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## **Swiss Neolithic Copper Beads Revisited: Currency, Ornament or Prestige Item? New Evidence of the Metrological Concept in Prehistoric Europe**

An interesting discovery was made in 1967 in the course of excavations of the Cortaillod culture settlement in Seeberg, Burgäschisee-Süd (Sangmeister, Strahm 1974), where two strings of copper beads were recovered from a shallow pit close to one of the dwelling structures. There were no traces of a pouch or some other container accompanying them. The leather strings had small knots on both ends preventing the beads from slipping off. All the beads were well preserved, displaying various degrees of oxidation, suggesting “that they had not always been together as two strings” (Ottaway, Strahm 1975, 311).

The Early and Middle Neolithic sites of the Cortaillod culture to which the beads discussed here are attributed can be found in western and central Switzerland. Most of these sites are clustered around Lake Zürich, although this distribution is no doubt a reflection of the state of research. Territories to the east of the Cortaillod sites concentrations were occupied by the Pfyn culture, while those to the west by the Chassey culture, the latter being genetically linked to the Cortaillod tradition (Ottaway, Strahm 1975, 307).

The two strings, designated K1 and K2, comprise 18 and 36 beads, respectively. Two of the beads have metal fillings and all of them carry wear traces although their interpretation as ornaments was rejected already by their discoverers (Ottaway, Strahm 1975) who see them rather as exchange items, something like “special purpose money”. The current work presents new evidence supporting in some manner this latter interpretation (Fig. 1).

Ottaway and Strahm stress two aspects of their finds. Firstly, the numbers of beads on the two strings represent a straightforward mathematical proportion (36 + 18). Secondly, the two strings clearly differ in terms of bead weights, there being twice as many light beads as there are heavy beads (cf. Fig. 2). String K2 consists of 36 beads weighing between 0.6 to 8.8 g, while the shorter string K1 consists of 18 beads weighing 8.1–17.3 g.



Fig. 1. The copper beads from Seeberg (after Strahm 1994).  
Ryc. 1. Miedziane paciorki z Seeberg w Szwajcarii (wg Strahm 1994).

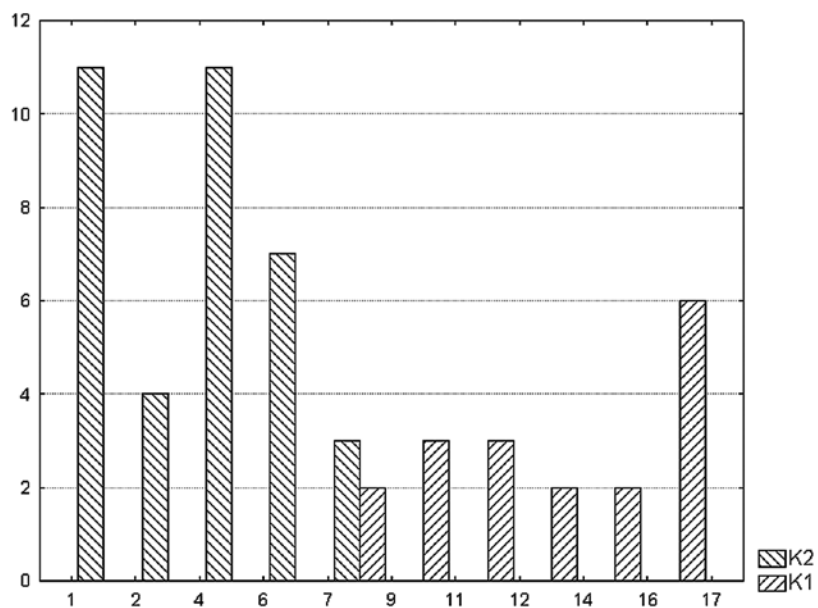


Fig. 2. Distribution of the weight variable for beads recovered from Seeberg, Burgäschisee-Süd. K2 – longer string of 36 beads; K1 – shorter string of 18 beads.  
Ryc. 2. Dyspersja zmiennej: waga dla paciorków z Seeberg.

## Analyses

Ottaway and Strahm (1975) quote several reasons why the Seeberg beads should not be interpreted as ornaments, most importantly:

- the various degrees of wear suggest that they had not always been together on the same string; in other words, the various beads were being removed and added to the strings;
- the numbers of beads on the two strings display the simple mathematical ratio of 36 to 18 which may have signified something.

The authors go on to say that the different weights and shapes of the beads also rule out the possibility that they were objects of a standardized value. In an earlier publication, Sangmeister and Strahm (1974, 255) distinguish six types of beads. Typological and metalographic analyses of the beads discussed here would suggest that they originate from different metal workshops (different types and chemical compositions) but from a single source. Also worth mentioning here is that the aforementioned analyses show the Seeberg finds to be very much like the Mondsee culture materials (Strahm 1994, 20).

It turns out, however, that the beads from Seeberg, Burgäschisee-Süd only seemingly lack weight standardization. A more detailed analysis revealed a hitherto overlooked characteristic of this deposit (Fig. 3),

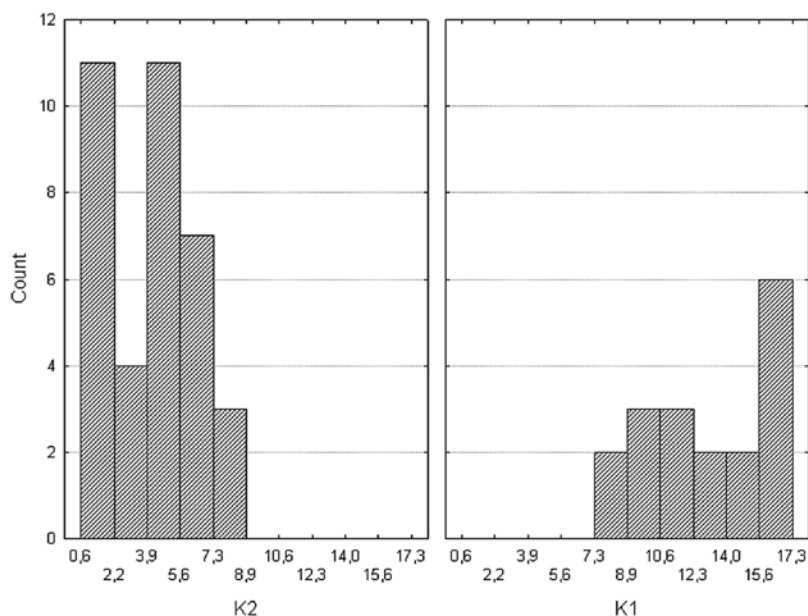


Fig. 3. Bead weight distribution for strings K2 and K1.  
Ryc. 3. Dyspersja zmiennej: waga dla rzemieni K2 i K1.

Analysis of beads from Seeberg, Burgäschisee-Süd

Table 1

Tablica 1

## Analiza paciorków z Seeberg

1.	2.	3.	4.	5.	6.
Bead weight (stem-leaf diagram representing actual data, e.g. 2 5 = 2.50 g)	Weight groups (cf. Table 2) distinguished based on variable distribution analysis	Typological groups distinguished in Sangmeister & Strahm (1974) – right column. When some groups are combined, we see full overlapping with weight groups (left column)	Strings	Number of beads	Basic statistical data for variable
0 569		G1,G2	K2	3	
1 0113		G1	K2	4	
1 788	Group 1	G1,G2	K2	3	
2 124		G2	K2	3	
2 5		G2	K2	1	25%
3 4		G2	K2	1	
4 1222		G3,G4	K2	4	
4 9		G3,G4	K2	1	
5 13444		G3,G4	K2	5	
5 599	Group 2	G3,G4	K2	3	median
6 01		G3,G4	K2	2	
6 579		G3,G4	K2	3	
7 2		G3,G4	K2	1	
8 00		G2,G4	K2,K1	2	
8 57		G2,G4	K1	2	
9 1		? G1	K1	1	
9 8		? G1	K1	1	
10 1		? G1	K1	1	75%
10 6	Group 3	G2	K1	1	
11 6		G2	K1	1	
12 0		G2	K1	1	
12 8		G2	K1	1	
13 8		G1	K1	1	
14 7		G1	K1	1	
15 0		G1	K1	1	
15 68	Group 4	G1	K1	2	
16 2		G1	K1	1	
16 78		G1	K1	2	
17 3		G1	K1	1	
min = 0.57 max = 17.32 sum N:				54	

Table 2

Weight groups of beads distinguished based on weight distributions illustrated in Figs 2 and 3

Tablica 2

Grupy wagowe paciorków wyróżnione na podstawie danych z tabel 2 i 3

	<b>N</b>	<b>Mean</b>	<b>Min</b>	<b>Max</b>	<b>St. dev.</b>
<b>Group 1</b>	14	1,55	0,57	2,54	0,65
<b>Group 2</b>	22	5,69	3,49	8,05	1,23
<b>Group 3</b>	12	9,74	7,28	12,80	1,74
<b>Group 4</b>	8	16,05	14,74	17,32	0,90

namely that the bead weight distributions for both the strings is bimodal, which is to say that two weight categories can be distinguished for each of the strings, viz. 0.7–3.0 and 3.0–7.0 g for string K2, and 8.0–14.0 and 14.0–17.0 g for string K1. Not all of these weight categories can be distinguished with equal precision, this being probably due in part to postdeposition phenomena and the already mentioned differences in wear degree (which in turn probably result from different “biographies” of the various beads). All this notwithstanding, the distinguished weight categories can be discerned even today without any serious problems. They will become even more apparent if we look at some comparative materials which do not display weight groupings of the kind we have here.

Let us consider the copper beads from Kelsterbach in southern Germany (Witter 1941; Behn 1938; Janus 1953). They were discovered in a Corded Ware culture amphora and are thus younger than the Seeburg beads. Not counting several spiral bracelets, the Kelsterbach deposit comprised 106 unprocessed copper beads which may have been half-finished products (blanks), although they too bear traces of intense wear. Given this, the authors describing them agree that they served a dual purpose, being at once ornaments and objects of exchange with a specific value attached to them. The weight distribution for this collection of artifacts (Fig. 3) features just a single peak<sup>1</sup>. Although the distribution is shifted to the left which means there are slightly more beads of less-than-average weight, it is still so close to being normal that the Kolmogorov-Smirnoff test does not provide grounds for challenging its

<sup>1</sup> The collection includes also two very heavy beads which were left out of this analysis. The entire Kelsterbach deposit is the subject of a separate publication.

normalcy<sup>2</sup>. We can thus assume that the Kelsterbach beads were intentionally manufactured as identically sized objects. The technology employed in this case was primitive, with molten copper being poured into drilled holes with sticks inserted in them.

## The Metrological Concept

Coming back to the Seeberg beads, we will now proceed to define the weight categories discernible in Figs 2 and 3. The weight figures for these categories are shown in Table 2. Although we are dealing with approximate figures, it is clear that the entire range of variability has a common denominator – ca. 5.6 g (Group 2). We have groups of beads with double and triple that value (Groups 3 and 4 respectively). The least distinct Group 1 should represent half the common denominator and the fact that it fails to fit the suggested pattern may be due to various reasons, most probably to wear which was most severe in the case of the smallest beads.

What we thus see in the Seeberg beads is a simple metrological structure involving manipulations of the basic value of ca. 5.5 g. This seems to be the most logical interpretation for the following reasons. Metrological systems in Antiquity were based on simple rules of proportionality (Petrušo 1992, 10) whereby specific units were either halved or doubled. Assuming in our case that the basic unit was the maximum value of the weight variable (ca. 16 g in Group 4; cf. Table 2) – which could have been one-fourth of the Ancient mina – then half that value would fall precisely midway between the maxima represented by Groups 2 and 3. This would obviously be out of line with the observed regularity. In the case of the Seeberg beads the figure that best fits the regularity is 5.6 g, which, incidentally, also happens to be represented by the largest number of finds (Fig. 5). This figure corresponds quite well to the Anatolian shekel, among others, although similar weight units were also in use in the Aegean region (Petrušo 1992).

We must not be discouraged by the fact that by today's standards these are not precisely defined weight categories. Given the rules of Ancient metrology, measurement units may be identified only according to their distribution which should be close to normal for the individual variable peaks (Fig. 5; see also Broadbent 1955, 46). We know why

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<sup>2</sup> The museum in Dortmund where the Kelsterbach beads were kept was damaged by fire in 1944 which destroyed part of the museum's collection. The beads suffered in the blaze and their original weight might have been affected (oral communication by the museum staff).

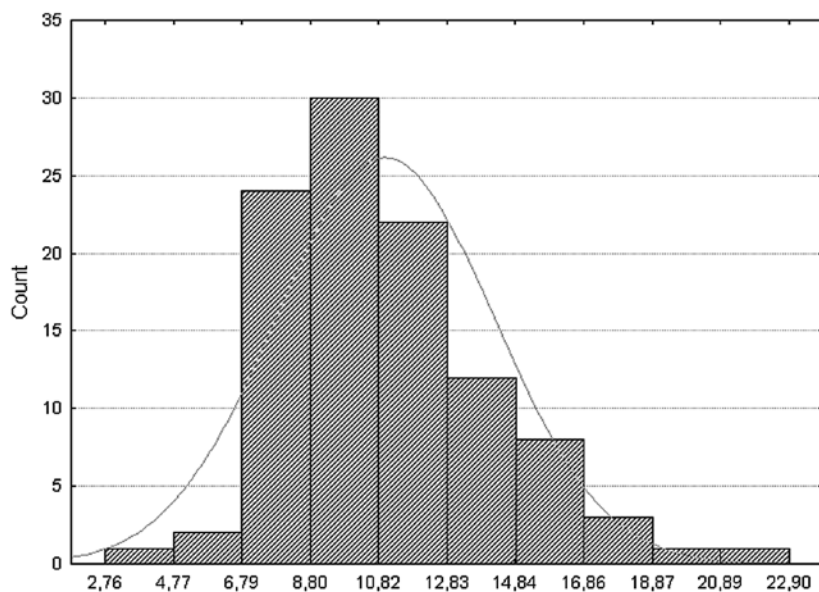


Fig. 4. Weight distribution of beads from Kelsterbach (Germany). This is an example of unimodal distribution of a variable lacking metrological peaks.  
 Ryc. 4. Dyspersja zmiennej; waga dla paciorków z Kelsterbach (Niemcy). Jest to przykład na rozkład jednomodalny, bez skoków metrologicznych.

some of the distributions of Ancient variables differ from the classical bell curves (Petrușo 1992, 70), with some of the reasons having to do with postdeposition processes. We also have mathematical models which provide good descriptions of these phenomena (Broadbent 1955; Dzbyński 2004).

It is hard to say whether the Cortaillod people considered weight alone when precisely categorizing their beads. This is doubtful when we look at the low weight of these artifacts. That said, the Cortaillod people would probably have no problems in formally distinguishing four weight categories in the analyzed collection of beads, considering that present-day scholars can easily distinguish more of them. In fact Sangmeister and Strahm distinguish six typological groups for both strings (Sangmeister, Strahm 1974, 255). If we superimpose the typological groups proposed by these authors on our weight distribution scheme (Table 1), we see a logical system emerging with the various types of beads coinciding with weight figures to give four weight-typological groups. We do not know the exact function of the Seeberg beads in the Cortaillod community but we may confidently assume that these categories did in fact exist, being carriers of specific quantitative and quali-

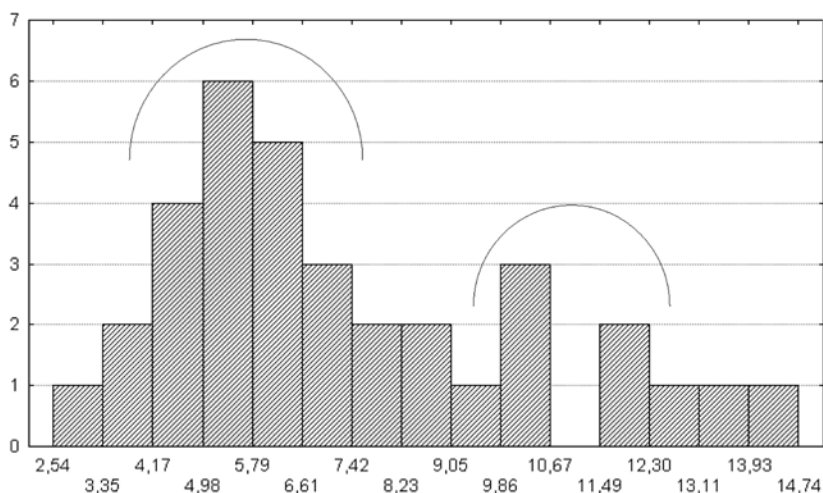


Fig. 5. The middle part of the weight variable distribution showing the distinct subdistribution on the left (Group 2). The subdistribution on the right (Group 3) is much less pronounced.

Ryc. 5. Środkowa część dyspersji zmiennej: waga dla paciorków z Seeberg uwidaczniająca maksimum grupy 2. Maksimum po prawej stronie (grupa 3) jest mniej zaznaczone.

tative values. We can also assume that these categories were verbalized and that they served specific functions in social communication processes of the kind described by, for example, Ottaway and Strahm (1975) who relied on ethnological literature in their analyses. It is thus to be concluded that the Seeberg beads represent not one but as many as four value categories which probably had to do with the amounts of raw materials used to make them. Also significant in this approach is the initial form of the beads which were made by twisting ordinary copper bars (Sangmeister, Strahm 1974, 193). Beads like this could be transported more easily. Assuming the above findings are correct, the copper beads would have been a very modern form of social communication in the Cortaillod culture<sup>3</sup>.

The analysis presented here has significant epistemological implications. It not only confirms the hypothesis of Attaway and Strahm (1975) who were the first authors to examine the beads of the Cortaillod culture and to interpret them as specific objects of exchange, but also adds new cultural elements to this hypothesis.

<sup>3</sup> Beads of this kind are very common in Cortaillod sites in Switzerland although we do not know their exact numbers.



## Conclusions: A Touch of Rationality in Prehistoric Europe?

Metrological structures were till now attracting little attention from archaeologists exploring the prehistory of Europe. This issue was being examined primarily by scholars looking at civilisation (Petrusco 1992; Nissen, Damerow, Englund 1993; Powell 1973) or the Bronze Age (Sommerfeld 1994; Lernerz-de Wilde 1995; Primas 1986). The only work outside this area of research is a book by Schmandt-Besserat (1992) in which the author attempts to reconstruct the emergence of writing in the Middle East. Schmandt-Besserat pointed out that phenomena of this kind are part of social communication and that they persist for extended periods. These phenomena evolve over time. Schmandt-Besserat also stressed that the first tangible traces of communication using metrological symbols in the Middle East probably appear in the Early Neolithic, with this communication serving to record certain values, agreements or administrative actions (recording systems) in the increasingly complex Neolithic societies.

A similar model of communication processes evolution may be suggested for Europe. The Seeberg beads are further evidence that already in the Neolithic Europe was experiencing a specific development of communication processes that till now remained elusive to archaeologists (cf. Dzbynski 2004; Georges 2006). This development may be tentatively described as rationalization of communication processes. The effectiveness of the type of communication we are dealing with here does not require its reference to the totality of culture (Habermas 1981, 91–143). A significant element of this phenomenon is emphasis on a new form of verbal communication, viz. the metrological concept thanks to which new semantic fields begin emerging in the universe of culture, in their turn leading to the emergence of symbols of a more universal nature that could be employed with greater ease in various contexts of use. Although symbols of this kind already possess a certain potential as communication media, they continue to remain strongly rooted in structures of the world we live in and their scope of expression continues to be limited. The process we are referring to here was probably brought about by the increasingly dynamic differentiation of Neolithic societies and the ever greater possibilities of communication and exchange between various groups of people, with the metrological concept significantly reducing the likelihood of misunderstandings in communication.

We thus have to do with an increasing body of evidence that communication processes were undergoing rationalization in European communities already in the Neolithic, just as was the case in the Mid-

dle East. Till now it was being assumed that this process began in the Bronze Age when we see a highly developed monetary metrological concept (Sommerfeld 1994; Lenerz-de Wilde 1995; Primas 1986). However, we already have examples of metrological systems dating to the Late Neolithic (Dzbynski 2004; Georges 2006) and studies are under way to reconstruct the whole of the “metrologization” process in Neolithic Europe. Already at this stage it is becoming clear that the European solutions differed from those in the Middle East. While we have analogies to the latter in southern Europe (Budja 1999), the metrological concepts in central Europe evolved based on the local substratum and European cultural traditions. The central-European concepts probably also spread over a smaller area. Needless to say, the phenomena we are discussing here cannot be considered outside the context of socio-economic changes in the Europe of those days.

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## Bibliography

### **Behn F.**

1938 Ein Grabfund der Steinkupferzeit von Kelsterbach, Starkenburg, *Germania* 22, 77–78.

### **Broadbent S. R.**

1955 Quantum Hypotheses, *Biometrika*, 42 (1), 45–57.

### **Budja M.**

1999 Clay tokens – accounting before writing in Eurasia, *Documenta Praehistorica* XXV, 219–235.

### **Dzbyński A.**

2004 *Metrologische Strukturen der Kultur mit Schnurkeramik*, Langenweissbach.

### **Georges V.**

2006 La volumétrie dans les agrosystèmes préhistoriques: céramique étalon (campaniforme) ou instrument de mesure complexe? Le contenant céramique et le modèle campaniforme, *Bulletin de la Société préhistorique française* 103 (3), 609–613.

### **Habermas J.**

1981 *Theorie des kommunikativen Handelns*, Frankfurt.

### **Janus W.**

1953 Neue Bodenerkunden aus Starkenburg, *Veröffentlichungen des Amtes für Bodendenkmalpflege im Regierungsbezirk Darmstadt* 2, 24–35.

### **Lenerz-de Wilde M.**

1995 Prähistorische Zahlungsmittel in der Kupfer- und Bronzezeit Mitteleuropas, *Fundberichte Baden-Württemberg* 20, 229–327.

**Nissen H. J., Damerow P., Englund R. K.**

1993 Archaic Bookkeeping: Early Writing and Techniques of Economic Administration in the Ancient Near East, Chicago.

**Ottaway B., Strahm Ch.**

1975 Swiss Neolithic copper beads: currency, ornament or prestige items?, *World Archaeology* 6, 307–321.

**Petruso K. M.**

1992 Ayia Irini: The balance Weights. An analysis of weight measurement in prehistoric Crete and the Cycladic Islands, Mainz am Rein.

**Powell M. A.**

1973 Sumerian Numeration and Metrology, Ann Arbor.

**Primas M.**

1986 Die Sichel in mitteleuropa I. *Prähistorische Bronzefunde* XVIII (2), München.

**Sangmeister E., Strahm Ch.**

1974 Die Funde aus Kupfer in Seeberg Burgäschisee-Süd, *Acta Bernensia* II, 189–259.

**Schmandt-Besserat D.**

1992 Before Writing. From Counting to Cuneiform, Austin.

**Sommerfeld Ch.**

1994 Gerätegeld Sichel. Studien zur monetärer Struktur bronzzeitlicher Horte im nördlichen Mitteleuropa, Berlin.

**Strahm Ch.**

1994 Die Anfänge der Metallurgie in Mitteleuropa, *Helvetica Archaeologica* 25 (97), 2–39.

**Witter W.**

1941 Neue Ergebnisse der Metallforschung in Deutschland und ihre Beziehung zu den Schnurkaramikern, *Mannus* 33, 70–80.

## Miedziane paciorki kultury Cortaillod w Szwajcarii. Próba ponownej interpretacji z wykorzystaniem idei konceptu metrologicznego

W 1967 roku, w trakcie badań wykopaliskowych na osadzie tzw. kultury Cortaillod w Seeberg, Burgäschisee-Süd (kanton Bern) w niewielkiej odległości od jednego z domostw, w płytkiej jamie znaleziono depozyt miedzianych paciorków. Nie dopatrzono się śladów woreczka lub innego pojemnika, co nie byłoby czymś niezwykłym w środowisku wilgotnym osady nadjeziornej tej kultury. Paciorki zdeponowane były bezpośrednio w jamie i nanizane na dwa rzemienie (ryc. 1). Niewielkie supły na końcach rzemieni zabezpieczały przed zsuwaniem się paciorków. Wszystkie paciorki były dobrze zachowane; wykazywały jedynie niejednakowy stopień utlenienia, co w efekcie doprowadziło odkrywców do konkluzji, że nie zawsze znajdowały się razem na obu rzemieniach.

Badacze, którzy podjęli się analizy tego znaleziska, podkreślają dwie istotne obserwacje dotyczące tych przedmiotów. Po pierwsze specyficzna liczba paciorków na obu rzemieniach odzwierciedla prostą proporcję matematyczną (36 + 18). Po drugie, egzemplarze z obu rzemieni różnią się wyraźnie wagą w taki sposób, że lekkich paciorków jest dwa razy więcej niż ciężkich. Relacja ta jest zilustrowana na ryc. 2. Na rzemieniu zawierającym 36 paciorków (K2) zawiązano egzemplarze ważące od 0,6 do 8,8 g, a na rzemieniu zawierającym 18 paciorków (K1) dyspersja wagi wynosi od 8,1 do 17,3 g.

Dalsze analizy statystyczne wagi paciorków prezentowane w niniejszym artykule prowadzą do konkluzji, że prezentują one prostą *strukturę metrologiczną*, polegającą na manipulacji podstawowej wartości, którą jest około 5,5 g. Nie są to w dzisiejszym rozumieniu precyzyjne kategorie wagowe. Zgodnie z zasadami antycznej metrologii, starożytne jednostki miar można identyfikować jedynie na podstawie ich rozkładu, który powinien być, dla poszczególnych skoków zmiennej, zbliżony do normalnego. Wydaje się ponadto oczywiste, że w społeczeństwie kultury Cortaillod nie posługiwano się wyłącznie ciężarem w celu precyzyjnej kategoryzacji paciorków. Przede wszystkim ich waga jest na tyle niewielka, że można mieć wątpliwości co do tego, jakim praktycznym czynnościom mogłyby one służyć. Tak niewielkie różnice pomiędzy poszczególnymi grupami mogłyby być używane jedynie w odniesieniu do bardzo cennych i rzadkich materiałów jak złoto, którego jednak

w kulturze Cortaillod nie stwierdzono. Pierwsze wagi szalkowe pojawiają się w Europie ok. 2 tys. lat później.

Jednakże już formalne rozpoznanie czterech kategorii *typologiczno-wagowych* wśród nich nie stanowiło zapewne problemu dla społeczności kultury Cortaillod, skoro współcześni badacze rozpoznają aż sześć grup typologicznych. Jeżeli naniesiemy te grupy na skalę zmiennej „waga” (tabela 1) przekonamy się, że poszczególne typy paciorków można skojarzyć z ich wagą tak, by tworzyły logiczny system, składający się z czterech grup typologiczno-wagowych. Prawdopodobnie w ten sposób oceniano różną wielkość paciorków, tzn. stosowano *miarę rangową*, posługującą się uporządkowaniem kolejnych wielkości według jednego, dwóch podstawowych wyróżników. Tymi wyróżnikami były zapewne: wielkość zewnętrzna paciorka, jego względna grubość oraz wyczuwalna masa.

Nie wiadomo, w jaki dokładnie sposób paciorki z Seeberg funkcjonowały w społeczności Cortaillod, możemy jednak śmiało przypuszczać, że istniały cztery kategorie będące nośnikiem konkretnych *wartości* jakościowo-ilościowych. Były one niewątpliwie przedmiotem społecznej uwagi, podlegały werbalizacji oraz spełniały konkretne funkcje w procesach komunikacji. Mogły służyć jako pewien specjalny środek wymiany, znany z literatury etnologicznej *special purpose Money*, na co powoływali się już pierwsi badacze tego znaleziska. Ważne jest przy tym, że paciorki z Seeberg posiadały nie jedną, ale właśnie cztery kategorie wartości, odnoszące się zapewne *również do ilości* surowca, z którego były wykonane. Nie bez znaczenia w tym ujęciu jest fakt, że pierwotna ich forma była zwykłą sztabką miedzi. Poprzez jej skręcenie otrzymywano paciorki, które w ten sposób było łatwiej transportować.

W kontekście powyższych wywodów miedziane paciorki w kulturze Cortaillod byłyby dość nowoczesnym sposobem komunikacji społecznej, który moglibyśmy śmiało zakwalifikować jako *racjonalny*. Choć trudno przypuszczać, że sprawdzano ich wagę w kontekście różnych interakcji społecznych, to wydaje się, że cecha ta mogła już spełniać jedną z głównych ról w kategoryzacji i waloryzacji tych przedmiotów, tzn. była *zauważalną* cechą każdego paciorka.

