

Introduction and Background

On the Great Hungarian Plain during the Bronze Age, there was a general shift from egalitarian societies to more complex societies; many have reasoned that the shift was due to trade networks [7]. A fixed settlement system developed, and with it came an urban transformation. A hierarchy settlement structure was forming, along with new material culture that spread through the advancing trade routes. There seems to be evidence of evolving funeral practices a possible indicator of the changing social system amongst the peoples in the Carpathian Basin [16].

The Bronze Age Körös Off-Tell Archaeology (BAKOTA) Project focuses on the Békés 103 site, a Bronze Age cemetery in the Körös region of Hungary. Excavations conducted in the cemetery have uncovered 68 burials, of which 58 are cremations interred in ceramic funerary urns [13]. This study will present preliminary analysis of color patterns of the burned human bone found in the cemetery.

Previous studies on bone color show a correlation between the temperature of the pyre and the color of the burned bone [3, 4, 5, 8, 11, 13, 14, 15]. At lower temperatures, the yellowish white color of bone will turn tan. As the temperature rises, the tan color of bone will turn dark brown, black, and blue-grey (Figure 1). Finally, when a certain high temperature is achieved the bone will calcine and turn white and/or blue-white (Figure 2, 3, 4, respectively) [3, 5, 8, 14].

This study aims to analyze bone calcination and color in order to compare data across different age and sex groups within the cemetery. The results of this research may show a difference in how different groups of people were treated in Bronze Age Hungary.

Materials & Methods

Materials

The bones included in this study were 19 cremation burials. One double burial (HB 8) was separated into subadult and adult bones and was included in the sample.

All diagnostic bones were scored from each human burial. A 20% sample of the remaining cranial and postcranial bone fragments was taken as this allowed for a more efficient yet still representative collection of data [2].

Figure 5 includes all 20 human burials (including HB 12 which was not listed in Table 2 due to it spanning multiple subadult age categories), while Figure 6 only includes 18 human burials, because two of the human burials were omitted as their age categories were unable to be refined. The four age categories were utilized as a means of age estimation and possible material culture significance based on these age categories in the cemetery [13].

Methods

Munsell Soil Color Charts were used to identify a burned bone fragment's hue (color observed), value (lightness), and chroma (richness) [4, 9]. One predominant color (color that covered the majority of the bone's outer surface) was chosen and recorded as well as other minor colors found on the bone [1, 11].

Ultimately, bone color data were collapsed into two categories: White and Non-White. The data were analyzed using chi-square.



Figure 2 – HB15220
Adult Postcranial Bone – Calcined with some orange brown color



Figure 3 – HB22102
Subadult Ectocranial Bone – Calcined with some light greenish gray



Figure 1 – HB48089
Adult Postcranial Bone – Dark bluish gray with some calcined edges



Figure 4 – HB28133
Adult Endocranial Bone – Light bluish gray

Calcination Percentages of Subadults vs. Adults

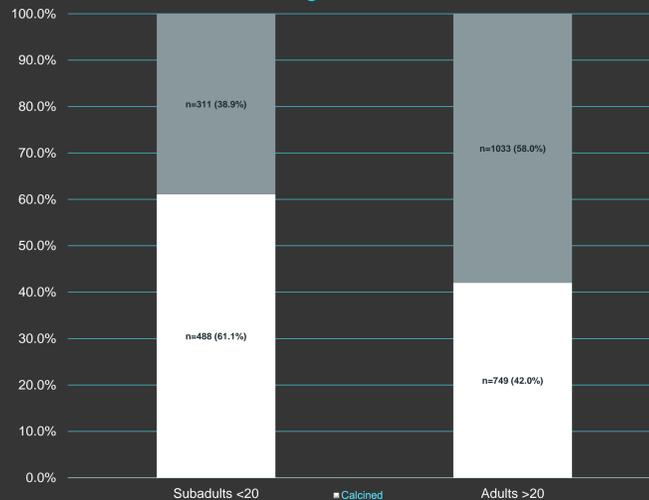


Figure 5. Comparison bar graph of Munsell Color Scores between Subadults and Adults.

Human Burials Analyzed

Age Group	Number of Burials	Category
Adults (Ages 20 and up)	8, 10, 28, 41, 46, 47, 48, 49, 53, 54	Adults
Juveniles (Ages 12-20)	17, 27	Subadults
Infant II (Ages 6-12)	22, 31	
Infant I (Ages 0-6)	8, 11, 13, 65	

Table 1. Human Burials analyzed in Figures 5 & 6.

% Calcination Across Age Categories

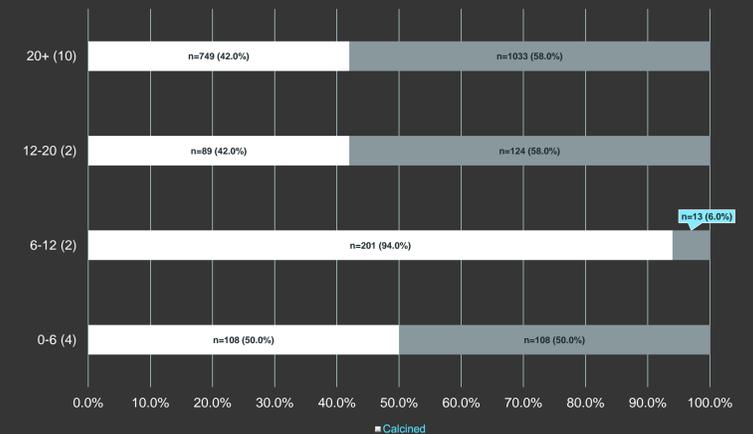


Figure 6. Comparison bar graph of Munsell Color Scores between the four age categories (Infant I, Infant II, Juveniles, Adults)

Results

- There was a statistically significant difference in the presence of white between subadults and adults ($\chi^2=79.41$, $df=1$, $p<.0001$) [Figure 5, Table 1]
- There was a statistically significant difference in the presence of white among the four age categories ($\chi^2=209.71$, $df=3$, $p<.0001$). [Figure 6, Table 1]
- There was a statistically significant difference in the presence of white between females and males ($\chi^2=8.83$, $df=1$, $p<.0003$). [Figure 7, Figure 8]

Discussion and Conclusion

A higher percentage of calcinated bone in urns containing subadults than in those that held adults was found. This may be due to a difference in bone composition between adults and subadults regarding bone thickness, weight, and chemical composition [10]. Alternatively, this finding may relate to varying funerary practices by age, wherein some age groups undergo cremation of different temperature and/or duration. The individuals aged between 6-12 exhibited the most calcination, far more than other age categories. In fact, juveniles (aged 12-20) and those in the infant I category (birth – 6 years) were not significantly different from adults. An experimental study on burned animal bone found that there was no significant difference in calcination percentages among older juveniles and younger juveniles [6]. This suggests that the difference in calcination between the age groups is driven less by physiology, and may reflect a difference in mortuary practices. Further analysis of more subadult burials is warranted.

Males were found to have higher calcination percentages than females, although one female (HB 8) had a higher calcination percentage than one male (HB 46). No far reaching conclusions can be drawn for the sex comparisons, as the two male burials showed no consistency and there was a small sample size.

Future Research

- ❑ Experimental study between subadult and adult animal models to explore difference in degree of calcination
- ❑ Explore the calcination percentages of the double burials and compare them with subadults and adults.
- ❑ Explore the chronology of the cemetery and compare the human burials and ceramics studied with the approximated time period of the burial.

Acknowledgments

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Calcination Percentages of Males and Females

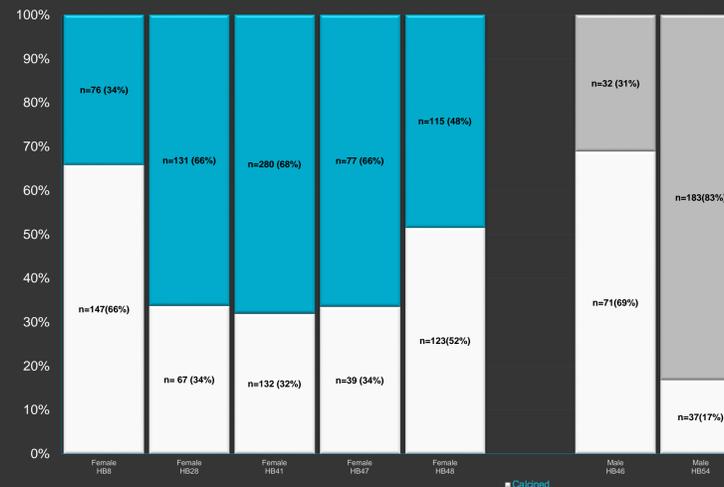


Figure 7. Comparison bar graph of Munsell Color Scores between individual males and females

Comparison of the Calcined and Non-Calcined Bones of Female and Male Burials

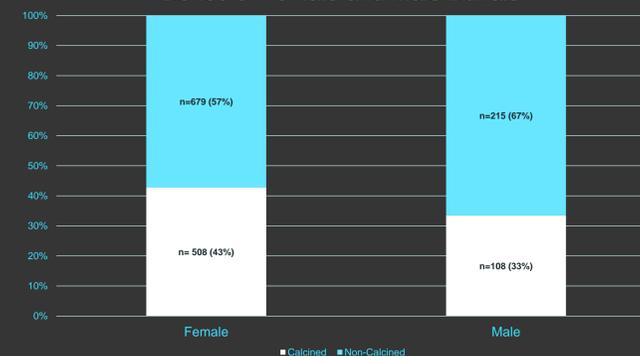


Figure 8. Comparison bar graph of Munsell Color Scores between Males and Females