

MEROVINGIAN BEADS ON THE LOWER RHINE

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This paper presents a classification for beads of the Merovingian period in the Lower Rhine region of Germany. Strings of beads recovered from graves are ordered by a seriation (correspondence analysis) which results in an ethnic (Roman vs. Frankish) and chronological structuring of the material. By comparing this with the chronological scheme established for the other associated archaeological finds, it becomes evident that the favored types of beads changed about every two generations. Besides changes in distinctive types, a development in general color preference is also observed.

INTRODUCTION

During the Merovingian period (ca. A.D. 450-750), it was customary in Central Europe to bury the dead uncremated in an extended posture. Apart from their clothing, the deceased were interred with jewelry, weapons and food. The study of these graves and their inventories considerably enriches our knowledge of an epoch for which only a meager number of written records exist. For the Lower Rhine, an area in western Germany (Fig. 1),¹ some 160 find-spots dating to this period are presently known. They have produced some 3,300 grave inventories, approximately 2,200 of which have been published (Fremersdorf 1955; LaBaume 1967; Pirling 1966, 1974, 1979; Siegmund 1989; Stampfuss 1939).²

With a few exceptions, the beads discussed here were found in the graves of females. They once formed strands of beads worn around the neck or the wrists; only exceptionally can one prove that they were sewn to clothing. The 7,000 beads found in toto came from only 210 burials; thus, not every woman was buried with a string of beads.

CLASSIFICATION

A comprehensive classification of the beads of the Rhenish Franks has been wanting up till now. Therefore, the beads had first to be grouped into types according to their attributes: the most important being raw material, color, shape and decoration.³

Very detailed recording of individual bead characteristics, especially color, had to be rejected since the writer not only had to deal with beads he personally recorded, but also with previously published material. Since, as a rule, the latter contain only rough descriptions, a more generalized definition of the individual attributes was necessary. Also, the resulting types could not be differentiated too finely as they would then be represented by too few examples.

The classified bead types are illustrated in Plate V and described in Appendix A. Generally, the beads are classified primarily according to their raw material (opaque glass, translucent glass and other materials) and their color, whereas shape and decoration form subordinate criteria. Deviating from this are several types of undecorated beads which are grouped according to distinct shapes as opposed to color (Per-1).⁴ There follow beads for which a distinct decoration forms the principal attribute of classification (Per-2). Subsequently, the beads are listed by types of opaque (Per-3) and translucent (Per-4) glass. In groups Per-3 and Per-4, the first numeral is suffixed by another which indicates an approximate color; here I restrict myself to the basic colors black (1), white (2), yellow (3), orange and ocher (4), red (5), green (6) and blue (7). Finally, the types are numbered sequentiall, following a period.

As well as decorated beads, the classification contains undecorated ones. However, only those

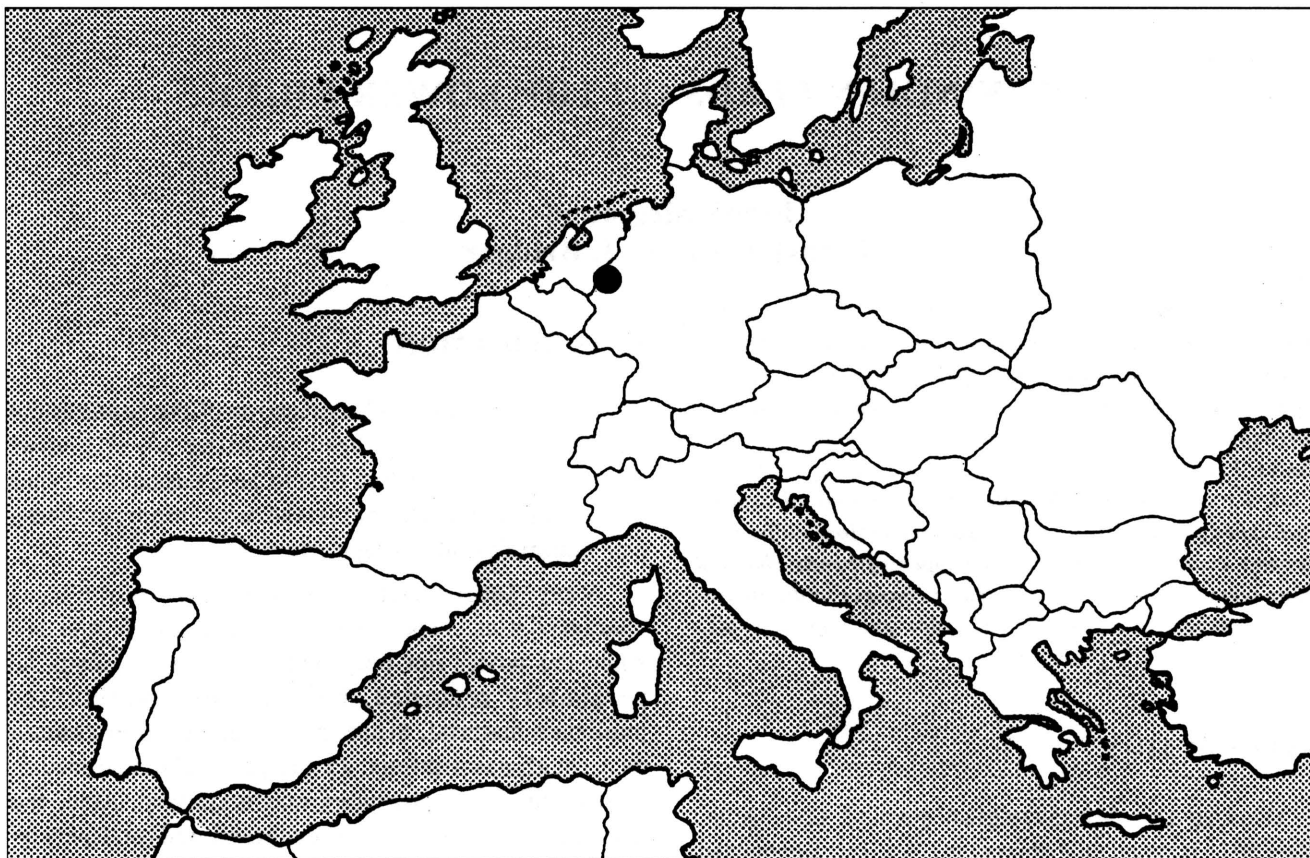


Figure 1. Map of Europe with the Lower Rhine area represented by the black dot (drawing: Irene Steuer).

undecorated beads found to be chronologically relevant have been included. Thus, the study area has produced 117 types derived from 212 strings of beads composed of 4,542 beads in all.

MODEL

It is assumed that the bead types composing bead strands buried with the deceased change through time. A bead type is developed by an artisan and appears occasionally in strings. It subsequently becomes popular (fashionable) and, as a result, appears often in strings, only to slowly fade from the scene afterwards. Since certain beads can be reused or passed from one generation to another over a period of time (inherited or heirloomed), the changes in strand composition occur only slowly. The method of classification used for this model (Gauss' seriation model) is correspondence analysis (Ihm 1983; Zimmermann 1995). By means of an appropriate mathematical

method, a contingency table which tabulates the frequencies of all 117 bead types in the 212 strings was thus produced diagonally, a plot of the first two eigenvalues being shown in Fig. 2.⁵

CONTROL HYPOTHESIS

Correspondence analysis almost always leads to a diagonal in a contingency table. The method itself cannot show whether this order is archaeologically useful; it, therefore, needs external control mechanisms. In the present instance, the chronological relevance of the resulting order can be tested in two ways.

Apart from beads, other objects (such as fibulae and pottery vessels) are also found in many graves. Since relative chronologies exist for these, the classification of the beads can be checked against the dating of the accompanying grave goods.

A second method involves an examination of burial distributions at the cemeteries, some of which were laid out systematically in a recognizable pattern; the oldest burials are situated together in one area and subsequent burials are added on to these in recognizable conglomerations (Ament 1976; Siegmund 1982, 1989). Thus, the proposed chronological order for the bead strands can be tested against their location in a cemetery.

CHRONOLOGY

As the comparison between the classification and the control hypothesis shows, the first eigenvalue only imperfectly displays the expected chronology. A more detailed analysis shows that the bead strings are divided firstly into ethnic groups.

The beads discussed here originated from Frankish graves of the 5th to early 8th centuries. Furthermore, some late Roman strings were recorded at the cemetery of Krefeld-Gellep which was continually in use from the Roman period (Pirling 1986). Evidently, during the 4th and 5th centuries, the differences between Frankish and Roman bead strings were so extreme that, in the first instance, an ethnic division occurs, the result of which is that only a moderately satisfactory chronology occurs within the Frankish beads.

Only the second eigenvalue brings the strings and beads into a convincing chronological sequence.⁶ The resulting order of beads is presented in Appendix B.

In order to gain a better assessment of the results, the individual strings, corresponding to their chronological position, have been combined into larger groups which have been termed "clusters." These clusters then had to be interwoven into the general Frankish chronology. To this end, the female graves, with all their grave goods, were subjected to a correspondence analysis in which the strings were included at the level of these clusters. Moreover, the clusters were included in the analysis of the areas of utilization within the cemeteries. The results of this are presented in Table 1.⁷ This clearly shows that the individual clusters overlap slightly and, as a rule, are strewn over two phases. Strings of beads are, therefore, readily datable but, compared with other

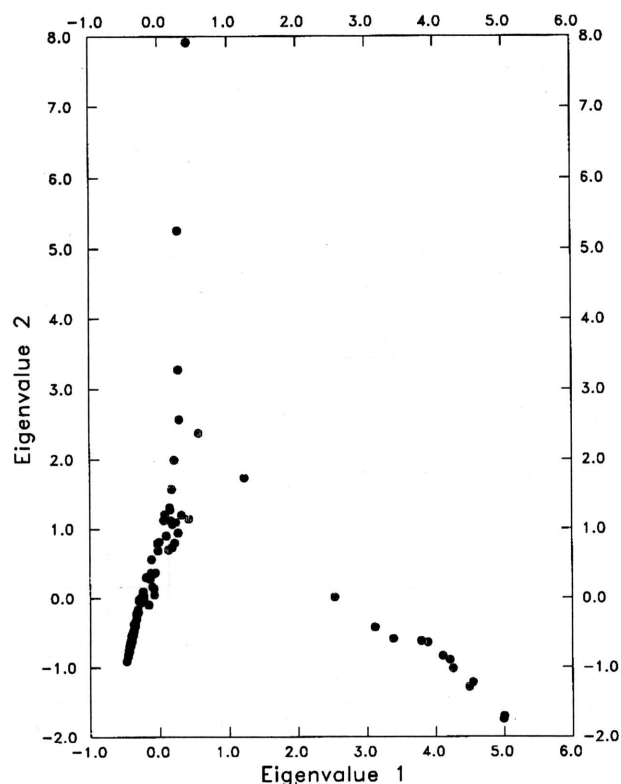


Figure 2. Correspondence analysis of the first two eigenvalues. Eigenvalue 1 represents ethnicity (Roman-Frankish); eigenvalue 2 represents chronology.

artifact groups, chronologically somewhat less sensitive.

TRAIT FREQUENCY

The more important and frequently encountered bead types in the clusters are shown in Plates VIA-VIB, where they are arranged according to their position as determined by correspondence analysis.

Other, more general, tendencies of Frankish bead "fashion" on the Lower Rhine can be better observed at the more abstract level of the clusters.⁸ In Fig. 3, the material of the beads composing the strings is tabulated according to the level of the clusters. The scale of reference is the sum of the glass and the amber beads. Amber occurs to a small degree in every cluster but is especially frequent in strings of cluster C; after D its proportion diminishes. It was, therefore, meaningful to include the category "much amber" in

Table 1.
Bead String Clusters and their Relationship to Phases of the Lower Rhine Chronology.

Phases	Bead Clusters									A.D.	
	A	B	C	D	E	F	G	H	I		
											705
10								5	12		670
9						1		7	3		640
8						7	4	7	7		610
7					1	8	7				585
6				3	5	5	3				570
5				5	4	1					555
4	1		10	7	4						530
3	1		6	1							485
2		3									440
1											400
Roman	17										

the contingency table, where the lower cut-off point was set at 20%; i.e., to qualify, at least 20% of a stand had to consist of amber beads.

Beads of translucent glass dominate the recorded Roman strings of beads in the 4th century (cf. Guido 1978:91 et. seq.). In the early Frankish strings of cluster B, decorated beads of opaque glass are quite frequent—mostly comprising decorated, opaque black beads—as opposed to the later period. In the subsequent clusters, the proportions of the raw materials are roughly similar; noteworthy in cluster F is the much higher ratio of decorated beads. For this reason, the category "many decorated beads" (which excluded black beads) was also incorporated into the contingency table. To qualify, at least 50% of a strand had to consist of decorated beads.

In the case of the segmented beads which enclose silver or gold foil, their proportion remains generally quite low and mostly well below 1.0%. Only in strings

of cluster C, and to a lesser degree in D, do they occur more frequently.

In Fig. 4, the color combinations of the bead strings are tabulated according to the level of the clusters. The scale of reference in each case is the sum of the glass beads, with segmented beads enclosing metal foil and millefiori beads having been excluded. The rare ocher-colored beads have been added to the yellow ones and turquoise-colored beads have been included with the blue ones.

A marked transformation in the general color spectrum of the strings is evident. The curve is very similar for the colors blue and green, an increasing proportion of blue going hand in hand with an increasing proportion of green. This is contrary to the development of the color yellow; a very high proportion of yellow beads is characteristic of clusters D-F, reaching a maximum in E. For this reason, the attribute "many opaque yellow beads" was included in

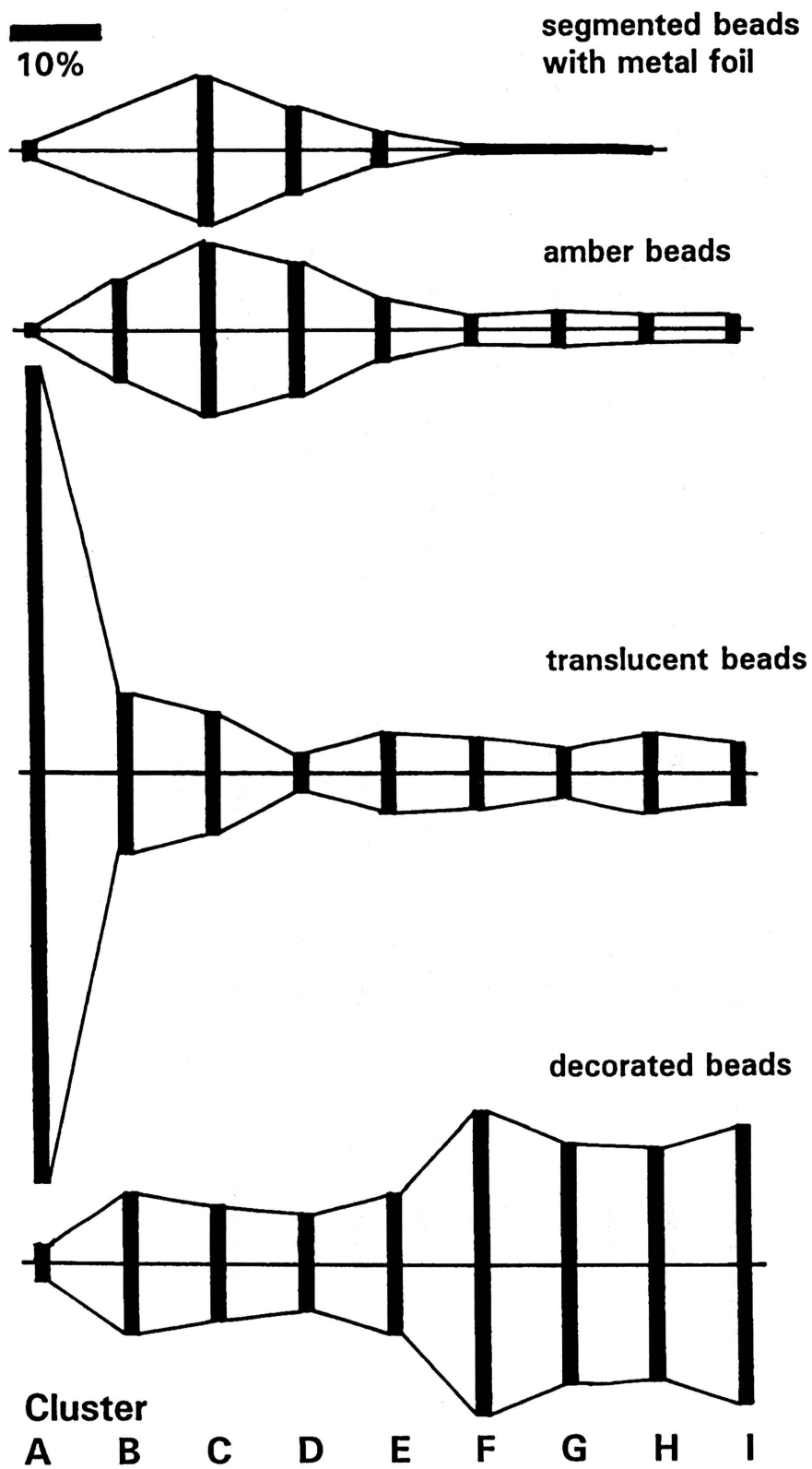


Figure 3. The frequency of several major bead groups in clusters A-I.

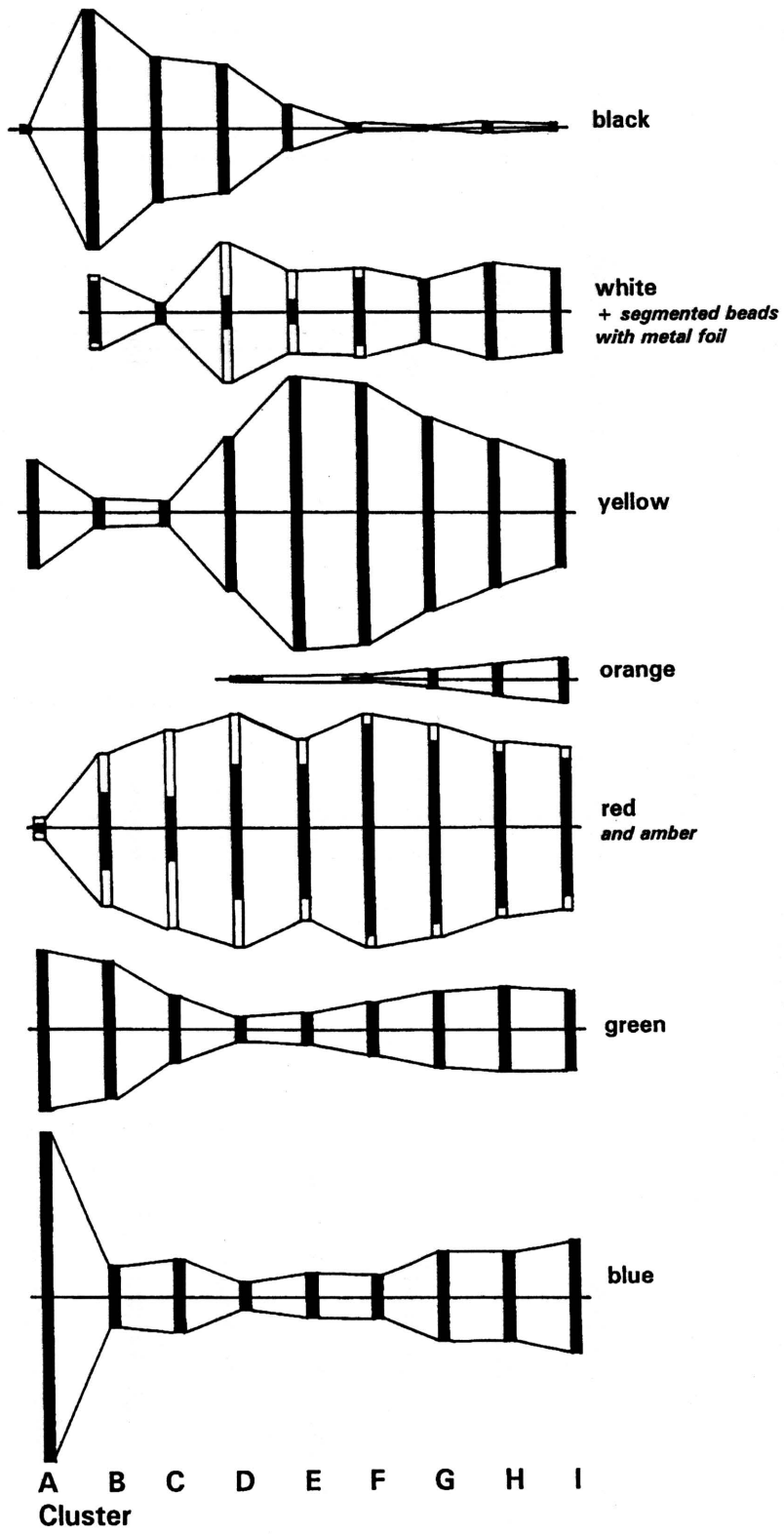


Figure 4. Color frequency among the bead strings in clusters A-I.

the contingency table, with the lower cut-off point being placed at 45%.

The proportion of red beads remains very stable through time, being much less frequent only in clusters A to C. However, if one considers that the more frequently occurring amber beads of clusters B to D also display a mainly reddish hue, the proportion of red beads remains fairly constant throughout the Merovingian period.

The color orange first appears in cluster G and becomes more frequent after cluster I.⁹ Since there is a decrease, if only very slight, during this period in red beads, one could regard orange beads as a somewhat lighter substitute for red beads, thereby reinforcing the notion that red beads appeared in about equal proportions during the period under study.

White beads are not generally very common. In Roman strings they occur mostly as translucent white to colorless beads. In the early Frankish strings, white occurs very seldom, but its proportion increases steadily thereafter.

Black beads are very common in the early Frankish strings. After a maximum in cluster B, the proportion of black beads drops in clusters C and D, after which they appear only sporadically.

As a rough generalization, one can see color preference coming full circle when looking at the Merovingian period as a whole. If one considers the amber beads and the opaque red beads as a single group, an approximately constant proportion of red beads can be seen throughout the Merovingian period. In clusters B and C, the strings contain lots of blue and green beads, after which the spectrum shifts considerably towards yellow beads and thence, in clusters G to I, reorients itself to the blue/green mode. Black is very common at the outset, then disappears until a minor reoccurrence in the two most recent clusters (H-I). The question remains whether this picture is applicable to a larger geographical area.

CONCLUSION

A comparison of the new bead seriation presented herein with the chronology of the other grave goods demonstrates that the bead clusters fit in meaningfully. One, therefore, finds confirmation for

the proposed classification of the beads into 120 types (see Pl. V and Appendix A), as well as the choice of correspondence analysis as a statistical method for obtaining this chronological sequence. However, one finds that the development of "fashion" in beads seems not to keep pace with other grave goods, so that one bead cluster covers two to three chronological phases (approximately 70 years). Comparable studies of the beads from two cemeteries in southern Germany (Theune-Vogt 1990; Sasse and Theune 1996) produced similar results regarding the classification of important types and in the precision of the dating. This suggests that strings of beads were seldom replicated in succeeding generations, but that individual bead types in them were replaced successively.

Apart from the gains regarding bead chronology, the general development of the favored materials and colors can now be demonstrated. Beads of opaque glass dominate the whole Merovingian period (clusters B-I), while translucent glass is common for Roman beads (cluster A). This major difference allowed correspondence analysis to find an ethnic division at its first eigenvalue and the time-related development at the second.

The only non-glass bead material that appears in any notable quantity is amber. Amber beads occur throughout the time frame in low frequencies, although they do become very fashionable for a short time (clusters C-D). Shell beads appear at the end of the Merovingian period.

While red beads are common during the whole Merovingian period, black, green and blue ones are preferred at the beginning, followed by a period with many yellow beads, with a return to green and blue beads at the end. Beads of translucent glass predominate at the outset, then disappear only to reappear with more intensity at the end of the period. One can thus recognize a cyclical course of human behavior regarding the general taste in color.

ACKNOWLEDGEMENTS

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ENDNOTES

1. The study area encompasses the administrative district of Düsseldorf and the County of Heinsberg in the State of Northrhine-Westphalia, Germany. Two other cemeteries a little further to the south have also been included: Junkersdorf and Müngersdorf within the city limits of Köln, as well as the cemetery of Iversheim in the Borough of Bad Münstereifel, County Euskirchen.
2. Color plates of some of the strings analyzed here appear in Fremersdorf (1955:Pl. 133); Pirling (1986:Figs. 156-158, 170); Siegmund and Weiss (1989a:40 [Pl. 8]).
3. For basics, *see* Beck (1928). More relevant to the present study is Ihm, Sasse and Theune (1994). For the Merovingian period, *see* Grünewald (1988); Koch (1977) (however, this only deals with the decorated beads); Sasse and Theune (1996); Theune-Vogt (1990). Chemical analysis of the glass and its colorants is not available. On Alamannic beads from southern Germany, *see* Hoffmann, Buchta-Hohm and Sasse (1988).
4. The prefix "Per-" derives from the German word *Perlen* (beads).
5. The program KORAN V-3.4 was utilized, kindly provided by A. Zimmermann of Frankfurt, whom I warmly thank. Canonical correlation-coefficients of eigenvalues 1-5 are 0.88958, 0.74486, 0.65091, 0.57543 and 0.49096, respectively.
The term "eigenvalue" is derived from the German *Eigenwert* ("its own value"). Eigenvalues are coordinates in a theoretical space, in this case indicating the relative position of each bead type and string in the diagonally reordered table.
6. Similar results were obtained by Stehli and Strien (1986). The inventories were initially divided regionally; however, the desired chronological order of the attributes occurred also only with the second eigenvalue.
7. In Table 1, the bead strings in each cluster are correlated to the dates derived for each burial based on the other associated grave goods. Consequently, only those strings found in association with other datable finds are recorded.
8. For more information on the special graphics depicted in Figs. 3-4, *see* Clarke (1970:424 [Fig. 1, #3]) and Ford (1962).
9. Orange beads are similarly frequent in contemporary strings of the Wendic period in Denmark (Høilund Nielsen 1986:50 [Table 1], 52 [Table 2]; 1988:38 [Table 1], 41 [Table 2]).

APPENDIX A: INVENTORY OF MEROVINGIAN BEADS ON THE LOWER RHINE

Equivalent types in the typologies for decorated beads developed by Koch (1977) and Theune-Vogt (1990), and in those for undecorated beads prepared by Grünewald (1988) and Theune-Vogt (1990), are listed as follows: (Koch Group xx), (Grünewald Type xx) and (Theune-Vogt Type xx).

Shape as the Primary Criterion of Classification

- Per-1.1 Heart-shaped bead, translucent glass (Guido 1978: 92 [Fig. 37, #17], 99).
- Per-1.2 Long cylindrical bead, translucent or opaque glass, blue (Grünewald Type 55).
- Per-1.3 Polygonal bead, opaque glass, five or six sided, large (Theune-Vogt Type 19).
- Per-1.4 Polygonal bead, opaque glass, six sided, small.
- Per-1.5 Square-sectioned bead of opaque or translucent glass, small (Guido 1978:92 [Fig. 37, #7], 96).
- Per-1.6 Cube-shaped bead.
- Per-1.7 Pendant bead.
- Per-1.8 Flat, almond-shaped bead (*flachmandelförmig*)(Theune-Vogt Type 20).

Decoration (and Shape) as the Primary Criterion of Classification

- Per-2.1 Short cylindrical bead of translucent glass (colorless, yellow or green), decorated with an opaque wavy band (white, yellow or green).
- Per-2.2 Short cylindrical bead, decorated with a wavy band around the middle and a straight band around either end.
- Per-2.3 Short cylindrical bead decorated with combed bands and straight bands around the ends, large.
- Per-2.4 Generally short or long cylindrical bead, decorated with straight bands around the ends and a monochrome row of dots (Koch Group 16).
- Per-2.5 Long, square-sectioned bead of opaque glass, decorated with dots, one at each corner and in the center of each face (Koch Group 4; Theune-Vogt Type 58).
- Per-2.6 Truncated biconical bead of opaque glass, decorated with many monochrome dots of the same color (similar to Koch Group 3).
- Per-2.7 Short barrel-shaped bead of opaque glass, decorated with many opaque red dots, large.
- Per-2.8 Oblate-disc bead of opaque glass (not black), decorated with a row of monochrome dots (belongs to Koch Group 1).
- Per-2.9 Short cylindrical to barrel-shaped bead of opaque glass, decorated with a monochrome row of dots around the middle (belongs to Koch Group 1).
- Per-2.10 Short cylindrical to barrel-shaped bead, decorated with bichrome eyes (Koch Group 6-8).
- Per-2.11 Reticular bead (Koch Group 48).
- Per-2.12 Millefiori bead (*Blättchenmillefioriperle*), short cylindrical, large (concerning Per-2.12-14, *see* Koch 1974).
- Per-2.13 Millefiori bead (*Blättchenmillefioriperle*), barrel shaped (Theune-Vogt Type 70.2).
- Per-2.14 Millefiori bead (*Blättchenmillefioriperle*), long polygonal, six sided (Theune-Vogt Type 70.1).
- Per-2.15 Crumb bead (*Flockenperle*), short barrel-shaped bead of opaque or translucent glass with randomly impressed "dots" of various colors.

Opaque Glass, Sorted According to Color

(N.B. When a specific shape is not provided in the descriptions below, it means that this attribute is not significant in the definition of the bead type. However, the illustrations in Plate V depict the most common shape for each type.)

Black

- Per-31.1 Opaque black bead, small (Theune-Vogt Type 24.9).
- Per-31.2 Opaque black bead, double or multiple segment.
- Per-31.3 Opaque black bead, decorated with a light plaited band (white or white and light blue) and bichrome eyes with dark spots on a lighter background.
- Per-31.4 Opaque black bead, elongated biconical, decorated with white antithetic arcs.
- Per-31.5 Opaque black bead, decorated with an opaque yellow plaited band with opaque yellow dots.
- Per-31.6 Opaque black bead, short barrel shaped, decorated with a wavy band around the middle and straight bands around the ends.
- Per-31.7 Opaque black bead, oblate disc or short barrel shaped, decorated with a wavy band.
- Per-31.8 Opaque black bead with decoration, not further differentiated.

White

- Per-32.1 Opaque white bead, spherical, small; wound manufacture.

- Per-32.2 Opaque white, double or multiple-segment bead (Grünewald Type 42).
- Per-32.3 Opaque white bead, truncated biconical (Grünewald Type 39; Theune-Vogt Type 15.3).
- Per-32.4 Opaque white (or yellow) bead, long cylindrical bead decorated with dots.
- Per-32.5 Opaque white bead, decorated with a red plaited band (belongs to Theune-Vogt Type 52.3).
- Per-32.6 Opaque white bead, decorated with a green plaited band.
- Per-32.7 Opaque white bead, decorated with a blue plaited band (belongs to Theune-Vogt Type 52.3).
- Per-32.8 Opaque white bead, decorated with a red plaited band with opaque blue dots in the central fields (Koch Group 21, 1-5).
- Per-32.9 Opaque white bead, decorated with a red band.
- Per-32.10 Opaque white bead, short cylindrical, decorated with green bands.
- Per-32.11 Opaque white bead, elongated square sectioned, decorated with fine green stripes.
- Per-32.12 Opaque white bead, cube-shaped, translucent light blue edges with opaque yellow dots, and tricolored eyes (opaque red, opaque yellow and translucent light blue) in the center of each face.

Yellow

- Per-33.1 Opaque yellow bead, short cylindrical, small.
- Per-33.2 Opaque yellow bead, irregular, small; wound manufacture.
- Per-33.3 Opaque yellow bead, spherical, small.
- Per-33.4 Opaque yellow bead, asymmetric biconical.
- Per-33.5 Opaque yellow bead, truncated biconical (Theune-Vogt Type 15.2).
- Per-33.6 Opaque yellow, double or multiple, distinctly segmented bead (Theune-Vogt Type 11.2).
- Per-33.7 Opaque yellow bead, decorated with a red plaited band.
- Per-33.8 Opaque yellow bead, decorated with a red plaited band and red or green dots.
- Per-33.9 Opaque yellow bead, decorated with a green or, less often, a blue plaited band.
- Per-33.10 Opaque yellow bead, decorated with red bands or stripes (similar to Koch Group 21,10-12).

Orange

- Per-34.1 Opaque orange bead, truncated biconical (Theune-Vogt Type 15.8).

Ocher

- Per-34.2 Opaque ocher-colored bead, oblate disc or spherical, small.

Red

- Per-35.1 Opaque red bead, long cylindrical (Theune-Vogt Type 31.1).
- Per-35.2 Opaque red bead, short cylindrical, small.
- Per-35.3 Opaque red bead, oblate disc, small.
- Per-35.4 Opaque red bead, irregularly spherical, small (Theune-Vogt Type 10.1).
- Per-35.5 Opaque red bead, irregular; wound manufacture.
- Per-35.6 Opaque red bead, truncated biconical (Theune-Vogt Type 15.1).
- Per-35.7 Opaque red, double or multiple-segment bead (Theune-Vogt Type 11.1).
- Per-35.8 Opaque red bead, decorated with a white plaited band.
- Per-35.9 Opaque red bead, decorated with a white plaited band and white dots (Theune-Vogt Type 52.2).

- Per-35.10 Opaque red bead, decorated with a white plaited band and applied white, layered eyes with green or blue centers.
- Per-35.11 Opaque red bead, decorated with a yellow plaited band.
- Per-35.12 Opaque red bead, decorated with a yellow plaited band and yellow dots (Theune-Vogt Type 52.1).
- Per-35.13 Opaque red bead, decorated with white bands (belongs to Koch Group 42; Theune-Vogt Type 55.2).
- Per-35.14 Opaque red bead, decorated with yellow bands (belongs to Koch Group 42).
- Per-35.15 Opaque red bead, cylindrical, decorated with a white wavy band.
- Per-35.16 Opaque red bead, barrel shaped or truncated biconical, decorated with irregular yellow inclusions.
- Per-35.17 Opaque red bead, long truncated biconical, decorated with combed yellow bands.
- Per-35.18 Opaque red bead, broad cylindrical, large, decorated with combed yellow bands.
- Per-35.19 Opaque red bead, cylindrical, decorated with combed white or yellow bands (Theune-Vogt Type 56.1-2).
- Per-35.20 Opaque red bead, decorated with opaque white bands overlaid by a wavy line of a light-colored translucent glass, mostly blue, sometimes green (similar to Theune-Vogt Type 53.1).
- Per-35.21 Opaque red bead, long polygonal, six sided, decorated with multicolored bands (Koch Group 45).
- Per-35.22 Opaque red bead, decorated with definitely applied, raised yellow dots (Theune-Vogt Type 60.2).
- Per-35.23 Opaque red bead, long cylindrical, decorated with opaque white or yellow dots.
- Per-35.24 Opaque red bead with interspersed fine black stripes, barrel shaped.
- Per-35.25 Opaque red bead containing white and yellow swirls, truncated biconical.
- Per-35.26 Opaque red bead containing white and yellow swirls, decorated with straight yellow bands around the ends (Theune-Vogt Type 82.1).
- Per-35.27 Opaque red bead containing white and yellow swirls, decorated with straight yellow bands around the ends and middle.
- Per-35.28 Opaque red bead containing white and yellow swirls, decorated with straight yellow bands around the ends and a row of yellow dots around the middle.

Green

- Per-36.1 Opaque green (or turquoise) bead, short cylindrical, small (Theune-Vogt Type 35.5).
- Per-36.2 Opaque green (or turquoise) bead, short cylindrical, large.
- Per-36.3 Opaque green (or turquoise) bead, irregularly spherical; wound manufacture.
- Per-36.4 Opaque green bead, double or multiple segment, large (Theune-Vogt Type 11.5).
- Per-36.5 Opaque green bead, decorated with red bands around the ends (Theune-Vogt Type 71.1).
- Per-36.6 Opaque green bead, decorated with opaque yellow dots, long cylindrical.
- Per-36.7 Opaque green or blue bead containing banded inclusions of opaque red glass.

Blue

- Per-37.1 Opaque blue (or blue-green) bead, truncated biconical (Grünwald Type 25).
- Per-37.2 Opaque blue (or blue-green) bead, double or multiple segment.
- Per-37.3 Opaque blue bead, oblate disc or short barrel shaped, decorated with a wavy white or yellow band.

Translucent Glass, Sorted According to Color

- Per-40.1 Segmented bead enclosing silver-metal foil (Grünwald Type 51; Theune-Vogt Type 30.0; for technique *see* Astrup and Andersen 1987:222-228).
- Per-40.2 Segmented bead enclosing gold-metal foil.

Colorless/White

- Per-42.1 Translucent white bead, spherical or truncated biconical, small.
- Per-42.2 Translucent white or yellow bead, segmented (the individual segments are clearly defined).
- Per-42.3 Translucent white bead, long cylindrical, small (Theune-Vogt Type 31.0).

Yellow

- Per-43.1 Translucent yellow bead ("honey-colored"), spherical or truncated biconical, small.

Red

- Per-45.1 Translucent red bead, oblate disc, small.

Green

- Per-46.1 Translucent green bead, truncated biconical, small.
- Per-46.2 Translucent green bead, long cylindrical, small.
- Per-46.3 Translucent green to yellow-green bead, long cylindrical (Theune-Vogt Type 43.5).
- Per-46.4 Translucent green bead, long polygonal, five or six sided.
- Per-46.5 Translucent green bead, cylindrical; wound manufacture.
- Per-46.6 Translucent green bead, decorated with a combed feather pattern of opaque white glass.

Blue

- Per-47.1 Translucent blue bead, short cylindrical or spherical, tiny.
- Per-47.2 Translucent blue bead, truncated biconical, small (Theune-Vogt Type 40.2; Guido 1978:92 [Fig. 37, #12-13], 97).
- Per-47.3 Translucent blue bead, truncated biconical, large.
- Per-47.4 Translucent blue bead, long cylindrical, obliquely wound.
- Per-47.5 Translucent blue bead, elongated biconical.
- Per-47.6 Translucent blue bead, truncated-cone (somewhat teardrop-shaped) (Theune-Vogt Type 45.6; similar to Grünwald Type 31 [Schneider-Schneckenburger 1980:36]).
- Per-47.7 Translucent blue bead, double or multiple segment.
- Per-47.8 Translucent blue bead, short cylindrical, ribbed (Grünwald Type 32).
- Per-47.9 Translucent blue or, rarely, another dark color such as green or brown, cornerless cube (*Polyederperle*) (Grünwald Type 30; Theune-Vogt Type 44.6; Guido 1978:92 [Fig. 37, #20], 99).
- Per-47.10 Translucent blue (or green) bead, cornerless cube (*Polyederperle*), decorated with bichrome eyes consisting of a light-colored dot with a dark blue center (belongs to Koch Group 9).

Beads of Other Raw Materials

- Per-5.1 Rock-crystal bead.
- Per-5.2 Amethyst bead (Theune-Vogt Type 90.2).
- Per-5.3 Agate bead.
- Per-5.4 Meerscham bead, short cylindrical, large (Theune-Vogt Type 90.5).
- Per-5.5 Shell disc (Theune-Vogt Type 90.6; Siegmund and Weiss 1989b).

APPENDIX B: MEROVINGIAN BEAD TYPES IN CHRONOLOGICAL ORDER

I. "Eigenvalue 1" less than 2.0, with increasing value sorted according to "Eigenvalue 2":

Type	Description	EV 1	EV 2	EV 3	Cluster Dominated
5.5	Shell disc	-.477	-.911	.856	I
46.5	Tsl. green, cylindrical, wound manufacture	-.472	-.898	.866	I
32.11	Op. white, square sectioned, green stripes	-.472	-.894	.825	I
47.3	Tsl. blue, truncated biconical	-.456	-.834	.777	I
37.1	Op. blue (or blue-green), trunc. biconical	-.458	-.827	.749	I
2.15	Crumb bead	-.459	-.820	.739	I
2.2	Short cyl., wavy band + bands at ends	-.450	-.803	.722	I
33.5	Op. yellow, truncated biconical	-.447	-.777	.686	I
32.9	Op. white, red band	-.443	-.777	.666	I
36.3	Op. green, irreg. spherical, wound mfr.	-.449	-.768	.661	I
2.3	Short cyl., combed bands + bands at ends	-.451	-.759	.639	I
31.2	Op. black, double or multiple segment	-.440	-.734	.613	H
1.8	Flat, almond-shaped	-.436	-.723	.607	H
35.20	Op. red, white bands/blue wavy line	-.427	-.701	.573	H
47.8	Tsl. blue, short cylindrical, ribbed	-.436	-.695	.549	H
34.1	Op. orange, truncated biconical	-.426	-.681	.567	H
35.6	Op. red, truncated biconical	-.419	-.678	.558	H
32.3	Op. white, truncated biconical	-.426	-.676	.532	H
2.9	Op., cyl./barrel shaped, monochrome dots	-.425	-.671	.537	H
36.7	Op. green or blue with red inclusions	-.421	-.662	.553	H
2.5	Op., long square sect., monochrome dots	-.424	-.655	.546	H
35.7	Op. red, double or multiple segment	-.420	-.648	.482	H
32.2	Op. white, double or multiple segment	-.418	-.637	.492	H
1.6	Op., cube shaped	-.405	-.635	.504	H
2.7	Op., barrel shaped, many red dots, large	-.415	-.615	.448	H
5.3	Agate	-.414	-.608	.465	H
2.1	Short cyl., tsl. yellow/green, wavy band	-.400	-.600	.498	H
36.5	Op. green, red bands around ends	-.399	-.579	.428	H
46.3	Tsl. green-yellow green, long cylindrical	-.400	-.571	.426	H
35.5	Op. red, irregular, wound	-.405	-.546	.365	G
32.1	Op. white, spherical, wound, small	-.407	-.545	.355	G
35.10	Op. red, white plaited band, bichrome eyes	-.382	-.528	.335	G
47.4	Tsl. blue, long cylindrical, wound	-.388	-.525	.315	G
36.4	Op. green, double or multiple segment	-.394	-.518	.319	G
36.2	Op. green, short cylindrical, large	-.389	-.501	.335	G
2.10	Short cyl./barrel-shaped, bichrome eyes	-.381	-.491	.297	G
37.2	Op. blue/blue-green, double or mult. seg.	-.372	-.466	.268	G
32.6	Op. white, green plaited band	-.376	-.460	.236	G
35.15	Op. red, cylindrical, white wavy band	-.364	-.414	.193	G
33.6	Op. yellow, double or multiple segment	-.356	-.408	.215	G
47.7	Tsl. blue, double or multiple segment	-.364	-.391	.151	G
2.4	Cylindrical, bands at ends + mono. dots	-.357	-.387	.161	G

35.23	Op. red, long cyl., white or yellow dots	-.361	-.381	.172	G
36.6	Op. green, long cylindrical, yellow dots	-.372	-.377	.089	G
35.16	Op. red, bbl./biconical, yellow inclusions	-.346	-.333	.085	F
--	Proportion of decorated beads 50%	-.357	-.297	-.005	F
32.7	Op. white, blue plaited band	-.332	-.296	.083	F
35.19	Op. red, cylindrical, combed bands	-.328	-.252	.019	F
32.10	Op. white, short cylindrical, green bands	-.333	-.239	-.050	F
47.5	Tsl. blue, elongated biconical	-.335	-.221	-.070	F
35.12	Op. red, yellow plaited band + dots	-.318	-.213	-.075	F
35.11	Op. red, yellow plaited band	-.309	-.200	-.016	F
35.8	Op. red, white plaited band	-.316	-.182	-.016	F
33.10	Op. yellow, red bands or stripes	-.312	-.178	-.091	F
32.8	Op. white, red plaited band, blue dots	-.313	-.163	-.126	F
35.27	Op. red with swirls, yellow bands	-.165	-.093	-.017	E
35.13	Op. red, white bands	-.277	-.069	-.171	E
--	Proportion of op. yellow beads 45%	-.278	-.052	-.251	E
32.4	Op. white or yellow, long cyl., dots	-.285	-.049	-.229	E
35.24	Op. red, fine black stripes, barrel shaped	-.301	-.036	-.264	E
1.7	Pendant bead	-.268	-.031	-.162	E
33.7	Op. yellow, red plaited band	-.273	-.030	-.238	E
33.3	Op. yellow, spherical, small	-.234	-.023	-.191	E
2.6	Op., truncated biconical, mono. dots	-.297	-.019	-.326	E
33.8	Op. yellow, red plaited band + mono. dots	-.266	.015	-.303	E
35.9	Op. red, white plaited band + dots	-.229	.030	-.287	E
33.4	Op. yellow, asymmetric biconical	-.078	.052	-.386	E
32.5	Op. white, red plaited band	-.239	.095	-.245	E
35.25	Op. red with swirls, truncated biconical	-.084	.144	-.232	D
35.26	Op. red with swirls, yellow bands at ends	-.106	.169	-.285	D
33.1	Op. yellow, short cylindrical, small	-.139	.278	-.438	D
35.14	Op. red, yellow bands	-.189	.303	-.606	D
1.3	Op., polygonal, five or six sided, large	-.194	.304	-.009	D
33.2	Op. yellow, irregular, small, wound	-.083	.359	-.575	D
35.4	Op. red, irregularly spherical, small	-.126	.368	-.459	D
35.3	Op. red, oblate disc, small	-.063	.373	-.602	D
33.9	Op. yellow, green or blue plaited band	-.118	.559	-.585	D
36.1	Op. green, short cylindrical, small	-.022	.687	-.937	C
34.2	Op. ocher, oblate disc or spherical, small	.129	.700	-.689	C
2.11	Reticular bead	.179	.734	-.834	C
35.18	Op. red, broad cyl., combed yellow bands	-.032	.795	-.945	C
35.22	Op. red, applied, raised yellow dots	.217	.802	-.699	C
35.2	Op. red, short cylindrical, small	-.005	.813	-.652	C
35.1	Op. red, long cylindrical	.097	.902	-.311	C
--	Proportion of amber 20%	.266	.944	-.734	C
40.1-2	Segmented bead enclosing metal foil	.266	.945	-1.006	C
31.1	Op. black, small	.186	1.070	-1.038	C
1.2	Long cylindrical, tsl. or op. blue	.232	1.095	-.976	C
2.8	Oblate disc, op., monochrome dots	.161	1.118	-1.109	C
2.14	Millefiori bead, long polygonal, six sided	.063	1.121	-1.293	C

42.3	Tsl. white, long cylindrical, small	.424	1.142	-1.133	C
46.6	Tsl. green, white feather pattern	.318	1.198	-1.243	C
2.12	Millefiori bead, short cylindrical, large	.079	1.208	-1.325	C
5.4	Meerscham bead, short cylindrical, large	.152	1.274	-.836	C
35.28	Op. red with swirls, yellow bands and dots	.148	1.306	-1.336	C
--	Proportion of black beads 15%	.221	1.479	-.479	B
35.17	Op. red, trunc. bicon., combed yellow bands	.179	1.574	-1.369	B
31.3	Op. black, plaited white band + bichr. eyes	1.228	1.731	1.040	B
5.1	Rock-crystal bead	.217	1.993	-1.617	B
31.4	Op. black, elong. biconical, antithetic arcs	.570	2.374	.810	B
37.3	Op. blue, oblate disc, wavy white or yellow band	.292	2.571	-1.788	B
31.7	Op. black, oblate disc or bbl., wavy band	.278	3.278	2.086	B
--	Proportion of decorated black beads 10%	.504	4.427	4.122	B
31.6	Op. black, short bbl., wavy and straight bands	.271	5.255	5.584	B
31.5	Op. black, yellow plaited band and dots	.419	7.917	10.378	B

II. "Eigenvalue 1" greater than 2.0, with increasing value sorted according to "Eigenvalue 1":

Type	Description	EV 1	EV 2	EV 3	Cluster Dominated
47.9	Tsl. blue or green, cornerless cube	2.532	.015	-.633	A
47.1	Tsl. blue, short cyl. or spherical, tiny	3.118	-.420	.202	A
42.2	Tsl. white or yellow, segmented	3.383	-.588	.145	A
46.4	Tsl. green, long polygonal, five-six sided	3.792	-.622	-.272	A
46.2	Tsl. green, long cylindrical, small	3.889	-.641	.349	A
47.2	Tsl. blue, truncated biconical, small	4.109	-.832	.478	A
43.1	Tsl. yellow, spherical or trunc. biconical	4.211	-.890	.168	A
1.1	Tsl. heart-shaped bead	4.256	-1.014	.345	A
42.1	Tsl. white, spherical or trunc. bicon., small	4.494	-1.280	.909	A
1.5	Tsl./op., square sectioned, small	4.546	-1.218	.520	A
46.1	Tsl. green, truncated biconical, small	4.992	-1.746	1.360	A
45.1	Tsl. red, oblate disc, small	5.001	-1.704	1.294	A

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