Osteoarchaeological assessment of generalized stress indicators in skeletons from the Tápé-Széntéglaégető cemetery, Hungary

Agata Kostrzewa - Warsaw University, Poland and
László Paja - University of Szeged, Hungary

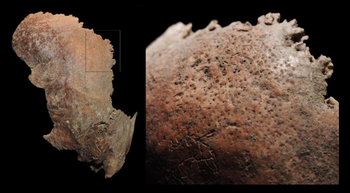


Fig. 1. Cribra crani i on the occipital squama (grave 40).

Fig. 2. Superficial lytic lesions (hipervascularization) on the anterior surface of vertebral body (garve 40).

Introduction / Research questions

Skeletal stress markers are non-specific skeletal and dental anomalies which usually are adaptive responses to stressors working on the body during one's life and can be related for example to diet, diseases or traumas. Differences in stress marker patterns are said to be in association with different processes. e.g. infection, famine, and these processes may develop with different prevalence amongst different social status people (Roberts and Manchester: 2005).

As the Bronze Age is the period with increasing differences in social stratification, this seemed like a perfect period to examine the above-mentioned phenomena. Supplementing archaeological data with stress marker analysis may provide us more complex perspective on quality of life of past populations or possible social status of individuals.

The main aim of our study is to compare the degree of development of stress markers in selected individuals from the Tápé-Széntéglaégető cemetery in relation to archaeological data about burial equipment of individuals examined to see if there is some kind of characteristic pattern. Is it possible to confirm that people buried with richer equipment are characterized with better biological condition (Roberts, Manchester; 2005)?

Fig. 3. Active proliferative periostitis on the visceral surface of ribs (grave 157).

Fig. 4. Enamel linear hipoplasia on upper mesial incisors (grave 117).

Archaeological background

The multi-component site of Tápé-Széntéglaégető is located in the Great Hungarian Plain at the confluence of Maros and Tisza rivers, on the right side of Tisza in the area of present Szeged (Fig.13).

Graves dated back to the Bronze Age, Gepids, Avars, and Hunnic, Sarmatian and Árpád Age settlements had been excavated in this site. The Late Bronze Age part of the cemetery which we are focusing on is related to the Tumuli Culture (Tóth; 1994, Vörös; 1992, Trogmayer; 1960, 1961, 1962, 1963, 1964). In the Late Bronze Age (1400-900 BCE, Tumuli Culture) Tápé-Széntéglaégető cemetery almost 700 graves were excavated, but the estimated total number of burials in Tápé is 1300-1500, including both inhumations and cremations with distinct domination of inhumations indicating the influence of Middle Bronze Age Perjámos Culture (Csányi; 2003).

Fig.5. Periosteal lesions on the surface of long bones (from left to right :grave 157, 157, and 225).

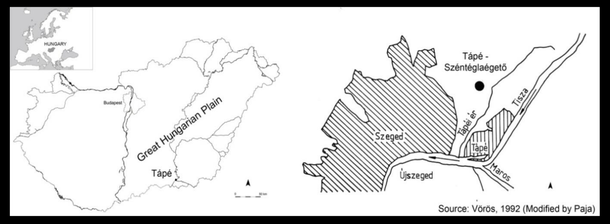


Fig. 11. Localization of Tápé – Széntéglaégető site.

Fig. 6. Periosteal lesions next to mandibular foramen refer to infection (grave 157).

Fig. 7. Healed fracture of a metatarsal (grave 40).

Fig. 8. Congenital vertebral fusion in the thorasic spine. Left: anterior view; right: posterior view (grave 25).

Materials and methods

Our sample originates from the Late Bronze Age part of cemetery, where both rites of burial coexisted together. For the purpose of our studies we chose 16 individuals' skeletal remains, all of the osteoarchaeological specimens are from inhumations. All of them were chosen by number of bronze items in the graves, and we created two sub-groups of individuals (Fig. 12).

without bronze items	Gr_nr	Age	Sex	Bronze									Sum of bz objects
				Ring	Footring	Bracelet	Pin	Pendant	Spiral necklace	Belt	Blade	Awl	Plate	
1	46	Adultus	M	0	0	0	0	0	0	0	0	0	0	0
2	59	Maturus	M	0	0	0	0	0	0	0	0	0	0	0
3	72	Maturus	F	0	0	0	0	0	0	0	0	0	0	0
4	84	Maturus	M	0	0	0	0	0	0	0	0	0	0	0
5	99	Adultus	M	0	0	0	0	0	0	0	0	0	0	0
6	109	Maturus	M	0	0	0	0	0	0	0	0	0	0	0
7	117	Adultus	F	0	0	0	0	0	0	0	0	0	0	0
8	274	Adultus	F	0	0	0	0	0	0	0	0	0	0	0
with bronze items	Gr_nr	Age	Sex	Ring	Footring	Bracelet	Pin	Pendant	Spiral necklace	Belt	Blade	Awl	Plate	Sum of bz objects
1	20	Maturus	M	0	0	0	1	0	0	0	0	0	0	1
2	25	Maturus	F	0	0	4	2	3	1	0	0	0	0	10
3	40	Adultus	M	0	0	0	1	0	0	0	0	0	1	2
4	65	Adultus	F	0	0	0	2	0	0	0	0	0	0	2
5	73	Adultus	F	2	4	3	2	3	1	1	0	0	0	16
6	136	Maturus	M	1	0	0	0	0	0	0	1	0	0	2
7	157	Maturus	M	0	0	0	0	0	0	0	1	1	0	2
8	225	Adultus	M	0	0	0	0	0	0	0	0	1	0	1

Fig. 12. Bronze items recorded with our sample individuals.

The skeletal material is stored at the Department of Biological Anthropology, University of Szeged. The sample contains individuals belonging to Adultus (20-39 ys) and Maturus (40-59 ys) age categories, all of them were found in the southern part of cemetery. Concerning sex determination and age estimation we relied on the analyses carried out by Farkas and Lipták (1975) (Fig. 12 and 13). We recorded macro-morphologically detectable lesions related to different stress markers, our recording and later analyses were based on palaeopathological (e.g. Aufderheide, Rodriguez-Martin; 1998, Ortner; 2003, Roberts, Manchester; 2005, Waldron; 2009) and modern medical (e.g. Resnick and Niwayama; 1995) publications. Moreover, other macroscopically visible bone pathologies were also recorded (Fig.6-8), these lesions may give us a more complete picture of quality of life of single individuals. We have to note, that complete palaeopathololical analysis is not demonstrated here.

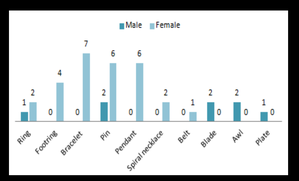


Fig. 9. Number and type of bronze items in the grave in relation to the sex of individuals.
Fig. 10. Orientation, side, and sex in the grave in relation to number of bronze items in the grave.

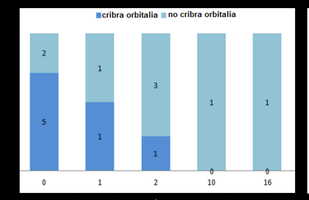
Grave number	Orientation	Side	Number of bronze items	Sex
117	NW-SE	right	0	F
72	S-N	left	0	F
274	S-N	left	0	F
99	SE-NW	left	0	M
84	SE-NW	right	0	M
46	S-N	back	0	M
59	S-N	right	0	M
109	SW-NE	left	0	M
225	E-W	right	1	M
20	E-W	right	1	M
65	S-N	left	2	F
40	NE-SW	left	2	M
157	NE-SW	right	2	M
136	SE-NW	right	2	M
25	E-W	left	10	F
73	E-W	left	16	F

Stress Indicators

The main stress markers we choose are cribra cranii (Fig.1.), cribra orbitalia (Fig.14.,15.), linear enamel hypoplasia (Fig.4.), periostitis (Fig. 5.), endocranial lesions (Fig. 17.) and hypervascularisation (Fig.2.) Many factors may be involved in development of such skeletal and dental anomalies, as they are an adaptive response to stressors working on the body during the years of development (Roberts, Manchester; 2005). The response might be determined by several factors like genetic predisposition, individual's immune status, , environmental influence, and impacts of socio-cultural systems. However, it should be remembered that lack of stress indicators in the skeleton may refer to not only a healthy person but also person who never got a chance to recover (Siek; 2013, Wood et al.;1992).

Without bronze items	Gr_nr	Age	Sex	LO	LCO	RO	RCO	CC	Nr of Teeth	LEH	TA	C	CL	PL	LRP	RRP	EL	HV	ATH	SD	F	OP
1	46	Adultus	M	1	1	1	1	0	17	1	9	0	2	0	N	0	1	0	0	0	0	0
2	59	Maturus	M	1	1	1	1	1	20	4	13	0	4	1	1	1	1	0	1	0	0	1
3	72	Maturus	F	1	0	1	1	0	21	0	19	0	1	1	2	4	1	0	0	1	0	1
4	84	Maturus	M	1	0	0	0	0	16	1	16	0	6	1	0	0	1	0	1	0	0	1
5	99	Adultus	M	1	0	0	0	0	26	10	5	3	6	1	5	7	0	0	0	1	1	1
6	109	Maturus	M	1	1	1	0	0	0	N	N	N	N	1	0	0	1	0	1	0	0	1
7	117	Adultus	F	0	0	1	1	0	29	14	22	5	3	1	0	2	0	0	0	1	0	0
8	274	Adultus	F	0	0	0	0	0	0	N	N	N	N	0	0	0	1	0	0	0	0	0
With bronze items	Gr_nr	Age	Sex	LO	LCO	RO	RCO	CC	Nr of Teeth	LEH	TA	C	CL	PL	LRP	RRP	EL	HV	ATH	SD	F	OP
1	20	Maturus	M	0	0	1	1	0	8	4	11	0	1	1	0	0	0	N	0	0	0	0
2	25	Maturus	F	1	0	1	0	0	24	2	24	9	13	1	1	3	1	0	1	1	1	0
3	40	Adultus	M	0	0	1	1	1	23	15	16	0	12	1	0	1	1	1	0	0	0	1
4	65	Adultus	F	1	0	1	0	0	11	0	11	5	0	0	0	0	1	1	1	1	0	1
5	73	Adultus	F	0	0	1	0	0	16	1	16	3	12	0	0	0	1	0	1	0	1	1
6	136	Maturus	M	1	0	1	0	0	25	13	25	0	23	1	0	4	0	0	0	0	0	1
7	157	Maturus	M	1	0	1	0	0	1	0	5	0	5	1	6A	1(16)	1	0	0	1	0	1
8	225	Adultus	M	1	0	1	0	0	28	1	28	2	16	1	3	2	1	0	1	1	0	0

Fig. 13. Occurrence of stress indicators in examined skeletons LEGEND: Left orbit (LO); Left cribra orbitalia (LCO); Right orbit (RO); Right cribra orbitalia (RCO); Cribra cranii (CC); Linear enamel hypoplasia (LEH; yellow); Teeth attrition (TA); Caries (C); Calculus (CL); Periosteal lesions (PL); Left rib periosiitis (LRP); Right rib periosiitis (RRP); active (A); endocranial lesions (EL); hypervascularization (HV); arthrosis (ATH); spondylosis deformans (SD); other pathologies (OP); unidentified fragments ((...)).



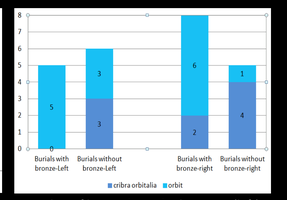


Fig. 14. The incidence of cribra orbitalia in relation to number of bronze items in the grave (left).
Fig. 15. The incidence of cribra orbitalia in relation to preserved orbits (right).

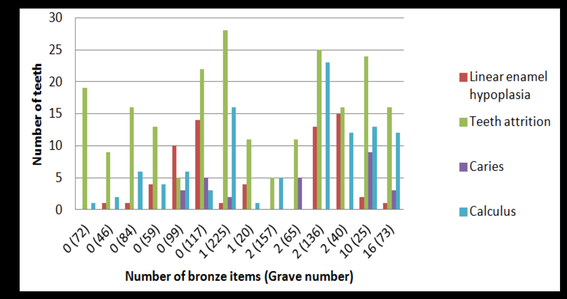


Fig. 16. Shape of teeth in relation to number of bronze items.

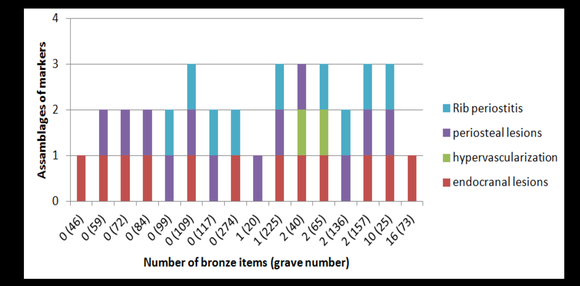


Fig. 17. Assamblages of non-specific stress indicators in relation to bronze items in the grave.

Results

To understood social role and status of particular individual, more complex approach is required. That's why we decided to check if there is any relation between number of bronzeitems in burials to sex, grave orientation or side of the body on which the dead were buried. We observed differences between male and female burials based on burial furnishing in oursample (Fig. 20). We can also see a difference in orientation of the graves in relation to number of bronze objects. There is clearly breaking point between two group (Fig. 21) where themajority of owners of bronze objects were buried on or close to the east-west axis, while most of the individuals without any bronze object on the south-north axis. This may suggest that number of bronze items might be appropriate differentiating criterion for our sample.

The first we recorded was that there is a visible degree in occurrence of cribra orbitalia with increase of number of bronze items in burial (Fig.16.). Figure 17 is showing us the relationship between the amount of preserved orbits in both groups and diagnosed cribra orbitalia. We can observe much more cases of the disease in group without bronze items, which might confirm the theory about the correlation between the development of cribra orbitalia and probable lower social status.

Unfortunately, some individuals in our sample had no teeth preserved. Despite this we can observe few tendencies (Fig.18.). Linear enamel hypoplasia does not seem to be connected with only one group. But we definitely can see clearly visible tendency in occurrence of calculus and caries. The prevalence of these alterations is higher in the group with richer burial equipment, it might be related to different type of food they consumed.

During the anthropological analyses we also recorded non speciffic stress indicators. We found few cases of hypervascularization in the thoracic spine (sub-sample 'graves with bronze items'). Rib periostitis was common in both groups, indicating some lung infection, in all probability. In the majority of cases irregularities (mainly undulation) on the visceral surfaces can be seen, only in one single case proliferative bone lesions refer to active periosteal processes were recorded (Fig. 3.). As several palaeopathological publications (e.g. Pálfi et al. 2012, Spekker et al. 2012) suggest that co-existance of diferent non-specific stress markers may be related to early-stage tuberculosis, we examined the co-existance of these lesions (Fig. 19). Interestingly people from the group with higher number of bronze items in burials are showing the presence of bigger assemblages of the markers. However, we can't say anything about the underlying disease in these cases, prevalence of tuberculosis (or infectious processes, at least) might seem to be higher in the latest group.

Conclusion / Future studies

However, the sample is too small to draw conclusion on the whole population buried in the Late Bronze Age Tápé- Széntéglaégető cemetery, our project has demonstrated that the previously assumed general association between stress markers and number of bronze artifacts found in graves is not present. Except for cribra orbitalia, we didn't find less stress markers in skeletal remains with more bronze artifacts, nevertheless, these results can easily change, with higher number of examined individuals. Our project shows, how important is the multidisciplinary approach in archaeological-bioanthropological research. For further studies it would be very useful to analyze the rest of inhumations from this site in case to see if the observed tendencies can persist through the bigger sample. Our project is a promising start for further studies of the subject.

References: Hard copy available upon request.

The support of Quinnipiac University, NSF/REU grant, Department of Biological Anthropology (University of Szeged), BAKOTA staff is greatly acknowledged