Diachronic Research on the Decomposition and Preservation of Buried Human Remains in the Soil of Flanders

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Aim

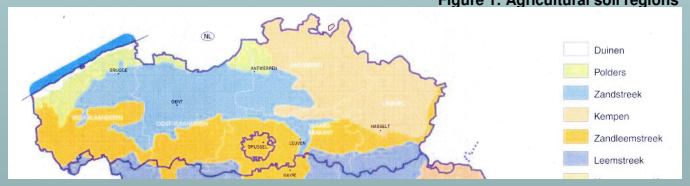
Is there a diachronic constant between the preservation or degradation of buried human remains in specific soil types of Flanders?

Introduction

Why is a research project on degradation and preservation important?

1. It gives a clear view of the **taphonomic processes**; to distinguish natural, universal processes and processes of human origin.
2. To estimate Time Since Death/**Postmortem Interval** (PMI).
3. The **DVI**** from the Belgian Federal Police asked for this research; what is the chance of a complete or partial recovery in specific soils?
4. To **predict** the degradation of archaeological skeletal remains; excavating or preserving them as national heritage.
5. To investigate the right locations to **plan a cemetery**; some cemeteries found decompostion problems in specific soils.

Figure 1: Agricultural soil regions



Method and Material

→ Restrictions

The ideal situation is to work with bone samples on a microscopical level and soil samples.

1. Collecting bone samples from different soil types would take years and would be ideal for a long-term research.
2. Bones out of storage depots don't serve the purpose because fragile bones or ghost burials are not stored.
3. Most excavations don't take soil samples.
4. The anthropological reports of the VIOE*** express the preservation in quantity rather than in quality.

Figure 2: Ghost burial

Category	Description
1. Strong Bone	Strong, solid, no traces from weathering, plants or animals. Washable.
2. Affected Bone	Strong and solid, but affected by moss formation, root etching, cracking and flacking. Washable.
3. Fragile Bone	Lamellair, soft and fragile. Not washable.
4. Bone Meal	Very soft. You find it as bone meal or crumbles of by contact. Washing them is not possible anymore.
5. Ghost Burial	No skeletal remains left, only a ghost or imprint. Tooth enamel can still be left (figure 2).
6. Keratin en Tanning	Bone has decomposed totally. Skin, nails or hairs are preserved as leather or keratin.
7. Completely Decomposed	No traces noticeable anymore. Even ghost traces are disappeared.

Table 1: Classification of the qualitative preservation of human skeletal remains by Eline Schotsmans.

→Applied Method

Altough the same preservation of bone seen on macroscopic level can show a different preservation on microscopic level, this research took place on individual case studies that described macroscopic preservation. So this research served as a preparatory study for further and more detailed survey.

- Sources: Excavation reports, publications and conversations with archaeologists and DVI.
- Criteria for the excavations used as casestudy:
  - Only buried remains.
  - Only inhumations, no cremations.
  - Existence of Lambert co-ordinates to locate the site.
  - Sufficient and adequate information about the preservation or degradation.
  - Cases needed to be spread over different agricultural regions of Flanders (**figure 1**) and through different periods.

→ 29 sites were selected, from Roman period to the contemporary period in different agricultural soil regions of Flanders.

- Record sheet based on a questionnaire of Manhein (1997) **(figure 3).**
- Qualitative description of the bones: a new system to categorize bones was used, based on Behrensmeyer (1978) and Gordon & Buikstra (1981) (**table 1**).

Record Sheet

Case Number
Name of the Archaeologist
Location
Lambert Co-ordinates
Year of Excavation
Postmortem Interval (PMI)
Period

Preservation Soft Tissue
- Good
- Moderate
- Bad

Preservation of Bone
1. Strong Bone
2. Affected Bone
3. Fragile Bone
4. Bone Meal
5. Ghost Burial
6. Keratin and Tanning
7. Completely Decomposed

Adipocere
- Absent
- Minimal
- Much

Soil Type
pH
Number of Burials
Orientation of Burial
Depth of Burial
- Surface
- Less than 2 metres
- More than 2 metres

Covering of Burial
- No covering
- Clothing: describe
- Material of coffin
- Other

Traumata
Material Culture

Other Observations

Table 2: Overview classified by soiltype

Case	Soil Type	Agricultural Soil Region	PMI: years	Bonepreservation: category	pH	Preservation of Timber
Sint-Andries (Molendorp)	ZbG	ZS	<2000	5 & 7	*low = acidic*	timber totally decomposed
Varsenare	ZbG	ZS	1000-1600	5 & 7	*low = acidic*	timber totally decomposed
Ouwen	Zbmy	K	1300-1350	5	/	timber totally decomposed
Sint-Andries (Refuge)	ZdG	ZS	300-500	3 & 4	/	timber in bad condition
Engelmanshoven	SAx	LS	1400-1500	5 & 7	low = acidic	timber totally decomposed
Lindel	Shpo(0)	K	1300-1400	5	*low = acidic*	timber totally decomposed
Donk	Shm	ZLS	1700-1850	5	*low = acidic*	timber totally decomposed
Kruishoutem	Scc	ZLS	500-1100	2, 3 & 4	*neutral*	timber totally decomposed
Meer	Scm	K	170-250	3 & 4	/	/
Broechem	Pbcy	ZS	1300-1500	5 & 7	low = acidic	timber totally decomposed
Zonnebeke	s-PDx	ZLS	89	1 & 2	/	/
Beerlegem	Lba	ZLS	1300-1400	5 & 6	low = acidic	timber in air decomposed, not the waterlogged part
Erps-Kwerps	Lba0	ZLS	1300-1400	2 & 3	*neutral*	timber totally decomposed
Sint-Gillis-bij-Dendermonde	Lbaz	ZS	500-900	2, 3, 5 & 7	/	timber totally decomposed
Edegem	w-Lba	ZS	800-1100	3, 4 & 5	/	timber totally decomposed
Neerhespen	Aba1	LS	1500-1600	1, 2 & 3	high = alkaline	/
Duingrond (DVI)	X	K	2 or 3	1 & 2 + soft tissue	/	/
Koksijde	d.B1	DUIN	600-900	1 & 2	/	timber totally decomposed
Plassendale	m.A2	POLO	1700-1900	1 & 2	/	/
Oudenburg 1	m.P2	POLO	1730-1930	3 & 4	/	timber under watertable still intact
Oudenburg 2	m.P2	POLO	1730-1930	3 & 4	/	fragments of timber preserved
Oudenburg 3	m.P2	POLO	1650-1700	3 & 4	/	/
Dudzele	m.DM	POLM	1100-1400	1 & 2	high = alkaline	/
Tongeren	OB	KUNST	1600-1700	1, 2 & 3	/	timber almost totally decomposed
Orsmaal-Gussenhoven	OB	KUNST	1400-1500	2, 3 & 4	/	timber totally decomposed
Munsterbilzen	OB	KUNST	1300-1600	1, 2 & 3	/	mixed preservation of timber
Boekhoute	OB	KUNST	100-600	3	/	/
Oostende	OB	KUNST	300-400	2 & 3	/	some fragments of timber preserved
Chemich vervuilde bodem (DVI)	OB	KUNST	7	1 & 2	/	/
Metaal vervuilde bodem (DVI)	OB	KUNST	7	1 & 2	/	/
Kunstmatig bos (DVI)	OB	KUNST	9 months	soft tissue / adipocere	/	/

Results

Table 2:

- Cases classified by soil type based on texture. Sandy textures (Z-S-P), loamy textures (L-A), clay in the polders (POLO/POLM) and contaminated soil (KUNST)
- 2nd classification on drainage (b-d)

Results:

- Agricultural soil regions give no predictions about decomposition.
- Sandy texture + dry drainage (b, A) lead to a bone degradation in categorie 5 and 7; ghost burial or completely decomposed.
- Sandy loam (L) shows mixed preservations
- Soil in polders better preserved because of the clay (cat. 1-4).
- Artificial soils (=contaminated soil) show strong to fragile bones (cat. 1, 2, 3 & 4) and an absence of cat. 5, 6, 7.
- pH has an influence on the preservation of bones.
- Small PMI preserved bones well, no influence from soil.
- Wooden coffins have no long term influence because they decomposes by themselves.
- Material culture has no influence on decomposition with the exeption of MPO's (Mineral Preserved Organisms): corroding metallic artifacts can preserve traces of organic materials with which they are in immediate contact.

Conclusion

- Texture, drainage and pH affect the qualitative preservation of bones within a PMI of more than 100 years.
- During the initial decomposition local factors predominate, but when the bulk of soft tissue decay has ended, general soil chemistry has a greater direct effect.
- 'The more fragile the bones, the older they are' is not true: it depends on the soil.

Discussion

- More research needs to be done on this topic in Belgian soils.
- For the DVI there is a need for more research in contaminated (city) soils.
- Further microscopical research is required.
- Archaeologists / anthropologists have to record qualitative preservation clearly.

→ Modern archaeology needs an interdisciplinary approach between social sciences and exact sciences. The future of research on degradation and preservation depends on this integration.

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** Disaster Victim Identification Team Belgium

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