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VARIABILITY OF INDIVIDUALS BURIED IN COMMON GRAVES OF THE BRONZE AGE IN THE TERRITORY OF POLAND

ABSTRACT: *The macro- and microelements concentration in 30 teeth obtained from 30 individuals was analyzed. The investigated individuals had been explored from 3 common graves of the Trzciniec culture (Bocheniec). This paper is an attempt at providing an anthropological interpretation of the phenomenon of Trzciniec collective burials by finding variations at the level of macro- and microelements accumulated in teeth in the aspect of possibly insignificant biological and environmental differentiation of the individuals examined. As a result a very low inter-individual variability was observed in the concentrations of Ca, Sr, Ba and Zn. The Sr/Zn and Zn/Ca ratios showed that the diet of the examined Bocheniec individuals was exceptionally rich in animal protein.*

KEY WORDS: *Macro- and microelements – Paleodiet – Collective burials – Bronze Age – Poland*

INTRODUCTION

Analyses of macro- and microelements found in bone material have become a very important research tool of physical anthropology, as they offer a possibility of examining a diet (Sandford 1992, Wolfspurger 1992, Schutkowski 1994, Szostek *et al.* 2003). The elements whose analysis provides wealth of information about the biological status of a population under study are strontium, zinc, calcium, copper, iron and barium (Burton, Wright 1995, Glen-Haduch *et al.* 1997, Schutkowski *et al.* 1999). The strontium-calcium, strontium-zinc and barium-strontium ratios are particularly sensitive indicators. For some time it has been well known that strontium absorption and accumulation are in inverse proportion to the position of an organism in the trophic pyramid. Herbivores absorb and accumulate large amounts of strontium directly from the environment, whereas carnivores accumulate this element secondarily – via consumption of plants or other animals (Radosevich 1993).

During the Late Bronze Age (1900–1200 BC) the regions of eastern and central Poland were represented by the Trzciniec Culture. Funeral rites of the Trzciniec culture

are vastly diversified, but at the same time skeletal graves outnumber cremation ones. Among the former there can be distinguished individual and common, flat and mound-like graves. The frequent occurrence of collective burials is one of the most enigmatic traits of Trzciniec funeral rites, which contributes to the specificity of sepulchral practices of the Trzciniec cultural circle societies in both their western and eastern segments (Makarowicz 2000). In common graves, the dead were buried in sepulchral caves in a strictly determined, custom- and ritual-imposed manner. There could be seen a tendency towards an antipodal arrangement of corpses, whose heads were placed in the northern or southern part of a grave. The majority of the dead lay on one side in a cramped position, with arms positioned in the vicinity of the head. Regarding the mortality pattern of individuals buried in common graves, attention should be paid to the balanced ratio between masculine and feminine burials, and a relatively high proportion of infants remnants. These findings indicate that the family character of burial customs, with objects destined for basic families or tribes, was a characteristic feature of the cult of the dead in the Trzciniec Culture (Matoga 1985, Włodarczak 1998, Szczepanek 2001).

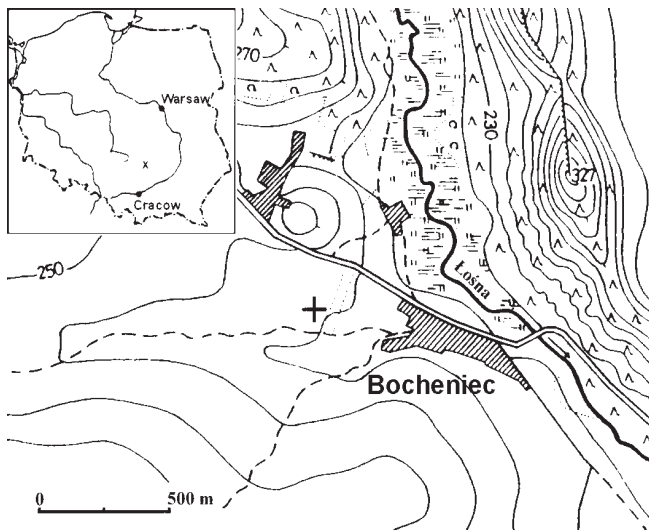


FIGURE 1. Localisation of the cemetery: X – Bocheniec.

Anthropological studies of Trzciniec Culture skeletons are of great importance to the research into culture and population transformations in the Bronze Age in the territory of Poland. This paper is an attempt at providing an anthropological interpretation of the phenomenon of Trzciniec collective burials by finding variations at the level of trace elements accumulated in teeth in the aspect of possibly insignificant biological and environmental differentiation of the individuals examined.

MATERIALS

The common graves of the Trzciniec culture from Bocheniec (Figure 1) contained the remains of 49 individuals (Szczepanek 2001).

In Grave pit 114 there were buried at least 8 bodies (2 of them of *Infans* age, a woman, a man, and 4 adults of undetermined sex), in Grave 118 – at least 12 bodies (2 of them of *Infans* age, one of *Juvenis* age, 5 women, 2 men and 2 adults of undetermined sex), and in Grave 126 – at least 29 individuals (9 of them of *Infans* age, 2 of *Juvenis* age, 9 women, 5 men, and 4 adults of undetermined sex) (Figures 2, 3).

The assay was carried out on 30 teeth obtained from 30 individuals. The individuals whose age ranged from *Infans I* to *Senilis* came from common graves explored at Bocheniec: 114 (6 individuals: a woman, a child and 4 adults of undetermined sex), 118 (2 individuals: a woman and a man) and 126 (22 individuals: 5 women, 5 men, 4 adults of undetermined sex, and 8 children). The analysis was carried out on samples of the soil from a grave cavity and – as a trophic background – on an animal (cattle) tooth which had been intentionally placed in the grave pit.

METHODS

Before the analysis was undertaken, each tooth was carefully washed in an ultrasonic washer, being wholly immersed in water obtained using the Milipore Water Purification System. Afterwards, the teeth studied were dried at a temperature of 60° C, and weighed with an accuracy up to 0.001 g. The thus rendered material was subjected to wet mineralization in the 4:1 mixture of the spectrally pure acids: nitric (70% Suprapur, Merck) and perchloric (65% Suprapur, Merck). After mineralization, samples were quantitatively transferred to calibrated flasks, and were diluted with spectrally pure water. The thus prepared samples served to determine the content of the following elements: Ca, Ba, Sr and Zn, using the atomic

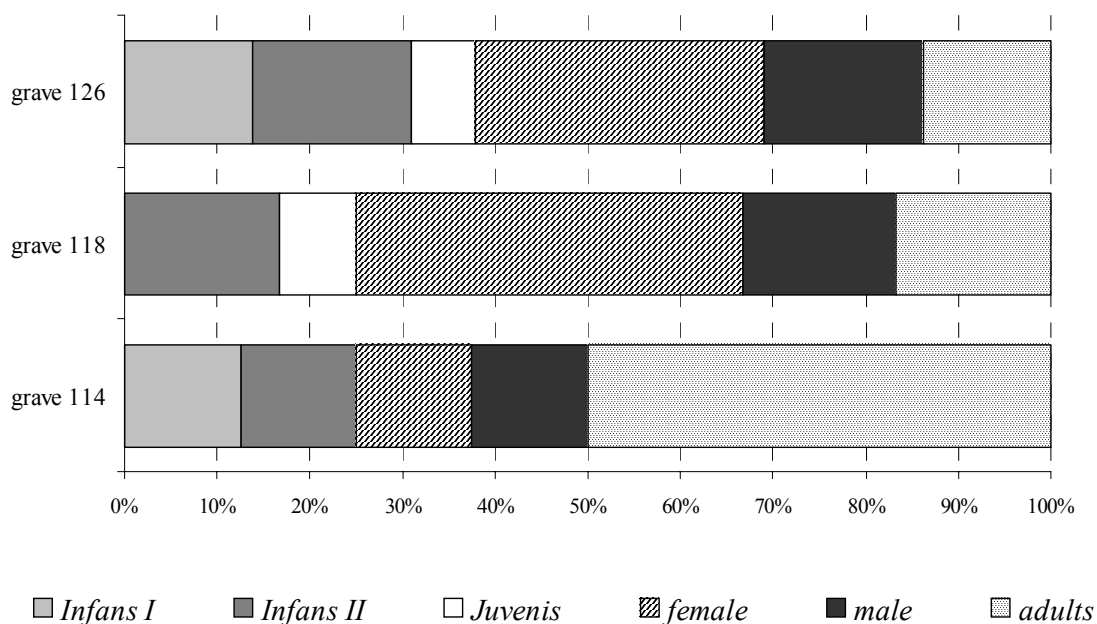


FIGURE 2. The anthropologically determined individuals in common graves.

absorption spectrophotometr ICP AES "PLASMA 40". Then the Zn/Ca and Sr/Zn ratios were calculated.

Statistical estimation was based on a multifactor analysis of variance (ANOVA), and the Carlo Bonferroni procedure was used as an *a posteriori* verifying test. Null hypotheses were verified at the significance level $p=0.05$.

RESULTS

The average content of the micro- and macro-elements under study, as well as the ratios calculated on their basis are shown in *Table 1*.

Owing to a close-to-neutral pH of the soil, or due to the lack of any statistical relationship between the content of the remaining elements, determined in the teeth and the soil, the influence of external *post mortem* factors – e.g. diagenesis – on the odontological material under study should, in all probability, be excluded. Only in one case an elevated Zn content was observed in the tooth examined: this was probably due to the influence of a bronze object deposited in the grave pit. The individual with a high Zn level was excluded from further analyses.

The material under analysis came from 3 roughly concurrent common graves discovered in the Bocheniec cemetery. Mean values of the Zn/Ca and the Sr/Zn indices, obtained for the individuals buried in Graves 114, 118 and 126, are compared below (*Figures 4, 5*).

The lack of differences in the content of macro- and micro-elements in the teeth of individuals buried in Graves 114, 118 and 126 enabled a joint analysis of the Trzciniec culture population buried in the Bocheniec cemetery. Successive graphs (*Figures 6, 7*) show values of the calculated Zn/Ca and Sr/Zn indices in the human teeth under study, depending on the age of the buried individuals. For comparative purposes, the index values obtained for the animal tooth discovered in the pit of Grave 126, as well as the values calculated for the healthy teeth of adults



FIGURE 3. Bocheniec – Grave 126.

TABLE 1. Mean concentrations of elements in human teeth compared with the soil and an animal tooth from the same site.

	Ba µg/g	Ca %	Sr µg/g	Zn µg/g	Ba/Ca	Ba/Sr	Sr/Zn	Zn/Ca
individuals								
N	30	30	30	30	30	30	30	30
x	67.58	32.76	90.14	177.05	2.05	0.75	52.65	5.41
Sd	21.6	2.16	21.27	37.11	0.59	0.16	14.68	1.11
Vs	31.9%	6.6%	23.6%	20.9%	28.8%	21.6%	27.8%	20.5%
a cattle								
1	108.20	32.48	116.65	52.25	3.33	0.92	223.23	1.6
soil								
1	65.84	0.86	14.08	24.29				
2	26.78	0.90	10.52	22.99				
3	23.61	0.99	9.17	15.36				
4	17.60	0.91	4.32	13.27				

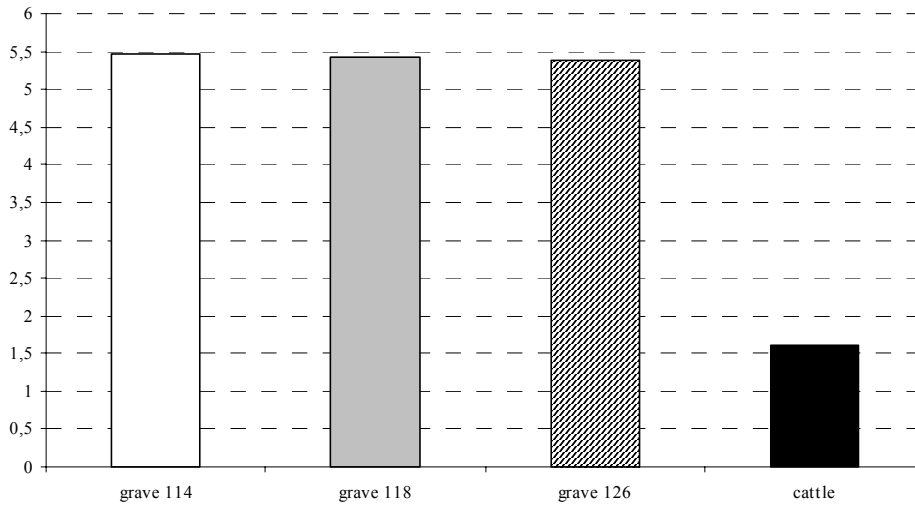


FIGURE 4. Zn/Ca ratio in common graves from Bocheniec.

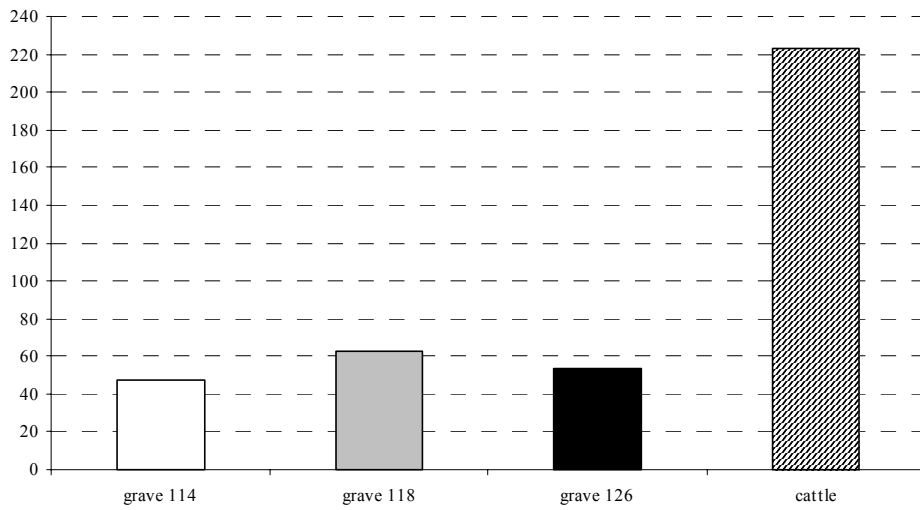


FIGURE 5. Sr/Zn ratio in common graves from Bocheniec.

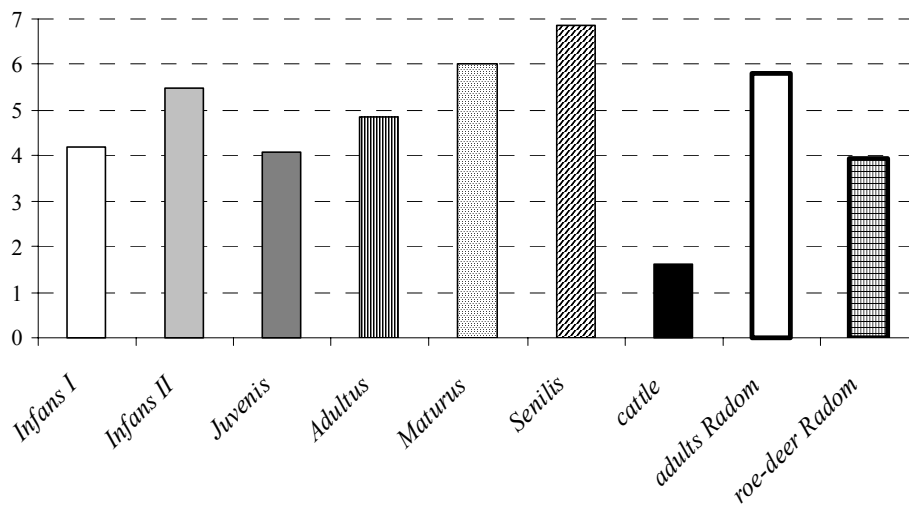


FIGURE 6. Zn/Ca ratio in different age groups.

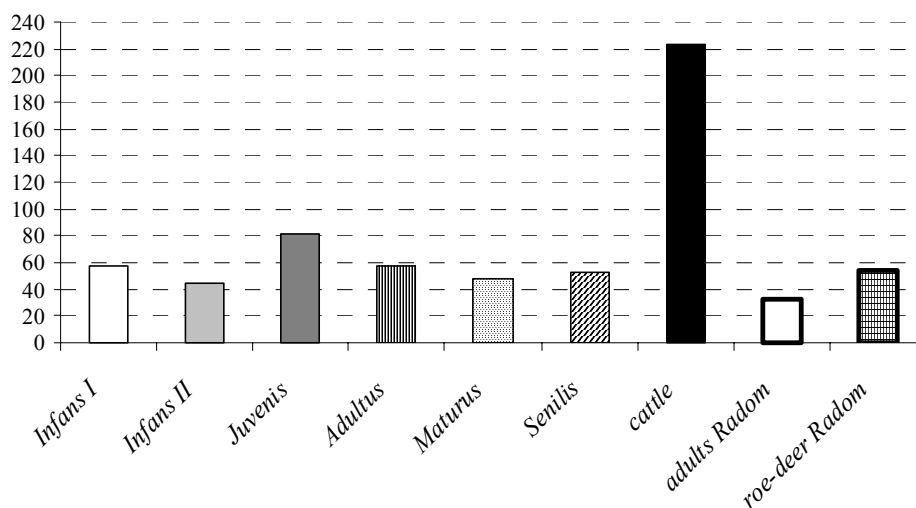


FIGURE 7. Sr/Zn ratio in different age groups.

presently inhabiting Radom and of the roe deer hunted down in the vicinity of Radom in the past 10 years have also been shown. The questionnaire data indicate that the group of Radom inhabitants had good nutritional status with the prevalence of animal protein-containing products in their diet.

DISCUSSION

In the archaeological literature it has already been pointed out that in the collective graves at Trzciniec there are no signs of elitism in the form of rich grave-goods (e.g. weapons, prestige goods and hunting artefacts). Neither is the status of the dead emphasised. On the contrary, the burial offerings and similar artefacts (ornaments), together with the laying of the dead, apparently suggest that the classic and late Trzciniec communities were rather egalitarian or low-ranked (Makarowicz 2000).

A statistically insignificant, very small difference could be seen between individuals derived from the common graves examined (Table 1). Such insignificant inter-individual variability is extremely rare in the case of historic osteological material subjected to a chemical analysis. This low variability may testify to a close relationship between the individuals under analysis, and to their very homogeneous habitat.

Statistically significant increases with age of an individual were observed in the Zn content and the Zn/Ca ratio (Figure 6). The lowest levels of that ratio were found in children's teeth. The Zn/Ca ratio for the examined group of individuals from Bocheniec was higher than that for the cattle. Both zinc content and the above-mentioned ratio indicate a relatively high amount of the consumed protein of animal origin. Thus it may be assumed that the access to qualitatively better food was undoubtedly easier for older individuals, i.e. for those who achieved a higher position in the family or social hierarchy. Such differences may

also stem from the transfer of family dietary habits to successive generations (children and adults). At the same time, no significant differences in the Sr/Zn ratio were found between the studied individuals (Figure 7).

CONCLUSIONS

1. Very low inter-individual variability was observed in the concentrations of Ca, Sr, Ba and Zn.
2. Low variability in the concentrations of Ca, Sr, Ba and Zn determines the high degree of kinship between individuals buried in collective graves.
3. The diet of the examined Bocheniec individuals was exceptionally rich in animal protein.
4. The individuals of that population increased the consumption of animal protein with age.

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