ANIMAL REMAINS

Bones and teeth are the most common animal remains found at archaeological sites. A simplified term for this type of find is 'animal bones'. Animal bones help us understand the natural environment and society of the past, along with their social, economic, and cultural aspects. For example, we can study which animal species were hunted or bred, what resources were obtained from animals, what other roles animals played, and how animal populations developed.

Unburnt and burnt animal bones.

IMPORTANT OBSERVATIONS FOR FIELDWORK

- **Context.** During fieldwork, it is extremely important to describe the context of the bone specimen being sampled. Animal bones must be associated with their context as precisely as other archaeological finds.
- **Collection.** Animal bones in cultural layers may be preserved either intact or fragmented. It is essential to choose the appropriate collection method (sieving, wet sieving, etc.) to avoid losing valuable material.
- **Packaging and transport.** It is crucial to minimize damage to animal bones during fieldwork and to ensure that all morphological features are preserved. Fragile bones should be collected in boxes rather than in plastic bags. During transport, ensure the bones are not crushed by each other or other equipment.
- **Risk of sample contamination.** Unlike human remains, there is no contamination risk to animal bones during fieldwork.

Bone Preservation

- The information obtained using biomolecular methods depends on how well the bones are preserved.
- Burnt bones cannot be analysed with most biomolecular methods because the organic component of the bone has burned away.

Analyses possible with burnt bones:
- ✓ Radiocarbon (^{14}C) AMS-dating
- ✓ Strontium isotope analysis

Analyses not possible with burnt bones:
- × DNA analysis
- × Carbon, nitrogen, and sulphur isotope analysis
- × ZooMS-analysis

- Bone collagen withstands environmental conditions relatively well and is largely accessible in archaeological bone finds. Ancient DNA has even been extracted from mammoth teeth found in Siberian permafrost that are up to 1.2 million years old.

IMPORTANT OBSERVATIONS FOR INDOOR WORK

Storage

- Animal bones are **usually washed** to identify and describe their morphological features (necessary for determining the animal species), pathologies, cut marks, etc.
- Care should be taken to avoid fragmenting the material during washing and repackaging.
- Bones should be washed with cool water and the remaining soil should be sieved. Before packaging, bones should be left to dry thoroughly.
- **Poorly preserved, fragile, and crumbling bones should not be washed**; instead, larger debris should be gently brushed off with a soft brush without scrubbing.
- Bones should be packaged according to their documentation (by context, find number, etc.).
- Bones should be stored in acid-free, standard-sized bone boxes in a dedicated animal bone storage facility.
- The optimum storage temperature is about 21°C, with humidity levels 45–50%.
- Animal bones are generally not conserved.

When washing animal bones, one must be careful to avoid fragmentation of the material.

Sampling

- Always consider **which research questions the requested analyses are supposed to answer**.
- Assess whether and how much the sampling will interfere with further analyses or different types of analyses.
- **Document** the sampling process. **Always complete a sampling protocol** when taking samples from archaeological finds. See Tallinna Ülikooli Arheoloogia Teaduskogu.
- Use the best-preserved bone and the most optimal part of it for sampling (e.g. the area where the compact tissue of the bone is densest).
- Avoid sampling morphologically or taphonomically informative parts of bones (e.g. those with species-specific features, cut marks, pathologies, etc.).
- Ensure that different samples are taken from different individuals.
- **Leave part of the bone intact whenever possible**.
- Wrap samples in foil and place them in resealable bags. Label the bag (and, if necessary, the note inside) with sufficient information to identify the original bone find, sampling time, and sampler.
- After sampling, add the sampling information to the record of the returned bone find. If the entire bone find is transferred to another institution/laboratory for sampling, include a note in the bone box and after sampling return the leftover sample/specimen to the collection.

When taking samples from animal bones, care must be taken not to use the entire bone. This preserves the possibility of using the same bone for other analyses in the future.

The sampling label with the bone specimen that has been returned to the collection.

Biomolecular analyses for obtaining Information from animal bones.

RESEARCH QUESTION	BIOMOLECULE /METHOD	ANALYSED MATERIAL	SUITABLE SKELETAL ELEMENT	SAMPLE AMOUNT
dating	Carbon (^{14}C)	collagen extracted from unburnt bone or tooth dentine; carbonates extracted from tooth enamel or burnt bone	all suitable	1.5–3 g
genetic origin and phylogeny, pathogens, taxonomic identification, sexing	DNA	DNA extracted from unburnt bone or tooth dentine	all suitable; best preserved in tooth cementum and petrous bone (small cranial bone behind the ear)	100–150 mg
diet, environment	Carbon ($\delta^{13}C$)	collagen extracted from unburnt bone or tooth dentine	depending on research question: teeth provide info about the individual's early years, bone tissue for recent years	60–100 mg
	Nitrogen ($\delta^{15}N$)			
	Sulphur ($\delta^{34}S$)			
origin, migrations, seasonality	Strontium ($^{87}Sr/^{86}Sr$)	phosphate extracted from tooth enamel	teeth (only enamel)	7–10 mg
	Oxygen ($^{18}O/^{16}O$)	carbonates and phosphates extracted from unburnt bone or tooth enamel	all suitable	3–5 mg
taxonomic identification	ZooMS	collagen extracted from unburnt bone or tooth dentine	all suitable	10–30 mg

See more: www.archemy.ee

The leaflet has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101079396, and from UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee (grant agreement No. 10063975).
Text Eve Rannamäe, English editing Enn Veldi, photos Eve Rannamäe, design Jaana Ratas.