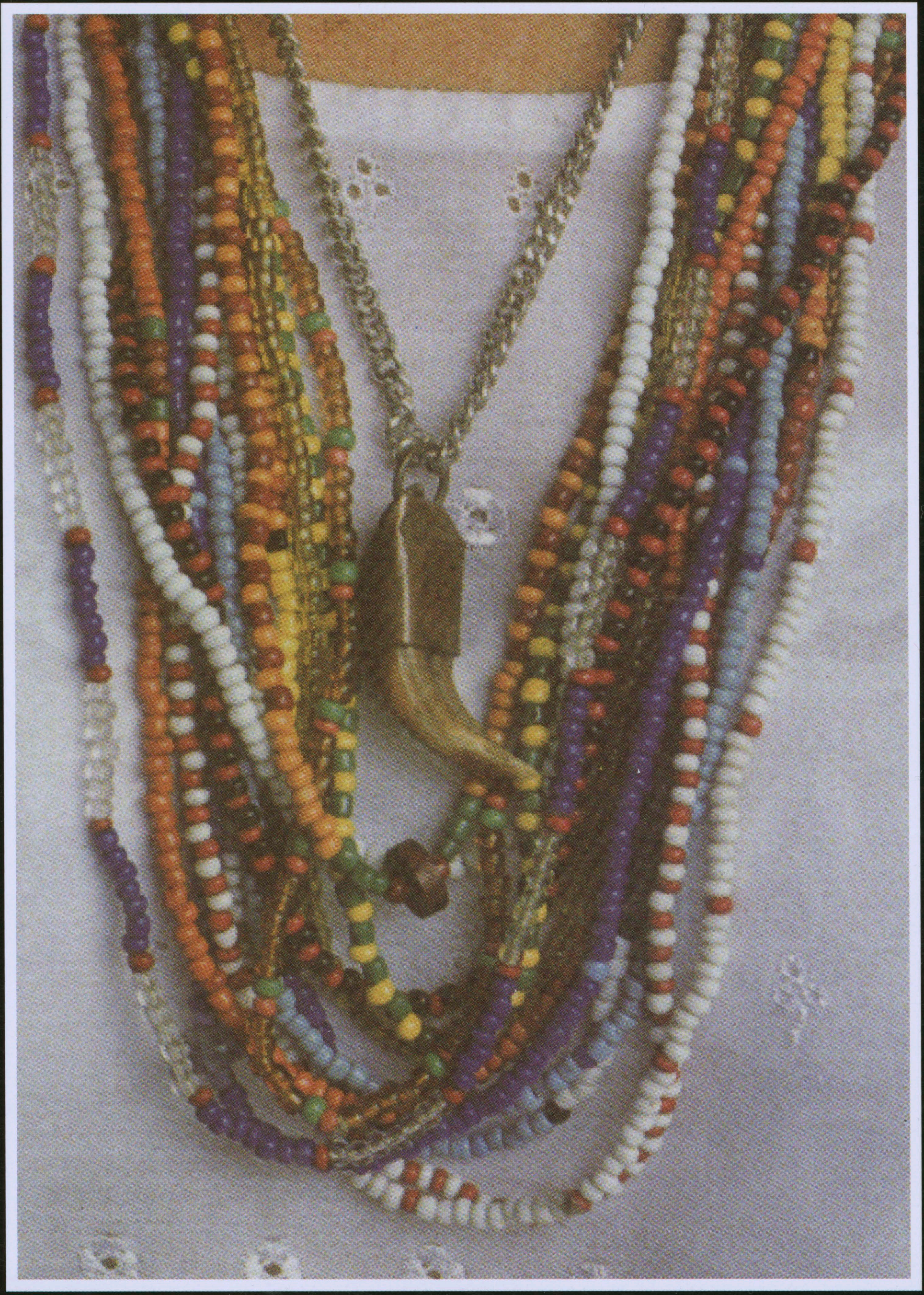
# BEADS

Journal of the Society of
Bead Researchers



2005 Vol. 17

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**Cover.** *Santería*: Assortment of Santería necklaces from the author's collection (photo by author).

# BEADS

**Journal of the Society of Bead Researchers**

**2005 Vol. 17**

**KARLIS KARKLINS, editor**

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## BOOK REVIEWS

# INFORMATION FOR AUTHORS

1. Papers submitted for publication must by typed double-spaced, justified left, with 1 in. margins. Submissions should not exceed 50 pages including references cited. The hard copy should be accompanied by the text as an email attachment or on a 3-1/2 disk or CD in Word Perfect 8/9 (.wpd) or Rich Text File (.rtf).

2. All manuscripts must be prepared with the following internal organization and specifications:
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# NECKLACES USED IN THE SANTERÍA OF CUBA

**Lourdes S. Domínguez**
**Translated by Jayson Rubio**

*This article examines the necklaces used in the Afro-Cuban Rule of Orisha, more commonly known as Santería. This religion, created by African slaves brought to Cuba starting in the 16th century, combines aspects of Yoruba orisha worship and Spanish Catholicism. It allowed African religious beliefs and practices to survive despite the imposition of Catholic doctrine. One of the outcomes of this amalgamation is the practice of associating individual orishas (deities) with certain Catholic saints. Each orisha is represented by specific necklaces that incorporate particular bead forms, colors, and numbers.*

## INTRODUCTION

Research on bead necklaces is relatively uncommon in the world because they are generally considered to be articles of little importance and only come into debate within the cultural process that created them. Even dictionary definitions are weak and individualize them exclusively as objects for feminine use. They are of sundry forms and the materials that can be used to make them are also quite varied.

This study deals with the necklaces presently utilized in the Afro-Cuban Rule of Orisha *(Reglas de Ocha)*, more commonly known as *Santería* (the Way of the Saints). To start, we will examine the origins of the necklaces. So far, it is not known if identical necklaces were brought directly from Africa, or if their use was copied from the beads introduced by the Spanish. Perhaps when the Spaniards encountered the natives of Cuba, who also used necklaces, they realized that a symbiosis was achieved that permitted the necklaces to be converted into part of the fashion associated with worship. What is clear is that the necklaces used by the Rule of Orisha possess antecedents common to the three cultures (aboriginal, European, and African) that have helped shape the symbiosis originating from the African-American religions of which Santería is a part.

This is an initial study of the subject that will not only support future work but can also be used to initiate the investigation of other elements of the material that forms a part of the paraphernalia used in the ritual of Santería.

We begin our study with the compilation of bibliographic information which, although scarce, allows us to create a coherent overview of the possible origins of Santería necklaces without having to utilize interviews or investigating the *Libretas* (documentation that the officiants must follow) of Santero. We then define the value and the use of these necklaces, examine their production, their sanctification, their relationship to relics, and–most importantly–their relation to the saints or orishas. We will also examine the forms and design elements of the necklaces with respect to their size, the variety and artistic use of color, the shapes and sizes of the beads, the materials, and the strands on which they are strung.

We use the descriptive method for the detailed analysis of the necklaces and the historic method for the narrative treatment of the orishas and their corresponding glass beads and how they are arranged in necklaces.

Some aspects of Santería necklaces will not be dealt with in this article, but it can be noted that the present use of these necklaces differs greatly from their original use to such an extreme that it makes us think that this proliferation of necklaces confirms a real change in religious ideas and their practice in Cuba. The use of the necklaces is currently very popular in Cuba and reveals that what was once secret and kept hidden is now emphasized and so common that it no longer garners much attention, primarily due to the commercialized over-production of the necklaces. So what once was very restricted in use is now popular with tourists.

## HUMAN ADORNMENT

Ever since humans sprouted from the face of the earth, they have utilized many different forms of adornment, whether by adding auxiliary items to the body or by making

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changes to themselves, always in keeping with the aesthetic criteria prevalent at the time.

Members of many cultures have frequently altered the forms of their bodies, and this is also what today's Cuban Indians have done. They have mutilated their teeth to form points (Rivero de la Calle 1974), and they have pierced their ears, noses, lips, and genitals, placing in these everything that was of importance to them and that they could obtain. Humans have also painted their bodies, or have tattooed or scarified their skins; in other words, doing just about everything possible to permanently decorate the body in a manner pleasing to the person and totally dependent on fashion (Brain 1979; Vallés 1992).

One of the simplest forms of self-decoration, and also the most common, is to adorn the neck with whatever objects that can be suspended there. Strands of such objects have come to be called necklaces, and have been utilized throughout time and in every socioeconomic class.

There are numerous forms of necklaces, composed of various materials, that have been worn by both men and women of all ages. The significance of a necklace varies depending on the different aspects of the life of its creator or wearer; i.e., whether it is used as a symbol of status, of religious ideas, of creative dress, of likes, or of fashion. The necklaces, therefore, incorporated the principal materials that were available to them and were important in their lives (Matillo Vila 1978).

Whether for status or for pleasure, humans hung from their necks something that would accompany them in their lives and could offer security. These incorporated beads of various substances such as glass, ceramic, shell, metal, and seeds. They also incorporated such things as colorful bird feathers, seashells, and pieces of metal, all of which were adapted for use as the wearer desired.

Archaeology provides numerous examples of the significance of the past use of necklaces and pendants. An example is the Sofka II site at Vienguerovo in Western Siberia where, in 1982, excavations uncovered a Neolithic tomb containing the burial of a child with a small bag of cowry shells tied around his neck. Centuries later, this same shell continues to be important in the Afro-American religions where they possess extraordinary value (Domínguez 1980).

In Cuba, excavations conducted at the Ingenio Taoro slave cemetery in Havana in 1970 revealed the presence of necklaces composed of round, white, wooden beads in one of the coffins. Another burial at the same site was accompanied by necklaces formed of jet beads and North American coins perforated for suspension, as well as canine teeth (Pl. IA). These date to the period from around 1865 to 1873 (Domínguez 1986).

## SOURCES OF INFORMATION

In dealing with the theme of this study, we had two options for carrying out the initial search for information: 1) doing the work using the books of Santería (Arango1990) as well as informants, or 2) only using the literature that existed in Cuba and was generated by Cubans. We chose the second option because the first required a series of actions beyond our capability.

An initial review of the literature revealed that relevant sources were quite limited and these would need to be utilized to the fullest to achieve a true understanding of the subject. We sorted the gathered literature into three different categories: 1) works that deal specifically with the necklaces of the orishas, 2) those that deal with the theme jointly with other ethnographic research, and 3) the general literature.

Studies concerning the necklaces of the Santería are very scarce with most of the information being found in the works that embrace the theme of Afro-Cuban religion. Being very broad in scope, they provide little information. Though concise, there is one very useful study that deals entirely with the subject. It is by the ethnologist and folklorist Rogelio Martínez Furé (1961). Using the works of Lydia Cabrera (1989) and Teodoro Díaz Fabelo (1956) as a basis for his study, he incorporates the results of his own field research, successfully explaining the use of the necklaces and their relation to the protective deities through the colors used and their marking number. Romulo Lachatañeré (1961) is the author of another classic on the subject: *Tipos étnicos africanos que concurrieron en la amalgama cubana*.

Three other works—though they provided a very general analysis of the Afro-Cuban theme—contribute a great deal of information about the necklaces of the Santería. The first two are by Jesús Guanche: *Procesos etnoculturales en Cuba* (1983) and *Componentes étnicos de la nación cubana* (1996). The third, *Componentes africanos en el etnos cubano*, is by Rafael L. López Valdés (1985). They all provide a valid analysis from the ethnographic point of view, including the use of the necklaces, and give us a general overview of the Yoruba religion as practiced in Cuba and of the progression of the Afro-American religions in our country.

Guanche (1983) dedicates a chapter to the paraphernalia used in the Yoruba religion and closely examines everything concerned with the necklaces. He also gives credit to Lydia Cabrera and to Martínez Furé, although he is much more explicit than they are, especially concerning the initiation ritual, also clarifying the production of the necklaces and the rules for their use.

In all of these works, great emphasis is placed on the number of necklaces that can be associated with any one saint. While there are rules that dictate what constitutes a necklace for a specific orisha, the appearance of the necklace depends on the creativity of the *Padrino* (the highest ranking official in the Rule of Orisha; also called *Babalao*) and the bead stringer (Arguelles n.d.).

The most recent work that has permitted us to derive an understanding of the Yoruba religion and the use of Santería necklaces therein, especially their association with specific orishas, is that of esteemed ethnologist Natalia Bolívar (1990). She has systemized the study of the Yoruba pantheon, and provides knowledge about the system of stringing beads for the necklaces of the different orishas and the value that is placed on the necklaces.

A novel point that arose during this study is the possible relationship of the Yoruba pantheon and the Arawak, the prehistoric inhabitants of Cuba. We found great similarities by consulting two works that are the basis for the study of Arawak mythology: those of José Juan Arrom (1989) and Sebastián Robiou Lamarche (1996). Combining this knowledge with the magnificent work of the much-esteemed Antonio Stevens-Arroyo (1988), as well as the studies by Daysi Fariñas (1995) and José Manuel Guarch (Guarch and Querejeta 1993), we were able to achieve our initial goal of determining the interrelationship of the *cemíes* (powerful spirits), saints, and orishas.

## ORIGINS

The religious beliefs of the Cuban people are derived from the symbiotic relationship (or *ajiaco*, as it was called by Don Fernando Ortiz [1963]) of three major cultural groups: the aboriginal, European, and African. Each of these was influential and dominant in Cuba at different times during the past 500 years. Their interaction led to the sociological process called trans-culturalization (Ortiz 1963).

As the new culture evolved, it is logical that religious ideas played a significance role and syncretization occurred. Until now it has always been stated that the syncretization was between the Christian pantheon with its saints and the African pantheon, especially the Yoruba, with its orishas, but no one has ever spoken of the syncretization with the Arawak pantheon, in which the so-called *cemíes* have the same function as the saints and orishas. This was not recorded in the Chronicles of that time, but it had to have happened in Cuba because it did occur in other parts of the Americas. What is certain is the presence of many of the elements of Arawak religion in the Afro-Cuban religions, the Rule of Orisha and the Palo Monte, a religion that originated with Bantu slaves from central Africa.

There are a great many examples, some of which are unrecognized as having been part of the daily life and beliefs of the Taíno Indians. These include the petaloid axe, better known as the stone of lightning (*piedra de rayo*), of indispensable use in Yoruba ritual but which was a tool for ordinary work originally, and the maraca which was initially a part of Arawak ritual and not a musical instrument. Also the worship of the forest or mystical trees and, especially, the use of necklaces (Domínguez 1997; Pérez 1979; Tro Pérez 1978).

Necklaces were used by the three participating cultural groups for one reason or another, but the group that seems to have actually utilized the necklaces of Santería was the aborigines who originally inhabited Cuba. We briefly studied the necklaces in the three groups and could establish their form and mode.

The Cuban aborigines were of South American Arawak origin, and profusely used adornment, from body paint to glass beads of all kinds. Made of various materials, necklaces were a major item and many have been excavated by archaeologists. These include strings of small shell beads in the style of the *mostacilla* (very small glass beads) in which the color as well as the number per string played a considerable role. Today they are still used in communities bound to their ancestors and who live in Venezuelan lands. There the colors red and pink are highly appreciated and the necklaces are made with fixed quantities of beads (Domínguez 1994). The forms of the necklaces present an extraordinary likeness to those that are made today for the Santería, above all those which correspond to the simple or single-strand necklaces and to the *mazo* necklaces which consist of several strands.

Spanish conquerors brought into mode the necklace of glass beads, of different colors and shades and styles, and these were used as much by men as by women. They were used as part of the initial commerce with the aborigines, as archaeology reveals them in great quantities from this period.

The men of African origin who arrived in Cuba during the early part of the conquest came from Spain. Blacks born in the motherland were the only slaves permitted to be brought to the New World. They, of course, brought European customs with them. This did not happen later in the 18th and 19th centuries when the slaves came directly from Africa (León 1980).

## BEADS

Glass beads were first brought to the Caribbean region by Christopher Columbus in 1492 (Karklins 1967). Some authors suggest that the glass-bead industry originated in Barcelona and Andalusia, but there is solid evidence that they were produced in other parts of Spain, as well as in Italy (Venice), Holland, and other European cities (Smith and Good 1982).

The beads that came over with the Europeans during the early colonial period have been found at various sites in the Caribbean including Nueva Cádiz in Venezuela where they were found in large numbers (Goggin n.d.; Smith and Good 1982), as well as in St. Augustine in Florida, in La Isabela in Santo Domingo, and even Havana. These early beads have nothing to do with the present-day necklaces that are discussed here. And if by chance any of them were used in the necklaces of Santería, they were only used as *glorias*, large beads that are inserted into necklaces to segment the strand.

Everything suggests that the Santería necklaces were first used by the Africans. We know, however, that the slaves that arrived in the 16th and 17th centuries came mostly from Spain and any beads would probably have originated there. But the slaves that arrived in the 18th and 19th centuries came directly from Africa and they would have brought the beads with them if they really did use them. Information on this subject is very limited, with very few archaeological excavations carried out at the embarkation points and generally interest there has been focused on what are considered more important artifacts such as those made of metal (León 1980). Prof. Irmino Valdés, who worked in Africa for a long time, did tell us that he could not find any reference to necklaces of beads in the major African departure points for the Caribbean, and that the necklaces that were occasionally found in archaeological excavations were composed of durable seeds. Furthermore, he was almost certain that the interaction of cultures in the Americas resulted in the assimilation of beads into the occult worship of the Yoruba and the Palo Monte (Valdés 1994: pers. comm.).

As previously mentioned, the few excavated archaeological sites in Cuba and in other parts of the Caribbean have not produced examples of African beads. There have been some similar ones but made of wood, and monochrome. For example, grave no. 5 in the Ingenio Taoro cemetery contained a Black individual who had beads at the neck. The strand did not reach completely around the neck and had a jet bead attached to it. It could have been a *gloria* (Domínguez 1986).

The conclusion is that the Santería necklace initially was not what it is today, not in its form, nor in the array of colors that we are presented with in the market, and that the necklace that resembles it the most is the aboriginal one composed of *mostacillas* (very small glass beads) in white and red.

There is a system for stringing glass beads for the necklaces of the Santería as each deity in the Yoruba pantheon is represented by different forms and colors. The beads are called *matipós* (opaque necklace beads) and can be strung into different forms, either simple ones composed of a single strand or the ones called *mazo* which are formed of several strings held together at intervals by larger beads. They are also made for personal use, like the simple necklace, in the form of a bracelet that is called *ildé* (a bracelet or charm with the colors of the orishas).

The beads are generally small and rounded, bright, of transparent or opaque or dull glass, and present all the primary and secondary colors in various shades. They vary in size from 2 to 3 mm in length and with a diameter of 1 mm. At times larger beads (*glorias*) are used as spacers. These can be of different materials and shapes, such as faceted glass.

When the necklace is completed it is said to be a Jewish (*judio*) necklace and is called *eleke* (a necklace of an orisha that has not passed through the consecration ceremony). After it has gone through the ceremony it is called *iñale* (necklace of the consecrated saint ) or *ñale* (contraction of *iñale*). The necklaces may be divided into three groups:

1) The simple necklace composed of a single strand (*see* cover) that is worn around the neck. Its length depends on the size of the person who will wear it as it should end at the top of the stomach, but always maintaining the prescribed marking number without altering the number of beads.

2) Rarely used, the double necklace is composed of two parallel strands held together at intervals by a *gloria* that could be made of jet, coral, or shell. Each saint or orisha has a specific base or foundation necklace to which the *Babalao* or *Padrino* makes additions pertaining to other saints for his godchild or initiate, depending on the paths he believes he or she should follow.

3) The *mazo* necklace (Pl. IB) is a true work of art that consists of various strings joined together at intervals with large *glorias*. These are necklaces for officiating and keep a relation in color and number with the guardian orisha. Generally they are not for personal use but used only while officiating in ceremonies (Figs. 1-2). Subsequently they are placed on the altars.

It is common to incorporate other elements into the necklaces that symbolize different aspects of great value

**Figure 1.** Vestments worn by those officiating over orisha rites relating to Obatalá (left) and Yemayá (right), along with other regalia (Museo Casa de Africa, Oficina del Historiador de la Ciudad de la Habana, Havana).

**Figure 2.** Ceremonial vestments and other paraphernalia related to Shangó (Museo Casa de Africa, Oficina del Historiador de la Ciudad de la Habana, Havana).

such as the canine teeth of leopards or tigers or, lacking these, those of dogs or pigs. The introduction of shells is essential in some necklaces and if these are cowries, from Africa for excellence, they are much more effective, although other species of specific value can be used in their place. Long valued, cowries in the Caribbean are substituted for the so-called *cinturita* which are also used for divination.

Other objects utilized in the necklaces include chains, perforated coins, and medals; in short, anything that appeals to the maker. Also used are beads of semiprecious materials like jet, amber, coral, and lapis lazuli, as well as conch shell, mother-of-pearl, ivory, and bone.

## THE RULE OF ORISHA OR SANTERÍA

The first news about the religions that apparently arrived directly from Africa with the slaves comes from the beginning of the 19th century. In reality, however, those who arrived in Cuba found religious beliefs already in place that had been derived from many elements of an endless number of beliefs. In time they would meld and produce what we know as the Afro-American religions which are very special in Cuba, as well as in other places in the Americas where African slaves arrived. In Cuba today there are two major religious groups: the Santería and the Palo Monte.

The religion of Lucumí origin, that we know as Yoruba and that originated from the area of present-day Nigeria, is what received the name Rule of Orisha or Santería. It is a polytheist cult that presents in its pantheon a conglomerate of deities called orishas, eminently earthly and thus a popular tradition (López Valdés 1985).

The other cult established in the Caribbean is also derived from Africa. Called the Rule of the Palo Monte, or the Arará religion of Bantu origin, it has elements similar to the previous one in some aspects of its pantheon with which it is interrelated and also utilizes elements of its paraphernalia. Both cults utilize necklaces for special purposes in their rituals, since both share at times their deities and other elements of official manner, but only those associated with the Santería will be described here.

We think that the Yoruba religion in Cuba and the rest of the Caribbean, where they profess actual conformity to a coherent cult and with many followers, has taken many elements from previous cults and has "transculturized" (Ortiz 1975) and given way to something new, which is what we see today.

In the Rule of Orisha, the necklaces are of great importance, whether they are simple or the ones called *mazo* which are used in rituals only. They are defined by their colors and by the number of beads. Each orisha is represented by favored colors and numbers. In making the necklaces, there can be variants that are decided upon by the one who rules the initiation of the neophyte, the *Padrino* or *Babalao*.

The use of the necklaces is traditional, possibly from the 19th century. The values attributed to them are many, but above all and specifically they serve to unite the worshiper and the religion. Their use is evident and that is what accredits the person with sound judgment. The necklaces are also displayed boastfully today because it is believed that they serve to ward off bad things, and with them, one can acquire the strength to live.

## CEREMONY

The preparation and imposition of the necklaces in the Santería has its regulations. We did not want to use the criterion provided by informants but rather we have just utilized information gathered from the surveyed literature which, though quite scant, has provided enough data to put the whole process in order.

The stringing process can be entrusted to a professional bead stringer whom the *Padrino* provides with specific instructions in each instance, or the *Babalao* or *Padrino* can make the necklace himself. The thread should be made from the agave (*pita*) plant and never nylon, keeping in mind the size and the order of the colors along with the proper number of beads, as well as the type of beads required for a specific orisha.

They are an example of *animismo* since a series of rituals are indispensable in initiating the necklaces and the neophyte who wears them. It is the initiation into life for the believer, and it is the initiation into life for the necklaces, but so that they can be effective and serve as an amulet or good luck charm, strict rules must be observed, otherwise they will not serve the purpose for which they are intended.

The ceremony of imposition is known as *medio santo*, or middle saint, and it consists only of receiving the necklaces; later they are returned to the warriors, another phase in the religion.

The necklaces invigorate life as soon as they are worn and to permit the wearer to feel real protection against evil, their primary function, the wearer should obey certain rules that regulate his or her austerity and comportment, from here the influential role playing of the Yoruba religion. When the necklace is to be initiated it should first be "washed" (*lavarse*) or "wiped" (*enjugarse*), bathing it in the blood of the animals that were sacrificed for this purpose. Called *asiento* (accession), this ritual lasts three days. Offerings (*omiero*) are placed for the saints and for the necklaces and prayers, called *súyeres*, are offered by the initiate and the *Padrino*, in accordance with what is stipulated in the *Libretas* and always said in *lengua* (tongues).

The *Padrino*, before imposing the necklace, must have consulted the divination system or the Panel of Ifá, so that he could be told which saint or holy protector is appropriate for the initiate. At this time other necklaces may be added or additions may be made to the base necklaces themselves to invoke the aid of other saints for the future life. Once the necklace has been imposed, it is said to be *trabajados*, or "working."

For the new worshipers who have had necklaces placed upon them, there are obligatory norms in their daily use, the most important being that there should be periodic offerings to them. One must also be aware of their behavior, since they talk to their master, their deity. For example, when the necklaces get tangled, that could mean that something bad is going to happen to the wearer, who should seek the advice of the *Padrino* to learn what can be done about the situation. The same thing holds true if the necklace breaks, which is even a worse case still, and the person should go quickly to the *Padrino* for advice (Guanche 1983).

The necklaces can be worn around the neck exposed to the view of others or they can be hidden and carried in a little purse in the pocket or a pocket book, depending on the occasion. The *ildé* (bracelet) can also be worn openly or hidden inside a skin bracelet. As much for women as for the men who wear them, there are rules that limit the wearing of the necklaces during sexual activities and, in the case of woman, they should be taken off during the menstrual cycle (Martínez Furé 1961).

## THE ORISHAS AND THEIR NECKLACES

Having provided an introduction to the subject, we will now delve deeper by providing a summary of each saint or orisha in the Yoruba pantheon with a corresponding reference to the *eleke*, the foundation or base necklace that relates to each. It is impossible to list all the variants of the foundation necklaces as they are practically infinite.

Although some deities have more than one foundation necklace, it has been possible to compile the marking numbers and sacred numbers for each deity, as well as the colors that pertain to each. It will also be noted if the necklaces are single or double; i.e., whether they have one or two strands. *Mazo* and composite necklaces will not be dealt with because their production and uses are different, nor will the *ildés* or bracelets because they relate to other facets of Yoruba ritual.

The orishas are presented in alphabetical order since the hierarchy of these deities is very complex and it is not possible to present a clear exposition given the interrelationship of the Yoruba pantheon. Aided by the work of Natalia Bolívar, it has been possible to provide a short biography of each orisha, which clarifies their importance in Yoruba cosmogeny, and how they syncretize with the Catholic saints. Something new that has come from this research is the similarity that many of the orishas have with the *cemíes* named in the works of Pané (1977).

### Aggayú

This major orisha is also called Aggayú Solá and Argayumare in the Yoruba pantheon. In the Palo Monte they call him Quendú and he syncretizes with the Catholic Saint Christopher.

He is the strong and violent man of the pantheon. He is the one who sustains the world and on many occasions is personified as the sun. He is also called the Giant of the Orishas. He is the father of Shangó, powerful and feared, master of the rivers and the rich and fertile land with optimum possibilities for planting.

Another of his characteristics is the energy he possesses, and he is considered the patron saint of wanderers or travelers. He is the patron saint of the city of Havana, which pays homage to him. His refuge as orisha is the royal palm. He has similarities with Huión in the Arawak cosmology who symbolizes the sun and is the divine ruler of the land.

Aggayú's necklace is plain, being of a single strand, and the marking number is 9, or a multiple of 9 until reaching 18. There are other numbers that can be used as well with this orisha and they are 3 and 6, but in this event the colors must be properly inserted when making the necklace.

The most representative color is caramel or cocoa-colored, although it is also valid to insert supporting colors like dark turquoise blue, as well as yellow, green, and red.

Some base necklace varieties for Aggayú are:

- Caramel-colored beads alternating with other beads of *agua de jabón* ("soapy water"–a translucent milk-white bead, much prized) until reaching 18 and then repeating this until the end of the necklace; the other three colors may also be added at this time.
- Cocoa-colored beads alternating with 9 beads that can be turquoise blue, and at other times red, green, and yellow.

- Round beads (*perlas*) in red and white with a sequence of 6 in 6.
- Cocoa-colored beads; after every nine beads may be inserted beads of red and turquoise blue, or green and yellow.
- Sequence of 9 red and 8 yellow beads with a large white bead at the end of the sequence, repeating the order until the end.

**Babalú Ayé**

A major orisha, also given the name of Obaluaye, who is syncretized with the Catholic Saint Lazarus in his two manifestations, the one of the church and the popular one which is the image of the saint with two dogs.

He is a much venerated saint because of his ties to the contagious diseases, especially leprosy, syphilis, and the infectious diseases that assaulted the New World in the 19th century. He is personified as the Father of the World. He had a very licentious life from which he fell ill and died, but it is told that he returned to life because God, who is so merciful, wanted it that way. The mythological persona that corresponds to him in the Arawak religion is Abeborael Guahayona, sufferer of a skin disease that was cured through prayer.

His necklace is simple with the marking number 17, although it can also be 7, 13, or 14. His unique color is purple, in its full spectrum. The beads that represent him are of the dull type (*matipó*) or opaque, white with small aqua blue stripes.

Variants of his basic necklace include:

- A complete strand of white *matipós* with small blue lines without the interference of any other color.
- Round beads of blue and white in a running sequence.
- Black beads, with *matipó* of Oyá (of various colors) and of Saint Lazarus (white with blue stripes), and red beads, all combined as one likes (Pl. IC) and sometimes with the addition of cowries or pierced African snails.

**Dada**

A minor orisha, syncretized with Our Lady of Rosario. He is the brother of Shangó, who raised him. He does not have any representation in any necklace, number, or color.

**Eleggua**

Minor orisha who also receives the name Elegbá. In the Rule of Palo Monte they call him Mañunga and he syncretizes in the Catholic sainthood with various deities such as The Holy Child of Atocha, the Lonely Soul (*Anima Sola*), St. Anthony of Padua, and St. John the Baptist.

He represents the god who holds the keys to destiny and is the first of the four warriors. He is also known as the gatekeeper of the forest and the savannahs, and to enter them one must ask his permission. He is considered the god of play and trickery, but for everyone he is the one who opens pathways, but very importantly, he can also close them.

There is a great similarity with the Arawak god Yucahú, the most important of that pantheon because he was the one who gave nourishment to the world and therefore opened the way for humanity.

His necklace is the simple type with the marking number 3, with red and black as its most representative colors, colors that simultaneously represent life and death, the beginning and the end, one and the other, in short duality, and the struggle between the two.

The variants that the foundation necklaces can have are as follows:

- Alternating red and black beads (Pl. ID, central strand).
- Black and red *matipós* which are augmented with something white and of jet.
- White and black round beads.
- A sequence of 3 red, 3 black, and 3 white beads, repeated until the string is finished.
- Alternating white and black beads.

**Ibeyis**

Minor orishas, represented by twins and always found in venerated situations in almost all the religions. They represent good luck in the Yoruba pantheon. They syncretize in the Catholic sainthood with Dimas and Damian, saints who appear to be brothers. They are the preferred and spoiled sons of Yemayá and Changó. They are cheerful and deceitful, and enjoy sweets very much. In Arawak mythology the presence of twins is very common and they are represented by conjoined Siamese twins.

They do not have a marking number or colors, and are not credited with necklaces.

## Inle

A major orisha also called Erinlé who is syncretized in the Catholic religion with the Archangel St. Rafael and the Guardian Angel. In the Arawak religion there are similarities with the *cemí* Baibrama who is the guardian of health and of farming and its produce.

It is said that Inle is the remedy of God and is known as the Doctor of the Orishas. He is the patron saint of doctors and physicians, and it is said that he is the one who directs and organizes the guardian angels. He was so handsome in his physiognomy that Yemayá (c.f.) fell so in love with him that she kidnaped him and took him to the bottom of the sea, as she knew these depths and their more secluded parts. He saw all her secrets so that when he wanted to leave, Yemayá cut out his tongue so that he could not describe what he had seen.

The necklace of Inle is simple with the marking number 21, although 5 and 7 can also be added. His most common color is dark green.

Variations of the foundation necklaces include:

- 21 bright blue beads and 3 yellow beads.
- 1 dark blue bead and 2 yellow beads.
- Dark green *matipós* for the entire necklace with 2 Prussian blue beads and one coral.

## Iroko

He is represented by the ceiba, a much-venerated mystical tree. It is believed that all of the orishas reside in this tree. It was also a sacred or mystical tree to the Taínos. It was venerated by all and offerings were left at its base. The ceiba was adopted by the Africans upon their arrival in place of the boabab, an African tree of equal mystical value.

Iroko represents the principles of the world, the heavens and the earth, and he is considered the staff of Olofi. When he finds the time he will dance around with a staff covered with various necklaces representing all of the saints and sometimes a broom adorned with beads. He syncretizes with the Immaculate Conception

In most cases it is reported that he does not have a necklace, but in others it is said that it is of a single strand with alternating white and red beads.

## Naná Bukurú

She is not considered to be a major orisha, nor a minor one, but she is the mother of Babalú Ayé. She has many mysteries associated with her, and in addition is as terrible as the thunder and as unpredictable. In the Catholic sainthood she syncretizes with Saint Anne. She has some relation with the *cemí* Guatuaba who represents thunder.

As for her necklace, there does not seem to be a concrete one, and there is no marking number. The necklaces that can represent her since he doesn't have her own are:

- Black and red beads, joined by alternating purple beads.
- Alternating round beads of white, red, and blue (Pl. ID, outer strand).

## Obatalá

Major orisha, son of Olordumare and creator of the earth. Above all he is known as the sculptor of humankind. He is the deity with pure excellence, master of the head, and is considered by many to be the best of the orishas. He was commanded to go to earth and do good. He is merciful and a lover of peace and harmony. He is always seen as the source of things.

He is syncretized in the Catholic sainthood with the Virgin of Mercy (*Mercedes*). In the Palo Monte he is called Quenqui and Mamá Quenqué. He may have a close relation to Yayael, the son of the supreme god Yaya of the Arawaks, although he also has a strong relationship to Marohú, a *cemí* who represents good times, happiness, and the good that pervades everything.

His necklaces are simple and the marking number is 8 or a multiple of 8. His color is white, although in the necklaces there can be beads of red, coral, green, purple, mother-of-pearl, *agua de jabón* (a translucent milk-white bead), and sometimes ivory.

The base necklaces are varied:

- A continuous strand of white beads with a single point of color (Pl. ID, inner strand).
- Sequence of 16 white beads, 4 of *agua de jabón*, 1 of coral, and 4 of *agua de jabón*, repeated thus until the end.
- All round white beads with a single bead of another color; it could be black, red, or blue.
- 24 white beads, and 1 red and 1 of ivory or mother-of-pearl.

This orisha can have an infinitie number of paths in accordance with the suggestions of the *Padrino* which, in any case, are represented in the necklaces by the established colors and marking numbers.

**Obba**

A major orisha, she is one of the wives of Shangó. She represents conjugal joy and is the eternal lover and advocate of difficult causes. She is also called Obá and syncretizes in the Catholic sainthood with Saint Rita of Cascia, Saint Catherine of Siena, Saint Lucy, and the Virgin del Camino.

In the Palo Monte she is called Totonkúa. She is portrayed without an ear as it is said that she was fooled by Ochún, who told her that to fuss over her man she should cut off an ear and she did so. She has similarities with the *cemí* Guamanaco who represents the first woman, who is seen to have been created by the moon.

She has a plain necklace with the marking numbers of 8 and 5. The most representative colors are caramel and amber, and also beads of translucent white glass (*jabón*). Pink and yellow beads are always a part of these necklaces.

The base necklaces and their varieties are as follows:

- 8 translucent white glass (*jabón*) beads, 8 caramel-colored beads augmented with 5 real amber beads (jet beads may be used in place of the amber beads, but both should be real).
- 27 caramel-colored beads, 3 honey-colored, and one of coral, repeated until the desired length is achieved.
- Alternating pink and lilac beads.
- Alternating purple and lilac beads.

**Ochosi**

Major orisha, also called Oshosi. He is syncretized with Saint Norbert, Saint Hubert, and Saint Albert, as well as with the Archangel St. James. Ochosi is the son of Yemayá. He lives in the forest and is king of the hunt and of justice. He is the best of the hunters, therefore his symbol is always the bow and arrow. It is said that his arrows never fail. He is the patron saint of those who have problems with injustice, magicians, diviners, and warriors.

His necklaces are double, composed of two strands which are joined by larger *gloria* beads placed at intervals. His marking number can be 2, 3, or 7, and his colors are green and blue. His necklaces always incorporate a snail shell, a bead of amber or of coral; a leopard's canine tooth is highly ranked. Occasionally chains are added.

The variants of the base necklaces are:

- Two strings with 14 blue beads on each which are then joined together by passing the thread through 3 honey-colored beads, one of amber, and another 3 honey-colored ones. This sequence continues to the end of the strand with the addition of snail shells and a coral bead.
- Bright green *matipos*.
- Round beads of transparent green or clear violet.
- Two strings of Prussian blue beads and from string to string one amber bead mixed in with 4 snail shells separated into twos by the amber bead, and alternates with some coral beads.

**Ochumare**

He is an orisha who was venerated in the 19th century, and is syncretized with Catholic St. Bartholomew. He is the orisha of the rainbow when it appears in the sky and for that reason has a relation with Oyá for having all the colors. He symbolizes the benediction of the world and humanity.

There is no known marking number and his necklace is a sequence of all the colors without order.

**Ochun**

Major orisha also known as Oshún. In the Palo Monte she is called Chola Nagüengue. She is personified by a splendid mulatto, who represents feminine excellence, and is syncretized in the Catholic religion with the Patron Saint of Cuba, the *Virgen de las Caridad del Cobre*.

She is the wife of Shangó and very intimate with Elegguá who is her protector. She is the beauty among the beautiful, reigns over love, and is the symbol of flirting, grace, and feminine sexuality. She assists in everything that deals with the process of human birth. She likes to walk through the forest singing and playing with the animals, which are obedient to her and praise her. She tames the wild beasts and it is said that not even the scorpion can sting her.

In a popular argot it is said "that she is the only one who brings enjoyment to Changó." She is very good, but can kill anyone with a smile, and in reality, when she laughs, she is truly the angriest.

Ochun is comparable in the Arawak-Taíno religion to the *cemí* Atabey, mother of the waters, mother of the Supreme Being, the feminine divinity of excellence and guardian of good childbirth, and above all, the ruler of happiness.

Her marking number is 5 and multiples thereof, but 8 is her day and also her number. Her colors are yellow and red. Her preference is for gold and everything that is golden. Her necklace is of a single strand and apart from the foundation necklaces, represent an infinite number of paths (Pl. IIA).

Her base necklaces are:

- Bright yellow strings of *matipó*.
- Round beads of yellow glass or of amber with red beads alternating 5 with 5.
- Round yellow beads in fives or multiples of 5, inserting one red bead every 5 beads.

**Oddúa**

This major orisha represents the mysteries of death and all of its secrets. It is suggested that he is able to cure the dying. Oddúa is a historical king in the foundation of Ifé. He is considered the King of Oyó and for all is Father Death.

He is syncretized with Jesus Christ and with the Holy Sacrament of the Altar. His father, as did the father of Jesus, sent him to earth to help mankind establish order over the land. He is also known as the ruler of solitude.

Oddúa can be compared with Maquetaire Guayaba of the Arawak pantheon, who is the servant of the dwelling of the dead and from another prospective he is related to Yayael, who was sent to earth by his father to help man.

The marking number is 4, and his colors are white and the color of coral. His necklaces are simple and should be 18 inches long. There are twelve known paths in addition to the foundation necklaces that are:

- 4 green and 4 white beads alternating to the end.
- 1 green and 1 white bead alternating to the end.
- 16 green and 16 white beads, with the addition of a mother-of-pearl or ivory bead.
- 16 white beads, then 8 red, 8 white, 1 of coral, and 8 white until finished.
- A necklace with 8 sections of milk-white beads separated from each other by 2 mother-of-pearl beads with a coral bead between them.

**Oggan**

A minor orisha who is the saint who serves as a warrior. Also called Asia Eleké or Bandera, he represents all the saints and that is why he is able to wage war. He lives and eats with Oggún.

He does not have a marking number and enjoys all of the colors. The foundation necklace is a great gamut of repeating colors with the addition of 3 snail shells and a chain.

**Oggún**

Major orisha and brother of Shangó and Elegguá. He is the master of iron. In the Palo Monte he is called Zarabanda, and is syncretized with a great deal of saints from the Catholic religion including St. Peter, St. Paul, St. John the Baptist, and the Archangels St. Michael and St. Raphael.

He is represented by a dark *negrito*, is violent and astute, and is considered the god of minerals, tools, and the mountains. He is also known as a lone hunter and a wanderer who travels through the woods and understands all of its secrets. As a sorcerer he rules the secrets and the mysteries of the forest and the mountains. He is the master of keys, chains, and jails.

His is a simple necklace with the marking numbers 3 and 7. His colors are black, green, and sometimes something red. His foundation necklaces are:

- A black bead and a green one with a red one.
- Alternating transparent green and black beads.
- 21 black, 7 green, 1 red, 1 jet, and 1 red bead, until done.
- 3 black and 3 green beads, to the end.
- 7 green, 1 red, 7 black, and 1 red bead, repeated until finished.

The canines of large feline animals, cowrie shells, and jet can be incorporated into the necklaces. When the necklace of Oggún belongs to an *oriaté* (a master of orisha rites and major ceremonies), cowries are added to it.

**Oke**

A minor orisha, Oke is the patron god of the mountains and is syncretized with the Apostle St. James. He represents the first hill or promontory that emerged from the depths of the ocean and everything that is elevated or high. He is vigilant and a guardian. He does not have a number, a color, or a necklace.

**Oko**

Major orisha who is the deity of agriculture, the earth, and the harvest. He is syncretized with St. Isidore, the Farmer. In the Palo Monte he is called Musilango. He has a really strong relation to the *cemí* Boynayel or Llora Lluvias who in the Arawak pantheon is the one who makes the land prosper.

Oko is personified as a young farmer, serious and chaste, and for that reason he is the patron saint of farmers.

This orisha assures the prosperity of the land because he is the master of everything that is harvested and everything that has to do with the earth. He is also seen as the arbitrator of disputes between women and, above all, between the orishas.

His marking number is 7 and his colors are pink and blue together. His necklace is simple. The foundation necklaces can be:

- 7 clear turquoise blue and 7 pink beads that are almost lilac, and may be adorned with snail shells.
- Red beads with darker stripes.
- 7 transparent blue, 1 red, 7 purple, and 1 jet, with interspersed coral.
- Alternating aqua blue and black beads.

**Olokun**

Major orisha, owner and master of the ocean, powerful and terrible on land and in the sea. Tries to dominate the land by all possible means. Lives at the bottom of the ocean with a giant marine serpent held by seven chains. He does not relate to any known Catholic saint. He has a certain relationship to Deniman Caracaracol who is the ruler of the seas in Arawak cosmology.

His necklace is simple. The marking number is 9 and his colors are blue and white. The variants present in his base necklace include:

- Alternating blue and white beads.
- Alternating dark blue and translucent white glass (*espuma de jabón*) beads.
- Round crystal beads of different tones of blue, with the addition of a few green and red beads.
- Indigo blue beads combined, as one likes, with red glass beads, and opal and coral beads.

Previously necklaces were formed of large beads of an intense blue that resembled lapis lazuli, mounted on an iron wire.

**Orula**

He is a major orisha, also given the name of Orumilla, who is syncretized with Saint Frances of Assisi, Saint Joseph of the Mountain, and Saint Philip. He is the one who has the secret of divinations that was given to him by Shangó. Orula is the only orisha who Olodumare confided in regarding the secrets of Ifá.

A complex religion has been organized around this deity that highlights him and distinguishes him in relation to the other orishas. He is presented as a great benefactor of mankind and for all, the most important advisor, because he can reveal the future and allows man to influence it. Personified with wisdom, he is also the supreme oracle and knows the secrets of Ifá. He can be personified with Yayael, the son of Yaya, in Taíno mythology because he has come to earth to help mankind.

His necklace is simple. The marking number is 8, and his colors are green and yellow. His foundation necklaces are:

- Alternating green and yellow beads (Pl. IIB). This necklace can only be worn by the *Babalao*. There is also a bracelet or *ildé* with the same color pattern.
- Alternating red and green beads. The same pattern is used for the bracelet.
- 8 red, 8 pale blue, 8 white, 8 caramel-colored, and 8 yellow beads, then 8 white and 8 red beads, until finished.
- Alternating round beads of opaque yellow glass and green glass.

Orula is also accorded a necklace of all the colors because it is the necklace of war and he is the force.

**Osaín**

A major orisha, also known as Osayín and Irosun, who is syncretized with Saint Joseph and Saint Benedict. In the Palo Monte they call him Gurunfinda. He may be related to Yahubaba, who is the *cemí* in charge of collecting herbs in the forest. There are *cemíes* that are characterized as having only one eye who may be related to Osaín.

Osaín has only one hand, one leg, and one eye. He is the master of the forest and of herbs. He does not have a father or a mother, but sprouted from the earth like a plant. For this reason he is established as the ruler of nature. He is also the ruler of all the shrubs, good and bad, and possesses magical powers because of these plants.

His necklace is simple; its marking number is 4 and its colors very varied. The foundation necklace is as follows:

- Beads of different colors like red, blue, green, white, etc.

Various items may be added to the necklace: silver coins; old copper coins (*quilo prieto*); beads of mother-of-pearl, ivory, amber, and other materials; tortoise shell; rooster spurs; tiger skin; grains of toasted corn; dog canines, etc.

### Osun

Major orisha who is the guardian of the heads of the believers. He is syncretized with the Staff of St. Francis, St. Manuel, St. Dimas, and the Divine Providence. He is the guardian of Obatalá and the messenger of Olofi. He is the orisha of irradiation and is considered next to the warriors. Ultimately he represents life itself. He is related in Arawak cosmogeny to Maroya who radiates because she is the moon and watches over the world.

His necklace is simple and the marking number is 8. The colors are clear blue, white, yellow, and red. The foundation necklaces are:

- 8 clear blue, 8 yellow, 8 white, and 8 red beads alternating to the end of the strand.
- Beads of 4 colors (white, blue, yellow, and red) that signify the paths. These beads are separated by 2 mother-of-pearl beads with a coral bead in between.
- 16 white and 8 *punzo* (vibrant red) beads alternating to the end.

### Oyá

A major orisha also known by the names Yaya and Oyá Yansá. She is syncretized with the Virgin of the Candlemas, the *Virgen del Carmen*, and Saint Teresa of Jesus. She relates to the Arawak *cemí* Guabancex who is the lady of the winds, personifying the hurricane with her arms in the form of whirlwinds.

Oyá represents lightning and that is how she is known in the Palo Monte. She is the goddess of winds and storms, and guardian of the foremost part of the cemetery. She is violent and impetuous, loves war, and personifies hurricanes. Oyá accompanied Shangó in all of his battles and fought together with him to destroy the enemy with her spears and lightning. She was Changó's lover and is considered his favorite.

Her marking number is 9 and her colors are very varied. Her necklaces are very simple, with the foundation necklaces as follows:

- 9 caramel-colored beads with black and white stripes, followed by 1 red or maroon and 9 caramel-colored beads, alternating.
- 9 black and 9 white beads that alternate.
- *Canutillos* (beads that are smaller than the normal ones) of clear sienna or dark sienna.
- 9 white and 9 black beads in 9 groups each.

### Shangó (Changó)

Major orisha who is syncretized with St. Barbara, although he is considered a male orisha. In the Palo Monte he is called Siete Rayos. In the Arawak religion he is similar to the *cemí* Bayamanaco, ruler of fire and master of the secret of the making of cassava bread.

Shangó is the king of fertility and of fire, chief of the thunderbolt and of war, as well as of the drums. Son of the orishas Aggayú and Yemayá, he was raised by Obatalá who gave him his white and *punzó* (vibrant red) necklace and told him that he would be King of the World.

He is the representation of virile beauty, and patron and advocate of warriors. Storms are entrusted to him for he guides them. He is a very festive supporter of dancing and music. His preferred symbol is the metal axe and the *piedra de rayo* (stone of lightning), which is none other than the petaloid axe of the Taíno.

The necklace of Shangó is simple. The marking number is 4 or multiples of 4. His color is red, symbol of love and blood, with the addition of the color white to refresh it.

The variants that have been found for the base necklaces are:

- Alternating red and white beads (Pl. IIC).
- Alternating round beads of red and white.
- One white and one red bead, 6 white and 6 red, which are followed by a white bead and a red bead to a total of 12, and then 6 white and 6 red beads; this sequence continues until the desired length is reached.

### Yemayá

A major orisha, Mother of the Waters, who possesses other names like Yemanya and Yemaja. She is syncretized with Our Lady of Rule. In the Palo Monte she is called Baluanda. She compares with the Arawak *cemí* Guabonito. She is grand since she lives in the depths of the ocean and has great magical powers.

As Yemayá is the mistress of the waters, from her came the seas and the rivers and therefore everything that is nourished and lives on the land, since water is the fountain of life. Because of this she has received the name Mother of Life, the fundamental fountain of life. She is also considered the goddess of fish and marine life in general. She prefers to live in the foam of a wave, and to show reverence one must make an offering of coins at the edge of the shore as a sign of grace.

Her necklace is simple. Her marking number is 7 and her color is every shade of blue. Also white beads, especially when they are used with the beads that are called *espuma de jabón* (translucent milk-white).

The foundation necklaces (Pl. IID) are:

- *Ñales* or aqua blue beads.
- Round beads of white glass and clear or translucent blue, alternating 7 each.
- Ultramarine blue beads of opaque or transparent glass, alternating 7 and 7 or multiples of 7, being 14 or 21.

### Yewa

A major orisha that has the name Bantalonqui in the Palo Monte. She is syncretized with Our Lady of the Abandoned, Our Lady of Sorrows (*la Virgen de los Dolores*), Saint Clare of Assisi, Saint Rose of Lima, and also Our Lady of Monserrate.

She is the beautiful daughter of Oddúa, mother of Shangó, and seduced by him, for which she was punished by being made to oversee the dead when they are given to Oyá for burial in cemeteries and tombs. She is the equal of the *cemí* Itiba Cahubaba, great mother, the great giver who also takes care of cemeteries.

Her necklace is simple. Her marking number is 11 and sometimes 4. Her color is pink. Her foundation necklaces are:

- A strand of opaque pink *matipó* beads.
- 4 pink and 4 red beads, 1 real coral bead, and an interspersed jet bead.

## CONCLUSION

This study supports the hypothesis that the necklaces used in the Santería of Cuba are derived from a symbiosis of the earlier Antillean native legacy and the later African one of slave origin.

Beginning with the use of color, the selection of numbers, and the counting of beads for the stringing of the necklace, we find a union of ideas and forms that permit an implicit reading of the necklaces. Thus, a specific message is expressed by means of the necklace that hangs from a believer's neck.

There is still much more to investigate and clarify about necklaces of the Santería, beginning with their origins. We have only outlined the subject and explained or taken into account the inferences from the written documentation available in Cuba and leave the subject open for future interpretation.

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# *DIE PERLE:* A 1920s GERMAN TRADE JOURNAL

Anita von Kahler Gumpert and Karlis Karklins

*Though short lived, the German trade journal,* Die Perle, *contains a wealth of information concerning the European bead and jewelry industry of the 1920s. Short articles provide insight into new machinery and apparatus for producing beads, natural and artificial materials for the production of beads and other ornaments, fashion trends, market reports, and numerous other topics. As well, there are several departments which deal with specific themes such as technical questions and sources of supplies. As the journals are in German, English summaries are provided for a representative sample of the articles to give the reader an idea of their vast scope.*

## INTRODUCTION

*Die Perle* was a technical trade journal published in Naunhof bei Leipzig, Germany, from 1924 to 1929. Although written in German, it was aimed at the entire European beadmaking community. In the early years, its full title was *Die Perle: Zentralorgan für die gesamte Edel- und Kunstperlen-Industrie, Perlenschmuck, Korallen-, Bernstein- und Edelsteinbranche* (The Bead: Central Organ for the Entire Gem- and Artificial-bead Industry, Bead Jewelry, Coral, Amber, and Gemstone Branch). In June of 1927, it became *Die Perle: Zeitschrift für die gesamte Perlen-Industrie, sowie Schmuckwaren, Besatz- und Devotionalien-Branche* (The Bead: Journal for the Entire Bead Industry, as well as the Jewelry, Embroidery, and Devotional Branch).

Each issue, with 8-12 pages, contains a number of brief articles on sundry aspects of the bead, jewelry, and button industries, as well as several departments, including:

1) *Aus der Werkstatt des Perlenmachers* (From the Workshop of the Beadmakers). Contains brief items concerning technical aspects of beadmaking.

2) *Export-, Zoll- und Handelsnachrichten* (Export-, Customs- and Commercial Report). Presents information relating to the export of beads and jewelry to specific countries worldwide.

3) *Technischer Fragekasten* (Technical Question Box). Provides answers to specific technical questions from commercial correspondents.

4) *Bezugsquellen-Anfragen* (Inquiries Regarding Sources of Supply). Contains inquiries from readers concerning sources for specific products, supplies, and equipment.

5) *Patentschau* (Patent Review). Lists recent patents relevant to bead and jewelry production.

6) *Marktbericht* (Market Report). Provides current prices for various raw materials required for the beadmaking and jewelry industry.

7) *Literatur, Büchermarkt*, or *Bücherschau* (Literature, Book Mart, or Book Reviews). Announces technical publications of interest to the industry.

Each issue also contains numerous display advertisements which reveal what various enterprises were manufacturing and supplying (Fig. 1). Some of them include illustrations of the advertiser's factory (Fig. 2), or the beadmaking equipment (Figs. 3-5) being offered for sale.

In all, the journal contains a goldmine of information concerning beadmaking and the European bead and jewelry industry, especially that of Germany, during the 1920s. Unfortunately, the journal is obscure and sources for it are very difficult to find. Karklins was fortunate enough to track down and acquire a microfilm copy of volumes 1 and 3-6 from the Deutsche Bücherei in Leipzig a number of years ago. He was subsequently equally fortunate in enlisting Anita Gumpert to annotate a representative sample of the articles in the existing issues. Their translated titles and abstracts are presented below.

## SELECTED ARTICLES FROM *DIE PERLE*

Presented here are summaries of a representative sample of the articles that deal specifically with beads. Articles dealing with other aspects of the jewelry industry have not been included. The year, volume, number, and initial page for each article appear in parentheses at the end of each summary.


**Figure 1.** A sample page of display advertisements from *Die Perle* (1929:vol. 6, no. 1, p. 8).


**Figure 2.** Advertisement for the synthetic material Galalith, used to make both beads and buttons (*Die Perle* 1928:vol. 5, no. 1, p. 7).

## The Production of Machine-Made Wound Beads in France

A patented invention by M. Bonnet introduces a mechanized system for the manufacture of wound beads. The machine permits the mechanized rotation of glass gathers wound on a solid metal wire that is coated with a solution that prevents the gather from sticking to it. The invention presents distinct advantages, but whether the product can replace handmade wound beads by well trained artisans remains to be seen. (1924, vol. 1, no. 1, p. 3)

## Utilit, A New Art Material for the Manufacture of Beads

A new material called Utilit has been put on the market by the German Raw Material Industry that is a by-product of the distillation of wood and anthracite and therefore belongs to the category of phenol resin. It is fireproof, unaffected by water or temperature, can be carved, perforated, tooled, ground, and polished to a high gloss, and has a rich scale of colors, from transparent to vivid red. These characteristics led in a short time to its use in the manufacture of beads. Utilit is marketed in the form of sheets or bars about 25 mm thick. (1924, vol. 1, no. 1, p. 5)

## About Acid Polishing Glass Beads and Glass-Paste Gems

Polishing with acids is widely used for articles that cannot be easily faceted and polished. This article advises on the kinds of acids to be used, at what temperature, and in what proportions. The proportion of the various kinds of acids used varies according to the composition and hardness of the glass. (1924, vol. 1, no. 2, p. 10)

## The Manufacture of Venetian Glass Beads and their Decoration

The article recalls that the manufacture of small glass beads for decoration dates back to 1500 B.C. and seems

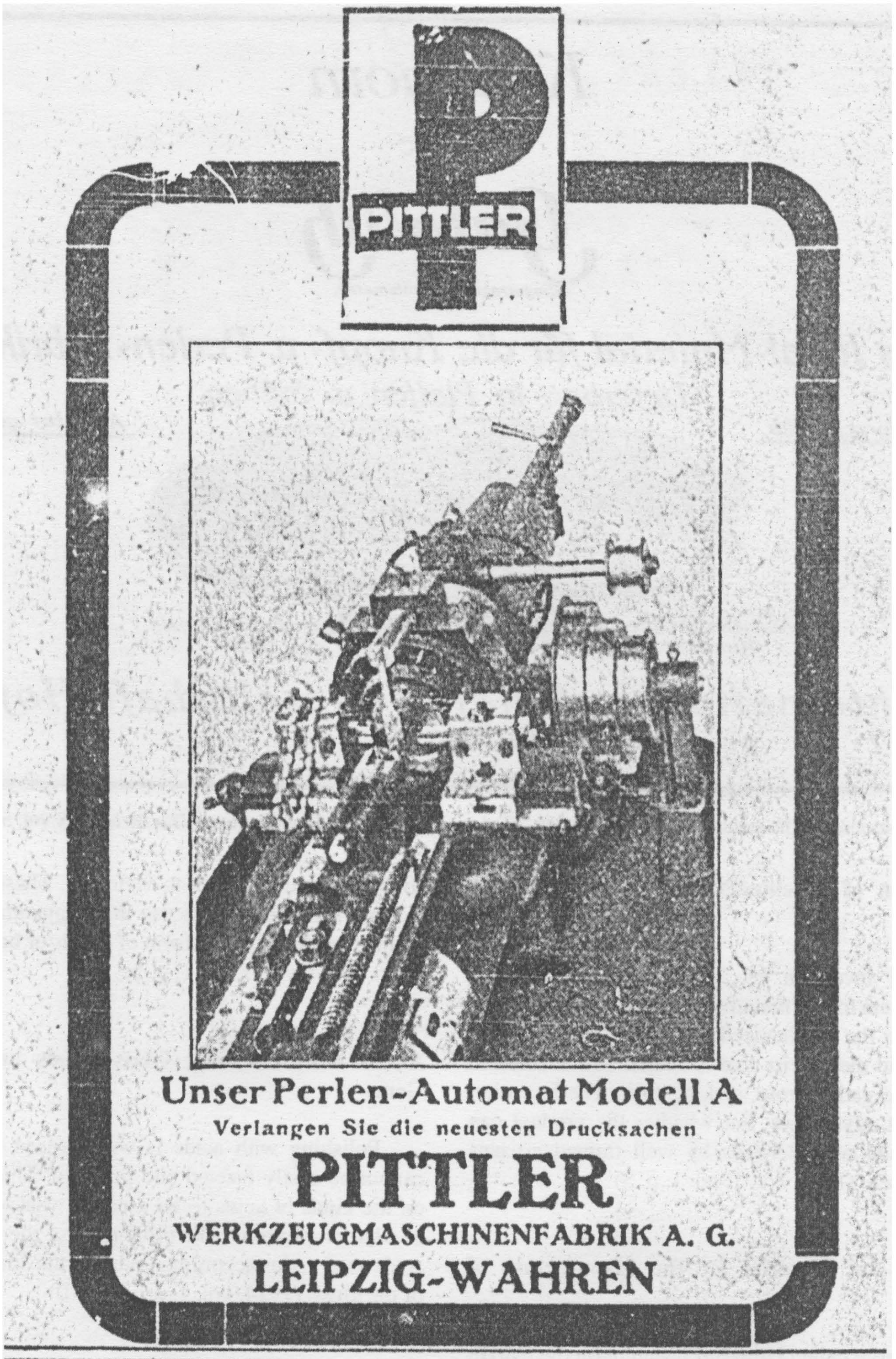


**Figure 3.** Advertisement showing the Pittler automatic beadmaking machine Model A *(Die Perle* 1924:vol. 1, no. 1, inside front cover)

to have been forgotten until the 14th century A.D. when Venice revived it for the manufacture of rosaries. In the 16th century, when the Italian Andre Viadora created a sensation with his hollow glass beads, the first machine for automatic beadmaking was introduced. Since those primitive and hand-operated beginnings, the machines have evolved into those

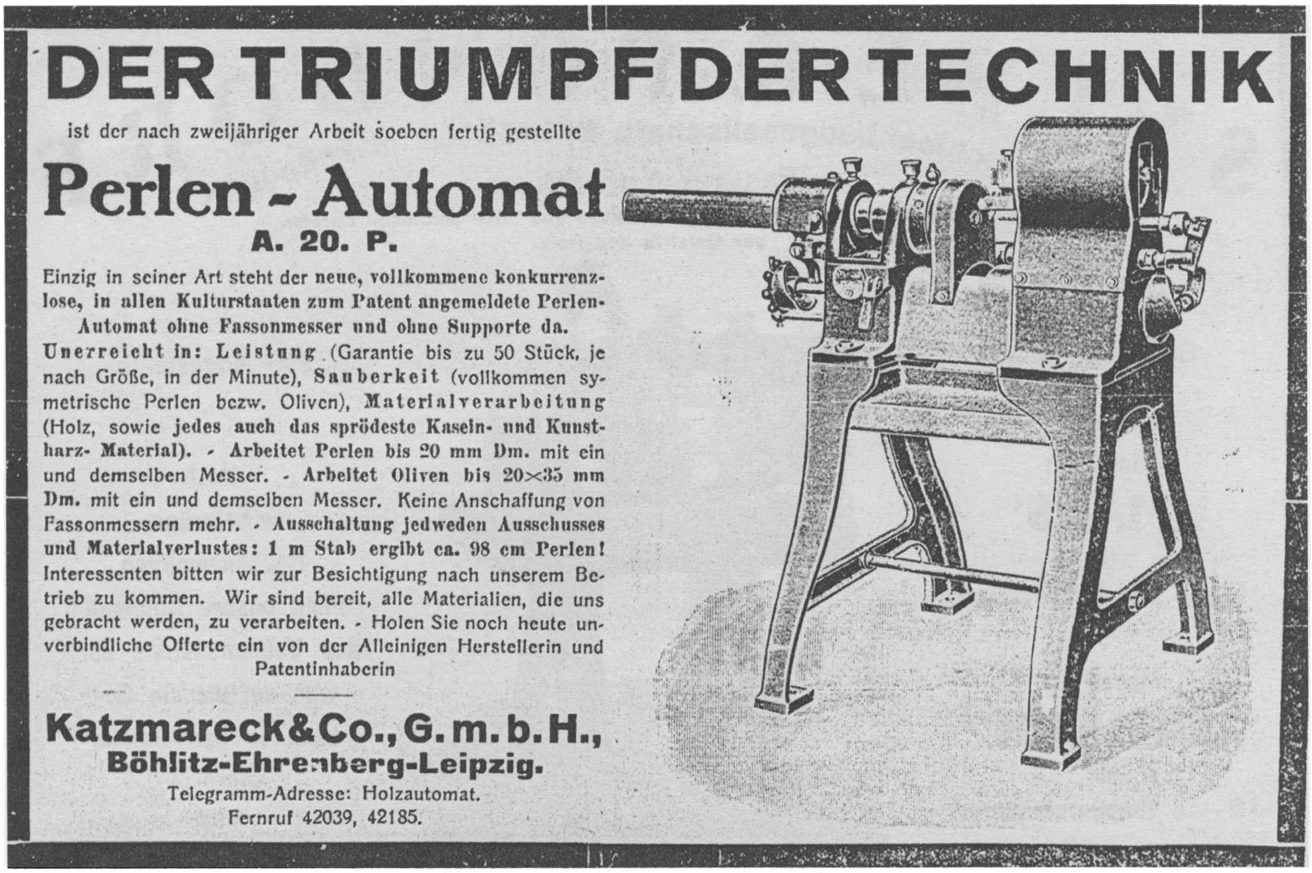


**Figure 4.** A machine for the production of beads from wood and other materials from the firm of Katzmareck & Co. (*Die Perle* 1924:vol. 1, no. 2, p. 16).

currently used for the manufacture of seed and bugle beads (Fig. 6). The process is described including the methods for silvering and gilding the beads. (1924, vol. 1, no. 2, p. 11)

### Perlfix, A New Machine for the Manufacture of Beads

Perlfix is to date the best patented machine for the production of beads of various forms from synthetic materials like artificial resins. It is small, easy to operate, and avoids the mishaps of previous systems, like the premature breaking of the articles. It can fashion the beads from the tiniest size to diameters up to 20 mm. It is marketed by the German firm Katzmareck & Co., Leipzig. (1924, vol. 1, no. 2, p. 12)

### New Synthetic Materials for the Bead Industry

Dekorit and Leukorit are two new synthetic materials for the manufacture of beads produced by the chemical factory of Dr. F. Raschig in Ludwigshafen. Dekorit resembles celluloid, Galalith, and hard rubber, but is not flammable and harder than celluloid. It can be used for imitation coral and ivory. Leukorit is the perfect substitute for ivory. (1924, vol. 1, no. 2, p. 13)

### About the Mechanized Mass Dipping of False Pearls in France

To keep abreast of the competition from Japan, European beadmakers have endeavored to simplify the production and decoration of beads. Now France has devised a mechanized system to decorate pearls with fish-scale luster that can be easily adapted to the coloring of other types of beads. It therefore deserves the attention of all bead manufacturers. A schematic drawing shows the apparatus (Fig. 7). (1924, vol. 1, no. 3, p. 20)

### About the Bead Market

Future prospects for the bead business are encouraging, according to trade circles. Particular attention is paid by

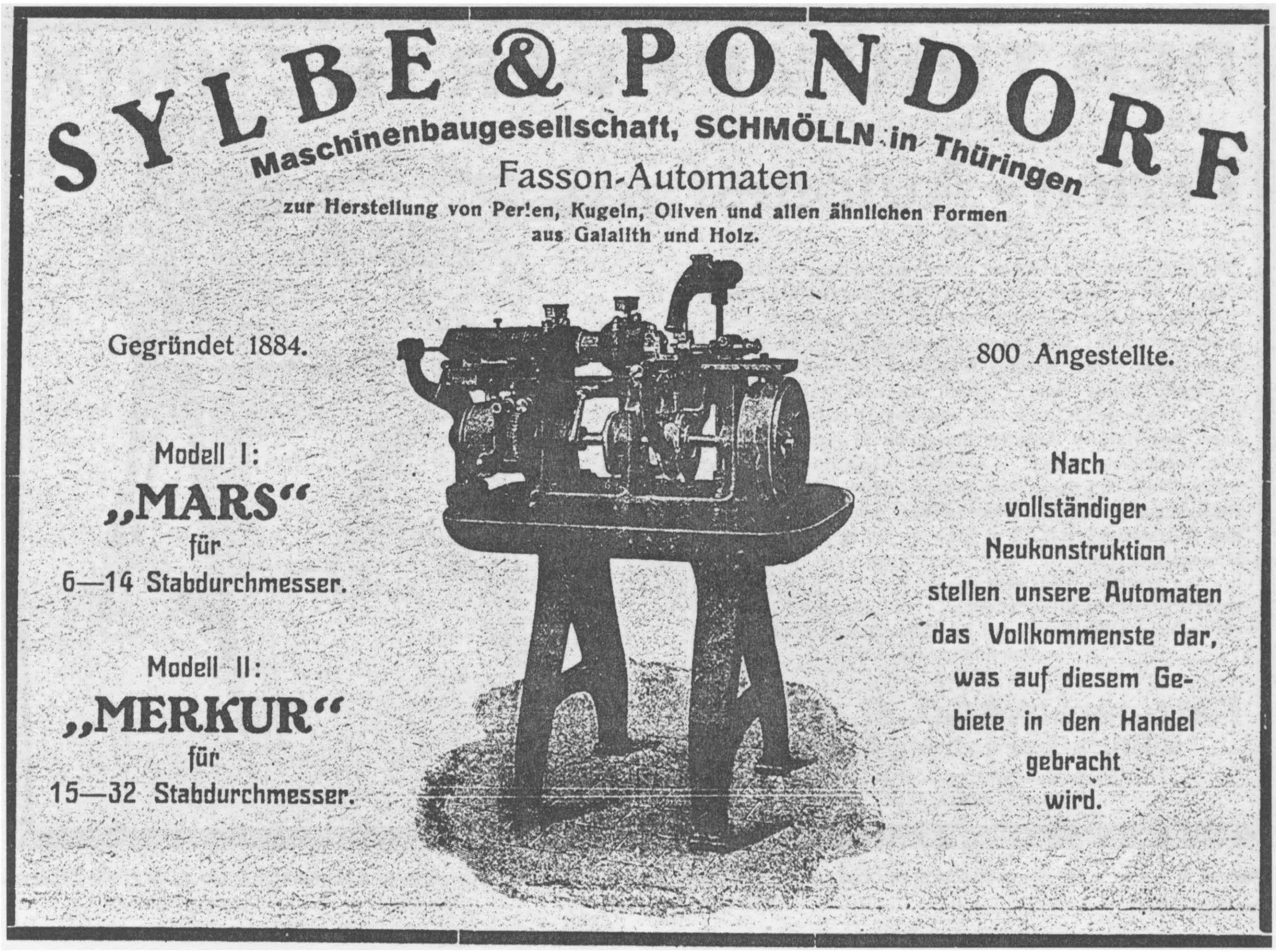


**Figure 5.** Advertisement offering two models of machines for the production of beads from Galalith and wood (*Die Perle* 1924:vol. 1, no. 2, inside back cover).

buyers abroad to beaded laces, fringes, and ornaments. An interesting phenomenon on the bead market is the attempt of Japanese beadmakers to be ahead of the French. A temporary truce occurred only because of the present American boycott of Japanese products. How long that boycott will last is questionable as the American buyer is calculating and will let the two rivals play it out among themselves to his own economic advantage. (1924, vol. 1, no. 4, p. 26)

### A Faceting Apparatus for Beads and Stones

Great progress has been made in this field, especially in France. The new machines are not specially manufactured in tool factories, but are systems created by competent mechanics that are based on their practical experiences. The article illustrates and explains the functioning of the apparatus. (1924, vol. 1, no. 4, p. 27)

### Synthetic Materials for Bead Manufacturing

Juvelith is widely used in the button and bead industries. It is the synthetic material that most resembles amber. It can also imitate gemstones, is light in weight, and easy to polish. Galalith or "milk-stone" is made into various convincing imitations of tortoise shell, amber, ivory, and horn. Unlike other synthetics, it is not only surface-colored, but dyed all the way through. (1924, vol. 1, no. 5, p. 36)

### A Simple and Practical Apparatus for the Faceting of Beads

This machine is destined primarily for small enterprises that still use pedal power and hand-control. It ensures absolute regularity of faceting, is simple in construction, and easy to use (Fig. 8). (1924, vol. 1, no. 7, p. 56)

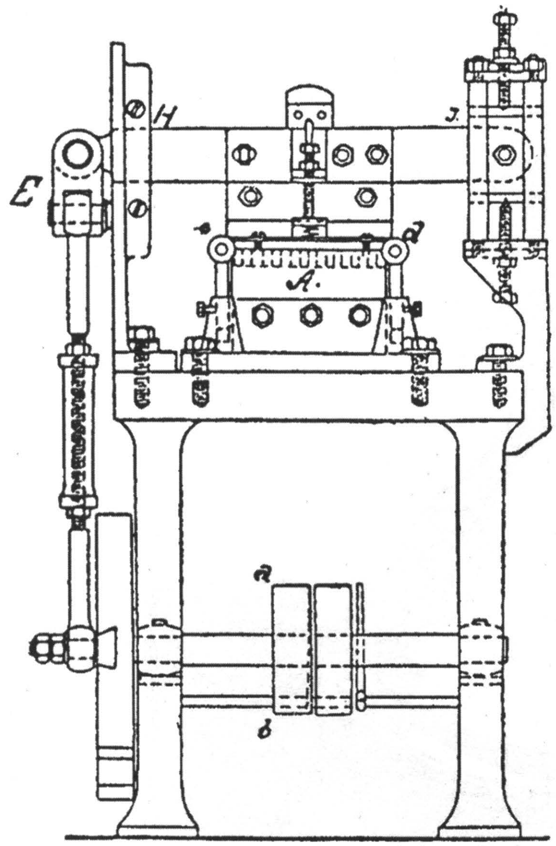

**Figure 6.** An example of the type of machine used in Venice to chop glass tubing into bead lengths (*Die Perle* 1924:vol. 1, no. 2, p. 11).

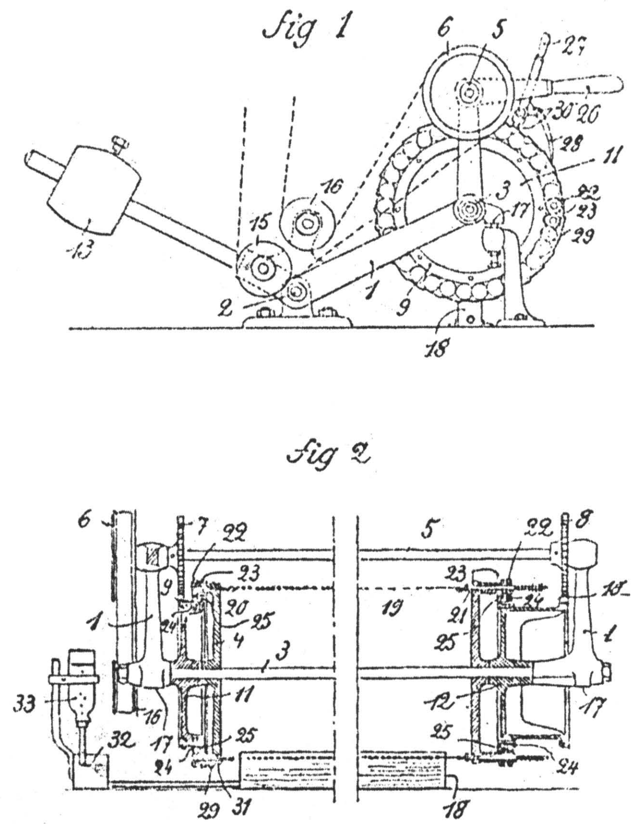

**Figure 7.** Schematic diagram of the mechanized system used to decorate pearls with fish-scale luster (*Die Perle* 1924:vol. 1, no. 3, p. 20).

**Iridization of Glass Beads and Glassware by a Cold Method**

This is accomplished through the application of various chemicals. The process is described in detail. (1924, vol. 1, no. 7, p. 56)

**About the Cutting and Polishing of Horn, Bone, Vegetable Ivory, Galalith, and Celluloid Beads**

The process is carried out in two stages: a preliminary, rough polishing followed by polish to a fine finish using pumice, emery, or felt discs especially manufactured for the purpose. Which one is used depends on the consistency of the material to be polished. (1924, vol. 1, no. 7, p. 57)

**Modern Beaded Purses**

This article describes and illustrates several modern Parisian beaded purses that incorporate glass, wood, and synthetic beads, but in a different way than before (Fig. 9). The beads no longer fill the entire surface of the purse, but outline the contours with stitched borders or tassels. Some are square, some oblong, and have metal frames. All have beaded handles. The latest Parisian creations are dainty purses woven with golden rocaille beads. Table runners and covers are decorated in a similar manner. (1924, vol. 1, no. 8, p. 66)

**Of the Overseas Glass Bead Business**

Germany and Bohemia have neglected the glass bead business because they have taken their overseas customers for granted. If they don't want to lose out to Japan and France in those markets, they will have to pay close attention to the evolution of tastes in the "exotic" countries where the bead business has undergone very little change because these countries have not been subject to fashion trends until now. (1924, vol. 1, no. 8, p. 68)

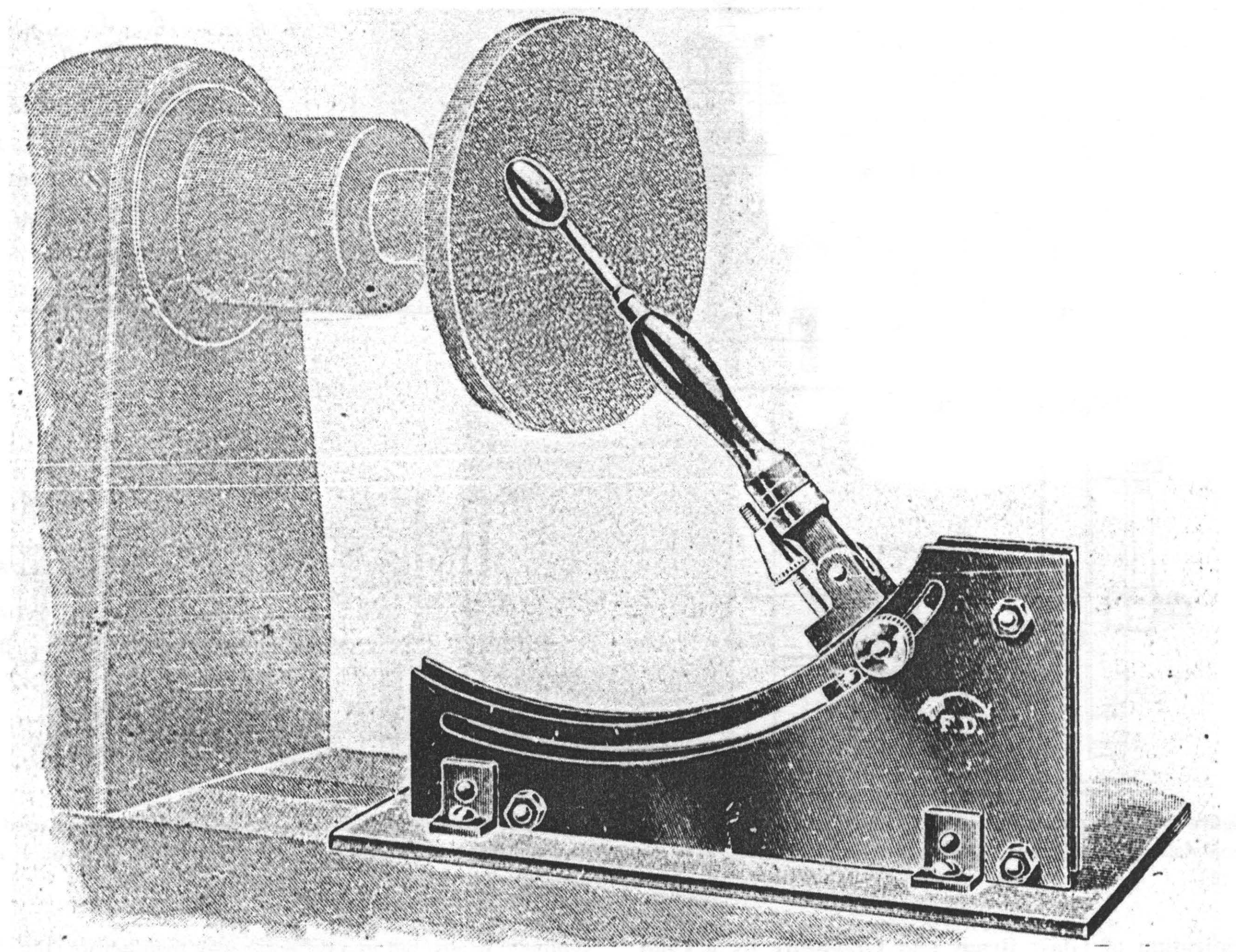


**Figure 8.** A simple and practical apparatus for the faceting of beads (*Die Perle* 1924:vol. 1, no. 7, p. 56).

**Year's Review in the Bead Industry**

The year 1925 was favorable for the bead and pearl industry in spite of foreign, especially Japanese, competition. This primarily thanks to technical advances in the creation and production of new synthetic materials. The popularity of natural, cultured, and artificial pearls has also contributed to a heightened interest in beaded jewelry. Prospects for the coming year are also favorable. (1926, vol. 3, no. 1, p. 2)

**Practical Instructions for Coloring Vegetable Ivory Beads and Buttons, etc.**

The method is similar to the coloring of cotton. The difference is that the amount of the coloring material is determined by the amount of liquid and not by the size of the material to be dyed. The article provides recipes for producing 33 different colors. (1926, vol. 3, no. 2, p. 14)

**Albolit and Utilit as Raw Materials for the Button and Bead Industries**

Although already widely used in the manufacture of buttons and beads, we again draw attention to these synthetic materials because of their usefulness for all kinds of industries. Both are made today in 200 shades of color and many shapes. Both are easy to mold, fireproof, and adaptable. Albolit is essentially based on the already well-proven Utilit, but surpasses the latter in solidity, hardness, and elasticity. It is thus an ideal substitute for natural ivory. (1926, vol. 3, no. 2, p. 17)

**News about Bead Embroidery**

Pearl embroidery retains its fashion value. There is much demand for brightly colored embroidery beads for

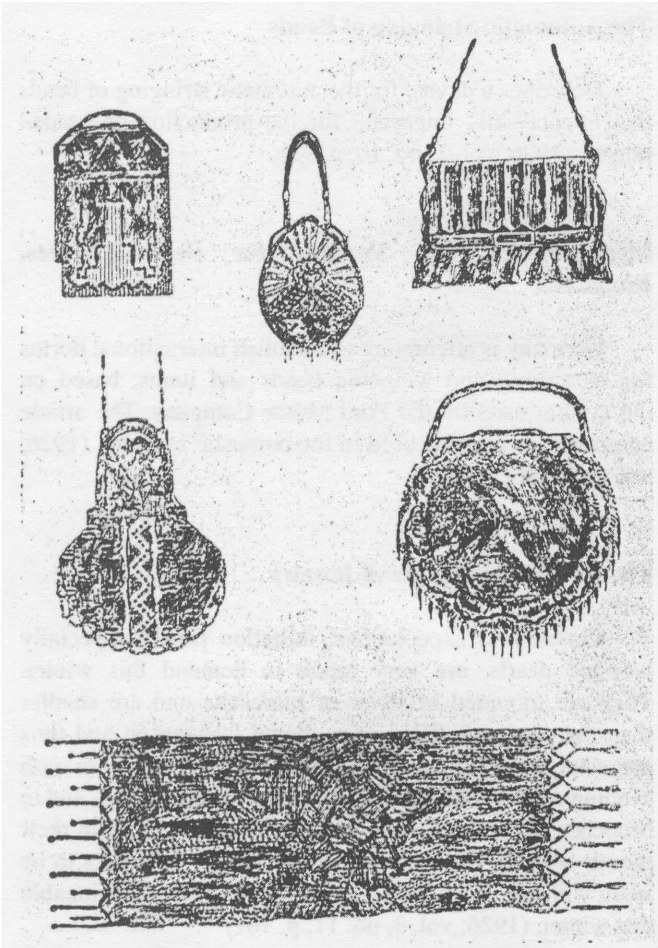

**Figure 9.** Examples of modern Parisian beaded purses that incorporate glass, wood, and synthetic beads (*Die Perle* 1924:vol. 1, no. 8, p. 66)

purses and pouches. Importance is now attached to the fabric foundation to ensure a favorable contrast with the stitched pattern. (1926, vol. 3, no. 3, p. 28)

### New Raw Materials for the Bead Industry

The new material called Vigorit has the advantage over other synthetic materials because of its greater solidity and stability of color when exposed to light. Also, it can be transparent, opaque, or translucent. It is particularly useful for much-handled objects like umbrella handles but should be used also for those that are now dependent on phenol-based synthetic resins. Also new is Dekufit, another phenol-based material which is available in all imaginable colors and is well suited for beads and other products. (1926, vol. 3, no. 3, p. 31)

### The Spring Fair in Leipzig 1926

The results of the fair reflected the world-wide economic crisis, but were favorable for the bead industry where movement was slow at the beginning but picked up encouragingly before the March closing. The application of new synthetic ivory materials to costume jewelry items was much admired. It is, however, difficult to predict to what extent this new form of decoration will influence future business. (1926, vol. 3, no. 4, p. 41)

### Parisian Novelties in Bead Jewelry

The trend among fashionable Parisian ladies is to wear pins of modest size that are adapted to the almost always present bead necklace. These popular pins usually consist of a central, transparent and finely faceted stone surrounded by innumerable tiny spherical beads that end in a spiral. An alternative is a simple metal filigree design encrusted with tiny spherical beads. These items in no way endanger the necklace fashion but, on the contrary, make the two dependent on each other. (1926, vol. 3, no. 6, p. 61)

### Miscellany about Glass and Other Beads

Written in Darjeeling in the Himalayas, this article discusses the significance of beads for the people living there and for their animals. The correspondent points out that most beads are European imports, always in great demand, as "elephants and camels need many meters of those necklaces." He then lists the beads made in India that it would be useful to import into Europe, like berries, ivory, and bone, including human bone. Indian ivory, he reports, remains white, while African ivory yellows rapidly. (1926, vol. 3, no. 7, p. 69)

### On the Subject of "Chemically Produced Pearls"

This article warns against erroneous reports of a complicated method for the fabrication of artificial pearls. Such reports appear even in specialized publications and should not be taken seriously as they reflect a total ignorance of the subject. (1926, vol. 3, no. 7, p. 71)

### Recognition of Amber

What distinguishes Baltic amber—or succinite—from other forms of fossilized resin is that it contains amber acid and the others do not. The article, quoting O. Helm, suggests two methods for determining if the substance contains amber acid. This is a way to ascertain what antique amber jewelry is made of. (1926, vol. 3, no. 7, p. 71)

**Glass and Glass Beads in Antiquity**

Glass was made in the Euphrates area and in Northern Mesopotamia thousands of years before it was produced by Egyptians who learned it from glass workers from these areas around 1500 B.C. This was stated by Egyptologist Sir Flanders Petrie in a lecture given in London to the Society of Glass Technology. Petrie also said that these glass workers of antiquity were able as early as 7000 B.C. to achieve the purple-blue color that is difficult even for today's industry. The first glass beads made in Egypt were made of glass paste only. (1926, vol. 3, no. 7, p. 71)

**Rivalry in the Bead Industry**

The entry of America into the bead industry will have catastrophic consequences for Germany's production. The technical advances in the manufacture of glass beads and beads of synthetic materials will enable America to become independent of imports and will enable her to swamp the outside world. (1926, vol. 3, no. 8, p. 77)

**Beadwares and Jewelry for Burma (Rangoon)**

Burma is an ideal market for jewelry produced in Germany as personal adornment is a priority among all women and men also. Women wear at least three types of jewelry at once. Beads of all sizes are purchased and many are used to decorate cows, horses, goats, and elephants. Bead curtains are also popular because they give an illusion of coolness. (1926, vol. 3, no. 9, p. 89)

**The Perfection of Amber Beads**

Impurities in amber are removed by immersing the rough pieces of amber in certain oils that are heated gradually and sometimes repeatedly. The semblance of polishing or faceting can also be achieved through the oil bath, as well as color changes when color is added to the oil. (1926, vol. 3, no. 10, p. 94)

**The Automatic Stringing of Beads**

Describes a device for the automatic stringing of beads that is especially important for the production of beaded purses. (1926, vol. 3, no. 10, p. 95)

**Measurements and Weights for Beads, Stones, Rings, etc.**

Germany is attempting to establish international norms for measuring and weighing beads and items, based on the system used by the Ford Motor Company. The article enumerates examples used in the domestic industry. (1926, vol. 3, no. 10, p. 96)

**The New Fashion in Bead Jewelry**

Contrary to expectations, imitation pearls, especially baroque pearls, are very much in demand this winter. They are mounted in silver or marcasite and are smaller than the obviously false ones shown last season and thus can easily pass for the genuine article. They are worn with evening clothes, as necklaces, bracelets, and earrings, and in brooches shaped like animals with a baroque pearl in their mouth or claw. Baroque pearls also appear in garters to be worn with the short, knee-revealing ball gowns fashionable this winter. (1926: vol. 3, no. 11, p. 101)

**The Pearl Enjoys Renewed Favor in Fashion Again this Coming Spring**

Imitation pearls will again be in great demand in the coming season, especially those made of enamel, alabaster, and opal materials. Japan and France are in close rivalry in this, with Japan slightly ahead because of its cheap labor. The Parisian pearls made of enamel fish-luster will also be much sought after. America shows great interest in baroque pearls of the finest quality supplied by Central Europe. (1926, vol. 3, no. 12, p. 109)

**Jewelry and Costume Jewelry Novelties Abroad**

Apart from the continuing popularity of pearl necklaces, especially with pearls made with fish-scale silvering, rosaries have become a fashion item in certain areas since manufacturers were supplied with brooch or pendant containers for rosaries with tiny pearls. There is a promising development in jeweled hat pins, combs, and buckles where the demand for black jet items has given way to multicolored and iridescent articles. (1926, vol. 3, no. 12, p. 109)

**Some Facts About Pearl Problems**

The growing demand for pearl essences and the great number of patents for Essence d'Orient in various countries points to an upswing in the manufacture of imitation pearls. Today there are substitutes, synthetic materials, and imitations in all fields, even for rubies and diamonds. But all of them are easily identifiable as imitations by the expert. Presented is a description of the advantages artificial pearls have over natural ones and of the various methods of producing them. (1926, vol. 3, no. 12, p. 110; 1927: vol. 4, no. 1, p. 1)

**The Decoration of Metal Beads**

The decoration of metal beads is limited to the embellishment of the surface with other metals, generally achieved by immersion. Detailed descriptions of gilding, silvering, and coloring are provided. (1927, vol. 4, no. 1, p. 3)

**The Pearl Necklace in its New Presentation**

The popular length for pearl necklaces is now 140-160 cm. They are either of uniform size, between 4 and 8 mm, or graduated from 2 to 8 mm. This type is the fashion in France, Central Europe, and America. The different designs of the necklaces and the materials used are described. This includes an American invention of a mother-of-pearl imitation and a Viennese synthetic product called Polopas. (1927, vol. 4, no. 2, p. 9)

**Germany's Amber Industry**

The industry focuses mainly on the exploitation of raw amber with which Germany supplies a large part of the world market. Production has remained the same as in pre-war times, but exports have diminished considerably, especially those for the markets of Russia and Austria. Germany also converts large amounts of raw amber into melted amber that, together with its byproducts, amber acid and amber oil, is used by the varnish and lacquer industry. (1927, vol. 4, no. 2, p. 12)

**America's Business in Pearls, Costume Jewelry, and Buttons**

In spite of its great absorption possibilities, America has held back recently on imports because it has been swamped by offers of low-quality merchandise. Another negative factor is that America has begun its own production of pearls and buttons of organic and glass-like materials. If there is a demand for cheap items, America will import these from Europe for re-export to Argentina or Australia, for example. The American market demands high quality in gem-jewelry as well as in cheaper costume jewelry. America's production of synthetic pearls has made such progress that it is becoming a dangerous rival for European manufacturers. (1927, vol. 4, no. 3, p. 18)

**Some Facts About the Manufacture of Porcelain Beads**

Attempts to make porcelain beads may have begun by the end of the 18th century, but the production was started in earnest by Bapterosses and later imitated in Germany and Austria. A description of the various raw materials that are utilized in the manufacturing process is provided. (1927, vol. 4, no. 4, p. 27)

**Anticipated Revival of the Bead Business through the Russian Market**

Prosperous circles in Russia spend a lot of money on personal adornment. The country's attempts to manufacture these items at home were not successful and that is why Russia offers good business opportunities for such items, mainly embroidery beads, ribbons, and belts, as well as purses adorned with beads and colored stones. Business is centralized, but satisfactory arrangements can be made, especially through exchanges. (1927, vol. 4, no. 5, p. 36)

**The Real Orient Pearl and the Cultured Pearl**

Describes a special microscope called the Endoscope for the fool-proof distinction between natural and cultured pearls and how to use it. Constructed by professors Chicowsky and Perrin of the Sorbonne (Fig. 10). (1927, vol. 4, no. 6, p. 44)

**The Coral Fishery**

Corals originate from the Mediterranean, especially the African coast. Methods of fishing have not changed

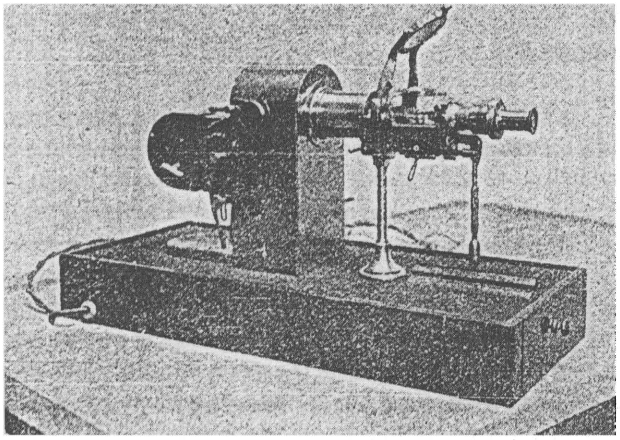

**Figure 10.** The Endoscope, used to distinguish natural from cultured pearls (*Die Perle* 1927:vol. 4, no. 6, p. 44).

much since the 15th century when the French held licence to harvest them. New sources have since been found in the Adriatic. The yearly yield in Italy alone is estimated at 160,000 kilos. A great part of this is shipped to East India. Coral beads in considerable amounts are exported to South America and Australia. (1927, vol. 4, no. 7, p. 51)

### Some Facts About Mold-Pressed Beads

This type has been made in Bohemia since 1780. The method is said to have been invented by chance by a glass-beadmaker who dropped the metal bar or wire he wound beads with into the glass mass and when he fished it out with tongs, he noticed that the glass that adhered to them took on its shape. Tongs with several bead-shaped molds have since been in wide use. Decorating the surface of pressed beads was introduced in the 1840s. (1927, vol. 4, no. 7, p. 52)

### Preparations in Jewelry Fashion for the Coming Season

Paris again endeavors to lead jewelry fashion in the coming season. It will be dominated by the black-and-white combination. The French bead industry was in the vanguard with the successful launching of necklaces of varying lengths and styles composed of black glass, wax, and jet beads, combined with pearls and white mother-of pearl. Such necklaces can also be adorned with tassels of seed beads. (1927, vol. 4, no. 8, p. 1)

### Novelties in Bead Jewelry and Devotional Articles

Beads retain their fashion value. Foreign countries seek particularly the finely stitched, embroidered items of earlier times. Trimmings in black and white are favored. For rosaries, beads on metal-links are used. They are made of nacre or jet; ruby-beads are the only colored ones. Carved wooden beads are still prominent. For adornment of such strands, new forms in pendants, such as hearts, tiny crosses, and horseshoes are used. (1927, vol. 4, no. 10, p. 73)

### The Matting of Glass Beads

This is usually done with quartz-powder in a tumbler, sometimes with acid. Several other methods and their recipes are listed. (1927, vol. 4, no. 10, p. 75)

### Future Tasks for the Bead Industry

To maintain and develop sales, it is indispensable to keep step with the fashion industry. This applies both to artificial pearls that are mass produced as well as to glass beads, and is to be achieved by constant improvement of the materials and the development of new forms of decoration such as oxidation that achieves iridization. A foremost task of the bead industry is to again draw the attention of women to bead embroidery and encrustations of glass stones that must, of course, conform to modern tastes. (1927, vol. 4, no. 11, p. 81)

### The Utilization and Working of Corals

Working coral for jewelry usually takes place at the site of its origin. The corals first have their rind removed, then are cut into bead shapes, ground, and polished. Ranging from white to dark red, the latter color is the most popular with large cabinet pieces having immense value. After the coral dies it turns brown if left at the bottom of the sea for a long time and is the cheapest. Black coral comes from the Indian Ocean, has an inner horn-like structure, and bends easily. It is used for mourning jewelry and for decoration on regal scepters. Then there is a very rare blue coral that in the Cameroons is called *Akori.* (1927, vol. 4, no. 11, p. 82)

### The Manufacture of Artificial Horn from Casein for the Production of Beads

This article lists methods for the production of artificial horn from casein that makes it as efficient as Galalith for the production of buttons, beads, cigar holders, and the like. (1927, vol. 4, no. 11, p. 83)

### Surface Decoration for Celluloid and Synthetic Beads

Describes methods for coloring celluloid, Galalith, and other synthetic materials. Galalith can be faceted, employing the same methods used for glass beads. (1927, vol. 4, no. 11, p. 84)

### New Designs in the French Jewelry and Costume Jewelry Industry

Astonishing novelties in this field are primarily fashion embellishments for such items as belts and hair ribbons as well as blouses, coats, and dresses. The slides used on such adornments are showy, but not aggressively so, and each piece is an adornment in itself, made of polished (faceted?) glass or synthetic material. A rarely seen novelty is the neck ring. Similar items have been created for the boy-style haircuts. They are glittery silk ribbons, sometimes decorated with beads. (1927, vol. 4, no. 12, p. 90)

### America's New Jewelry Fashion

Affluent American women are currently focused on hair jewelry and clothing ornaments. The various hairpins, combs, and coronets, all produced in America, are described. Clothing adornments are characterized by glitter and bright colors. Other articles of jewelry like necklaces, bracelets, and earrings have not changed much compared to previous trends. Whether Europe can be considered as a supplier is uncertain, but it is a possibility if it conforms to American tastes. (1928, vol. 5, no. 1, p. 1)

### Celluloid as a Raw Material for the Bead Industry

After a long struggle against prejudice because of its flammability, celluloid has rapidly become a most valuable material that is unequaled by any other plastic substance in malleability, the capacity to imitate precious raw materials, and economy. A description of its composition and methods of use is provided. (1928, vol. 5, no. 2, p. 12; vol. 5, no. 3, p. 19)

### The Polishing and Faceting of Beads

In the 1840s to 1870s, the faceted bead was a sought-after trade object. In those days, veritable faceting artists produced black-glass beads with 50-100 facets made on foot-activated grinding wheels. A similarly primitive technique was used decades ago for amber. The popularity and value of such beads led to the invention of automatic faceting machines that are described in detail. (1928, vol. 5, no. 3, p. 20)

### Modern Venetian Beads

The colorful Venetian bead has enlivened the jewelry market and supplanted the domination of oyster-pearl necklaces. The article presents a panegyric to the attractiveness, variety, and manufacturing techniques of these beads that "conform to Nordic tastes" in spite of their imaginativeness. (1928, vol. 5, no. 4, p. 25)

### Some Facts About the Bead Industry

The search of early beadmakers for raw materials easy to use in the manufacture of beads has opened the field to a wide variety of such materials. Bone and wood were used in rosaries, artistically carved and believed to have been soaked in resins as early as the 17th century. These products were not widely known as they were made with primitive techniques and mostly for local consumption. Very few of such beads have survived. They are mostly black and flattened. Now and then, the carved grooves were colored with some red material. They were never used as jewelry. (1928, vol. 5, no. 4, p. 28)

### Paris Brings New Jewelry

This year (1928) is under the sign of large and not always genuine jewelry creations from Paris that interest the great capitals of Europe. Last year, pearls or colored bead necklaces gave way to paste that does not attempt to look like real diamonds. Pearls, strung in novel ways and in very long strands are among the imaginative inventions of Paris jewelers. Another novelty is the snake necklace. Real and false jewelry is sometimes worn together. (1928, vol. 5, no. 5, p. 33)

### Madre Pearls

This new pearl is neither an imitation nor a synthetic. It is so far the most perfect elaboration of the nacre-pearl. Made from the thickest part of the real Macassar or Tahitian shell, it is used also for crucifixes, elements for modern crafts, and for rosaries. (1928, vol. 5, no. 5, p. 35)

**Rational Manufacture of Beads from Synthetic and other Materials**

Describes a machine that forms beads with a minimum of complication and labor and little waste material. (1928, vol. 5, no. 6, p. 42)

**About the Fabrication of Furfurol and Phenolresins for Industrial Articles: Radio Parts, Beads, etc.**

When heated, these materials become a black, shiny, and hard gum-like substance. Different ways of producing and applying it are provided. (1928, vol. 5, no. 6, p. 43)

**The Stringing of Beads**

This article describes a device for the mechanical sorting and stringing of beads (Fig. 11), by color and according to patterns. These strands are used for the weaving of beaded purses. (1928, vol. 5, no. 8, p. 57)

**Agitation Against German Glass-Stone Jewelry in India**

Great indignation was caused in India following the lively sale of precious gems in Calcutta that turned out to be glass imitations originating in Germany. Police investigations revealed that these items were the product of special polishing machines imported from Germany. It has not been discovered yet who imported them and where they were installed. The incident has led to a prejudice against all German glass products imported by India. (1928, vol. 5, no. 8, p. 59)

**News from the Necklace Design Market**

New designs intensified the interest in bead necklaces, especially in France and abroad. The new designs differ from previous mass-produced necklaces by returning to translucent, colored, and finely faceted beads and replacing simple one-strand necklaces with multi-string and multi-element neck adornments that completely fulfill the role of fine jewelry. (1928, vol. 5, no. 9, p. 65)

**The Decoration of Porcelain Beads**

This is similar to the methods used for glass beads. Frequently, however, attempts are made to give the beads an opalescent luster in different colors. This article describes the procedure and the chemicals used. Ready-made formulas are available in commerce. The recipes are mostly secret. (1928, vol. 5, no. 12, p. 91)

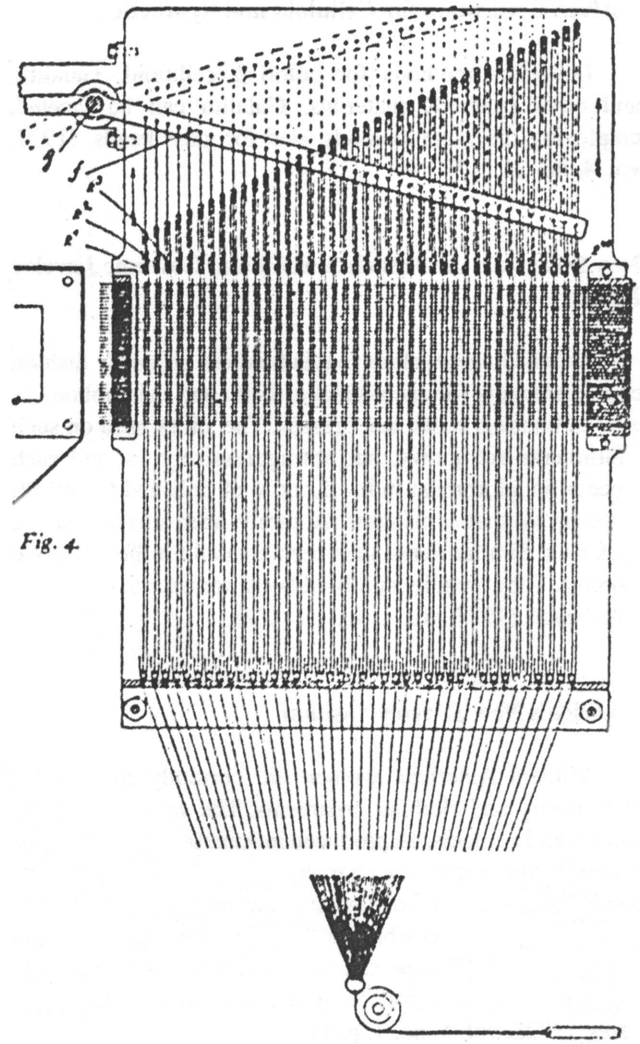


**Figure 11.** One of four schematic views of a device for the mechanical sorting and stringing of glass beads (*Die Perle* 1928:vol. 5, no. 8, p. 58).

**About Bead Embroidery in the Ready-Made Industry**

The article points to a coming fashion of bead embroidery for curtains, wall hangings, table mats, and purses that uses old models and has an antique look with some modifications. Several motifs are illustrated. (1929, vol. 6, no. 1, p. 1)

### A Bead-Turning Machine

The article describes and illustrates a machine that can measure, turn, perforate, and cut off beads from rods or pipes in a single procedure. The machine can produce 12,000 to 18,000 beads per day. A small schematic drawing of the machine (Fig. 12) and a description of the production process are provided. (1929, vol. 6, no. 1, p. 3)

### The Gablonz Industry during the Business Year 1928

On average, the year 1928 was rather satisfactory, but the aftermath of the earlier business crisis should not be minimized. It is difficult to predict future developments since for jewelry they depend on fashion and, in general, on custom's policies of the importing countries. (1929, vol. 6, no. 1, p. 4)

### Glass Beadwork

Paris and other fashion centers overseas are already preparing for an anticipated fashion wave that will favor glass beads for ornamentation on clothing, embroidery, and accessories. The designs will be based on models of the Biedermeier period but with a completely contemporary execution in form, color, and brilliance of the beads. For necklaces, crystal remains all important, but here too, the new creations show distinctive novel shapes and ways of faceting. It is pleasing that all contemporary craft enterprises are earnestly endeavoring to resolve the fashion problems and that their preliminary work is artistically mature. (1929, vol. 6, no. 3, p. 18)

### France's Bead and Fancy-Stone Industry

The article presents details of this industry given to a group of German industrialists by M. Legentil, president of the French Board of Trade that represents the stone cutting and artificial pearl industry. Paris has always been the site of artificial pearl production and the French Jura produces imitation stones. According to M. Legentil, France will soon be able to beat the competition of Czechoslovakia and Germany in price and quality, thanks to the latest improvements to the French industry. (1929, vol. 6, no. 4, p. 26)

### Bead Embroidery and Knitting

This article provides a brief history of glass and glass bead production and of the multiple decorative uses of beads, especially in Germany. Among the centers of production, the author, Dr. Charlotte Steinbrucker, mentions only Germany and Bohemia (after Egypt of antiquity and Venice beginning in the 12th century). Germany's glass bead production started at the beginning of the 16th century. Steinbrucker goes on to state that embroidery and the use of beads in knitted, woven, and crocheted items of all sorts peaked in the mid-19th century, declined in the 1870s, and revived only recently. (1929, vol. 6, no. 5, p. 33)

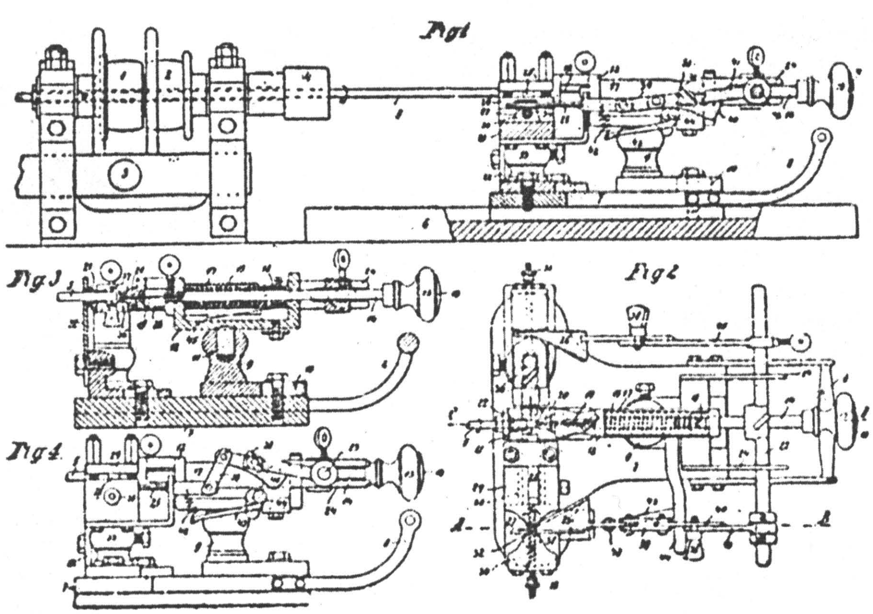

**Figure 12.** Schematic view of a bead-turning machine (*Die Perle* 1929:vol. 6, no. 1, p. 3).

### Perloid

Perloid is a perfect substitute for mother-of-pearl as a raw material. The so-called fish-silver, it is a German product on the borderline between organic and synthetic as it is made from the scales of a tiny fish found in East Prussian lakes, but attains its gloss only through a certain chemical treatment. It is made and marketed in sheets of different dimensions and lends itself to the manufacture of innumerable objects, and as an inlaid decoration. (1929, vol. 6, no. 6, p. 42)

### Some Information on the Production of French Colloid Pearls

Such imitation pearls have been on the market for some time and are very similar to but much cheaper than Japanese cultured pearls. They are made using a gelatine-solution. In the case of large pearls, one or more layers of cotton-wool are wrapped around a metal rod and dipped into the gelatine solution. Later techniques utilize water-clear celluloid instead of gelatine. (1929, vol. 6, no. 7, p. 1)

### The Polishing of Wooden Beads

This can be accomplished with special tumbling machines or with chemicals that also serve to harden the wood surface. The article goes on to describe methods for staining such beads and coloring them to conform to the fashion of the day. (1929, vol. 6, no. 7, p. 50)

### From the Patent-Literature on Pressed Amber Manufacture

Lists seven patents for methods to utilize waste amber, clarify amber, transform copal into a substance that more closely resembles genuine amber, and for the imitation of amber using bone. (1929, vol. 6, no. 8, p. 60)

### From the Gablonz Industrial District

The industry reports a weakening of business due to fashion changes and a long winter and cool spring. The manufacture of glass beads and gem stones is satisfactory, but payments are slow and insolvencies are increasing in the country and abroad. The Czech porcelain and glass industry is fighting to counter a planned increase in American customs tariffs by having all European countries raise their customs tariffs on all imported American products. A proposal to that effect was presented by Czechoslovakia and Germany to the European Customs Union for discussion. France, Italy, and Belgium are willing to go along with such a measure. (1929, vol. 6, no. 9, p. 67)

### On the New Fashion in Necklaces

Bead necklaces are again in fashion. Beads are more highly valued than any other kind of jewelry element, with glass as the favored material. The article goes on to provide a description of different types of modern necklaces, mostly composed of graduated, round beads of transparent, glossy materials in various colors. (1929, vol. 6, no. 12, p. 89)

### Novelties in Rosary Beads and Similar Articles

New sketches show very dainty rosaries of tiny beads and chain-links, housed in egg-shaped, flower-decorated capsules. The well-known book-shaped metal containers have been lowered in price by some firms to such an extent that customers lost confidence and stopped buying them. Rosaries of faceted beads, preferably black with shimmering silver overlays, are gaining popularity. Paris decorates rosary pendants in pearl or pear shapes that contain pictures of the Virgin Mary or Christ with his crown of thorns. Such adornments could again become the fashion for similar pieces of jewelry. (1929, vol. 6, no. 12, p. 89)

## CONCLUSION

Although it was only published for less than a decade–a victim of the 1929 stock market crash–*Die Perle* provides an amazing amount of information concerning the European bead and jewelry industry during the affluent Roaring Twenties. The summaries provided above present only a fraction of the information in its pages. There is much more there for the student of beads, beadwork, and jewelry. Unfortunately, the German text makes this information difficult to access by non-German-speaking individuals. It is, therefore, hoped that a selection of the more significant articles can be translated and published in the near future. It is also hoped that the text of all the extant issues can be made available to interested researchers in an electronic format.

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**Plate IA.** *Santería:* Necklace components from the Ingenio Taoro slave cemetery in Havana (photo by author).

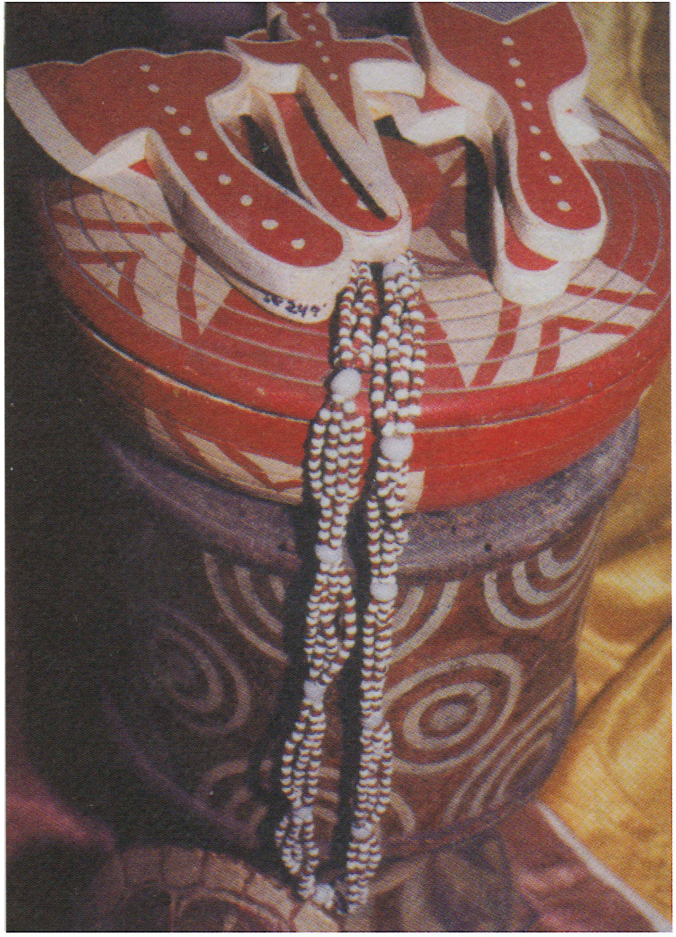


**Plate IB.** *Santería: Mazo* necklace and paraphernalia associated with Shangó (Museo Casa de Africa, Oficina del Historiador de la Ciudad de la Habana, Havana).

**Plate IC.** *Santería:* Necklace of Babalú Ayé, a major orisha also known as Obaluaye (photo by author).

**Plate ID.** *Santería:* Necklaces of Obatalá, Elegguá, and Naná Bukurú (photo by author).

**Plate IIA.** *Santería:* Necklaces of the major orisha Ochun or Oshún, the wife of Shangó (photo by author).

**Plate IIB.** *Santería:* Necklace of the major orisha Orula, also known as Orumilla (photo by author).

**Plate IIC.** *Santería:* Necklace of the major orisha Shangó or Changó (photo by author).

**Plate IID.** *Santería:* Necklace of the major orisha Yemayá, known as the Mother of the Waters (photo by author).

**Plate IIIA.** *Baar-Früebergstrasse cemetery:* Burial 3. A staff member of the Archaeology Department of Canton Zug carefully uncovers 145 glass and two amber beads lying in the chest area of a woman (Photo: Markus Bolli, Archaeology Department of Canton Zug).

**Plate IIIB.** *Baar-Früebergstrasse cemetery:* Burial 10. Reconstructed probable appearance of the single-strand necklace. Reconstruction by Katharina Müller and Eva Kläui, Archaeology Department of Canton Zug (Drawing: Sabina Nüssli Bouzid).

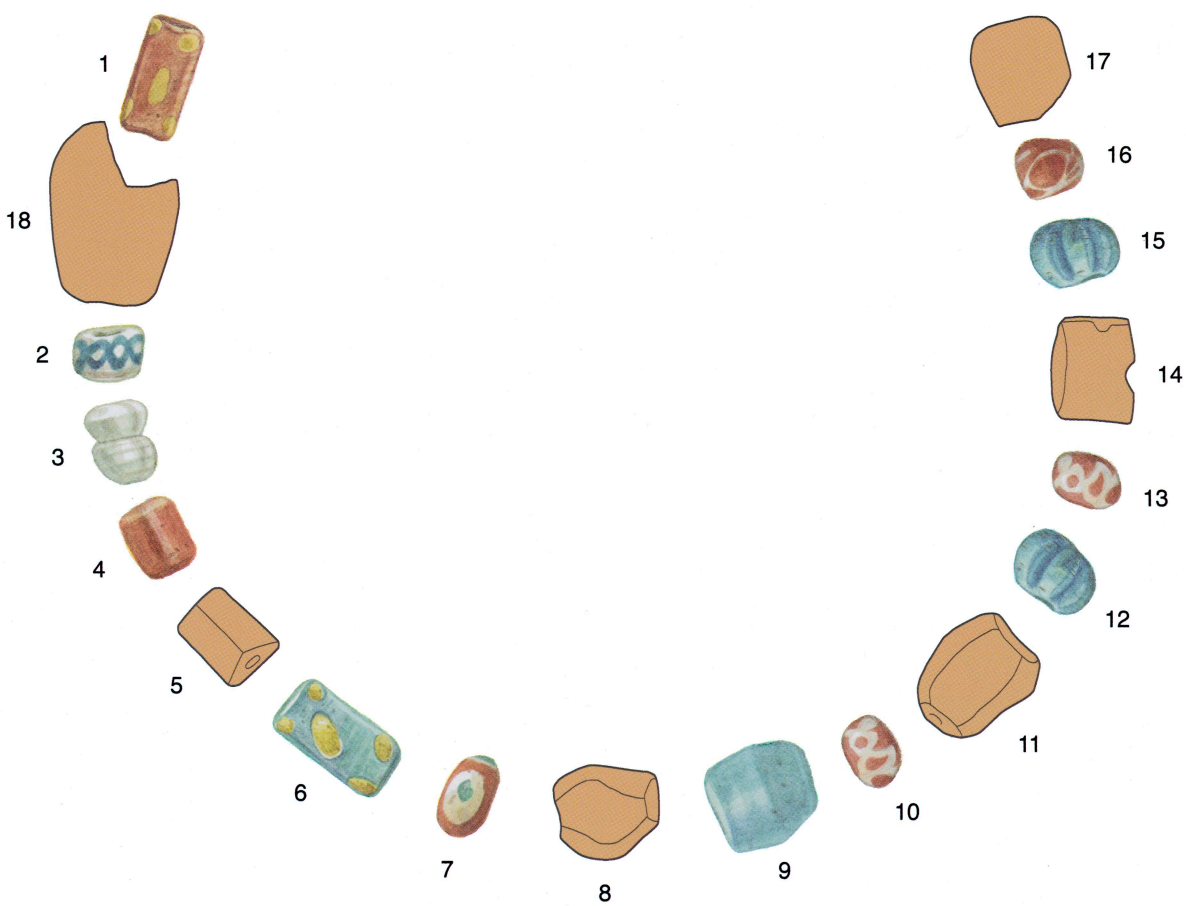
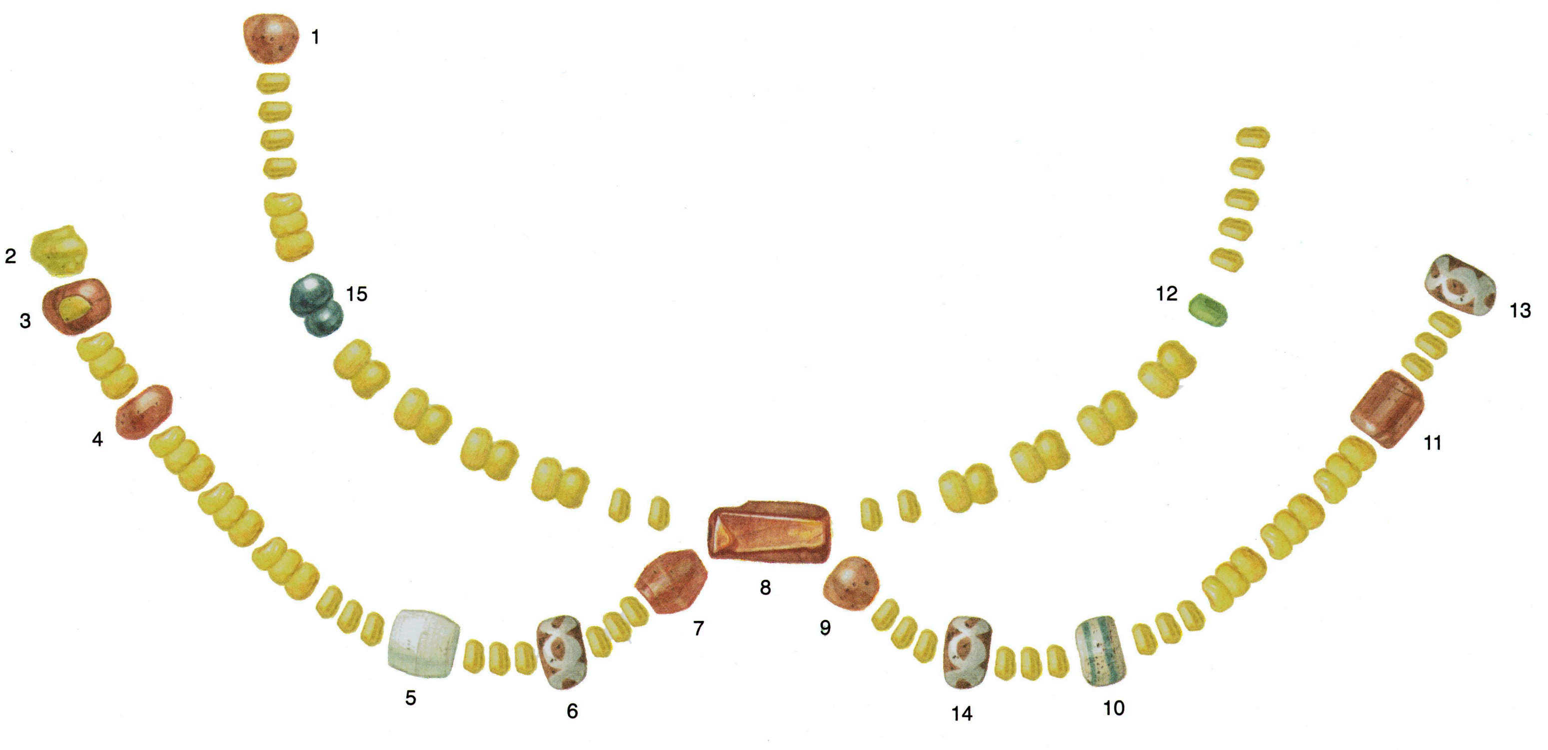



**Plate IVA.** *Baar-Früebergstrasse cemetery:* Burial 40. *In situ* context of the glass and amber beads (Photo: Markus Bolli, Archaeology Department of Canton Zug).

**Plate IVB.** *Baar-Früebergstrasse cemetery:* Burial 40. The probable appearance of the double-strand necklace. Reconstruction by Katharina Müller and Eva Kläui, Archaeology Department of Canton Zug (Drawing: Sabina Nüssli Bouzid).



# LATE 19TH- AND EARLY 20TH-CENTURY MANUFACTURE OF DRAWN GLASS TUBING FOR GLASS BEADS

**Lester A. Ross**

*Late 19th- and early 20th-century archaeological sites often contain machine-made drawn glass beads with unique shapes and perforations. Little information exists documenting when these beads were initially manufactured. Through an examination of hundreds of U.S. patents, it appears that the mechanized production of drawn beads could have occurred as early as the late 19th-century, but more likely, they were not mass produced until the end of World War I, after the invention of the Danner process for mechanically drawing glass tubing. Machine-made drawn beads with multiple sides and/or shaped perforations also appear to have been produced by the late-19th century, but again, mass production probably did not occur until after the end of World War I.*

## INTRODUCTION

Glass tubing used for the production of drawn beads destined for trade and sale to Native Americans was manufactured by a centuries-old process of pulling a hollow gather of molten glass into a tube (Anonymous 1881; Bussolin 1847; Carroll 1917; Francis 1988; Karklins with Adams 1990; Kidd 1979; Neuwirth 1994:130-149, 201-213; Sprague 1985:87-92). With the advent of the Industrial Revolution in the late 18th century, new equipment and techniques began being patented to speed the process and move the industry from a labor- to capital-intensive market, with the principal goal of reducing the costs of production. From known primary historical documents and existing secondary historical accounts, it is unclear if and when many of these newer methods were adopted and became common. In order to begin the research process of clarifying this transition, it would be helpful to identify dated sources to establish *terminus post quem* (i.e., post-), *terminus ad quem* (i.e., pre-), and *terminus a quo* (i.e.,post- to pre-) dates for new inventions, processes, and products. To this end, three hypotheses are offered and documented with the intention of having additional historical, ethnographical, and archaeological research evaluate and revise them.

Research for this article is based in part on a search of United States patent records using current classification numbers pertaining to specific products, processes, and apparatus. Online searches of the U.S. Patent Office web site for keywords can only be done for records later than 1975. Searching by classification numbers, however, it is possible to search all records from 1790. The initial search examined all patents under the current classification number of CCL/65, Glass Manufacturing. For glass tubing and cylinders, patents listed under CCL/65 were searched. From these primary searches, related classification numbers were identified and searched. Using this approach, thousands of patents were examined, locating over 250 patents for the manufacture of glass tubing and cylinders. Occasionally, patent records were filed by classification numbers that did not reflect the true nature of the patent, so searching by classification numbers probably failed to locate all relevant patents. Based upon secondary historical sources, however, it appears that at least the primary patents for glass tubing have been located.

During the late 19th century, there were hundreds of patents for the manufacture of glass articles by machine. Most notably were tools, equipment, and machines for the manufacture of:

Pressed glass articles, including:
- Ornamental glassware
- Telegraph and electrical insulators

Blown and molded glass articles, including:
- Lamp chimneys
- Bottles and jars
- Incandescent electric lamps

Molded glass articles, including:
- Buttons
- Imitation gems
- Pipes

Rolled glass articles, including:
- Window sheet glass
- Wired sheet glass

Drawn glass articles, including:
- Window sheet and cylinder glass
- Pipes
- Water gauge tubing
- Clinical thermometers

Of these processes, only the techniques for the manufacture of drawn glass tubing, with or without shaped perforations, which might have been used for the production of general purpose tubing, were examined. Associated patents for specialized parts of glass drawing apparatus were not examined in detail, unless they pertained to the manufacture of unique perforations and exterior shapes other than circular. Also not considered were various patents for the alteration of glass tubing for specialized functions. For example:

- U.S. Patent Nos. 883,875 (April 7, 1908) and 885,039 (April 21, 1908) for flanging mount tubes used inside incandescent lamps.
- U.S. Patent No. 946,179 (January 11, 1910) for the creation of microscopic glass tubing commonly referred to as fiber or spun glass.
- U.S. Patent No. 982,212 (January 17, 1911) for the shaping of pre-existing tube ends.
- U.S. Patent No. 1,024,116 (April 23, 1912) for the manufacture of vials from tubing.

Because of its title and possible confusion with ornamental beadmaking, the following patent is mentioned but not included in the following sections:

> U.S. Patent No. 1,117,060 (November 10, 1914) granted to Johann Kremenezky and Josef Jelliner of Vienna, Austria-Hungary, Assignors to the firm of Johann Kremenezky for a machine for producing beads on glass rods.

In their description, Kremenezky and Jelliner state that "this invention relates to a machine for producing beads on glass rods, more particularly on such glass rods as are used in the supporting frames for metal filaments of electric incandescent lamps...." From their descriptions and drawings, the appearance of the final product is unclear, but the "beads" may just consist of spheroidal upsets on one end of a short glass rod that can be inserted into the base of an electric light bulb.

## MANUFACTURE OF GLASS TUBING WITH SHAPED PERFORATIONS

Drawn beads with shaped perforations have been recognized at several late 19th- and early 20th-century archaeological sites:

1. An 1850s to early 1860s archaeological context at American Fur Company Fort Union, South Dakota, produced a single monochrome, transparent green, six-sided, short drawn bead with chopped ends and two rows of ground facets with a hexagonal perforation (Ross 1999: Variety 278). This is a relatively thin-walled bead, and the sides of the perforation align with the exterior sides. This indicates that the perforation shape was produced when the sides of the bead were formed, probably an accidental coincidence.

2. An 1873-1905 archaeological context at the Shepherd ranch house site, Inyo County, California, yielded a single monochrome, opaque white, short cylindrical, undecorated, hot tumbled, drawn bead with a triangular perforation (Fig. 1 a)(Ross 2004: Variety 34). Possibly an aberrant specimen of another bead variety at this site (Variety 6), although the shaped perforation appears deliberate and does not correspond with the shape of the bead, nor does it appear to have been created by flattening when the original tubing cooled.

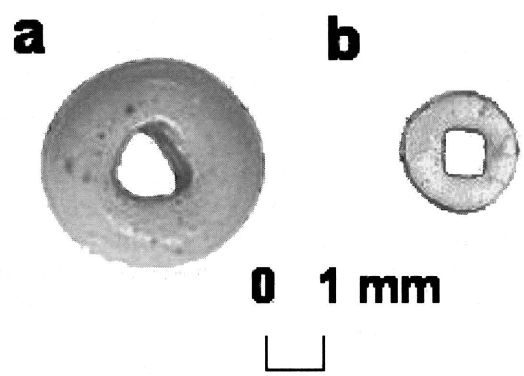



**Figure 1.** Examples of hot-tumbled, drawn glass beads with shaped perforations from archaeological sites: a) opaque white, short cylindrical with a triangular perforation from the Shepherd ranch house site, Inyo County, California, 1873-1905 (Ross 2004: Variety 34; enhanced photo by L. Ross); b) transparent light gray with an opaque light red enamel-coated square perforation from the Hudson's Bay Company York Factory site, Manitoba, Canada, ca. 1875-1950 context (Karklins and Adams n.d.), Variety 120; enhanced photo by R. Chan, Parks Canada).

3. At a ca. 1888-1921 site in The Dalles, Oregon, "a sample of 'seed' beads with square and hexagonal holes were collected by members of the Oregon Archaeological Society" (Hoffman and Ross 1974:74). Personal examination of these beads indicated that the perforations were intentionally manufactured resulting in shapes with sharp and well defined sides and corners.

4. At Hudson's Bay Company York Factory, Manitoba, Canada, where four varieties of monochrome, short cylindrical, undecorated, rounded drawn beads with square perforations (York Factory varieties 116a, 119, 120 and 121; Karklins and Adams n.d.) were found in contexts dating to the late 19th and first half of the 20th century:

- Variety 116a (n = 1), transparent pink
- Variety 119 (n = 26), opaque white
- Variety 120 (n = 5), transparent light gray with an opaque light red enamel-coated perforation (Fig. 1 b)
- Variety 121 (n = 1), transparent bright chartreuse with an opaque metallic silver-coated perforation

Beads with square perforations will probably be the most commonly observed variety, but other shapes can also be anticipated. For purposes of dating archaeological contexts, it would be helpful to know when beads with shaped perforations initially appeared.

In her book on beads from central Europe, Waltraud Neuwirth (1994:145) noted that "in the beginning the perforations had round cross-sections, later they could also have square, triangular or wide (for stringing on ribbons) shapes." Neuwirth, however, offers no information regarding the date or country where this transition initially occurred. It is further stated that: "The cross-sections of tubes and canes were also round in the beginning; the invention of square drawn glass is placed in connection with the Tiefenbach glasshouse in 1803" (Neuwirth 1994:145 citing Vienna [Wien] 1845, Lloyd 1845). One might conclude from a quick reading of this passage that the date of 1803 refers to the shaping of perforations. The cross-sections referenced pertain to the exteriors of tubing and canes, however, not the perforations of tubing.

Presently, the earliest primary historic document yet identified that discusses shaped perforations is the 1926 patent by Richard Hirsch (Table 1). Other inventors patented processes for imparting various shapes to the exterior of tubing as well as their perforations, but all were for tubing used for limited and specialized applications (Table 1).

It is doubtful that the 1906 date for Raspillaire's patent actually represents the *terminus post quem* for machine-made tubing with shaped perforations, since beads with shaped perforations seem to occur in earlier archaeological contexts, perhaps as early as the late 19th century.

U.S. Patent No. 321,369 (June 30, 1885) to Wesley Jukes may represent a precursor of a process for manufacturing tubing with shaped perforations. Jukes claimed to have invented a method for manufacturing glass tubing by creating a molded ball of glass with a perforation produced by the insertion of a plunger into the glass while it was still in the mold. This hollow ball was then hand drawn to form tubing with walls of uniform thickness. He claims that prior to his invention, glass balls were marvered to create their shape, and as such, resulted in the production of balls (and their tubes) with walls of unequal thickness. Although he does not mention alternative shapes for either the mold or the plunger, it seems obvious that by changing their cross-sections, it would be possible to create tubing with shaped exteriors and perforations.

Prior to Jukes's 1885 patent, glassworkers elsewhere in the world were aware of techniques for imparting exterior shapes to tubing by marvering. It is also likely that someone must have experimented with shaping perforations, but no evidence of such a process has yet been documented. Thus, Jukes' patent presently serves as the basis for the hypothesis dating the initial production of tubing with shaped perforations.

By the end of the 1930s, there is clear evidence that tubing with shaped perforations was being manufactured using the Danner machine:

> The blowpipe nose may be either a continuation of the refractory sleeve [i.e., circular] or a shaped tip of machined and polished nichrome steel. In the case of the refractory nose, if the extreme edge is irregular, due to "spalling" or mechanical abrasion, then very fine "flats" and ridges will be formed on the inside face of the tubing as it flows off the nose. These may be very minute, but being magnified by the tube wall give a bad appearance. For this reason the nichrome nose is usually employed... (Sibilia 1939:297).

There is relatively little historical evidence to determine the initial use of processes to create shaped perforations for beads. Nevertheless, based upon the above information it seems safe to hypothesize that <u>the *terminus post quem* for drawn beads with shaped perforations appears to be the late 19th century.</u>

**Table 1. Patents for Shaped Tubing and Perforations.**

| Patentee | U.S. Patent No. | Patent Date | Foreign Patent | Applications |
|---|---|---|---|---|
| Arthur Houghton (Corning Glass Works) | 586,188 | July 13, 1897 | | Hand-operated mechanical process and apparatus to produce shaped tubing for thermometers with a circular perforation (Fig. 2) |
| August Raspillaire, Morgantown, West Virginia | 834,165 | October 23, 1906 | | Glass tubing with shaped exteriors, such as hexagonal and octagonal |
| August Raspillaire, Morgantown, West Virginia | 839,421 | December 25, 1906 | | Glass tubing with shaped perforations, such as hexagonal and octagonal |
| Richard Hirsch (Jena, Germany), Libbey Glass Co. | 1,574,482 | February 23, 1926 | | Shaped tubing with shaped perforations (Fig. 3) |
| Gaston Delpech, Nemours, France | 1,894,853 | January 17, 1933 | France March 28, 1930 | Glass tubing and rods with shaped exteriors |
| James Gross | 1,899,146 | February 28, 1933 | | Hand-drawing method for shaped bars (tubing implied) for bathroom fixtures |
| William Said, Corning Glass Works | 1,919,259 | July 25, 1933 | | Mechanized vertical updrawing apparatus for shaped tubing with shaped perforations and colored stripes for thermometers |
| Ingvald Pedersen, Wilkinsburg, Pennsylvania | 1,987,633 | January 15, 1935 | | Glass tubing with polygonal exterior shapes |
| Georges Despret, Compagnies Reunies des Glaces et Verres Speciaux du Nord de la France | 2,267,554 | December 23, 1941 | France November 19, 1938 | Shaped instrument tubing |

## MECHANIZATION OF GLASS TUBING MANUFACTURE

For centuries and well into the 20th century, the manufacture of glass tubing and canes for the bead industry was a manual drawing process, but mechanization of the process began by the late 19th century (Bussolin 1847; Francis 1988; Kidd 1979; Springer 1921; Threlfall 1946). For canes and tubing:

> The requisite amount of molten glass is gathered on an iron and marvered into the shape of a thick cylinder. On a punty or post with a flattened end is taken a small gather of glass, which is shaped into a suitable condition for the attachment of the parison, that is, into a flat disc.
>
> The parison is meanwhile reheated at the furnace and, when soft, held vertically so that the end slowly sinks, touches and adheres to the glass on the punty held directly beneath. When attachment is complete the two workmen engaged in the process, one holding the gathering iron, the other the punty, walk rapidly in opposite directions over a wooden track or runway, on which the glass rod, as it is drawn out, gradually comes to rest. The rate at which the men move decides the distance apart which they finally attain, and consequently the thickness of the rod produced. Cane so made needs no annealing, and when cool is cut up into suitable lengths. Uneven portions are rejected, whilst the rest is sorted according to diameter.
>
> The only difference between the mode of making tubing and... rod is that the glass is gathered on a pipe and first worked into a thick-walled hollow cylinder (Hodkin and Cousen 1925:483).

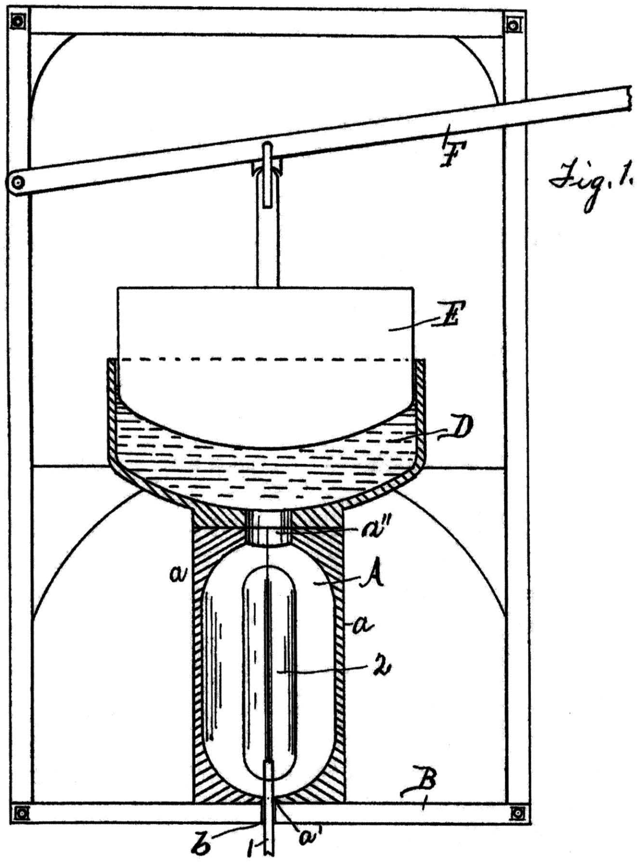



**Figure 2.** Hand-operated vertical downdrawing apparatus for the mechanical production of shaped tubing with circular perforations; Arthur Houghton (Corning Glass Works), U.S. Patent No. 586,188, July 13, 1897.

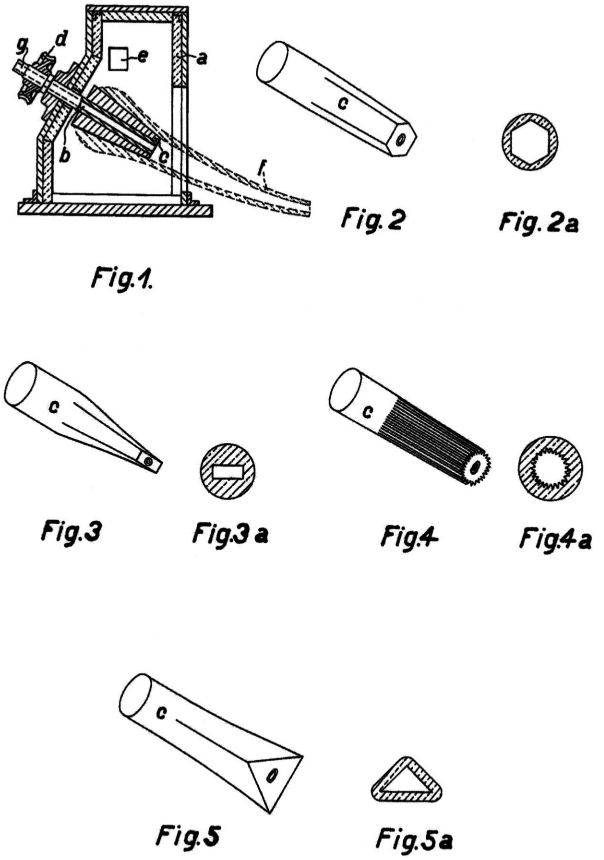



**Figure 3.** Shaped mandrels for a Danner tube-drawing apparatus; Richard Hirsch, Libbey Glass Co., U.S. Patent No. 1,574,482, February 23, 1926.

For beads, the preferred glass (vitreous silicate) was soda-lime (or lime) or alkali silicate (or alkali) glass for its relatively low melting point (generally 750° to 1000° C) and the readily available and inexpensive nature of its raw materials, basically:

- Silica from sand and crushed stone or sandstone
- Soda ash or saltwort, glasswort, barilla, salsola salt, sal soda, and glass salt (sodium carbonate)
- Saltcake (sodium sulphate)
- Crushed limestone (calcium carbonate)
- Quicklime (burnt limestone, calcium oxide), and/or
- Potash (potassium oxide), evaporated lye (leached wood ash), and pearl ash

These comprised the essential ingredients, but depending upon the quality, diaphaneity, color, and melting temperature desired for the tubing and canes, other substances were also added to the essential ingredients:

- Fluxes, to promote melting of the essential ingredients; e.g., borax, fluorspar (calcium fluoride), arsenic oxides, and antimony oxides
- Oxidizing agents, to promote decomposition of organic matter thus preventing discoloration of the glass and to prevent the reduction of ingredients desired in the glass; e.g., red lead or litharge (lead oxide), soda niter (sodium nitrate), and niter (potassium nitrate)
- Fining agents, to reduce the amount of small air bubbles (seeds) in glass; e.g., organic material plunged in the molten glass, ammonium nitrate, and the oxides of arsenic and antimony
- Reducing agents, to promote the incorporation of required oxides into the glass and to aid in the

formation of desired colors; e.g., coal or coke (carbon), Rochelle salt, and tin oxide

- Colorizing or decolorizing agents, to impart or eliminate color in glass (Brill 1999; Cable 1984; Hodkin and Cousen 1925:61-134; Phillips 1941:32-58; Weyl 1951); e.g.:
  – Clear, using glassmaker's soap (manganese dioxide) and selenium, cobalt, or nickel oxides
  – White, using tin oxide
  – Black, using manganese (producing a transparent to translucent, very dark purplish red) and chromium with cobalt, copper, or ferric silicates
  – Red, using copper and selenium compounds, and Purple of Cassius (gold)
  – Amber, using iron, manganese, carbon, and sulphur
  – Yellow, using ferric or cerium silicates, uranium, chromium, or silver compounds, and cadmium sulphide
  – Green, using ferrous silicates, cupric oxide, and chromium
  – Blue, using cupric silicates and cobalt
  – Purple, using nickel oxide, manganese silicates, and cobalt.

Accompanying these naturally occurring and processed ingredients was a wide range of impurities, commonly oxides and silicates of iron (e.g., hematite, limonite, and magnetite), magnesium, and aluminum.

Every glassmaking concern had its own processes and secrets for producing glass, and similar properties and colors could be produced in many different ways depending upon the raw materials and procedures utilized. Also, after glass ingredients (frit) were melted and drawn into tubing and canes, the waste (cullet) from the pot, furnace, and factory floor was often recycled in subsequent batches. Glass with highly variable properties could be produced by tubing and cane makers, even though they used a similar procedure with each subsequent batch. With the advent of mechanized production of tubing and canes, it became essential that batches retained certain characteristics necessary for the proper operation of glassmaking apparatus. Hence, stricter controls were required for the mixing and melting of raw materials and their additives. Subsequently, the reuse of cullet declined and variabilities in the quality and color were reduced.

During the late 19th and early 20th centuries, four basic processes for the mechanized production of glass tubing were invented and refined:

1. *Vertical Updrawing*, initially patented in the United States by Roger Pease in 1891, and culminating with the Woods (or Corning) process patented in the United States in 1931.

2. *Vertical Downdrawing* (or gravity feed), initially patented in the United States by Arthur Houghton in 1897, and culminating with the Vello process patented in France in 1929.

3. *Inclined Downdrawing* (or extrusion feed), initially patented in the United States by Edward Danner, Libbey Glass Co., in 1917.

4. *Horizontal Drawing*, initially patented in the United States by Robert Corl and Henry Hagemeyer for glass tubing.

At least one additional method was patented for the production of short tubes. Elihu Thomson (General Electric Co.) was issued U.S. Patent Nos. 761,111 (May 31, 1904) and 778,285 (December 27, 1904) for a method fusing granules of quartz coating a carbon rod with a high temperature electric arc or current.

The following discussion of the four principle techniques for mechanically drawing glass into tubes is confined to the production of tubes small enough to be used for beads. Documentation for the manufacture of larger cylinders of glass strictly for the production of window glass was identified, but has not been included.

**Vertical Updrawing Processes**

By the late 19th century, there were semi-mechanical processes patented in the United States for drawing molten glass into uniquely shaped tubing, specifically for the manufacture of thermometers. Mechanized vertical updrawing processes had been in wide use during the last half of the 19th century to produce large-diameter cylinders for the manufacture of window glass. In 1891, a mechanical vertical updrawing process for the "formation of cylinders, pipes, and other tubular or hollow bodies of glass" (United States Patent Office 1891:1) was patented by Roger Pease. This process was probably intended primarily for the production of window and sheet or plate glass, but could have been used for tubing of various sizes. Similar methods mentioning the manufacture of *tubing*, not just cylinders, were subsequently patented (Table 2).

The Raspillaire process explicitly allowed for the drawing of glass tubing with shaped exteriors. If the technique was used to produce tubes small enough for the manufacture of glass beads, then the canes could have been used for the production of multi-sided drawn beads (Karklins 1985: type If beads).

**Table 2. Patents for Vertical Updrawing Processes and Apparatus.**

| Patentee | U.S. Patent No. | Patent Date | Foreign Patent | Applications |
|---|---|---|---|---|
| Roger Pease, Rose, Minnesota | 463,644 | November 24, 1891 | | Window glass cylinders, pipes, tubular or hollow articles |
| | 463,645 | November 24, 1891 | | |
| Alexander Humphrey, Fairmont, West Virginia | 614,615 | November 22, 1898 | | Glass cylinders or tubes |
| Phillip Ebeling, Findlay, Ohio | 682,980 | September 17, 1901 | | Window glass cylinders, hollow articles, pipes, and tubing |
| Roger Pease, Rose, Minnesota | 788,142 | April 25, 1905 | | Window-glass cylinders and hollow articles |
| | 788,144 | April 25, 1905 | | |
| August Raspillaire, Morgantown, West Virginia | 804,173 | November 7, 1905 | | Glass tubing |
| Joseph North, Lancaster, Ohio | 810,218 | January 16, 1906 | | Glass tubing and cylinders |
| August Raspillaire, Morgantown, West Virginia | 834,165 | October 23, 1906 | | Glass tubing with shaped exteriors, such as hexagonal and octagonal |
| August Raspillaire, Morgantown, West Virginia | 839,421 | December 25, 1906 | | Glass tubing with shaped perforations, such as hexagonal and octagonal |
| William Keyes, Alexandria, Indiana | 935,663 | October 5, 1909 | | Long glass tubing and cylinders |
| Stephan Forgo, New York | 958,613 | May 7, 1910 | | Glass rods and tubing |
| Edward Hanson, Kane, Pennsylvania | 1,052,336 | February 4, 1913 | | Glass tubing and cylinders |
| Benjamin Chamberlin, Corning Glass Works, Corning, New York | 1,163,969 | December 14, 1915 | | Medical and laboratory tubing (Fig. 4); adapted from a re-issued patent to A.A. Houghton dated November 22, 1908, Serial No. 11702 |
| John Fagan, General Electric Co., Cleveland, Ohio | 1,273,345 | July 23, 1918 | | Glass rods and tubing (presumably for electrical applications) |
| | 1,273,346 | July 23, 1918 | | |
| James Smedley, General Electric Co., Cleveland, Ohio | 1,278,046 | September 3, 1918 | | Glass canes and tubing (presumably for electrical applications) |
| Frederick Keyes, Boston, Massachusetts | 1,291,921 | January 21, 1919 | | Glass tubing |
| Cleveland Quackenbush and James Smedley, General Electric Co., Cleveland, Ohio | 1,325,265 | December 16, 1919 | | Glass canes and tubing (presumably for electrical applications) |
| William Westbury, Okmulgee, Oklahoma | 1,439,855 | December 26, 1922 | | Glass canes |

**Table 2. Continued**

| Patentee | U.S. Patent No. | Patent Date | Foreign Patent | Applications |
|---|---|---|---|---|
| Louis Bruner and Simon Olsen, Brooklyn, New York | 1,458,518 | June 12, 1923 | | Glass tubing |
| Walter Riedel, Unter-Polaun, Bohemia, Czechoslovakia | 1,545,349 | July 7, 1925 | | Glass tubing |
| Schuller | | 1931 | Germany | |
| William Woods, Corning Glass Works | 1,829,429 | October 27, 1931 | | Shaped and striped glass medical and laboratory tubing |
| Robert Salomon, Neuilly sur Seine, France | 1,868,397 | July 19, 1932 | France October 11, 1927 | Spun glass tubing and rods |
| Ingvald Pedersen, Wilkinsburg, Pennsylvania | 1,892,806 | January 3, 1933 | | Glass tubing |
| Robert Salomon, Neuilly sur Seine, France | 1,894,201 | January 10, 1933 | France July 20, 1927 | Glass tubing |
| Gaston Delpech, Nemours, France | 1,894,853 | January 17, 1933 | France March 28, 1930 | Glass tubing and rods with shaped exteriors |
| William Woods, Corning Glass Works | 1,920,336 | August 1, 1933 | | Glass instrument tubing |
| Ingvald Pedersen, Wilkinsburg, Pennsylvania | 1,987,633 | January 15, 1935 | | Glass tubing with polygonal sides |
| William Woods, Corning Glass Works | 2,002,875 | May 28, 1935 | | Multiple-bore glass tubing |
| William Woods, Corning Glass Works | 2,141,456 | December 27, 1938 | | Glass tubing with shaped exteriors and perforations for thermometers |
| Georges Despret, Compagnies Reunies des Glaces et Verres Speciaux du Nord de la France | 2,267,554 | December 23, 1941 | France November 17, 1939 | Shaped glass instrument tubing |

The Woods (or Corning) process for creating tubing by the vertical updrawing method seems to have been the most successful of these techniques (Threlfall 1946:14). Nevertheless, these processes were typically employed for the production of window glass cylinders, medical instruments, and laboratory glassware.

### Vertical Downdrawing Processes

Shortly after the initial vertical updrawing processes for the production of tubing appeared, vertical downdrawing processes came into being (Table 3).

It would seem inconceivable that Houghton's 1897 process would not have been mechanized shortly after its invention. It was not, however, until Chamberlin's 1915 patent for a vertical updrawing process that a motorized apparatus is documented for a glass factory, albeit for the manufacture of medical or laboratory tubing.

The downdrawing process is also referenced as the gravity feed process (Pincus 1983, 1:viii). Some time after its initial patent in 1929, the Vello process became the predominant and preferred process for the production of general commercial tubing, replacing the inclined downdrawing Danner process patented in 1917 (*see* below). The principal differences between the Vello and Danner processes were that the Vello process resulted in the creation of glass with fewer air bubbles and that the molten glass flowed down a vertical metal blowpipe with a detachable tip of the appropriate size and shape of the finished tubing. Commercially, the Vello machine also was preferred because glass tubing could be drawn about twice as fast as with a Danner machine (Angus-Butterworth 1948:184; Bottger and Schotz 1994; Sibilia 1939:292).

**Inclined Downdrawing Processes**

It appears that the first major commercially viable invention for a mechanized process for general commercial tubing occurred in 1917, with patents in the United States by Edward Danner of the Libbey Glass Co. for a mechanized inclined downdrawing process and machine. It is also referenced as the extrusion feed or Danner process (Pincus 1983, 1:viii). The principal characteristic separating the Danner process from previous processes was that a molten stream of glass flowed down an inclined, rotating, conical blowpipe that had been coated with a shell of heat-resistant material such as fire clay. This blowpipe rotated at a speed from 4 to 10 revolutions per minute (Bailey 1930; Bottger and Schotz 1994; Sibillia 1939:297). The diameter of the tubing created by this process was determined principally, but not entirely, by the amount of air discharged through the blowpipe, the temperature of the glass at the point at which it leaves the blowpipe, and the speed by which the tubing was drawn away from the blowpipe. Solid canes of glass also could be produced by this method whereby the blowpipe was replaced with a solid conical mandrel. Danner consistently emphasized the terms "cylindrical" and "conical" for his descriptions of the blowpipes and mandrels in his patents. This and the 1926 patent by Richard Hirsch (*see* above) appears to support the view that during the early years when the Danner process was adopted, only tubing with circular perforations and exteriors was manufactured. After Danner patented his process and machine, numerous other individuals and companies patented improvements (Table 4).

By the mid 1930s, the new Vello process began replacing the Danner machine. The Danner machine retained one advantage, however, in that it could be used for the production of several very different glasses in succession (Sibilia 1939:292).

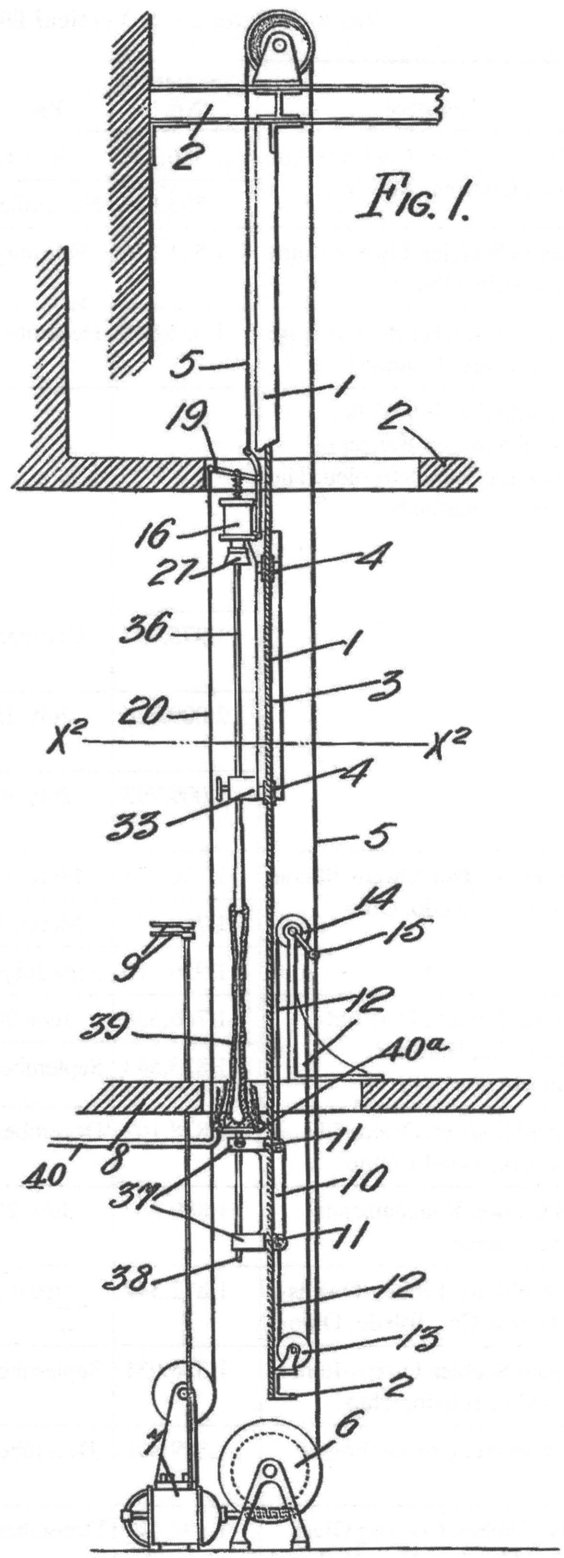



**Figure 4.** Vertical updrawing apparatus; Benjamin Chamberlin, Corning Glass Works, U.S. Patent No. 1,163,969, December 14, 1915 (adapted from a re-issued patent to A.A. Houghton, November 22, 1908).

**Table 3. Patents for Vertical Downdrawing Processes and Apparatus.**

| Patentee | U.S. Patent No. | Patent Date | Foreign Patent | Applications |
|---|---|---|---|---|
| Arthur Houghton, Corning Glass Works, Corning, New York | 586,188 | July 13, 1897 | | Shaped glass tubing for thermometers |
| | 593,581 | November 16, 1897 | | |
| Leonard Soubier, Owens Bottle Co., Toledo, Ohio | 1,571,216 | February 2, 1926 | | Glass tubing |
| Sidney Grotta, Hartford-Empire Co., Hartford, Connecticut | 1,653,848 | December 27, 1927 | | Glass tubing |
| Leopoldo Sanchez-Vello, Maatschappij tot Beheer en Exploitatie Van Octroolen, The Hague, Netherlands | | | France June 8, 1929 | Glass tubing |
| | | | British Patent No. 349,315, May 28, 1931 (Sanchez-Vello 1931) | |
| | 1,975,737 | October 2, 1934 | France June 8, 1929 | Glass canes and tubing (Fig. 5) |
| | 2,009,326 | July 23, 1935 | France January 26, 1931 | |
| | 2,009,793 | July 30, 1935 | France June 8, 1929 | |
| Leonard Soubier, Owens-Illinois Glass Co., Toledo, Ohio | 1,750,971 | March 18, 1930 | | Glass tubing |
| | 1,750,972 | March 18, 1930 | | |
| | 1,926,410 | September 12, 1933 | | |
| George Howard, Hartford-Empire Co., Hartford, Connecticut | 1,766,638 | June 24, 1930 | | Glass tubing |
| | 1,823,543 | September 15, 1931 | | |
| Leonard Soubier, Owens-Illinois Glass Co., Toledo, Ohio | 1,838,162 | December 29, 1931 | | Glass tubing |
| Jean Cardot, Bagneaux sur Loing, France | 1,869,303 | July 26, 1932 | France February 19, 1929 | Glass canes and tubing |
| Allen Wilcox, Libbey-Owens-Ford Glass Co., Toledo, Ohio | 1,872,542 | August 16, 1932 | | Glass tubing |
| Leonard Soubier, Owens-Illinois Glass Co., Toledo, Ohio | 1,876,031 | September, 6, 1932 | | Glass tubing |
| Pierre Favre, Crosne, France | 1,889,891 | December 6, 1932 | Austria November 6, 1929 | Glass canes and tubing |
| Walter Weber, Corning Glass Works, Corning, New York | 1,892,477 | December 27, 1932 | | Glass tubing |
| Leonard Soubier, Owens-Illinois Glass Co., Toledo, Ohio | 1,926,410 | September 12, 1933 | | Glass tubing |

**Table 3. Continued**

| Patentee | U.S. Patent No. | Patent Date | Foreign Patent | Applications |
|---|---|---|---|---|
| Ernest Le Coultre | 1,926,905 | September 12, 1933 | France May 22, 1930 | Glass cane and tubing |
| Henry Richardson, Westinghouse Lamp Co. | 1,933,341 | October 31, 1933 | | Glass tubing |
| Jean Cardot, Corning Glass Works | 1,949,037 | February 27, 1934 | France May 21, 1930 | Glass tubing |
| Leopoldo Sanchez-Vello, Maatschappij tot Beheer en Exploitatie Van Octroolen, The Hague, Netherlands | 1,975,737 | October 2, 1934 | France June 8, 1929 | Glass tubing |
| | 2,009,326 | July 23, 1935 | | |
| | 2,009,793 | July 30, 1935 | | |
| David E. Gray, Corning Glass Works, Corning, New York | 2,133,662 | October 18, 1938 | | Glass tubing and cylinders |
| Walter Hänlein, Berlin-Spandau, Germany | 2,155,131 | April 18, 1939 | Germany March 12, 1937 | Quartz glass tubing |
| Edward Danner, Newark, Ohio | 2,225,369 | December 17, 1940 | | Glass tubing |

### Horizontal Drawing Process

Tubing had been produced for centuries by hand drawing out a hollow gather of glass horizontally. In 1896, Josef Riedel of Polaun obtained an Austrian patent (Privilegium Nr. 46/2423) for a horizontal drawing apparatus (Neuwirth 1994:107, Pl. 58):

> Riedel received a privilege in 1896 for a "device to draw out molten glass into tubes and canes." This device relieved the drawer of the work almost entirely, since he now only had to cover a relatively short distance (5-8 meters), while the new device did the work of 60-70 meters (Neuwirth 1994:148).

This was not a completely mechanized apparatus, but rather a device to continue the drawing process initiated by the glassworker using the older hand-drawing process. From its patent illustration, the apparatus appears to be something like a conveyor belt possibly allowing the pontil or blowpipe to be placed on it so the drawing process could continue.

It appears that, at least in the United States, hand drawing was still a common method for producing small-diameter

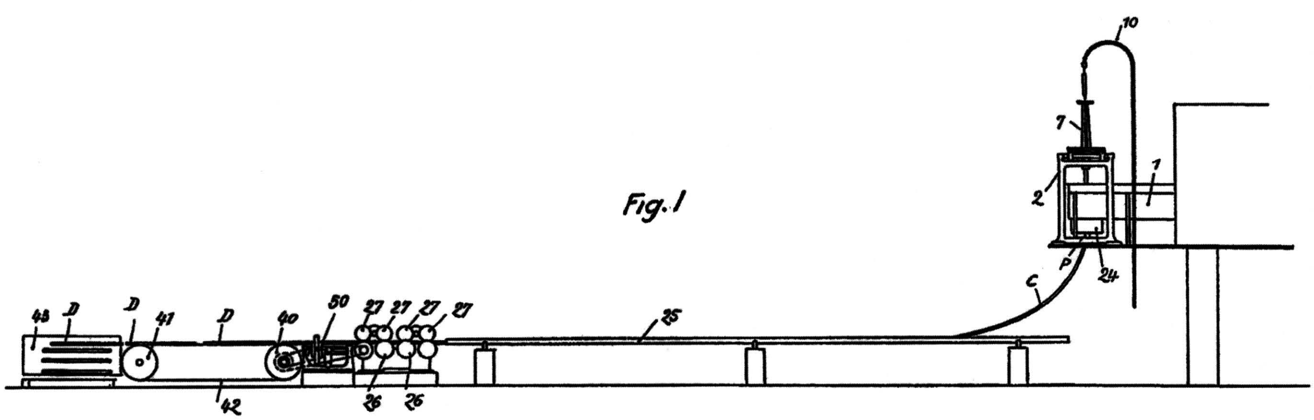



**Figure 5.** Vello downdrawing apparatus (edited version of patent drawing); Leopoldo Sanchez-Vello, British Patent No. 349,315, May 28, 1931 (process patented as early as June 8, 1929, in France).

**Table 4. Patents for Inclined Downdrawing Processes and Apparatus.**

| Patentee | U.S. Patent No. | Patent Date | Foreign Patent | Applications |
|---|---|---|---|---|
| Edward Danner, Libbey Glass Co., Toledo, Ohio | 1,218,598 | March 6, 1917 | | Glass canes and tubing (Figs. 6-7) |
| | 1,219,709 | March 20, 1917 | | |
| Albert Wilcox, Bridgeport, Ohio | 1,550,995 | August 25, 1925 | | Glass canes and tubing |
| Richard Hirsch, Jena, Germany, Libbey Glass Co., Toledo, Ohio | 1,574,482 | February 23, 1926 | | Glass tubing with shaped exteriors and perforations |
| Pancras Schoonenberg, Eindhoven, Netherlands, Naamlooze Vennootschap Philips' Gloeilampenfabrieken | 1,637,458 | August 2, 1927 | Netherlands December 2, 1920 | Glass canes and tubing |
| | 1,642,312 | September 13, 1927 | Netherlands August 20, 1926 | |
| Karl Peiler, Hartford-Empire Co., West Hartford, Connecticut | 1,663,093 | March 20, 1928 | | Glass canes and tubing |
| | 1,857,257 | May 10, 1932 | | Glass tubing |
| | 1,857,791 | May 10, 1932 | | Glass tubing |
| James Bailey, Corning Glass Works, Corning, New York | 1,892,126 | December 27, 1932 | | Glass tubing |
| Jules Arrault, Chalon-sur-Saone, France | 1,941,924 | January 2, 1934 | France November 16, 1928 | Glass tubing with a uniform diameter |
| Leonard Soubier, Owens-Illinois Glass Co., Toledo, Ohio | 1,977,956 | October 23, 1934 | | Glass canes and tubing |

tubing a decade prior to the invention of Danner's process. This is noted in part because of U.S. Patent No. 865,517 (September 10, 1907) to Cornelius Nolan, Libbey Glass Co, for a tube-forming apparatus that allowed a glassblower

**Table 5. Patents for Horizontal Drawing Processes and Apparatus.**

| Patentee | U.S. Patent No. | Patent Date | Foreign Patent | Applications |
|---|---|---|---|---|
| Robert Mackey Corl and Henry F. Hagemeyer, Toledo, Ohio | 1,298,463 | March 25, 1919 | | Glass tubing |
| Louis Bonnet, Perpignan, France | 1,466,575 | August 28,1923 | | Glass tubing on a wire |
| James Gross, Brooklyn, New York | 1,899,146 | February 28, 1933 | | Glass tubing with unique cross-sections and stripes |
| Joseph De Silva, Corning Glass Works | 1,920,366 | August 1, 1933 | | Glass tubing for thermometers |
| William J. Woods, Corning, New York | 2,002,875 | May 28, 1935 | | Glass tubing |
| | 2,085,245 | June 29, 1935 | | |
| Randolph H. Barnard, Toledo, Ohio | 2,150,017 | March 7, 1939 | | Glass tubing with various cross-sectional shapes |

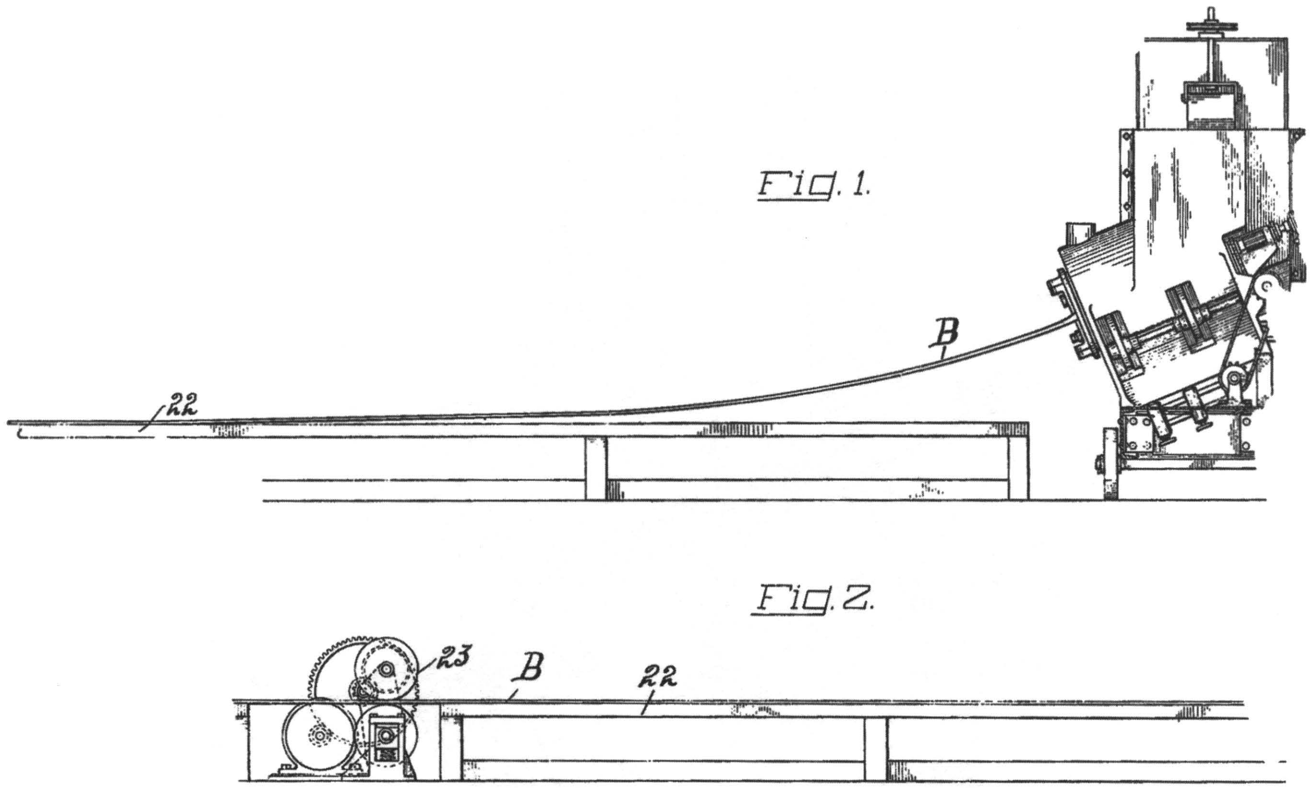



**Figure 6.** Danner inclined downdrawing apparatus (edited version of patent drawing); Edward Danner, Libbey Glass Co., U.S. Patent No. 1,218,598, March 6, 1917.

to hand draw tubing while supporting his blowpipe on a wheeled platform that he pulled as he walked backwards.

Similarly, at the French beadmaking factory of Alfredo Salvadori, established in 1929, hand drawing continued well past World War II:

> Until the 1950s, the process of drawing out the gather was done by hand. Now [presumably the 1980s], a machine replaces the two men who ran in opposite directions, each holding one end of the metal rod to which the hollow glass gather was attached. A regulating mechanism sets the speed; the faster it moves, the thinner the tube. Despite this mechanization, Gérard Salvadori remains one of the few masters at drawing canes by hand (Opper and Opper 1991:51).

Various patents for mechanically drawing horizontal glass tubing were granted after Danner's inclined downdrawing process was patented (Table 5).

### Commercially Viable Tube-Drawing Processes

Of all the newer processes that appeared after the invention of the Danner inclined downdrawing process, it appears that the only ones that enjoyed widespread usage were the Vello vertical downdrawing process patented in 1929 and the Woods (or Corning) vertical updrawing process patented in 1931. The Vello process replaced the Danner process for the production of general commercial tubing and canes because it could produce tubing at a rate nearly double that of the Danner process, while the Woods process seems to have been used principally for the production of medical and laboratory tubing (Angus-Butterworth 1948:184; Threlfall 1946:14; Wilson 1984).

Which of the above processes were initially used to produce glass tubing for the manufacture of beads has yet to be determined. Nevertheless, based on widespread use of these techniques for other small-diameter tubular products, it is hypothesized that the *terminus post quem* for the mechanized production of drawn glass tubing used in the manufacture of beads appears to be the late 19th century.

## DISTINGUISHING HAND- AND MACHINE-DRAWN BEADS

Distinguishing hand- vs. machine-drawn beads is difficult at best. Since machine-drawn tubing could be

Fig. 2

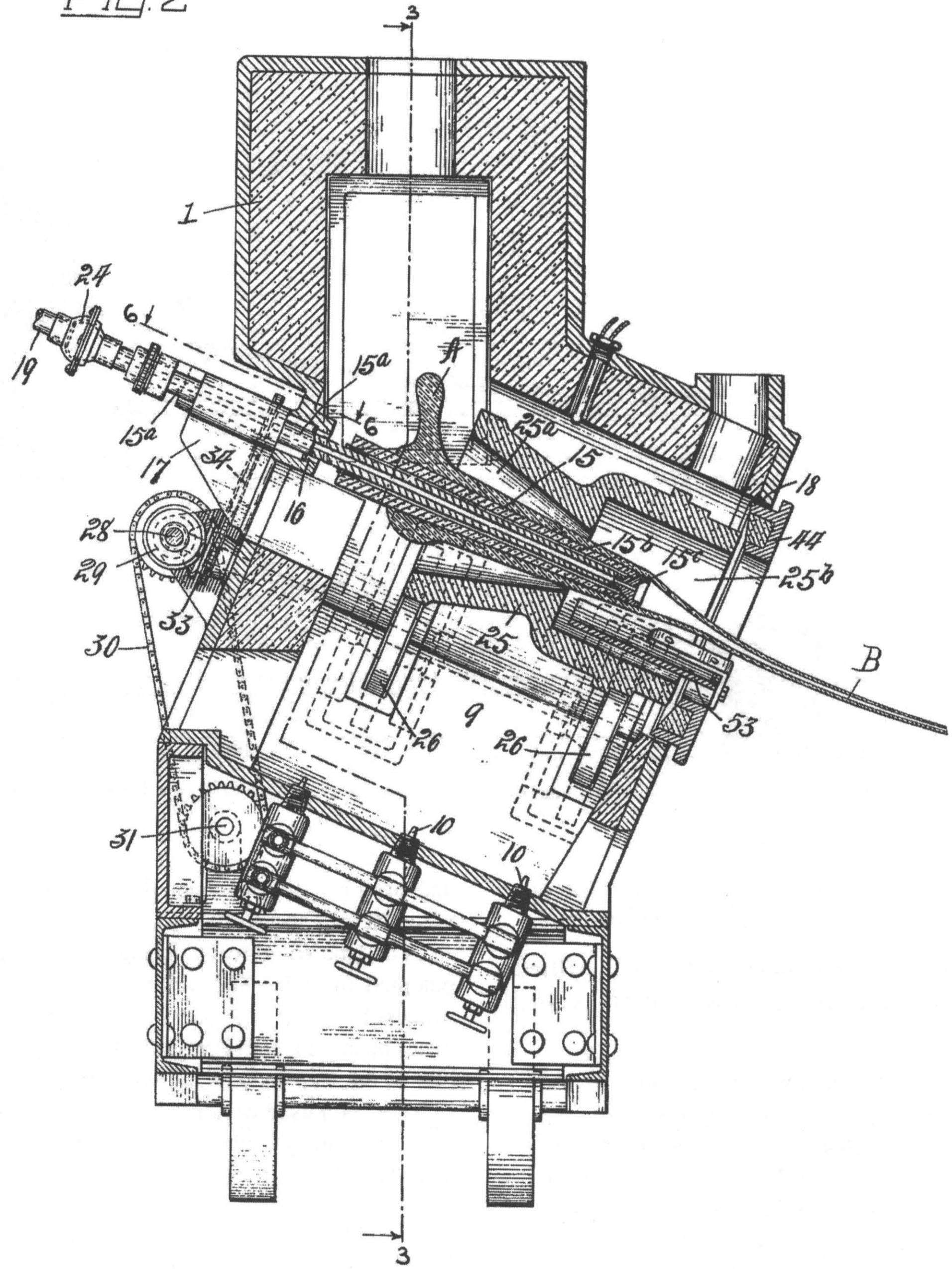



**Figure 7.** Close-up view of the Danner inclined downdrawing apparatus; Edward Danner, Libbey Glass Co., U.S. Patent No. 1,218,598, March 6, 1917.

produced with dimensions regulated by mechanical means, it would seem probable that resultant beads would have very uniform shapes and walls with uniform thicknesses. Well made hand-drawn tubing also could produce similar appearances, however. If we are to believe Richard Threlfall (1946:14), distinguishing hand-drawn from machine-drawn tubing should not be too difficult:

If you are ever in doubt whether a piece of tubing or rod is machine- or hand-drawn, look at the striae. If these run parallel to the long axis, the glass is hand-drawn, for most machine-drawing gives the glass a twist which is never taken out and therefore the striae in it run oft at an angle greater or less according to the diameter of the glass.

Observing parallel vs. angled striations within small beads may be impossible without access to a high-magnification microscope, although for elongated beads, such as bugles, the striations may be visible to the naked eye. The determination of hand- vs. machine-drawn beads may also utilize attributes such as decoration, uniform shape, relative sharpness of edges, bead size, and perforation size and shape.

With the mechanization of the manufacture of glass tubing, dimensional tolerances could be more tightly controlled. Within an assemblage of beads from an archaeological context, these tighter tolerances may be discernable within a relatively large population of beads comprising a single variety and/or size. Tolerances for wall thickness, perforation diameter, and bead size and shape may be less than those for beads produced from hand-drawn tubing. Comparisons of the dimensions of beads from pre-industrial vs. industrial-era contexts may provide better insights into tolerance variations. Presently, however, there is very little reliable data that can be used to positively distinguish hand- vs. machine-drawn beads using such attributes. For now, the best indicator may be perforation shape.

Beads with shaped (e.g., square) perforations manufactured by mechanized processes exhibit straight walls and sharp edges. Earlier beads with shaped perforations created by hand-drawn techniques appear to have poorly shaped walls and somewhat rounded edges. Machine-made beads with shaped perforations also may have coatings, such as enameling or metallic coatings, on the walls of the perforation.

Until additional historical documentation becomes available, the age and distinguishing characteristics of machine-made beads will be more a matter of conjecture than of fact. It is hoped that such documentation will appear more frequently as the history of the late 19th and 20th centuries becomes more relevant to archaeological investigations.

## MACHINE-MADE BEADS

During the 19th century, there were numerous methods for the manufacture of machine-made mold-pressed beads (Ross 2006:43-45). By the early 19th century, mold-pressed beads were manufactured using hand-operated mechanical molding machines; e.g., U.S. Patent No. 79,635 (July 7, 1868) to George J. Capewell, West Cheshire, Connecticut, for an improved glass-pressing machine to make glass beads and other glass ornaments. Other than hand-operated tongs, such hand-operated machines may have been in use earlier in Bohemia, the presumed origin for this type of manufacture, but no patents for such devices earlier than 1868 have yet been identified. The earliest known machine-operated method for the manufacture of mold-pressed beads may have been the "apparatus for molding fancy articles in glass, crystal, &c.," first patented by Charles Gaston Picard, Paris (French patent dated December 22, 1881; U.S. Patent No. 259,203 dated June 6, 1882). In Bohemia, the earliest documented patent is the button and bead press of 1888, by Albrecht Max, Reichenberg, Austria (Austrian Privilege No. 38/1616). The earliest American machine was one patented on March 21, 1893 (U.S. Patent No. 493,808) by William Bechtold of New York.

It remains unknown when the first machine-made beads were manufactured from glass tubing. In 1877, a machine for the cutting of beads from glass tubing was patented in Austria (Austrian Privliege No. 27/112) by Adolf Schindler, Vienna (Neuwirth 1994:138). Glass tubing small enough for beadmaking may have been manufactured as early as the late 19th century using Pease's vertical updrawing process, but there is no record yet identified that indicates beads were manufactured from such tubing.

According to Peter Francis, Jr. (1988:7), Danner machines were used for the production of bead tubing in Venice from perhaps the 1920s. Francis, on his web site for the Center for Bead Research, also stated that Danner machines were used for bead tubing in Venice and Bohemia shortly after the invention of the process in 1917. Unfortunately, Waltraud Neuwirth (1994) made no mention of the use of any mechanized process for the production of bead tubing in Bohemia. The only machines noted for drawn beads were cutting machines such as the one mentioned previously.

U.S. Patent No. 1,493,044 (May 6, 1924) to Gustave A. Lexman of New York was for a machine for making glass articles. In the patent it is stated that "this invention relates to a machine for making glass articles such as beads, buttons, and the like, from canes, rods or sticks of glass." The process required six solid glass canes which were held vertically. Their ends were heated, these were pressed in a mold to form beads, and the perforation was made by a sliding pin. This description appears to describe the manufacture of mold-pressed beads using solid rods of glass. Lexman, however, distinguishes canes and rods, but from his description it appears that both terms refer to solid rods of glass, not glass tubes.

U.S. Patent No. 1,580,076 (April 6, 1926) by Jean Paisseau, Courbevoie, France, was for the machine manufacture of glass beads using his process for the machine manufacture of horizontal glass tubes patented earlier on August 28, 1923 (U.S. Patent No. 1,466,575; *see* above).

It appears that totally machine-made drawn glass beads may not have been manufactured prior to the 1917 invention of the Danner process. Machines for the cutting of glass tubing for beads were in existence at least by the mid-19th century. It is therefore hypothesized that the *terminus post quem* for machine-manufactured drawn glass beads appears to be post-1917.

## CONCLUSION

The research presented in this article has been confined temporally to the period prior to World War II. It has focused on the machine production of drawn glass beads. Machine manufacturing of mold-pressed beads and some processes for the mechanization of wound glass bead production did exist prior to the early 1940s (e.g., U.S. Patent No. 1,391,527 on September 20, 1921, to William F. Chase, Peekskill, New York, for a hand-operated machine to manufacture wound glass beads on a wire). It is highly probable that other mechanized techniques were used during the period. By documenting the earliest techniques yet known and hypothesizing *termini post quem* for specific processes, it is hoped that additional historical and archaeological research will expand our knowledge and establish temporal markers for future use.

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# ELEMENTAL ANALYSES OF NORTH AMERICAN GLASS TRADE BEADS

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*Although European-made glass trade beads can be sorted into bead varieties and studied in that manner on the basis of physical attributes, much more information can be obtained about them by means of chemical analysis. Such analyses produce chemical fingerprints that may be compared and grouped. Bead varieties that have matching chemistries were made using the same ingredients that probably came from the same sources, suggesting that they were made in a specific manufacturing center and probably during the same approximate time period. Using this information may help to establish with which European nationals specific indigenous people were dealing and may perhaps even link archaeologically recovered beads to the European beadmaking houses from whence they came.*

## INTRODUCTION

The analysis of glass beads recovered from archaeological sites in northeastern North America began with typological classifications, based on the observed manufacturing technique, color, diaphaneity, shape, and decoration. The current definitive bead classification system for beads from this region was devised by Kenneth and Martha Kidd (1970), and was subsequently expanded by Karklins (1985).

Some polychrome glass bead varieties were manufactured and traded for only short periods of time, enabling researchers to developed variety-based chronologies for beads from archaeological sites that were in existence during the European contact period (e.g., Fitzgerald 1982; Hayes 1983; Kenyon 1984; Kenyon and Fitzgerald 1986; Kenyon and Kenyon 1983; Pratt 1961; Stark 1995). For beads that look different, even subtly, this approach works well, but for monochromatic beads, we may sort them by color, shape, and size, but this does not reveal their place of manufacture. Elemental analysis of these beads allows us to sort out what is different and what is similar in their glass chemistries, something which may eventually lead to a determination of which countries manufactured which beads.

A problem with elemental analysis is that the bead may be damaged during the process. Analytical techniques such as laser ablation ICP-MS (e.g., Gratuze et al. 1993) or neutron activation analysis (e.g., Gratuze et al. 1995; Hancock 2003) are therefore probably relatively appropriate, since they do little physical damage.

If we choose to use instrumental neutron activation analysis, we take whole beads for analysis. As long as we only analyze them for elements that produce short-lived radioisotopes that decay relatively quickly, the beads may be returned safely to their owners.

To describe glasses that were used to make beads, the important elements to be sought include the glass-forming elements such as calcium (Ca), aluminum (Al), manganese (Mn), magnesium (Mg), sodium (Na), potassium (K), iron (Fe), phosphorus (P), lead (Pb), and silicon (Si) together with the elements that produce coloring, including tin (Sn), antimony (Sb), arsenic (As), copper (Cu), cobalt (Co), nickel (Ni), gold (Au), and vanadium (V).

The elemental concentrations of >5-10 elements form a chemical fingerprint for each bead analyzed. Comparison of the fingerprints allows us to sort the beads into groups and/or follow specific bead compositions through time. Fortunately for archaeometrists, beads traded or given to the Native Peoples living in early eastern North America were generally interred with their owners, so that they generally tended to be buried within about forty or so years after their manufacture.

## NEUTRON ACTIVATION ANALYSIS

The principles of neutron activation analysis (NAA) are published in full elsewhere (e.g., Kruger 1971; Neff 2000; Pollard and Heron 1996). Very briefly, the sample to be analyzed is inserted into a source of neutrons. While there, neutrons bombard the atoms in the sample. Since atoms primarily consist of empty space, most of the neutrons pass through the sample but some do hit the nuclei of atoms in the sample. Many of these bounce off. A tiny fraction of the nucleus-hitting neutrons coalesce with the nuclei of elements in the sample and form artificial radioisotopes of each element that was activated. As they are formed, the artificial radioisotopes begin to decay by emitting gamma-rays of characteristic energies (like radio station frequencies). The sample is subsequently withdrawn from the neutron source. After a suitable waiting time, to allow intense shorter-lived radioisotopes to decay, gamma-ray detectors are used to measure the number of gamma-rays emitted in a specific period of time and these figures are proportional to how much of a particular element was in the sample. Hence, by comparing the measurements we get from samples with those from elemental standards, we can get an elemental analysis of the original sample for a number of elements.

One needs access to a relatively intense neutron source, usually a research nuclear reactor, and a gamma ray spectrometer (sometimes a beta counter or alpha spectrometer). Along with the McMaster University reactor in Hamilton, Ontario, Canada is also blessed with having low-flux SLOWPOKE reactors at the University of Alberta in Edmonton, at the Saskatchewan Research Council in Saskatoon, at the Royal Military College of Canada in Kingston, at l'Ecole Polytechnique in Montreal, and at Dalhousie University in Halifax.

Nuclear reactors produce neutrons with a broad range of energies. There are three types of neutron activation reactions: $(n,\gamma)$, $(n,p)$, and $(n,\alpha)$. The first is generated by low-energy (<0.1 eV or thermal) neutrons, and the other two are produced mainly by epithermal and fast (>1MeV) neutrons. Although thermal neutron reactions are favored, some activation products may be produced from elements of different atomic number. For example, $^{28}Al$ is produced preferentially from aluminum by the thermal neutron reaction $^{27}Al(n,\gamma)^{28}Al$; from silicon by the epithermal neutron reaction $^{28}Si(n,p)^{28}Al$; and from phosphorus by the fast neutron reaction $^{31}P(n,\alpha)^{28}Al$. Although these reactions tell us that it is potentially horrible to try and analyze a matrix including Si, P, and Al, we may use the activation product $^{28}Al$ to analyze for Al in aluminosilicate materials, for Si in silica-rich, or doped, materials, and for P in bones. By using suitable neutron absorbers it is possible, but more time consuming, to distinguish between these cases, as described below.

Prior to a neutron activation analysis, beads of mass 5-10 mg are first cleaned ultrasonically, as required. They are stored individually in 1.2 ml polyethylene vials, and are irradiated serially for about a minute at a neutron flux of $2.0 \times 10^{12}$ neutrons.cm$^{-2}$.sec$^{-1}$. Five to seven minutes after neutron irradiation, the induced radioactivity is counted for five minutes using a hyper-pure germanium detector-based gamma-ray spectrometer. This produces analytical concentration data for Co, Sn, Cu, Na, Al, Mn, Cl, and Ca. The samples are recounted for 5 to 33 minutes the next day to measure the concentrations of the longer-lived radioisotopes of Na, As, Sb, and K. The sodium measurements are used to link both counts. Elemental concentrations are calculated using the comparator method. Beads of larger masses are irradiated at suitably lower neutron fluxes to make enough radioactivity for reasonable chemical analyses.

## THE FINDINGS SO FAR

A student research project (Chafe 1986) started the sometimes-funded (but mainly not) glass bead analysis project that began at the SLOWPOKE Reactor Facility at the University of Toronto, moved to The Royal Military College of Canada, in Kingston, Ontario, and then to McMaster University in Hamilton. This initial work was expanded upon and eventually published (Hancock et al. 1994), and a number of general conclusions were drawn. Dark blue, cobalt-colored beads were readily separable from turquoise blue, copper-colored beads. Robin's egg blue beads were colored with cobalt and opacified with tin. In the dark blue beads, arsenic tended to increase with the cobalt, and manganese often occurred at concentrations much higher than in the turquoise blue beads. In the turquoise blue beads, for the Ontario Iroquois (Kenyon and Kenyon 1983), it was possible to distinguish Bead Period I beads from others by their low Ca ($\leq 2\%$) content and to distinguish Bead Period II beads on the basis of their high sodium (>12.5%) content. Disintegration of low-calcium beads probably occurred by the leaching of alkali metals from the glass. Groups of samples of similar chemistry exhibited elemental concentrations that were precise to about $\pm 10\%$ to $\pm 20\%$ relative.

After the initial research, it was decided to tackle the analysis of monochromatic beads, progressing from blue to white to redwood (brick red), and finally to black and yellow.

Seventeenth- to twentieth-century turquoise blue glass beads from sites in Ontario showed that different element concentration ratios could be used to sort the chronologies of turquoise blue beads over these centuries (Kenyon et al. 1995). A scatter plot of K/Na versus Cl/Na was the primary sorting tool. Traces of cobalt appeared in some of the Late French Regime beads (1660-1760), perhaps offsetting the lower copper levels in these beads, thus enhancing the blue color of the beads. Also, measurable amounts of tin were found in two early beads, and there were many cases of measurable quantities of both antimony and arsenic in later beads.

The Ontario-found turquoise blue bead chronological findings were applied to data from turquoise blue glass beads found at three sites in the Lac-saint-Jean region of Quebec (Hancock et al. 1996): Ashuapmuchuan, Chicoutimi, and Metabetchuan. Happily, the chemistry-based chronologies of the Quebec-found beads corresponded well with archaeological expectations. Again, cobalt at about the 200 ppm level appeared in early turquoise-colored beads, sometimes along with high levels of tin. Some of the later beads contained measurable levels of arsenic and measurable to high levels of antimony. It was gratifying to see that beads that physically looked alike matched in their chemistries.

At the Ashuapmuchuan site, a concentration of turquoise blue beads was found along with beads of other colors (Moreau et al. 1997). There was a fist-sized clump of beads and a dispersed association of beads. These two physical groupings produced only two distinct chemistries. It was proposed that the beads represented a bead-decorated bag filled with beads. Also, since the beads showed low concentrations of cobalt, it was thought that the time period of the beads should be in the Late French Regime (1660-1760), or perhaps the Early British Regime (1760-1840).

A study was made of cobalt-blue (royal blue or bright navy) beads from a glass beadmaking house in Amsterdam (ca. 1601-1610), and from the Neutral Grimsby (ca. 1625-1636) and Huron Ossonane (ca. 1636) sites in southern Ontario (Hancock et al. 2000). The Amsterdam beads produced two chemical groupings neither of which matched any of the data from the Ontario beads. This makes sense since the two Ontario sites were theoretically in the French trading sphere. Even though the Ontarioan sites are ca. 190 km apart, two separate groups of oval beads from Grimsby and Ossossane shared chemistries. A plot of arsenic versus cobalt inferred that the source of the cobalt was probably a cobalt arsenide ore that might have come from the Hartz Mountains of Germany.

White glass beads from the early-17th-century Auger site in southern Ontario produced four gross chemical groups that were based primarily on variations on the concentrations of potassium, sodium, tin, aluminum, and manganese (Hancock et al. 1999). The finding of early tin-opacified, turquoise-colored beads, followed temporally by antimony, and then arsenic, was confirmed using white glass beads from a number of sites in Ontario (Hancock et al. 1997). Tin opacification was used in the early 17th century; antimony starting in the late 17th century and extending into the 19th century; arsenic from the late 18th century onwards; fluorine in the late 19th century; and with none of the above, also during the late 19th century (Hancock et al. 1997).

The beads used by the Seneca of western New York state changed from tin-white to antimony-white in the second quarter of the 17th century (Sempowski et al. 2000). Beads very high in tin (>10%) were followed during the ca. 1625-1675 period by beads with ca. 3.4-4.2% tin. The primary reason for such low tin levels was that these beads had uncolored cores. Such cored white beads were only found in Ontario at the Orchid site (ca. 1625-1650) that is located near Fort Erie, Ontario, to the west of the Seneca lands (Hancock et al. 1997). Antimony-rich beads also came in uncored (ca. 3.0-4.5% Sb) and cored (ca. 1.0-1.6% Sb) varieties. Both kinds of beads generated multiple bead chemistries.

As previously mentioned, the purportedly decorated bag from the late-17th-century Ashaupmuchuan site in Quebec showed eight different antimony-white bead chemistries (Moreau et al. 2002).

Sempowski et al. (2001) studied the chemistries of opaque red (redwood) glass trade beads recovered from sites in Petunia in southern Ontario (ca. 1630-1650), in the Seneca territory in western New York (ca. 1610-1687), and from the Algonquian site of Ashaupmushuan in Quebec (ca. 1625-1700), as well as from a glass beadmaking house in Amsterdam (ca. 1601-1610). The data split into four gross chemistries, with the first two chemistries containing most of the pre-1655 beads and the last two chemistries containing mainly the post-1655 beads. The first three chemical groups contained measurable amounts of tin, with Group 3 beads containing both tin and antimony. This perhaps mirrors the transition from tin to antimony in white glass beads. Group 4 beads contained neither tin nor antimony and, as such, potentially reflect a technological change in the making of redwood beads. Chemical matches were found among beads from the four different geographic locations revealing the following connections: Amsterdam-Seneca, Amsterdam-Petunia, Amsterdam-Seneca-Petunia, Petunia-Seneca, and Algonquian-Seneca.

Two hundred and ninety glass beads and wasters from an Amsterdam beadmaking house (ca. 1601-1610) were characterized by their chemistries (Karklins et al. 2002). There was a diversity of colors: turquoise blue, royal blue, red, black, white, colorless, and gold. Apart from the gold-colored glasses (*see* below), all of the rest were soda-lime-silica glasses. Each color of glass produced multiple chemistries, illustrating clearly the diversity of material produced in one place over a relatively short period of time.

The 135 red glass beads in the collection all contained copper and tin and could be sorted into seven gross chemistries depending on whether the beads were cored, flashed, uncored, or multicolored. The 52 black/grey beads produced three different glass chemistries. The primary colorant was manganese in high concentrations. Eleven yellow beads split into three different coarse chemical groups. The notable features of these latter data are the very low levels of Na and K, and the low levels of Ca and Cl. These features imply that the yellow-colored beads were lead-silica glasses.

A beadmaking house in Middelburg, The Netherlands, was reputed to have operated during the last decade of the 16th century and into the early 17th century. Karklins et al. (2001) analysed an assortment of glass beads and rods of various colors. The glass beads and rods, which were chosen for their visual diversity, echoed that diversity in their chemistries. Apart from a single gold-colored glass rod of lead-silica glass, all of the other glasses were soda-lime-silica. Where opacification was expected, tin was used in all cases but two: a white bead (antimony) and a sky blue bead (cobalt/antimony). The presence of these two beads supports a closing date for the glass beadmaking house in the 1620s, after which time white glass beads that were opacified with antimony began appearing on Seneca sites in western New York (Sempowski et al. 2000).

## CONCLUSION

The vast majority of the European glass trade beads analysed to date were drawn beads made from soda-lime-silica glass formulations, with fewer than several dozen wound beads of potash-lime-silica or lead-silica glass. It has been established that the colors of beads tend to translate into the inclusion of specific colorants and opacifiers into the glasses. Indeed, glass bead chemistries may be used as fingerprints for tracking glass beads. In a few cases, and with much effort, we can in fact trace glass bead chemistries from their place of manufacture in Europe to archaeological sites in North America. In many more cases, we can see how beads of similar chemistry were eventually dispersed in northeastern North America.

An expanded version of this article, with data for those who would like to see the evidence, is in preparation for inclusion in a book on the analysis of archaeological glasses (Hancock n.d.).

Before all of the analytical data alluded to above disappear, it would be beneficial to establish a user-friendly glass bead analysis data base that could be accessed by interested people. It would also undoubtedly be of value in the future to expand upon the numbers of analyzed beads from glass beadmaking houses in at least western Europe for the periods that are of interest to archaeologists. Unfortunately, these sorts of ventures are costly in expertise, time, and money. Nevertheless, since there are still groups of researchers analyzing glass trade beads from around the world, there is hope that some day these tasks may be completed. It would then be possible to present a more complete story of the manufacture and distribution of both drawn and wound European-made glass trade beads in North America and elsewhere.

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# THIRTEEN-HUNDRED-YEAR-OLD BEAD ADORNMENTS FROM BAAR, CANTON ZUG, SWITZERLAND[1]

**Katharina Müller**
**Translated by Sandy Hämmerle**

I am not a person.
I am a succession of persons
Held together by memory.

When the string breaks,
The beads scatter. —Lindley Williams Hubbell

*In the year 2000, an Early Medieval (7th-century) cemetery containing more than 200 burials with rich grave goods was discovered in Baar, Canton Zug, Switzerland. Thanks to the painstaking methods used in the excavation and recording of the 2,985 glass, amber, coral, and amethyst beads found with the female burials, it was possible to reconstruct the necklaces and sewn-on appliqués they were part of. Comparisons with mosaic depictions of famous women–such as the Empress Theodora in San Vitale in Ravenna, Italy–suggest that the people of Baar imitated southern Alpine Byzantine bead jewelry fashion.*

## INTRODUCTION

In the year 2000, the Archaeology Department of Canton Zug carried out a rescue excavation at Früebergstrasse in Baar, which uncovered an Early Medieval cemetery containing more than 200 burials (Hochuli and Müller 2003:29-33; Hochuli and Röder 2001; Müller 2003, 2005, n.d.). Men, women, and children had been interred there over the course of approximately 100 years, from the late 6th century to the late 7th or early 8th century. It was the custom at the time to place offerings in the graves with the deceased. With few exceptions, these grave goods were gender-specific. Women and girls were mainly accompanied by adornments, while men and boys primarily had weapons interred with them. Besides ear, arm, and finger rings, the adornments placed with the women and girls included beads.

The Baar-Früebergstrasse cemetery produced 3,024 beads made of glass, amber, and coral, as well as a single amethyst bead. Of these, 2,985 beads were found in the graves themselves, while the remainder were stray finds from disturbed or robbed burials. Despite the fact that grave robbing was punishable by law with the imposition of fines (Nehlsen 1978:127-129)–as documented, for instance, in the *Pactus Alamannorum* and the *Lex Alamannorum*–it was widespread in Early Medieval times, and also took place at Baar-Früebergstrasse.

## METHODS OF EXCAVATION AND RECORDING

The Baar-Früebergstrasse cemetery was meticulously excavated and the findings were recorded to a very high standard. Contrary to what had been the norm for a long time in Early Medieval archaeological research, the features and finds assemblages and not the individual finds were at the center of the investigation. This focal point was also maintained during the post-excavation work in the finds laboratory and in subsequent conservation/restoration work. Consequently, it is the context details from the Baar-Früebergstrasse cemetery that hold the greatest potential for research. The beads, found in assemblages and clusters of individual beads, especially bear this out.

In order to gain as much information as possible, the beads were carefully exposed (Pl. IIIA). Where necessary, this was done in several stages. In addition, the soil from the area around the skeleton was wet-sieved using a series of sieves down to a mesh size of 1 mm. The exposed bead assemblages were then photographed in overview and in detail.

The location and shape of the beads within each assemblage were recorded on transparent film at a scale of 1:1. After being precleaned, each bead was given an excavation, burial, bead assemblage, and find number (Fig. 1). The latter was also recorded on the assemblage plan. The beads were subsequently properly cleaned in the laboratory and, where necessary, strengthened, and then inventoried.


**Figure 1.** Baar-Früebergstrasse cemetery, Burial 41. Each bead is cleaned before it is given its specific find number and packed in a plastic bag. The bead assemblage is drawn at a scale of 1:1 (Photo: Markus Bolli, Archaeology Department of Canton Zug).

## BEADS – SMALL BUT MIGHTY!

Even a single bead can provide information about trade, and production procedures and techniques. Chemical analyses[2] carried out on three, small, yellow glass beads from Burial 40 at Baar-Früebergstrasse revealed that they were made of soda-lime glass, also called lime-natron glass, which has as its main components sand ($SiO_2$), lime ($CaO$), and soda ($Na_2O$).[3] This was the predominant type of glass throughout Europe from around 900 B.C. into the Middle Ages (Heck 2000:3-6, 13-15, 89-92). To date, no evidence has come to light that would point to the production of soda-lime glass in Early Medieval Europe. It is assumed, therefore, that production took place in the Near East, probably in what is now Israel and Egypt, and that the raw glass was exported to Europe (Heck 2000:150; Sasse and Theune 2003:578).

The raw material for the amber beads found at Baar-Früebergstrasse was also imported, in this case from the Baltic area.[4] The origin of the amethyst bead found with female Burial 86 cannot be determined through scientific analysis. There are amethyst deposits in almost every country and because it is not an expensive gem–and therefore does not warrant provenancing in the eyes of the gem-working industry–provenance data are lacking.[5] Based on texts by Early Medieval authors such as Isidore of Sevilla or Cosmas Indicopleustes, there are many potential regions of origin, including India, Arabia, Lesser Armenia, Egypt, Galatia, Thasos, and Cyprus (Lennartz 2001:272).

It will probably never be determined where the coral for the beads in five of the burials came from. This is because the two morphological characteristics that are most important in identifying corals (concentric growth rings and polyp indentations [Zwicky-Sobczyk 2002:225]) were largely destroyed when the perforations were drilled followed by deterioration in the soil. One may reasonably assume, however, that the corals were imported from the Mediterranean region.

The analyses conducted on the yellow glass beads from Burial 40 also revealed the metallic oxides used to color the glass.[6] The yellow pigment was created using tin oxide ($SnO_2$) and lead stannate ($PbSnO_3$) extracted from lead oxide ($PbO$).[7] Lead oxide is a waste product resulting from silver production, which suggests close links between metal processing and glass-bead production (Matthes et al. 2004:133-134).[8] The closest evidence geographically for the production of lead/tin-yellow has been provided by a crucible fragment with yellow glass paste adhering to it that was discovered in the Early Medieval settlement of Schleitheim-Brüel in Canton Schaffhausen. This site also yielded evidence for the production of yellow glass beads (Heck, Rehren, and Hoffmann 2002). A planned analysis may reveal whether the small yellow glass beads from Burial 40 at Baar-Früebergstrasse–or at least the yellow glass paste used to make them–were produced in the glassworks at Schleitheim-Brüel.

Visible traces on the glass beads and investigations carried out using experimental archaeology (Gam 1992; Gam Aschenbrenner 1997) allowed us to reconstruct the manufacturing process. Viscous glass was wound around a conical, sometimes square-sectioned, iron rod. This is revealed by the shape of the perforation and the blackish coating on its surface that consists of iron oxide, probably magnetite ($Fe_3O_4$).[9] The separating agent used may have been salt,[10] which leaches out when the beads are buried in the ground and, therefore, can no longer be detected. While still hot, the bead was then shaped and decorated with one or more differently colored glass strands. In many cases, the wound glass thread can still be seen very clearly and overlapping decorative elements allow us to reconstruct the various steps in the application of the decoration. This basic process is still used in glass bead production today and can be observed, for example, in glass bead workshops in Turkey (Gebhard 1996:21; Sode 1997).

## À LA MODE

The Baar-Früebergstrasse cemetery produced 161 different types of glass beads: monochrome, opaque and transparent, and multi-colored opaque in various shapes and colors (Müller 2003).[11] While some glass bead types were used over a long period of time and by several generations, the composition of bead assemblages changed continuously over time. New fashionable beads were added, while old-fashioned types were discarded. Presently, Early Medieval bead fashion can be dated with an accuracy of approximately 30 years (Reich 2002; Siegmann 2003; Theune 1999), which roughly corresponds to one generation. Due to the fact that bead assemblages were placed in the graves at one particular moment in time, these assemblages are time capsules and as such are well suited for dating purposes. Bead assemblages are often the only feature in Early Medieval burials of women and girls that are suitable for detailed chronological analyses.

Bead assemblages were found in 48 women's and 9 girls' graves at Baar-Früebergstrasse. Four of these assemblages are described here. The excavation photographs show the *in situ* context and the location of the beads in relation to the skeleton (e.g., Fig. 2; Pl. IIIA). The reference numbers of the beads have been added to the drawings (e.g., Pl. IIIB). The drawn reconstruction reflects the location of the beads in the grave and as such shows how the beads were placed on the body of the deceased. This does not necessarily correspond with the way the woman wore the beads when she was still alive.

The threads of the beaded adornments and the textiles to which beads were sewn have decayed over the course of the past 1,300 years in the seasonally flooded Baar soil. In these conditions, organic substances are usually only preserved in conjunction with metal objects; when metals corrode in the ground, they release metal salt solutions which coat and permeate the organic material and thus preserve it in a mineralized state. Bead threads made of linen and wool have been found at other Early Medieval cemeteries where there were better preservation conditions (Lehmann 2003; Siegmann 2005:853).[12]

## NECKLACE COLOR SEQUENCE AND SYMMETRY

### Burial 10

The girl designated Burial 10 was four and a half to five and a half years old when she died between A.D. 600/610 and 630/640. The accompanying grave goods included a belt with an iron buckle, a broken iron knife with an ash-wood handle, and a toilet set with an ear scoop and a fingernail cleaner. She wore a broken bronze ring on her left ring finger. Twelve glass and six amber beads were located in the area of her chest (Figs. 2-3).

Despite the fact that some of the beads had shifted slightly, their original pattern could still be reconstructed conclusively (Pl. IIIB). The beads were threaded at a distance of approximately 0.5 cm from each other and formed a semicircle. No beads were found in the area of the neck. The location suggests that it represents a single-strand necklace, on which the beads were probably secured by a knot on either side of each bead. Thus only a single bead would be lost if the thread broke.[13] It is, however, possible that beads made of organic materials such as wood or leather were placed between the glass and amber beads, but have not survived.[14] The color sequence of the beads

**Figure 2.** Baar-Früebergstrasse cemetery, Burial 10. The glass and amber beads *in situ* (Photo: Christine Allisson, Archaeology Department of Canton Zug).

is not coincidental; one can identify a repeated pattern of color: amber/red/blue. The composition of the necklace also shows that the color of the beads was more important than their shape. One probably did not have too many beads of the same type at one's disposal.

## Burial 40

Burial 40 was a woman between 60 and 69 years of age when she died between A.D. 600/610 and 630/640. Her grave was robbed in Early Medieval times. Nevertheless, it still contained an iron belt buckle with preserved leather remains, an iron knife with an ash-wood handle, a small iron bar, 54 glass beads, and one amber bead. The beads were located close together between the collar bone and the lower jaw in two clearly visible rows on either side of a central amber spacer bead (Fig. 4; Pls. IVA-IVB). It is remarkable that the beads had not shifted and that the two strands were found in the grave in an almost horizontal position. The necklace shows color symmetry. The green beads in the upper row and the sequence of colors (red/red/white/red/red) in the bottom row are mirrored in the two halves.

How the beads were worn remains problematic. Had these beads been worn as a necklace[15] (Fig. 5), it is likely that they would have shifted when placed in a horizontal position; i.e., when the deceased was laid to rest (Fig. 6). Assuming, however, that the bead necklace was attached to a garment with a few stitches (Fig. 7), the location of the beads would correspond very well with the situation found in the excavation[16] (Fig. 8). This would suggest that the bead strands were sewn to a dress or some other garment, but this is by no means certain.

## Burial 134

The woman designated as Burial 134 also died between A.D. 600/610 and 630/640. She lived to be between 34 and 40 years of age. The burial was already disturbed in Early Medieval times and the grave goods removed. This

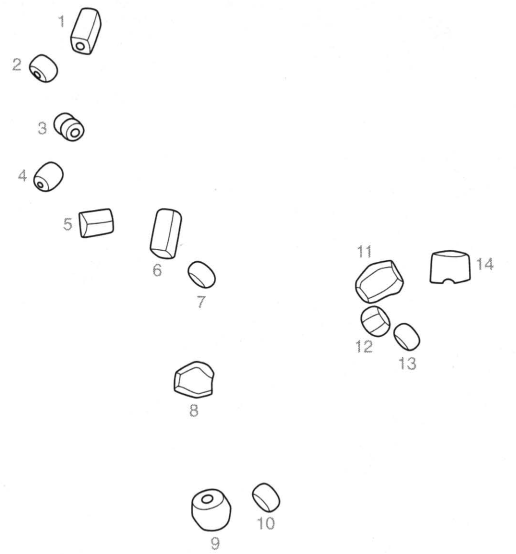


**Figure 3.** Drawing showing the placement of the beads in Burial 10 (Drawing: Eva Kläui, Archaeology Department of Canton Zug).


**Figure 4.** The disposition of the glass and amber beads in Burial 40 (Drawing: Eva Kläui, Archaeology Department of Canton Zug).

probably took place when the grave was opened in order to bury another woman (Burial 110) above Burial 134. Was this done by the woman's own relatives who were retrieving grave offerings? The iron belt buckle with remains of a leather belt and 89 glass and 11 amber beads were the only goods that remained.

The 100 beads lay in the area encompassed by the sternum, the lower jaw, and the right and left shoulders (Fig. 9; Pl. VA). As in Burial 40, two rows of beads are situated to the right and left of a central glass bead. The distance between the beads measures approximately 0.5 cm. In addition, there is a single row of beads in close proximity. It is believed that two necklaces are represented: a two-strand example of glass beads with a red double-bead in the center serving as a spacer, and another composed of a single strand of glass and amber beads (Pl. VB). The beads of the double-strand necklace seem to have been secured on the thread by knots on either side of each bead, as in Burial 10. While the composition of the necklace is based on color symmetry, there is a small mistake as the color in beads nos. 9 and 37 does not correspond. Is it that glass beads were too hard to obtain or very expensive? The glass and amber necklace also shows a more-or-less symmetrical design. Two color sequences can be distinguished: amber/orange and amber/orange/red.

As with Burial 40, the two rows of beads of the double-row necklace and the central portion of the glass and amber bead necklace are placed almost horizontally. Here too, the bead necklaces seem to have been arranged very carefully in the chest area and were probably secured to the dress with a few stitches. This would have meant that the necklaces could easily be seen when the body was laid out and maybe also when it was placed in the grave.

## BYZANTINE BEAD ADORNMENTS IN EARLY MEDIEVAL BAAR?

The woman in Burial 76 was 20 to 25 years old when she died sometime between A.D. 630/640 and 660/670. With the exception of the area around the head, the entire grave was robbed in Early Medieval times. The remaining grave goods suggest that it was a lucrative enterprise for grave robbers. Besides two fragments of an iron belt buckle, a fragmented iron ring, and 126 glass beads, two silver basket earrings remained in the grave. The earrings are northern Alpine imitations of Byzantine basket earrings (Fingerlin 1974).[17]

The 126 glass beads were located in the area encompassed by the lower jaw, the sternum, and the right and left shoulders (Fig. 10; Pl. VIA). In the left chest area, the beads were almost in their original position. Here, the larger beads formed a net-like pattern. The distance between the beads measured approximately 2 cm. The spaces in between were filled with small green and yellow glass beads, some of which had already decayed. Based on the location of each bead and its relation to the other beads, it was possible to reconstruct a netted weave of beads, which is based on principles of color symmetry (Pl. VIB). The beads could either have been strung on threads or they could have been sewn onto the textile base or applied in sections. Either way,

**Figure 5.** Simulation of the double-strand necklace with Burial 40 worn as a necklace in life (Photo: Katharina Müller, Archaeology Department of Canton Zug).

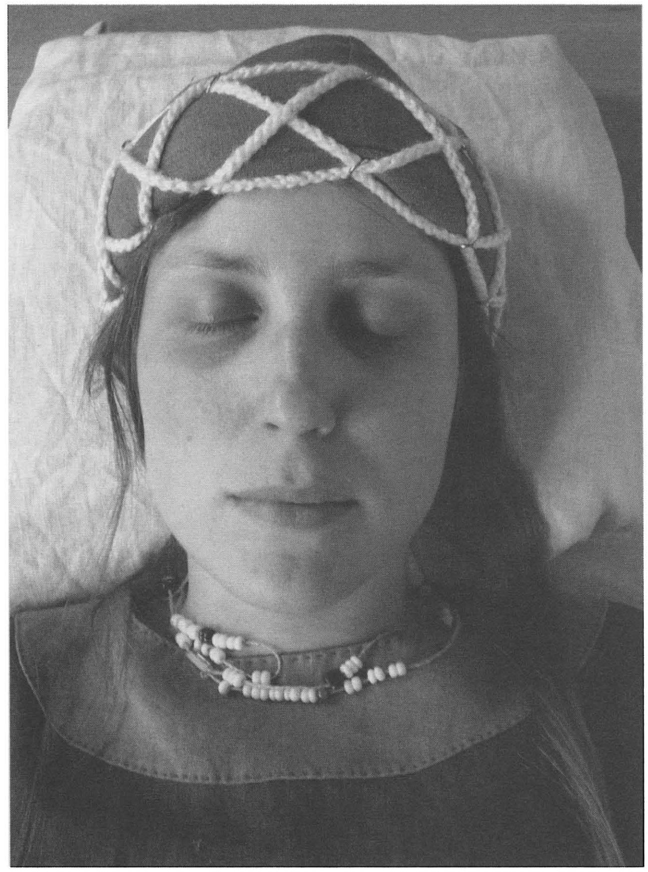

**Figure 6.** The simulated necklace in Burial 40 as it would appear when the body was placed in the grave (Photo: Katharina Müller, Archaeology Department of Canton Zug).

the reconstruction results in some kind of beaded collar. Similar beaded collars, so-called superhumerals or jewelled collars, are found in Early Medieval depictions of famous women from the 5th to the 10th century (Reich 2002:262-265; Schulze 1976). For example, Mary at the Annunciation and the Pharaoh's Daughter on the Occasion of Moses' Adoption depicted on the triumphal arch and in the nave of the Santa Maria Maggiore Basilica in Rome (A.D. 432-440) are both shown wearing such a collar (Karpp 1966:Color Pls. 6, 85). The Byzantine Empress Theodora is also adorned with a jewelled collar on the mosaic in San Vitale in Ravenna dated to around A.D. 547 (Bertelli 1989:80-81). The beaded collar from Burial 76 at Baar-Früebergstrasse and the jewelled collar worn by St. Agnes (Fig. 11) in the apse mosaic in the Sant'Agnese fuori le mura church in Rome (A.D. 625-638) are contemporaneous, so to speak. Of course, the beaded collar of the woman interred in Burial 76 at Baar-Früebergstrasse was not fitted with gemstones and precious metals.[18] It may, nonetheless, be an attempt at imitating Byzantine fashion, not only in relation to the earrings mentioned earlier but also in regards to beaded adornments.

## CONCLUSION

The four examples of Early Medieval beaded adornment described above reveal that there was quite a variation in the beaded ornaments of the period, provided one looks closely. As adornment is always a means of nonverbal communication, it seems an obvious conclusion to assume social differences to have been behind these variations. In order to support this, a large body of evidence is needed. Bead assemblages are rarely excavated, recorded, and published in a manner that would allow one to take the work a step further.[19] This is unfortunate, as the decipherment of detailed evidence is very rewarding and, even after 1,300 years, it can still provide insight into the lives of the people of yesteryear.

## ENDNOTES

1. A German version of this article will be published in *Tugium* 23 (2007). *Tugium* comprises the annual reviews

**Figure 7.** The bead strands from Burial 40 as they would appear if sewn to a garment in life (Photo: Katharina Müller, Archaeology Department of Canton Zug).

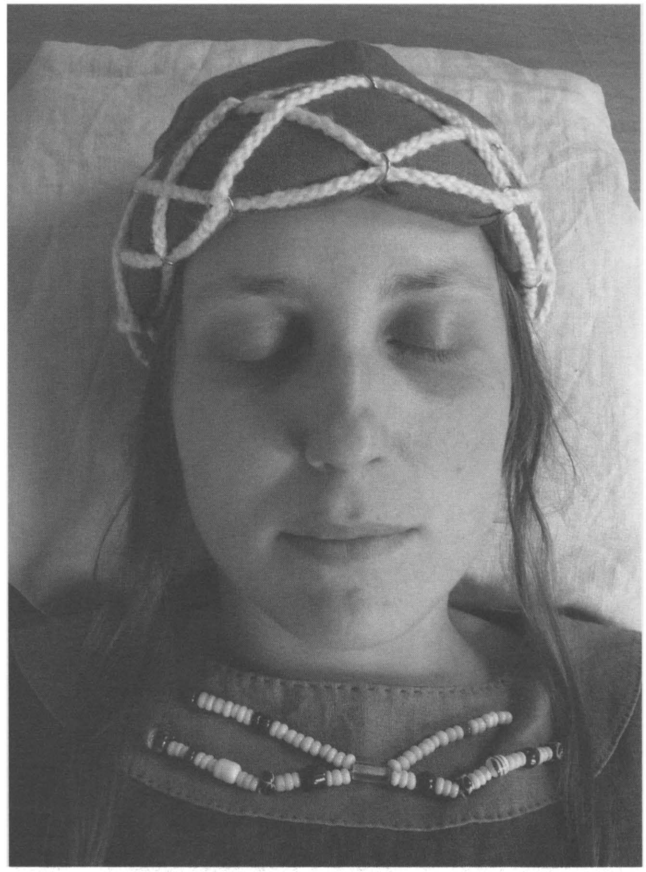

**Figure 8.** The bead strands from Burial 40 as they would appear in the grave if sewn to a garment (Photo: Katharina Müller, Archaeology Department of Canton Zug).

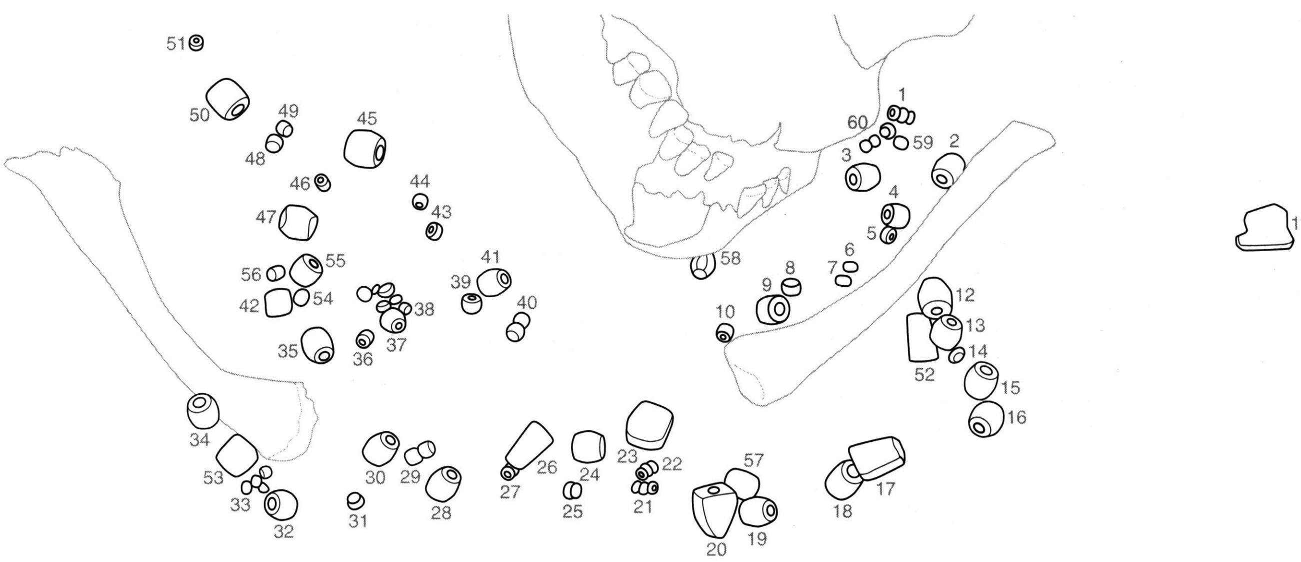


**Figure 9.** The disposition of the glass and amber beads in Burial 134 (Drawing: Eva Kläui, Archaeology Department of Canton Zug).

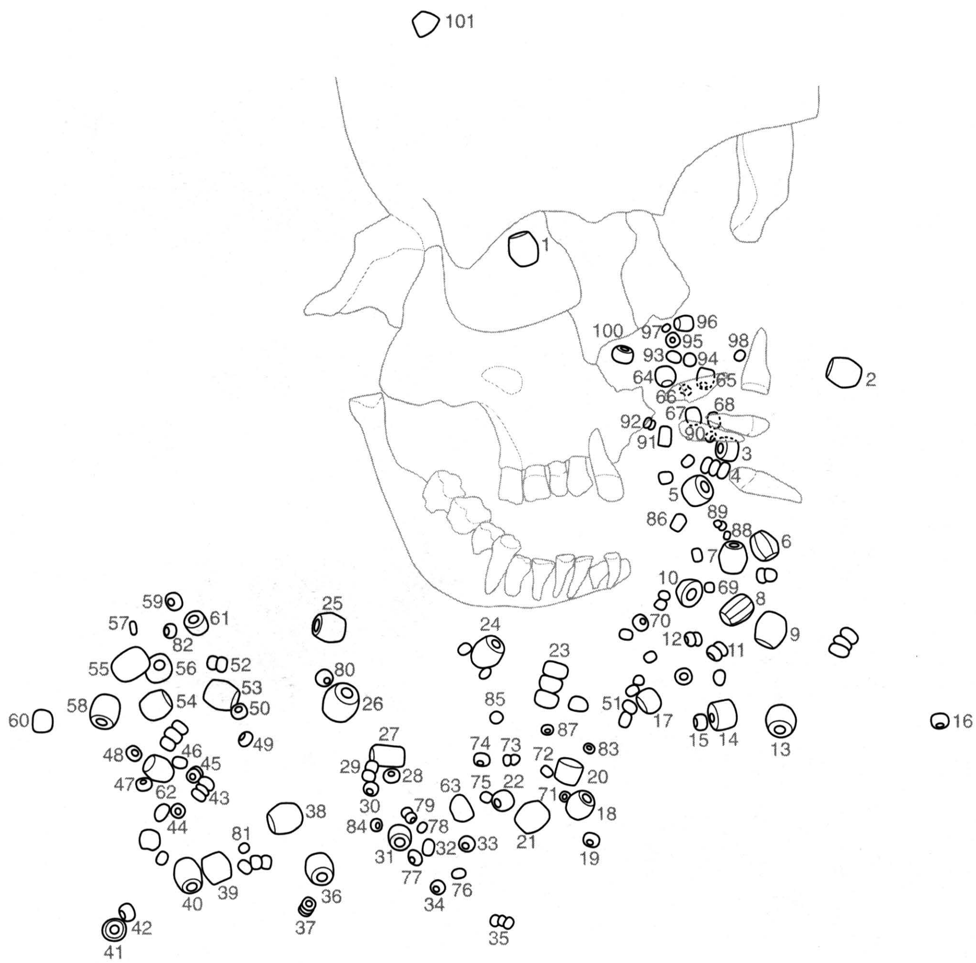


**Figure 10.** The disposition of the glass and amber beads in Burial 76 (Drawing: Eva Kläui, Archaeology Department of Canton Zug).

of the Public Record Office Zug, the Department of Conservation of Monuments and Archaeology, the Museum of Prehistory Zug, and the Museum of the Castle of Zug.

2. I would like to extend my gratitude to Peter Hoffmann of the Technical University Darmstadt, Material- and Geo-Sciences, Chemical Analytics, for his interest and for the glass analyses.

3. The composition of the glass is 73±5% $SiO_2$, 6±2% CaO, and 14.5±2% $Na_2O$.

4. I would like to extend my gratitude to Gerhard Heck from the Rathgen Research Laboratory at the Berlin State Museums for sourcing the material. Contrary to the results published in Horisberger, Müller, Cueni, and Rast-Eicher (2004:186), an amber bead from Burial 59 at Baar-Zugerstrasse was also identified as Baltic amber when it was re-analyzed by Gerhard Heck.

5. Personal communication from Henry A. Hänni, Swiss Gemmological Institute, Gemstone Testing, Basel.

6. The analyses were carried out by Peter Hoffmann, Technical University Darmstadt, Material- and Geo-Sciences, Chemical Analytics.

7. The composition of the pigmenting agents is 8±2% $SnO_2$ and 92±2% PbO.

8. The Early Medieval settlement of Schleitheim-Brüel SH yielded a silver ingot and a fragment of a crucible with yellow glass paste and a silver granule (Höneisen 2002:29-30, Figs. 16 and 30; Heck, Rehren, and Hoffmann 2002:Figs. 23 and 37).

9. Personal communication from Peter Hoffmann, Technical University Darmstadt, Material- and Geo-Sciences, Chemical Analytics.

**Figure 11.** St. Agnes depicted wearing the garments of a Byzantine princess. Detail of the apse mosaic in the Sant'Agnese fuori le mura church in Rome, A.D. 625–638 (Bertelli 1989:88).

10. At Görece Köy and Kemalpasa, located outside Izmir, Turkey, rock salt is used in glass bead manufacture as a separating agent (Sode 1997:321).

11. The forthcoming monograph on the Early Medieval cemetery of Baar-Früebergstrasse (Müller n.d.) will list descriptions and contain watercolor illustrations at

a scale of 1:1 of all the bead types, sorted according to typology.

12. Personal communication from Antoinette Rast-Eicher, Organic Materials Specialist, ArcheoTex, Ennenda GL.

13. I am grateful to Trix Schmid Voney, cultural anthropologist and staff member of the Archaeology Department of Canton Zug, for this suggestion.

14. I am grateful to Gishan F. Schaeren, archaeologist and staff member of the Archaeology Department of Canton Zug, for this suggestion.

15. The dress, bonnet, and bead necklace were made with Early Medieval examples in mind as a commissioned work by the Museum for Prehistory Zug as part of its clothes project "Didactic Module for Pre- and Protohistoric Clothes" (working title). The model is Emanuela Jochum Zimmermann.

16. My thanks to Kathrin Schäppi Andelfingen and Emanuela Jochum Zimmermann of Zurich for the stimulating discussions as to how the beads may have been worn.

17. *See* the catalogue of "genuine" basket earrings in Italy published by E. Possenti (1994).

18. Yvonne Reich (2002:264-265) mentions several examples of northern Alpine necklaces with gold pendants which could be seen as imitations of neck ornaments, the jewelled collars worn by the ladies at the Byzantine court in particular.

19. Some exceptions are Siegmann (2005), Reich (2002), Amrein, Rast-Eicher, and Windler (1999), and Geisler (1998).

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# BOOK REVIEWS

*Ornaments from the Past: Bead Studies after Beck.*

**Ian C. Glover, Helen Hughes Brock, and Julian Henderson (eds.).** The Bead Study Trust, London, England. 2003. 160 pp., 34 b&w figs., 151 color figs., index. $32.00/£19.95 (paper cover).

As proclaimed on its cover, "this volume comprises eleven papers on glass and hard stone ornaments surviving from ancient societies, and those made and worn by some traditional communities in the modern world." It is primarily intended for archaeologists, jewelry historians, and collectors. The papers derive mostly from the symposium *Bead Studies after Beck* which was organized by the Bead Study Trust at Cambridge University in 1997.

**Preface. Flora Westlake (née Beck), 1914-1998 – In Thanks and Appreciation, by Marjorie Hutchinson.** This provides a short biography of Horace C. Beck's daughter who was instrumental in the foundation of the Bead Study Trust in 1980, and subsequently served as the Trust's secretary and newsletter editor until 1993.

**Chapter 1. Horace C. Beck and His Influence on Non-Academic Bead Research and Collecting, by Robert K. Liu.** Reflecting on the last half of the 20th century, Robert Liu describes the enormous rise in the interest in beads by collectors, archaeologists, and researchers. In the 1970s, literally tons of antique beads from Africa entered the western market, as well as huge quantities of artifacts and beads from the Peoples Republic of China and other places. Bead references were few at that time, and Horace C. Beck's pioneering works on beads from the 1920s and 30s were among the few studies available to people to help classify and identify their beads. Beck himself was a self-educated bead researcher.

Some of our best bead researchers who began their work in the 1970s and 1980s were certainly well educated but not associated with universities. These non-academic bead researchers—among them Jamey D. Allen, Kirk Stanfield, and Jürgen Busch—have contributed enormously to the body of knowledge about beads.

Liu addresses the recent proliferation of replicas of historic beads. Some are made to deceive the unwary, while some are made to take the pressure off the market in ancient beads. There has been some experimental interpretation of ancient beadmaking by modern beadmakers who want to figure out how the work was done in the past. Many of these new beads are excellent copies. Wonderful color photos illustrate old and replicated beads.

**Chapter 2. The Mycenaean Greeks—Master Bead Makers: Major Work Since Beck, by Helen Hughes-Brock.** This chapter covers Mycenaean Greeks who lived a thousand years before the classical Greeks in the period known as the Late Bronze Age (ca.1650-1100 B.C.). They were prolific beadmakers and beads were hugely important in the lives of these people. They used a wide range of materials, including bone, ivory, glass, faience, gold, lapis lazuli, Baltic amber, shell, and stone. Jewelry made of relief beads is typical of this culture, some made of gold and many made of glass. The glass beads were cast in stone molds in a variety of styles. This facilitated the production of numerous beads of the same form. Blue was a favorite color.

After World War II, archaeological work in the Aegean region yielded magnificent finds, both on the mainland and on the adjoining islands, especially Crete. Hughes-Brock mentions sites where beads were abundant, and lists the museums where many of these beads are housed. Greek museums have the largest collections and best displays of Mycenaean and Minoan beads.

Dates for the Bronze Age temporal divisions are given for three periods and for three regions: Early, Middle, and Late periods, and Helladic (mainland Greece), Minoan (Crete), and Cycladic (islands) regions. The time period is approximately from the late 4th millennium to the end of the second. When the *Ulu Burun* shipwreck was discovered off the coast of Turkey in 1983, beads were found among the cargo. That ingots of raw glass were also recovered reinforces the notion that glass working was a secondary craft in Mycenae and that the glass itself was made elsewhere. So far there have been no raw glassmaking sites recorded in Mycenae.

There are remains of Late Bronze Age workshops where beads were made from glass though, both in the Aegean and in Egypt. Both of these places have yielded crucibles, molds, and glass wasters. Judging from the huge numbers of glass beads excavated, the crafting of them had to have been an important industry.

The island of Thera (Santorini) in the Cyclades is likened to Pompeii in that a volcanic eruption buried it and preserved many cultural features. Walls with frescos survived, some depicting how beads were worn. It is so difficult to determine how various bead materials functioned as social markers or what their significance was. Frescos give us a tiny window into the past.

**Chapter 3. Mycenaean Glass Beads: Technology, Forms, and Function, by Kalliopi Nikita.** It is obvious to archaeologists that beads were extremely important to the people of Late Bronze Age Mycenae. They loved and used glass beads in particular, and great numbers of them have been found in their burials. Jewelry was the main glass working product, rather than blown glass vessels which came later. Besides glass beads, glass plaques were made to be used as inlay decoration in furniture.

Typically, Mycenaean glass is a soda-lime-silica type with a high magnesium content, a kind of glass used over a long period of time and over a large geographical area. Nikita thinks the dark blue glass of Mycenae is similar to that of the 10th-Dynasty Egyptian blue glass used in core-formed vessels. Before glass became a useful material, faience was used for a very long time. On Crete, faience beads were found at Knossos in pre-palatial tombs.

Artisans used both open and closed carved stone molds to cast glass objects. The open molds were commonly used to produce unperforated plaques. Tools used by jewelry craftsmen have been found in palace settings and include stone celts, bone handles, and bone chisels. Glass was cold worked as well in such lapidary techniques as grinding, cutting, and polishing. Some workshops employed craftsmen working in a variety of media. After casting relief beads, the beads were sometimes covered with gold foil.

It is a curious fact that, numerous as they are, Aegean glass beads are rarely found in Mesopotamia or Egypt in the Late Bronze Age. It is also interesting to note that the Mycenaeans were quite indifferent to Egyptian and Mesopotamian amulets and beads. This could stem from very different religious beliefs as well as the properties attributed to the beads. It will probably never be known just what those properties were; maybe protective, maybe health-restoring, but certainly ornamental. Beads used as burial offerings had symbolic meaning and the styles were very carefully chosen. Beads can show wealth or differences in rank, they can have cultic or religious significance, but most aspects of their function are lost in the mists of time.

**Chapter 4. Beads in Scandinavia in the Early and High Medieval Periods, ca. AD 400-1200, by Johann Callmer.** This chapter describes a period in Scandinavian history in which local beadmaking grew from a relatively small craft to an important trade that supplied a growing demand. Glass beads are plentiful finds in Scandinavian graves from the Early to High Medieval periods, although they have been largely overlooked by Scandinavian archaeologists. Callmer relates that little research has been done on the symbolic language of these bead assemblages.

Beads were closely connected with women, their clothes and their metal jewelry, all of which probably defined their social role. Men wore beads too, but usually less of them, and they were probably used as amulets. Early on, imported Late Roman period beads were utilized. As local Scandinavian beadmaking grew in importance, the quantity of locally made beads increased well into the High Medieval period after which beadmaking declined. The quality of bead crafting varied widely as did the quantity produced. Eventually itinerant glass beadmakers began to make regular visits to places where people tended to congregate and made beads on the spot. But beads from other parts of Europe and the Middle East were also imported and mixed into the strands adding variety and interest.

The traveling beadmakers shared techniques and aesthetics. This may be one reason Scandinavian beads are recognizable through various time periods. They were highly skilled craft specialists who made something dearly wanted by the population. Scraps of glass were saved, sorted, traded, and used by the artisans as beadmaking material. Besides scrap glass, imported raw glass cakes or ingots were also utilized. The millefiore canes which provided off cuts for eye inlays for beads were both imported and locally made.

**Chapter 5. Viking Age Glass Beads from Ribe, Denmark, in the Light of Ethnographic Research, by Torben Sode**. Ribe, the oldest city in Denmark, was an organized trading center even before the city was established some time before A.D. 800. During the Viking period, traveling craftsmen made beads for people at the market in Ribe. In the mid-20th century glassworkers still made their rounds in the Middle East to places where their skills were in demand. That this phenomenon still exists after hundreds of years is what is documented in this chapter.

The earliest glass beads found at Ribe are blue and white monochromes which were preferred for about 20 years. They were made by the process of furnace winding which Sode describes as it is still used today in India, Turkey, and Egypt. About A.D. 720, there was a style change in the beads which lasted for another 40 years. Sode calls this The Blue Period in which mostly dark transparent blue glass was used. These beads were often decorated with dots, mosaic eyes, and contrasting colored threads. Sode describes the processes used now in Turkey and in Purdalpur, India, for applying such decorative elements.

Mosaic beads of a type called checkerboard were locally made. It was previously believed that these beads were imported or at least the checkerboard canes, but Sode feels that the techniques needed for making these checkerboard canes were within the capability of the Ribe glassworkers. In Purdalpur in the 1990s, glassworkers had different ways of making both mosaic canes and mosaic beads. These are clearly described with accompanying photos.

Toward the end of the 8th century, more and more imported beads came into use, including various segmented beads as well as those with gold and silver foil. Sode believes they were made in Arabia and the drawn beads found at Ribe probably were as well. Evidence for the production of drawn glass beads is not found in Scandinavia.

To see an ancient process for making drawn beads, Sode went to Papanaidupet in southern India in the 1990s. He describes the process that has changed little in the past 2,000 years, with the team of glassworkers and furnace stokers coordinating their moves like a well-timed machine. This production method is close to disappearing, Japanese seed bead machines having been installed in Firozabad, India.

**Chapter 6. Sasanian Beads: The Evidence of Art, Texts, and Archaeology, by St. John Simpson.** The Sasanian Dynasty began about A.D. 223, and the empire lasted for over four centuries until the Arabs conquered it in the 7th century. Simpson tells us how the people defined their social status with clothing, headgear, and various accessories. This article focuses on the beads people wore. Bead materials include precious stones, semi-precious stones, metals, natural organic materials, and artificial materials such as faience, ceramics, glass, and gypsum plaster. As Sasanian archaeology is relatively undeveloped, much is still unknown about what bead colors meant to the people, or what properties were attributed to the beads.

Beads from Sasanian graves at various sites are described, some of which can be broadly dated on the basis of the associated grave goods. A five-page appendix relates which beads are found at specific Sasanian sites and what materials they are made of. Simpson speculates that there was probably a local Mesopotamian glass bead industry associated with known glassware manufacturing places but so far there is no real evidence for this. No lapidary bead workshops have been found yet either.

Two very interesting misconceptions concerning purported Sasanian beads are corrected here. One relates to stamped glass pendants depicting classical mythological, Christian, or Jewish motifs. The other has to do with white quartz beads glazed with blue. Neither turn out to be Sasanian.

**Chapter 7. Size Does Not Matter — The Nature of Celtic Bead-Making Sites, by Chris Robinson.** It was previously believed that only larger fortified Celtic settlements (oppida) of temporate Iron Age Europe were home to specialized craftsmen, some of whom worked hot glass and made bracelets and beads for the community. Smaller nearby settlements have been largely ignored by archaeologists as far as these craftsmen are concerned. Robinson believes it is hard to ignore the growing body of evidence for smaller settlements hosting glassworkers and other craftsmen as well, and that they began working in their industrial media several hundred years before the emergence of the oppida.

Robinson's aims are to examine the evidence for glassworking at a smaller settlement called Le Patural and to relate this to other possible Celtic glassworking sites in this part of Europe. His second aim is to examine the evidence for glassworking as a kind of industrial specialization with special reference to the beginnings of urbanization in Late Iron Age Europe. The time period is the 3rd to 2nd century B.C.E.

The Celtic people produced soda-lime-silica glass of very high quality in a large range of colors. Their wares show an unusual degree of originality and invention. Translucent cobalt blue glass was a hands-down favorite for beads and bracelets. Translucent purple and opaque yellow were common as well, as was colorless glass. Possible sources for the colorants are explored.

The writer tells us that manufacture and distribution of products became more and more complex in Late Iron Age Europe, a time when the oppida came into being. Highly specialized industries with highly specialized craftsmen using specialized raw ingredients became a force in this period, with iron working and glassworking especially.

**Chapter 8. Alkaline Etched Beads in Southeast Asia, by Ian C. Glover and Bérénice Bellina.** Horace Beck's article on decorated carnelian beads published in the *Antiquaries Journal* in 1933 is still relevant and remains an important reference for anyone studying etched carnelian beads. Ernest Mackay published findings on these beads the same year. Since that time, more of these beads have been found extending their geographical range and increasing our understanding of dating and archaeological contexts.

Glover's main purpose for this article is to present an overview of the etched beads recovered in the last 20 or so years from excavations in Southeast and East Asia and he hopes to fill in their relationships with previously known etched beads of South Asia. Relatively recent finds from Eastern Asia are discussed.

It may be that beads were specially made in South Asia for the Southeast Asian market. At this time the authors believe all the bead types were made in South Asia and exported as finished products, giving evidence for trade between these regions in the first half of the 1st millennium B.C. The first unfinished etched beads from Southeast Asia seen by the authors came from central Burma. These are unperforated agate (and glass) beads.

The results of Scanning Electron Microscope (SEM) studies are discussed. This preliminary work has not yet allowed the identification of different manufacturing locations, but has revealed that great skill was required to produce high-quality etched beads.

The authors present an extensive discussion of the distribution of etched beads in Southeast and East Asia, including a number of archaeological sites in Thailand, Vietnam, Indonesia, the Philippines, Malaysia, Myanmar, and China. Various examples are shown. The symbolism and value of etched beads in Asian culture is also touched upon. They were likely indicators of wealth and status, but not much more can be inferred without further research.

**Chapter 9. Powder-Glass Beads in Africa, by Margret Carey.** The author begins her survey of powder-glass beads with an examination of Egyptian faience which, though considered a "glazed composition" as well, is different from true powder-glass. Faience beads typically have a glazed surface over a core formed by dipping the core in a slurry composed of silica, lime, an alkali, and copper, and then firing it. True powder-glass beads are not dipped.

Powder-glass beads have a long history in Africa. The first examples show up at Mapungubwe in what is now Zimbabwe in archaeological contexts dated to A.D. 970-1000. The so-called "garden-roller beads" are the earliest powder-glass beads in Africa and the only ones found in eastern and southern Africa. The bulk of the powder-glass beads made today come from West Africa, principally Ghana.

Carey then turns to the modern production of powder-glass beads, starting with the distinctive Kiffa beads produced in southern Mauritania. The controversial and much-valued *bodom* beads from southern Ghana are discussed as are other beads produced in the Krobo region. The variety of African powder-glass beads is immense and even include striking representations of chevron beads (Fig. 9. 12).

**Chapter 10. Present-Day Bead-Making in Ghana, by John Haigh.** This article presents a concise description of the production of powdered-glass beads in a number of villages to the northwest of Kumasi in south-central Ghana. The beadmakers are semi-independent craftsmen whose principal occupation is farming. Beadmaking, which purportedly was introduced to the area in 1957, is a secondary activity.

**Chapter 11. Ancient Hard Stone Beads and Seals from Myanmar, by Barbie Campbell Cole.** The ancient inhabitants of Myanmar, formerly Burma, utilized beads made from a wide range of materials. They are all generally locally referred to as Pyu beads, named after the people who dominated the region for the first nine centuries of the common era. Due to a lack of solid archaeological data, it is not known if any of them were produced locally, what their date ranges are, and which might be imports. As museum collections are small and poorly documented, the author has had to rely on an examination of beads in private collections in order to produce a database of the different types. Additionally, information was sought concerning the sources of the materials used in bead production to help identify local products.

The beads that have received the most attention are the etched ones of agate and carnelian, and those of decorated fossil wood. Etching is an ancient technique that has been used in South Asia for millennia, but such beads only appear in Myanmar somewhere between 500-200 B.C. Three different techniques were used to apply the decoration: etching, painting, and incising. Special attention is paid to the black and white etched pumtek beads so popular with the Chin in northwest Myanmar. While etched beads have thus far been considered imports from India, there is a growing body of evidence that suggests some were made locally. These include agate and carnelian beads carved into the form of conch shells, a number of which are etched.

Regarding local sources of beadmaking materials, especially agate and carnelian, there are numerous possible sites but it is difficult to locate them because there is little commercial interest in most semi-precious stones and their sources have become forgotten. Cole discusses the known sites and the local craftsmen who work the stone. She also covers intaglio seals and fake etched beads.

**Reviewer's Assessment.** This book should be in the hands of everyone who has an interest in other cultures, archaeology, and bead history. Each chapter is interesting, easy to read, and loaded with information. The writers have done a wonderful job in relating to us the stories told by the beads they have studied.

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**Plate VA.** *Baar-Früebergstrasse cemetery:* Burial 134. *In situ* context of the glass and amber beads (Photo: Markus Bolli, Archaeology Department of Canton Zug).

**Plate VB.** *Baar-Früebergstrasse cemetery:* Burial 134. Reconstructed probable appearance of the single-strand and the double-strand necklace. Reconstruction by Katharina Müller and Eva Kläui, Archaeology Department of Canton Zug (Drawing: Sabina Nüssli Bouzid).

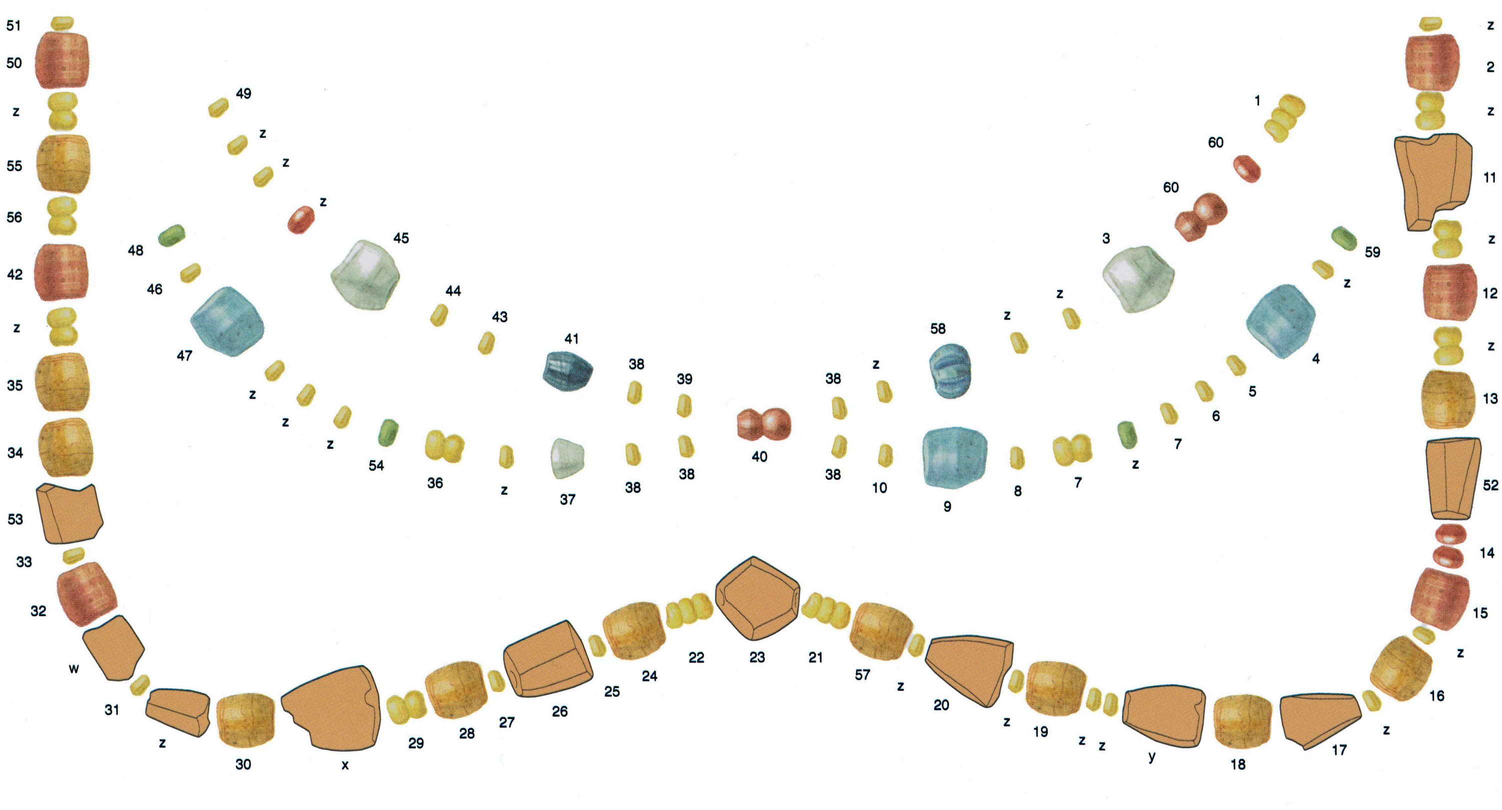

**Plate VIA.** *Baar-Früebergstrasse cemetery:* Burial 76. *In situ* context of the glass and amber beads (Photo: Markus Bolli, Archaeology Department of Canton Zug).

**Plate VIB.** *Baar-Früebergstrasse cemetery:* Burial 76. The probable appearance of what is interpreted as being a beaded collar. Reconstruction by Katharina Müller and Eva Kläui, Archaeology Department of Canton Zug (Drawing: Sabina Nüssli Bouzid).