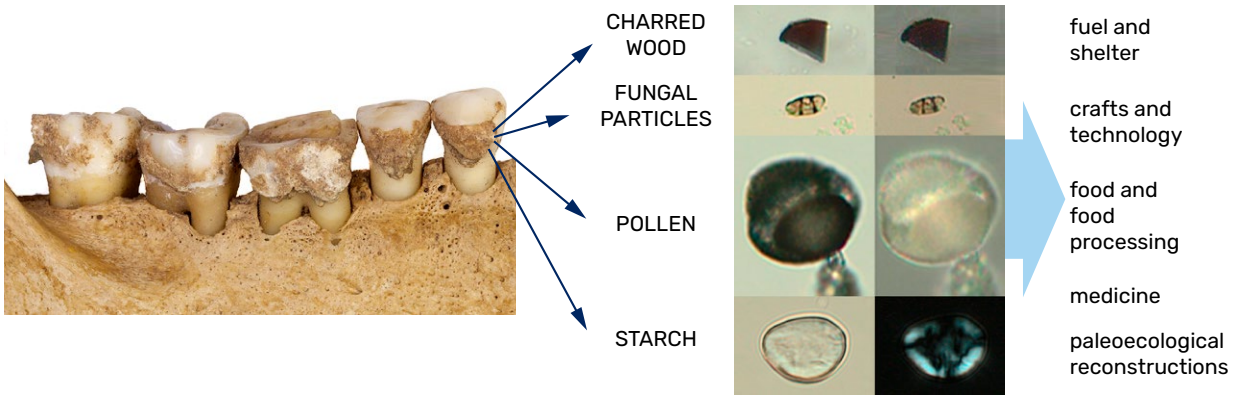
DENTAL CALCULUS – MICROREMAINS

Dental calculus is mineralized dental plaque that forms when teeth are not cleaned. The speed, composition, and amount of dental calculus formation vary from person to person. Its formation is influenced by such factors as the composition of microorganisms in the mouth, diet, and genetics. Micro-particles from the environment and food – e.g. starch, phytoliths, pollen, and fungal spores – make dental calculus a valuable research material. In addition to microremains, various biomolecules – lipids, proteins, and DNA – are also deposited in dental calculus. Past diets, diseases, and microbiomes can be studied with modern methods

What information can different dental calculus analyses provide?

Food particles trapped in dental calculus provide a more detailed picture of dietary history. For example, by identifying starch particles under a microscope, it is possible to determine the plant species consumed. Many plants produce starch while the most common starch-rich food sources are cereals and legumes.

Microscopic particles from a person's **environment** can also end up in dental calculus. For instance, finding large amounts of wood particles in dental calculus may indicate a person's occupation as a carpenter or woodchopper. Pollen deposited in dental calculus can give clues about the plants in the surroundings, and fungal spores can indicate the consumption of mushrooms; mouldy, and/or poorly cleaned food.



Dental calculus and the information obtained from It (modified after Johanson 2025).

IMPORTANT CONSIDERATIONS DURING ARCHAEOLOGICAL FIELDWORK

- During excavations, dental calculus must remain in its original context, that is, attached to the tooth.
- Care must be taken when cleaning teeth from soil. Excessive scraping of the teeth can break off the dental calculus.
- If dental calculus becomes detached from the tooth, it must be packaged separately with contextual information (site name, date, burial number, which tooth and which side of the tooth the calculus came from).

IMPORTANT CONSIDERATIONS DURING LABORATORY WORK

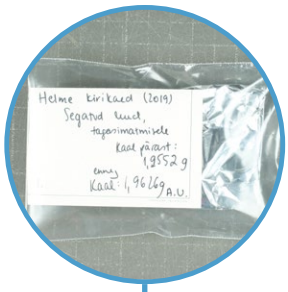
- Teeth **should not be washed**, as this can break off the dental calculus.
- If aDNA and/or proteomics samples are to be taken from the tooth, it must not be soaked in water.
- Dry cleaning is suitable for teeth: gently brushing with synthetic brushes. Do not use brushes made of animal or plant fibres, as they can leave microremains on/in the dental calculus, causing false signals. Excessive scrubbing can break off the dental calculus from the tooth and damage the tooth.
- Packaging – **dental calculus must remain attached to the tooth**. If it becomes detached, the piece must be packaged separately in a tube/ziplock bag. Contextual information must be added: site name, date, burial number, which tooth and which side of the tooth the calculus came from.

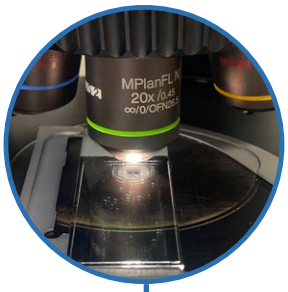
Conservation

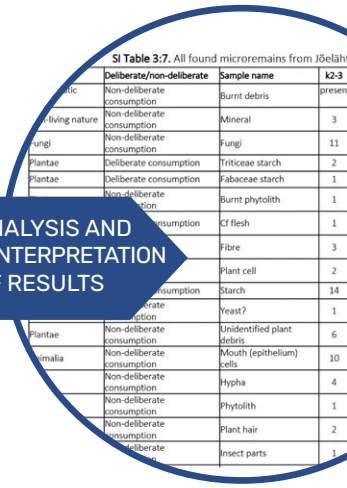
- Conservation can be a contamination risk and a limitation for further biomolecular analyses.
- If conservation is necessary, it is important that the entire conservation process is documented, and the list of the used preservatives and recipes is precisely known.

What to consider when taking a sample from dental calculus?

- Samples from dental calculus are taken by a specialist in a clean laboratory.
- The tooth and dental calculus, along with relevant background information, must be packaged in a clean ziplock bag and handed over to the research institution.
- A recognized sampling protocol is used to remove dental calculus.

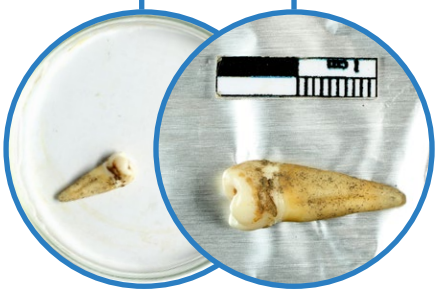


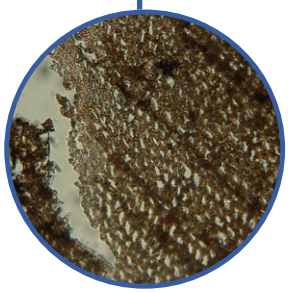



SI Table 3:7. All found microremains from Jõelähi

	Deliberate/non-deliberate	Sample name	k2-3
	Non-deliberate consumption	Burnt debris	presen
living nature	Non-deliberate consumption	Mineral	3
Fungi	Non-deliberate consumption	Fungi	11
Plantae	Deliberate consumption	Triticeae starch	2
Plantae	Deliberate consumption	Fabaceae starch	1
	Non-deliberate consumption	Burnt phytolith	1
	consumption	Cf flesh	1
		Fibre	3
		Plant cell	2
	consumption	Starch	14
		Yeast?	1
Plantae	Non-deliberate consumption	Unidentified plant debris	6
malia	Non-deliberate consumption	Mouth (epithelium) cells	10
	Non-deliberate consumption	Hypha	4
	Non-deliberate consumption	Phytolith	1
	Non-deliberate consumption	Plant hair	2
		Insect parts	1

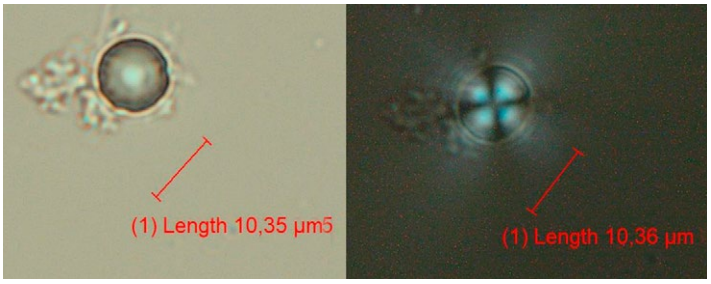
ARCHAEOLOGICAL EXCAVATIONS → STORING OF TOOTH WITH DENTAL CALCULUS → CLEANING THE TOOTH AND DENTAL CALCULUS → OBSERVING DENTAL CALCULUS WITH MICROSCOPE → DETAILS ON MICROSCOPIC IMAGE → ANALYSIS AND INTERPRETATION OF RESULTS





Case study from the Kukruse burial site

Microremains from the dental calculus of ten individuals from the 12th–13th century Kukruse burial site were examined. From these samples plant-based food (e.g., starch particles) were found. These were identified as belonging to cereals (tribe Triticeae), legumes (family Fabaceae), and a possible oat starch particle (genus Avena). Finding information about plant-based food in archaeology is generally challenging – plants do not leave many traces. Additionally, information about possible animal-based food, fungal spores, pollen, and much more was found in the Kukruse dental calculus.



Starch particle from a plant of the Triticeae *family seen through a polarizing microscope. On the right – under polarized light, the characteristic "cross" in the center of the starch particle becomes visible.*

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See also: www.archemy.ee

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