GLASS BEADS FROM THE BELBEK IV CEMETERY, SOUTHWESTERN CRIMEA

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Situated in the southwestern region of the Crimea, the Belbek IV cemetery was utilized for much of the first three centuries of the Common Era. A comparison of the morphological and technological characteristics of a select sample of the recovered glass beads has provided clues concerning their origins; the majority of the beads seem to have been manufactured in accordance with Syrian glassmaking traditions, a quarter belong to the Egyptian school of glassblowing, while just a little over one per cent were manufactured in Roman workshops. Judging from their burial contexts, it appears that beads in Late Scythian costume were used as buttons, amulets, and pendants, as well as in the preparation of necklaces and embroidery.

INTRODUCTION

The Belbek IV cemetery is located on the outskirts of Sevastopol in the southwestern portion of the Crimean Peninsula, Republic of Ukraine (Fig. 1). Excavated from 1969 to 1991 by a group of archaeologists from the State Historical Museum of Russia in Moscow under the direction of I. Guschina (1974, 1982), the cemetery dates to the period from the second quarter of the 1st century A.D. to the first half of the 3rd century A.D. In all 331 burials were investigated.

Beads were the most common grave goods at the Belbek cemetery. More than two thirds of the burials had beads of various materials in association (Pls. VIIIA-B; IXA). For the purposes of this study, some 2,500 glass beads from 65 burials that comprise approximately one third of the bead-containing complexes were chosen for thorough analysis.[1]

METHODOLOGY

The analysis of the glass beads was conducted using the system for studying excavated glass proposed by J. Shchapova (1989). The gist of the system consists in dividing all the information provided by any glass object into segments. These segments – namely morphology, technology, and material – are, in their turn, divided into sub-systems (Fig. 2). Thus, the morphology of a glass artifact provides a means for recording its shape, dimensions, decoration, color, and diaphaneity. The technological aspect allows the determination of how the bead was manufactured and by what means decoration, coatings, and other components were added.

Form, Decoration, and Color

Rounded beads (cylindrical, spherical, ellipsoidal, egg-shaped, bi-conical, pear-shaped, and conical) prevail among the Belbek beads (Fig. 3, #1-7). In addition, there are flattened (rectangular, flattened round, round, and oval) (Fig. 3, #8-11), faceted (prismatic, ellipsoidal, and cubical) (Fig. 3, #12-14), ribbed (spherical and cylindrical) (Fig. 3, #15-16), and granulated (spherical and cylindrical) (Fig. 3, #17-18) specimens (Table 1).

Round-sectioned cylindrical (39.2%), spherical (33.2%), and flat-rectangular (10.8%) beads are the most abundant forms. According to E.M. Alekseeva (1984:238), flat-rectangular beads were most widespread in the Roman Crimea, especially in the 2nd and 3rd centuries A.D.

Bead dimension categories are based on those proposed by J. Callmer (1977:35). These are based on bead diameter: micro-beads (up to 8 mm), medium-size beads (9-17 mm), macro-beads (18-29 mm), and giant beads (more than 30 mm). All but the last group are represented at Belbek (Table 2). Micro-beads are the most prevalent (90.4%).

Decorated beads comprise just 3.5% of the total. Geometric (Fig. 3, #19-26) and floral (Fig. 3, #27-28) motifs are represented with eyes, stripes, and speckles being the most common decorative elements. Other decoration is rare. It is worth noting that ornamentation is restricted to the rounded beads, principally the spherical and cylindrical ones.

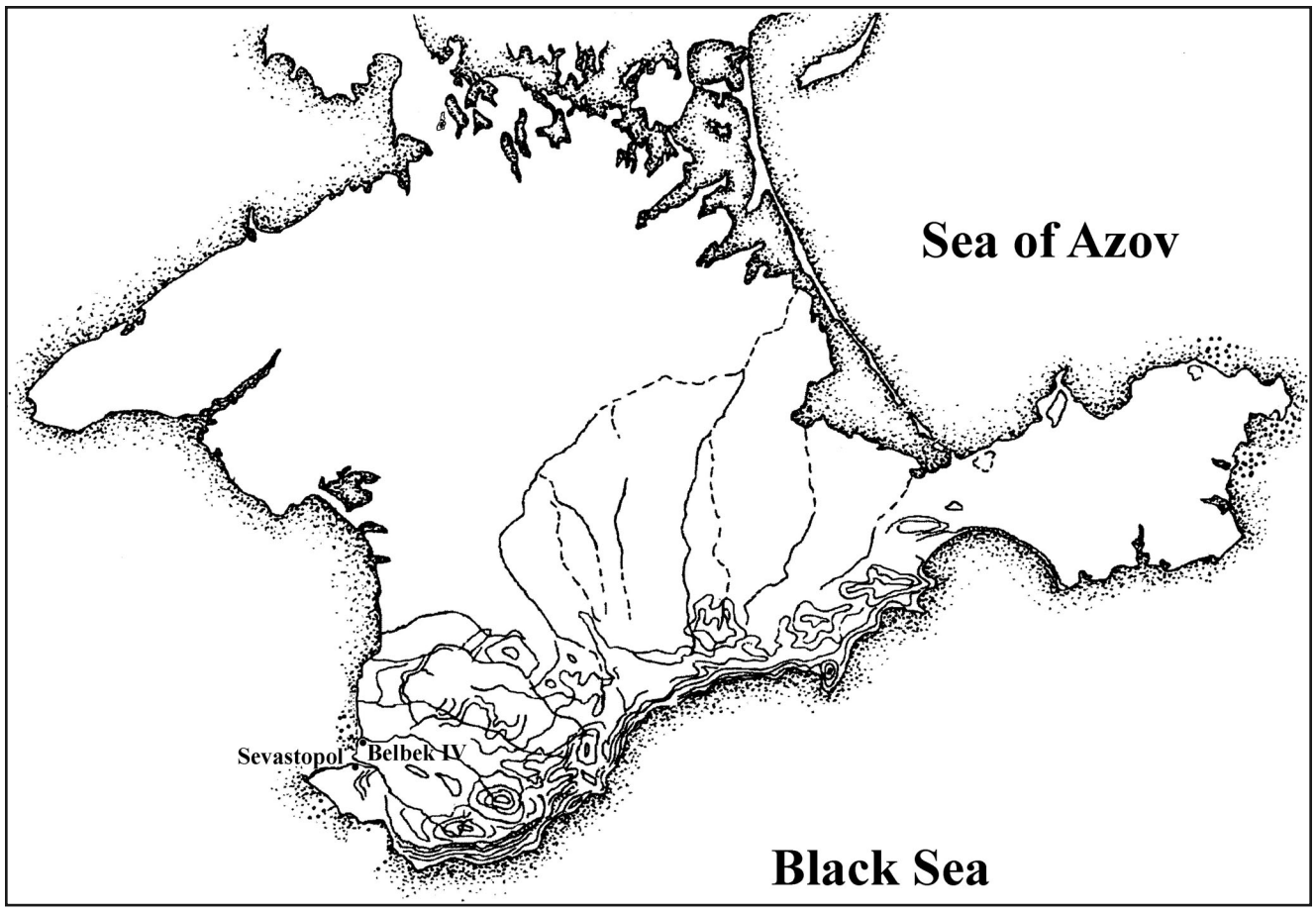

Figure 1. The Crimean Peninsula, Republic of Ukraine, showing the location of the Belbek IV cemetery (after Zubar' 2006:88).

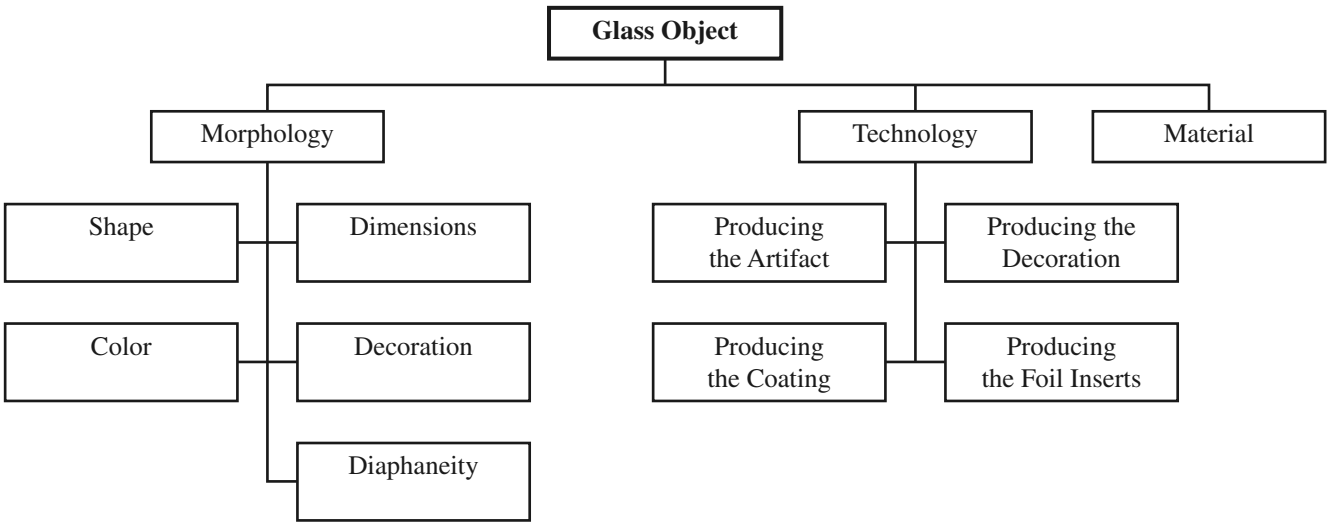

Figure 2. Types of information that a glass object provides.

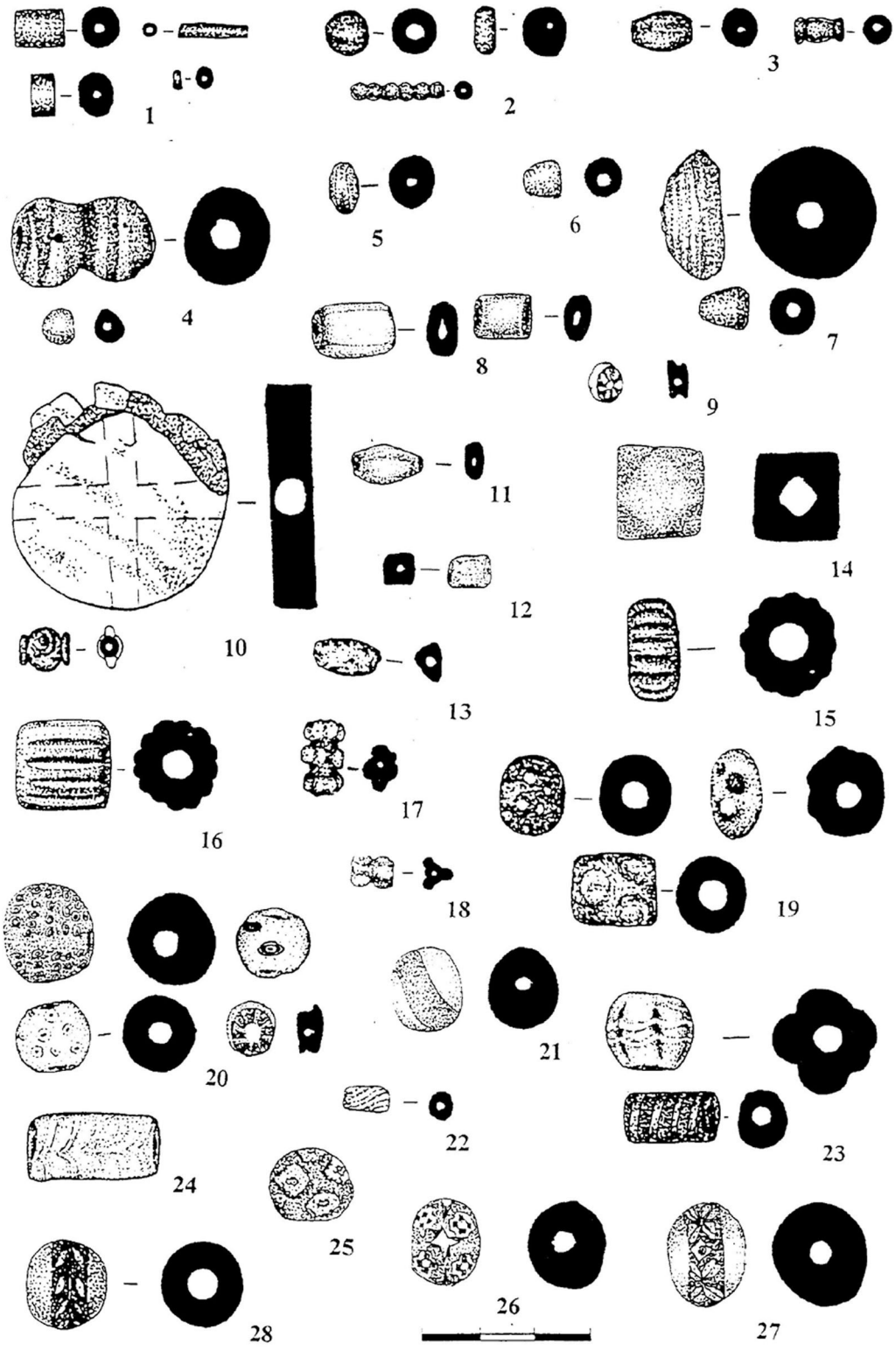

Figure 3. Glass bead shapes and types of decoration encountered at the Belbek IV cemetery: 1-7, rounded (cylindrical, spherical, ellipsoidal, egg-shaped, bi-conical, pear-shaped, and conical) ; 8-11, flattened (rectangular, flattened round, round, and oval); 12-14, faceted (prismatic, ellipsoidal, and cubical); 15-16, ribbed (spherical and cylindrical); 17-18, granulated (spherical and cylindrical); 19-26, geometric motifs; and 27-28, floral motifs (drawing: Anna Trifonova).

Table 1. Glass Bead Shapes, Belbek IV Cemetery.

Group	Shape	Number	%
Rounded	spherical	829	33.20
	cylindrical	979	39.20
	ellipsoidal	140	5.60
	conical	2	0.08
	biconical	14	0.60
	egg-shaped	30	1.20
	pear-shaped	6	0.24
Flat	round	11	0.44
	oval	1	0.04
	rectangular	271	10.80
Faceted	ellipsoidal	21	0.84
	cubical	1	0.04
	prismatic	153	6.12
Ribbed	spherical	18	0.72
	cylindrical	10	0.40
Granulated	spherical	11	0.44
	cylindrical	1	0.04
		2,498	100

Table 2. Glass Bead Dimensions, Belbek IV Cemetery.

Size Group	Measurements	Number	%
Microbeads	up to 8 mm	2,258	90.40
Medium-size beads	9-17 mm	231	9.24
Macrobeads	18-29 mm	7	0.28
Undetermined		2	0.08
Total		2,498	100

A scale created at the Archaeological Department of Moscow State University was used to record bead colors. Seventeen colors were identified with reddish-orange (35.5%), white (21%), and green (15.3%) beads being the most common. Other colors were scarce. It is interesting to note that reddish-orange beads – the most abundant in our sample – also predominated at other North Pontic sites of the same period (Alekseeva 1984:238).

The colors of the decorative elements of millefiori beads (27 specimens) are similar to those of the base glass. Ten colors of glass were used to produce both the beads and their ornamental elements with yellow, white, and reddish-orange being the most common. Applied decoration (61 specimens) is also fairly varied in color, 11 hues being recorded, with yellow, white, and bluish-violet predominating. Other colors are scarce.

Manufacturing Technology

The techniques used to manufacture the beads from the Belbek IV cemetery were determined using the procedures developed by Z.A. L'vova (1979:90-104; 1980:75-85). Seven major techniques were utilized: tube drawing, rod drawing, winding, single wrapping, repeated wrapping, molding, and fusing various components (mosaic or millefiori beads) (Fig. 4; Table 3).

Beads made of **drawn tubing** (Fig. 4, #1) were subject to additional shaping while the glass was soft with the aid of either tongs or a stone mold (Spaer 1993:11, Figs. 2-3), or else the so-called "grid" which is believed to have consisted of a wooden frame strung with parallel wires or blades (Dovgalyuk et al. 1995:8; Francis 1989:28). The use of these implements is evidenced by a slight neck at the edge of the perforation. It is, however, difficult to identify the use of a specific implement. A mold was indispensable for manufacturing granulated and bolster beads. Owing to the use of such implements, an artisan could not only make beads into specified shapes but also accelerate his work by producing series of similar beads. In order to keep the perforation cylindrical in the course of treatment, a metal rod was inserted into it (Spaer 1993:12, Fig. 4). If this was not done, the perforation would became enlarged. Both perforation forms have been recorded among the Belbek beads.

Twisting a plain square tube while drawing it out resulted in a ribbed bead. These were also produced by imparting grooves in the soft glass with a sharp implement, while marvering a hot tube or cold grinding were used to produce various kinds of faceted beads. Series of conjoined beads were divided into single specimens by touching the hot tube at the junction of two beads with a cold implement. The drastic difference in temperature caused a thermal crack and the beads separated.

Tube beads were decorated by means of applying stripes followed by twisting while the glass was hot and before the tubes were cut into bead lengths. Decorative elements such as eyes, however, could have been applied to individual tube segments after a tube was chopped into pieces. Some of the tube beads were subsequently rounded by placing them into a pot containing ashes which was heated and then slowly allowed to cool. As a result, the beads took on a rounded shape, as when conventional heat rounding (without the use of an ash matrix) is used.

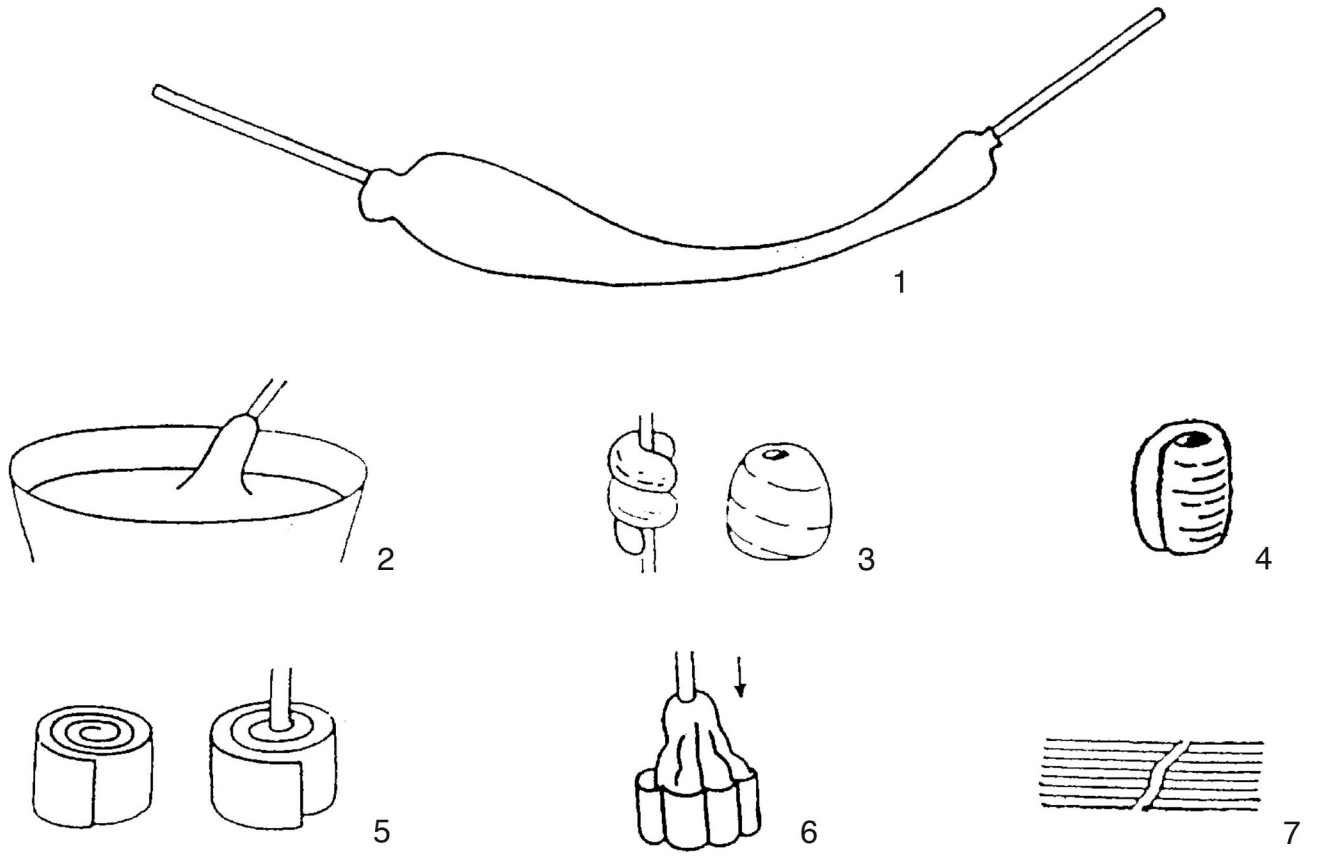

Figure 4. Glass bead manufacturing techniques, Belbek IV cemetery: 1, tube drawing; 2, rod drawing; 3, winding; 4, single wrapping; 5, repeated wrapping; 6, molding; 7, fusing (after L'vova 1979:94).

Table 3. Glass Bead Manufacturing Techniques, Belbek IV Cemetery.

Technique	Number	%
Tube drawing	1,831	73.30
Rod drawing	545	21.80
Repeated wrapping	45	1.80
Winding	43	1.72
Fusing	20	0.80
Single wrapping	7	0.30
Molding	1	0.04
Unidentified	6	0.24
Total	2,498	100

A little over eight percent of the Belbek beads incorporate metal foil. These were manufactured in two different ways (Alekseeva 1978:27). In the first, metal (possibly gold) foil was applied to a tube segment which was then cased with molten glass. The other method involved covering a small tube with foil and then inserting it into a slightly larger tube. The compound tube was then heated to fuse the layers (Spaer 1993:10-12, Figs. 2-3). The latter form predominated (186 specimens compared to only 20 cased beads). Foil beads are generally found to be undecorated (Alekseeva 1978:27), which is the case with the Belbek specimens.

Drawn rods (Fig. 4, #2) were divided into individual pieces with a knife while the glass was still soft or, more rarely, simply broken off after the glass had hardened. The segment was then heated and pierced with a sharp tool in one direction producing a conical hole with sharp edges at the exit point and a concavity at the point of entry. While these features tended to be blurred by further processing – including rolling, marvering on a flat surface, cold polishing, and molding by tongs – traces of piercing were sometimes still visible. The beads were decorated with applied elements.

Beads produced by **winding** a rod or filament of molten glass around a mandrel (Fig. 4, #3) were subject to a

minimum of additional processing. Those manufactured by means of serial winding were not made individually but in a connected series. They were probably separated by breaking them apart. Beads produced by individual winding were occasionally treated with a sharp tool to give them a ribbed surface. Decoration consisted of applied elements.

A longitudinal seam characterizes beads produced by **single wrapping** (Fig. 4, #4). All the beads belonging to this group are composed of square millefiori tessarae. The latter were fused together into strips which, in turn, were also fused together, polychrome and monochrome strips alternating (Fig. 3, #27-28). The strips were then cut into segments and wrapped around a mandrel to form beads. The resultant beads were probably final shaped by marvering.

Some beads were produced by **repeatedly wrapping** a strip of molten glass around a mandrel (Fig. 4, #5). They could be made individually or using serial-production techniques. In the latter case, a tube was produced which was then divided into individual beads using a knife when the glass was viscid or chopping off segments after the tube had cooled. The beads were then usually shaped by cutting grooves with a sharp implement, marvering on a flat surface, and cold polishing. The beads were decorated with applied elements. Occasionally this process was accompanied by twisting to impart a spiral effect. Some beads were rounded by placing them in a heated container with ashes.

Molded beads (Fig. 4, #6) are represented by a single specimen whose perforation was crosswise cold-pierced by drilling.

Multiple seams are the main characteristic of beads manufactured by **fusing** (Fig. 4, #7). They were produced either individually or serially. In the former case, the glass was pierced with a sharp tool in one direction after fusing. Then the beads were shaped by marvering. In serial production, pieces of mosaic tessaerae were cut off, pierced, and formed with the aid of forceps or marvering. Certain beads of this group consist of similar mosaic pieces that were fused together on a mandrel. The rough beads were then shaped and smoothed by marvering. In one case, multicolored strips were used instead of mosaic pieces. The resultant tube was twisted to impart a spiral effect and then segmented either using a knife while the glass was still viscid or by chopping off pieces when cold.

There were two methods for decorating beads. Either decorative elements were applied to a glass core or the bead itself was composed of fused multicolored components. The former method predominates, being twice as common as the latter.

The Belbek IV beads can be categorized as follows based on Shkolnikova (1978:97-106):

- Individually manufactured beads (1.96%); these were produced by individual winding (1.16%), repeated wrapping (0.4%), and fusing (0.36%), as well as mold pressing (0.04%).
- Beads manufactured either individually or in batch production (24.46%); these were made of drawn rods (21.8%), or by either repeated (1.4%) or single (0.3%) wrapping, serial winding (0.56%), or fusing (0.4%).
- Batch-produced beads (73.7%); these were made from various drawn tubes (73.3%) or by fusing (0.04%). Clearly, the majority were batch-produced.

SOURCING THE BEADS

The probable source or sources of the glass beads found in the Belbek IV cemetery was determined based on J. Shchapova's (1983:105) hypothesis concerning the existence of ancient glass-producing centers or "schools." The hypothesis postulates that different centers of glass production used different raw materials, different manufacturing techniques, and produced morphologically dissimilar articles. Thus, to identify the origins of synchronous glass articles recovered from the same site, one has to compare their morphology, technology, and chemical composition.

Such comparisons reveal that the batch-produced beads made of drawn tubes (both those made of solid glass and the laminated foil beads) originated from the Near Eastern (Syrian) school (73.3%). They make up the majority of the recovered beads. Beads manufactured either individually or by a combination of individual and batch-production techniques seem to characterize the Egyptian school. These include beads made of drawn rods and those produced by single and repeated wrapping, fusing, mold pressing, and winding (26.4%). It is worth noting that the millefiori technique in the Roman and Hellenistic periods was typical of Alexandria workshops (Shchapova 1983:113).

To determine the origin of glass articles, one has to identify the type of workshop they came from. The manufacture of beads from either tubes or rods involves a masterful handling of raw materials and of various tools used to increase production. To fuse various glass components (the millefiori technique) or to use the single-wrapping technique, one had to master the art of changing heat conditions and to handle glass of various compositions in its various physical states. Such a skill is characteristic of glassmaking centers specializing in a certain product. Beads

can be made either of molten glass or by heating a semi-finished item; i.e., on a complete or an incomplete cycle.

Thus, the majority of the cemetery beads (just under 99%) were manufactured in specialized bead-producing workshops with a complete or an incomplete production cycle. Such workshops were situated in the areas of traditional glassmaking (i.e., in Egypt and the Near East, notably Syria) and, according to a number of scholars, were connected with international trade (Likhter et al. 1991:244-260).

Winding was something else, however. It is one of the simplest techniques marking the emergence of a new school. One could use it without understanding glass composition or utilizing complex tools. Making wound beads was an auxiliary process to, for example, blowing glassware (Shchapova 1978:99). It seems likely that the manufacture of such small articles was a way of salvaging utilizable waste. During the period that the Belbek IV cemetery was in use, blown glass vessels were already fairly widespread and were being manufactured in workshops of the Roman glassmaking school (Shchapova 1983:119, 123). In the production of blown drinking vessels such as cups or beakers, only a part of the blown sphere is used. The rest is waste which could be used to make small articles such as beads. Indeed, new bead types made mainly of transparent colored and colorless glass that was normally used for manufacturing glassware do emerge in the 1st century A.D. (Alekseeva 1978: Fig. 15). The majority of the wound beads at Belbek are either medium-size or large and of medium quality, betraying an unskilled hand.

Thus, a small number of individually wound beads from Belbek (slightly over 1.0%) are the products of workshops where tableware and window panes were blown with the waste glass being used to manufacture small articles, such as beads. Such workshops are general purpose since they produce a wide range of glass objects. They function on complete-cycle production, from producing the glass to annealing the finished articles. In the period under study, such workshops are characteristic of the Roman glass-making school.

THE CULTURAL ASPECT

It is instructive to consider the place of beads in the material culture of the people buried in the Belbek IV cemetery. This can be discussed regardless of the origin of the ornaments.

Clusters of beads were mostly noted in direct association with skeletons. They were found under the skull, at the neck, on the shoulders, chest, and ribs, at the pelvis or on the thighs, around the wrists of both hands or around the wrist of either the right or left hand, and around the ankles or feet. Less frequently, beads were encountered near the head or feet of the deceased.

Most beads were found on the upper torso. Large beads, which were scarce (one or two items), probably served as buttons or amulets. Medium-size beads found in great numbers could have comprised necklaces. Small uniform beads could have been used to embroider dress fronts.

In those few cases where beads were found around the wrists of both hands, it is likely that they adorned sleeve cuffs. This is especially likely if the beads are small and uniform in shape. Beads around a single wrist, either the right or the left, probably formed bracelets. Bracelet-forming beads are more often found around the right wrist.

It seems likely that monochrome beads found around the ankles or feet were used to embroider footwear, the hem of a dress, or the cuffs of trouser legs. Small beads found along the thighs were probably sewn to trouser legs on both sides.

Beads found under the skull are usually small although some large specimens have been encountered. Occasionally temple-rings and earrings, and small rings are found with them. It may be that the small beads were used to embroider headdresses or served as pendants hanging from a headdress or coiffure.

In rare instances beads were found at the pelvis of the deceased. It seems likely that large beads served as amulets or pendants hanging from a belt. Spherical gold-foil beads occasionally found at the pelvis could also have been used to embroider some dress elements.

Large glass beads were sometimes found beside iron and bronze objects, such as daggers. They usually lay near either the left or the right hand. These beads, mostly polychrome, were likely suspended from the grips of swords, daggers, knives, and, probably, other articles.

Beads have also been found near either the head or the feet of the deceased, either by themselves or in containers such as bowls or dishes. In this case one cannot identify the function of the beads. It is only safe to say that they were part of the grave offerings.

CONCLUSION

The morphological study of the beads from the Belbek IV cemetery reveals that undecorated, round-sectioned cylindrical and spherical beads, as well as flat rectangular specimens, of reddish-orange, white, and green glass up

to 8 mm in diameter are the most abundant forms. From a technological perspective, most of the beads were manufactured from drawn tubing and rods.

The correlation of the morphological and technological traits of the Belbek beads reveals that they were manufactured in accordance with the traditions of three glassmaking schools. The majority (733%) are ascribed to the Near Eastern (Syrian) school, slightly over a quarter of the total number (25.3%) to the Egyptian school, and just over one per cent (1.16%) to the Roman school of glassmaking.

Being found in burial contexts, the beads also reveal much about how they were utilized by the local population. While beads were encountered in various loci from the head to the feet of the deceased, the majority were concentrated in the region of the upper torso. The medium-sized specimens found there probably comprised necklaces while the small-sized ones likely represent embroidered dress fronts. Large beads were scarce and probably served as buttons, pendants, or amulets.

The research potential of the beads from the Belbek IV cemetery has by no means been exhausted. For one thing, the chemical composition of the glass beads needs to be determined. This will hopefully enable researchers to identify more definitely the centers of their manufacture.

ENDNOTES

1. Here we used the random sampling method for the study of antiquities. According to the method, there is no need to study all the recovered items. A researcher only needs to create a random representative sample. A sampling of 30 specimens is thought to be minimal; 100 specimens are considered optimal. A sampling of 277 specimens enabled us to yield knowledge about a population of 1,000 items (Shchapova 1988: 102).

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