,000 kg; that is, about the same amount as made in the Fichtelgebirge. So, at least in the mid-19th century, the production of wound beads in the Fichtelgebirge region and Venice/Murano was about on par.

## The Market

The Fichtelgebirge beads were described by Sackur (1861) as "a near luxury good" and they had a world-wide distribution. According to Lobmeyr, bead factories exported directly to England, America, Egypt, and the Orient. Dealers in Bayreuth, Nuremberg, and Hamburg also marketed Fichtelgebirge products (Fig. 1).

Bavarian-made beads seem to have been important in the African trade. Karklins (1992:52, 54) has shown that certain wound varieties of large ring- and oval-shaped beads used for trade in Central East Africa were reported as coming from Germany. It is likely that these were Fichtelgebirge products, especially as one type was said to have been "made" in Nuremberg–a city from which the northern Bavarian beads were distributed. Similarly, the bead cards of the London merchant Moses Levin, which date to about 1851-1863, contain many varieties of wound beads intended for the African trade (Karklins 1985). Since Levin advertised that his goods came from Venice, Bohemia, and Germany, it is very possible that some varieties of his wound beads were Bavarian.

## The Archaeology

Although there have been no archaeological excavations, three production sites dating to the 18th and 19th centuries have been located (Peek 1995: pers. comm.). Even today, the Fichtelgebirge area is heavily wooded, making it difficult to locate sites.

## Conclusions

It would be of interest to learn more about the nature of the beads made in the Fichtelgebirge, including the disputed date and origin of this industry. From the few sources that we have consulted, it appears that in the mid-19th century this tiny part of Bavaria was a leading producer of large-sized wound beads having an international market.

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## 51. NEUTRON ACTIVATION ANALYSIS OF SOME 19TH-CENTURY FACETED GLASS TRADE BEADS FROM ONTARIO, CANADA, THAT HAVE CHEMICAL COMPOSITIONS RESEMBLING BOHEMIAN GLASS, by Ian Kenyon, Susan Kenyon, Ron Hancock, and Susan Aufreiter (1995, 27:4-9)

### Introduction

Necklace-size faceted beads are widely distributed on 19th-century archaeological sites in North America and elsewhere. These faceted beads are usually made in two different ways. Some (Kidd types If and IIIf; so-called "Russian" beads) are drawn beads, fashioned from segments of six- or seven-sided tubes with ground facets on their corners; others are mold-pressed (or "mandrel-pressed") beads, which also have cut facets.

Glass beads with cut facets are considered to be characteristic of the 19th-century Bohemian glass industry (Ross 1990; Ross and Pflanz 1989). It is fairly certain that mold-pressed beads were made in Bohemia (Ross 1990; Ross and Pflanz 1989; Schubarth 1835:371). Less certain, however, is the origin of faceted drawn beads: Lester Ross (1990:38) states that they "may represent items manufactured in Bohemia, possibly Venice." One way of further assessing the origin of these beads is by considering their chemical compositions. This paper looks at the chemical compositions of 11 faceted beads from six archaeological sites in Ontario and compares them to the composition of Bohemian glass as reported in the 19th-century literature on chemical technology.

### Bohemian Glass

By the 19th century, the Bohemian glass industry was known for the high quality of its tableware. Bohemia also had a good reputation for the manufacture of glass chemical apparatus; beads and other baubles were a significant sideline (Henrivaux 1883:312-318).

While in most parts of Europe fine tableware was usually made from lead glass (as in England) or soda glass (as in Italy), Bohemian crystal, in contrast, was potash glass. A typical 19th-century recipe for Bohemian glass calls for 100 parts of pulverized quartz (silica), 32 parts of refined potash (potassium carbonate), 17 parts of slaked lime (calcium hydrate), as well as small amounts of arsenic and manganese (Pelouze and Fremy 1865:890). In fact, the expression "Bohemian glass" came to denote this particular potassium-rich composition, even if not made in Bohemia itself. For example, Henrivaux (1883:318) reports that such "Bohemian glass" was also made in Prussia and Bavaria.

### Results and Discussion

To determine their chemical composition, the 11 beads were analyzed by instrumental neutron activation analysis at the SLOWPOKE Reactor Facility, University of Toronto (Table 1). Based on manufacturing technique, the beads can be divided into two series: the first series (A) consists of drawn faceted beads; the second (B) of mold-pressed beads, which also have ground facets. Samples 1 to 9 are colored