**How do different factors influence the ratio of relatedness and unrelatedness in a collective tomb from Mycenaean times?**

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**Project and Data:** The factors of „who was buried together“ in Mycenaean collective tombs in Greece (~1500-1000 BCE) are not yet understood. With our dataset from genetic and osteological analyses we provide very first insights to the organisation of joint and multi-generational burial as a reflection of social belonging. However, our tombs under study hold different parameters of length of use, estimated number of buried individuals and number of ‚successful‘ samples included in our kinship analysis, which we would like to take into account.

**Data Description:** Table on tombs’ basic parameters, table on kinship relations, table on individuals‘ metadata like tomb, sex, skeletal element of sample

**Research Question:**

* Develop and validate statistical models to predict the difference between observed and potential relatedness, using tomb parameters (length of use, estimated number of burials, sample success rate) as predictor variables, while accounting for potential confounding factors
* Build predictive models to estimate relatedness patterns using individual-level covariates (sex, age and skeletal element of sample), considering that some of these factors may be confounded with DNA preservation quality and sampling success

🡪 How different are relatedness patterns in different tombs when statistically correcting for selection biases and confounding variables?

**Preferred in English**

**Abbreviations:**

“T” tomb

“MNI” minimal number of individuals => based on osteological individual count, used as estimation of how many burials were conducted in the tomb

**Description of project:**

Two burial sites are included in our dataset: Amfissa and Elateia. Amfissa represents one single tomb (tholos tomb type) where a minimal of 110 individuals was buried. Elateia is a chamber tomb necropolis with 85 chamber tombs, of which we selected 8 for our study. T31, T36, T46, T50, T56, T62, T67

A map of a musical instrument

Description automatically generated

Figure : selected tombs at Elateia(only for internal use!)

The total MNI of Elateia is 2800 individuals, which makes a rough average of 35 individuals per tomb, but burial numbers greatly differ from 3 up to a maximum of 134 (tomb 62, included in this analysis).

The necropolis was in use for over 600 years, the tombs were used for different lengths of time.

A diagram of a diagram of a diagram

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Figure : time line for the use of the necropolis at Elateia (only for internal use!)

At Amfissa we sampled the more represented body side (to leave the other body side for further studies) of the bone element “petrous bone” (from the skull, surrounding the inner ear), which yields the best preservation of ancient DNA (aDNA), and teeth.

At Elateia we sampled also petrous bones and teeth the same, but the system of sample selection was a little more flexible, using also other bone elements (talus, phalanx, other)..

Due to the deconstructed state of the burial material mainly preserved in bone piles and secondary pit depositions with commingled individuals, we didn’t know during sampling which teeth and bone elements eventually belonged to the same individual (see foto)

Through osteological and genetic analysis, we found that some of our selected samples belonged to the same individual, so we merged their genetic data for our kinship analysis.

A diagram of the skull

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Figure : petrous bone in the temporal bone of the skull (surrounding the inner ear)

A diagram of a site

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Figure : Necopolis and tomb plan with many floor pits in tomb 62 (only for internal use!)

A black and white photo of a skeleton

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Figure : Chamber in state of excavation from tomb 62 (only for internal use!)

Bones in the ground with a sign

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Figure : a pit deposition with commingled skeletal material (only for internal use!)

A close-up of a cave

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Figure : excavated chamber with floor pits in tomb 62 (only for internal use!)

Our total sampling at Elateia comprised a total of 510 skeletal human samples, at Amfissa 163 samples. Due to the merging of genetic duplicate samples, preservation issues and failing quality control, only some of our samples made it into the final kinship analysis (see attached results table from the kinship software “Read”), and the summary table with all metadata for single individuals.

We would like to model, for each tomb, how the loss of individuals/samples through our selection biases (MNI 🡪 selective sampling 🡪 exclusion of bad quality and low data samples) might affect our tomb-wise results of relatedness differently.

Moreover, the sampled skeletal elements might play a role, since petrous bones and other bone elements yield better aDNA preservation than teeth.

We also like to know the correlation between the factors age (subadult/subadult? vs adult or undefined), sex (XX(female) vs XY(male)) and our results of tomb-wise relatedness. (can eventually be approached via Kruskal-Wallis testing? See example picture from other study)

A graph of age and age

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Figure : Kruskal-Wallis test for age and relatedness degree centrality

Finally, we like to understand what are the tomb-specific differences between maximum potential relatedness – i.e. if all individuals from the MNI had provided perfect data and were all related to each other – and the observed relatedness in our empirical dataset, where we only sampled a subset of the MNI and some samples have low-quality data that prevents full kinship assessment. Are there any predictors in our dataset that correlate with these differences? Can we model the true *relatedness to unrelatedness-ratio* by statistically correcting for selection biases in our data?

A group of people with a red square

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Figure : Visualisation of difference between observed and potential relatedness.

The Read results determine first (parent-offspring), second (uncle/aunt-niece/nephew, grandparents-grandchild), and third degree (first cousins etc). If two individuals have too few overlapping SNPs, their relationship cannot be accurately determined.

**Please filter the kinship data as follows:**

Column Rel (B) and column OverlapNSNPs (J):

* First degree: minimum 500 OverlapNSNPs
* Second degree: minimum 2000 OverlapNSNPs
* Third degree: minimum 15000 OverlapNSNPs

Pairs falling below these thresholds should be considered “uncertain” in their relationship assignment.

**Please exclude the site “LPS” / “Lapoutsi” from the analysis.**

**We wish you good luck and some fun with our data!**

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**About the project:**

<https://cordis.europa.eu/project/id/101001951/de>

<https://www.vfp-archaeologie.uni-muenchen.de/forschung/vorfrueh/mysocialbeing/index.html>