SUGGESTIONS FOR IMPROVING THE OBJECTIVITY OF PALAEODEMOGRAPHIC DATA, AS EXEMPLIFIED IN THE ANALYSIS OF EARLY BRONZE AGE CEMETERIES OF THE LOWER TRAISEN VALLEY

Part I

ABSTRACT: The demographic features of four recently uncovered Early Bronze Age cemeteries in the region of the lower Traisen (Franzhausen I: 757 individuals; Gemeindebarn F: 238 individuals; Pottenbrunn-Rattersdorf: 79 individuals; the partially excavated site of Franzhausen II: 134 individuals; a total of 1,228 individuals) were analyzed. We tested to what extent the criteria of experience and perception used for aging and sexing the skeletons were subjective. This led to a specific probability calculation. The two mortality tables calculated from differently prepared raw data (one set using conventional methods, the other using probability calculations) show marked differences.

In our opinion, populations should only be compared after a probability calculation has shown the magnitude of the uncertainties in the demographic parameters.

KEYWORDS: Palaeodemography — Probability calculations — Early Bronze Age.

INTRODUCTION

During large scale excavations which have been performed by the Abteilung für Bodendenkmalpflege des Österreichischen Bundesdenkmalamtes since 1981, about 80 new sites were uncovered and 2,500 graves dated between the Middle Neolithic and the Early La Tène were recovered (Neubauer 1987, Neubauer and Gatteringer 1988, Neubauer-Maresch and Neubauer 1988).

The four Bronze Age necropolises of Franzhausen I, Franzhausen II, Pottenbrunn-Rattersdorf and Gemeindebarn F yield the major part of the material. These cemeteries belong to the Early Bronze Age: they exhibit both subtle chronological differences as well as variations in density of occupancy (Table 1). The currently most copious field Franzhausen I contains 714 graves and represents, due to its relatively long period of use of 300 years, three phases (stages Gemeindebarn I, II, III): most of the burials are associated with the stage Gemeindebarn II, as is the small cemetery Pottenbrunn-Rattersdorf, containing 81 graves.

On the other hand, the 238 graves in Gemeindebarn F and the 134 graves from the currently incompletely recovered cemetery Franzhausen II are characterized by a predominance of the upper layer of the Early Bronze Age.

Table 1. Numbers and dates of the four Bronze Age cemeteries in the Lower Traisen Valley.

<table>
<thead>
<tr>
<th>CEMETERY</th>
<th>Stage</th>
<th>Early Bronze Age - Uncovering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Franzhausen I (N = 757)</td>
<td>GEM I</td>
<td>GEM II</td>
</tr>
<tr>
<td>Pottenbrunn (N = 79)</td>
<td></td>
<td>GEM II</td>
</tr>
<tr>
<td>Gemeindebarn F (N = 238)</td>
<td></td>
<td>GEM III</td>
</tr>
<tr>
<td>Franzhausen II (N = 134)</td>
<td></td>
<td>GEM III</td>
</tr>
</tbody>
</table>

(* = only partially recovered; GEM I = stages Gemeindebarn I-III)

Bronze Age (Gemeinlebnar III). These cemeteries must be chronologically younger by 100 years.

The preliminary results of our computations may indicate that this chronological differentiation may have a non-negligible influence on the analysis of population dynamics as well as on the interpretation of the demographic results.

In this article we pursue two objectives: first, we suggest corrections that enable us to more objectively estimate sex and age of the individual and calculate the consequences for the important variables of mortality tables; second, we use these consequences to compare the demographics of the Traental ensembles.

At present, we do not have a workable alternative to the model of a stationary population: we therefore calculate the mortality tables using this model, i.e., birth rate = death rate (Fechinger 1973, Acédi and Neméskéri 1976).

We believe that the prerequisites used for methodical analyses and comparisons of the Traental ensembles are favorable because: 1) all grave fields encompassed by the analysis were recovered in an identical manner, e.g., by the same excavator; 2) the material exhibits the same - non-ideal - state of preservation, as a result of the specific conditions in the riverine lowlands; 3) almost identical methods of sexing and aging were used - implying the same reference populations.

**MATERIAL AND METHOD**

For this analysis a total of 1,228 individuals (Franzhausen I: 157, Franzhausen II: 134, Gemeinlebnar: 258, Pottenbrunn-Ratzerdorf: 79) from 4 Bronze Age cemeteries were available.

I. Methods of estimation of sex and age at death

A preliminary estimation of the age at death was determined in the usual manner: for subadults, tooth eruption and calcification (Ubelaker 1978), the length of long bones (Stiolkau and Hanáková 1979) and epiphyseal union (Bermisch, Schwidetzky and Stiolkau 1979) were used; for adults the „complex method“ was used (Neméskéri, Harášnyi and Acédi 1960) – closure of the epiphysial sutures (modified tables after Rössing 1977), molar wear (Broughwell 1972), and degenerative changes of the vertebral column (Stiolkau, Vychnánek and Rössing 1976) and articular joints (Stiolkau and Vychnánek 1975).

The estimation of sex follows the list published by Acédi and Neméskéri (1970) (a total of 30 characteristics, including the robustness of the long bones).

II. Mathematical estimation of age at death and the consequences for the mortality tables

Experience has shown that the age intervals obtained using the various criteria are often disjoint (see Table 2). Various attempts at avoiding this dilemma are in use: either one enlarges the interval so that all estimated intervals are subsets or one defines an interval bracketed by the average of lower limits and the average of upper limits. In many cases, one relies on the problematic justification of having chosen some „reasonable“ interval.

Such criteria of reasonableness, based as they are on observation and experience, are difficult to assess. Since we do use the age intervals and presently do not dispute their reliability, yet want to eliminate the reasonableness criterion, we have developed the following mathematical approach.

Every age interval, determined by the appropriate criteria, is assigned a probability. In the refined model, we assume all probabilities to be equal (this is equivalent to assuming all age criteria are equally reliable). If, let us say, three criteria were usable, then the probability is 1/3 for each interval. Table 2 shows 4 cases that clarify the model. In the third case, the usual age estimate would have been 40–40 years. In our view, the probability is not constant: in particular, it is greater in the region of overlap. The mortality tables are now calculated with such probability functions for each individual. A comparison of the results of conventional demography shows a marked difference in the intermediate age groups – these age groups have more disjoint age intervals. In Table 3 and Graph I, we have exemplified life expectancy.

**Table 2. Clarification and comparison of the methods: „conventional“ = the currently used estimation of age at death interval, „refined model“ = age at death probability function, assuming all intervals are equally reliably estimated.**

**AGE AT DEATH PROBABILITY FUNCTION**

<table>
<thead>
<tr>
<th>Interval</th>
<th>Conventional</th>
<th>Refined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20-24</td>
<td>19-28</td>
</tr>
<tr>
<td>10-20</td>
<td>20-24</td>
<td>20-24</td>
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<td>30-40</td>
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<tr>
<td>50-60</td>
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<td>50-60</td>
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</tbody>
</table>

**Graph 1. Life expectancy calculated using the total population of Gemeinlebnar F.**

- * = conventional, • = refined probability model.

* We are indebted to F. - W. Rössing, Um, for clarifications of these methods.
In the subadult age range, there are almost no differences between the two methods, because in this age range, more consistent age estimators can be applied. (The uniformity in the 60-120 age group is due to the scarcity of individuals in this age group and also the extent of the range.)

A comparable difference between the two methods will be manifest in the calculated probability of dying in the age interval $a$.

$$q(a) = \frac{l}{d_a} \text{ with } \Delta x = \text{const}$$

$l_a$ = percentage of survivors at time $a$

d$_a$ = number of deaths at time $a$

The importance of making such model calculations before interpreting subsequent comparisons is all the more striking when comparing the life expectancy for the different sexes: the sex difference for the population of Geelhoven (Graph 2) is only slightly higher than the difference for life expectancy using conventional and the refined model calculations. Similar results are exhibited in the three other subgroups from Franzenhausen I, Pottenbrunn-Ratsersdorf and Frankenhäuser II.

III. Non-subjective sex estimation

In the present article, sex was estimated using an array of 30 criteria, each with a markedness ranging from hyperfeminine (-2) to hypermasculine (+2). Each of these criteria has a weight; different criteria do not necessarily lead to the same sex estimate. We
## Tab. 5. Mortality tables: calculated for females (F) and males (M) with the use of probability models.

### Comparisons of mortality tables

We list a few examples of the many particular results found among the Bronc Age populations of the Traisn Valley.

The comparison of the most important parameter of a mortality table, the life expectancy at birth (Table 4 and Graph 5), shows that the predominantly (chronologically) older populations Frankenhofen I and Potthenau-Rattenhofen (column 24) and Frankenhofen II and Potthenau-Rattenhofen (column 24 and 20.4 years, respectively) are to be contrasted with the younger populations Fränkisches Land, Gemeindebahn B (where the values are 27.2 and 28.6 years).

A similar trend can be perceived for the sexually differentiated case. (For males – for mass and – less marked – for females. (In the sexually differentiated cases calculations were done with the probability functions: if no anthropological data were available, archaeological data, viz. orientations, side of deposition and/or grave artefacts were used. The other sexually unidentified individuals were not used in the calculations.)

It is possible that these correlations are correlated with the chronologial age of the grave fields and that they reflect a change in the quality of living – e.g. improved environmental conditions. Supplementary investigations involving types and frequencies of illnesses in these populations are being carried out, as well as those directed at the problem of the infant deficit, which has not been addressed in any of the 4 centuries.

We are furthermore investigating the effect that the choice of functional parameters on the parameters of the mortality tables and we are also attempting at generalizing the formalism that calculates the probability functions for sex estimations.

### REFERENCES


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