Netherlands Forensic Institute
Ministry of Security and Justice

Forensic Archaeology: uncovering buried and scattered evidence

by the **Netherlands Forensic Institute**

Forensic Archaeology

Forensic archaeology in the Netherlands is a discipline that uses archaeological theory, methods and techniques in a legal context. A forensic archaeologist is specialised in outdoor crime scenes, specifically those underground. When evidence or a missing person is positioned within a matrix of soil, understanding that matrix is the primary basis for understanding buried evidence. Forensic archaeologists can deduce human actions from the observation, documentation and careful excavation of buried remains, finds and features found on a crime scene. Buried evidence requires a systematic approach, that needs to be flexible and easily adjustable to any crime scene, whether that is underground or, for example, at a fire scene.

In the Netherlands, forensic archaeology is one of the approximately 40 areas of forensic expertise at the Netherlands Forensic Institute (NFI) in The Hague. The NFI is an agency of the Ministry of Security and Justice and provides services to clients within the criminal justice chain. In addition, forensic archaeologists at the NFI develop and refine archaeological field methods and techniques that may be relevant in forensic cases, and research (underground) human decomposition processes (taphonomy).

Answering Questions

Forensic archaeologists use search strategies to find and document buried human remains, finds and features, in order to date the deposition and explain the relationship between the finds and features and the environment in which they are found. Forensic archaeologists participate in both the location and excavation of buried remains, personal effects, weapons, stolen goods, and other potential evidence of the crime or mishap. Excavating a grave under archaeological conditions can provide valuable evidence on the time and circumstances of burial, the manner of death, and the tools and techniques used for interment. With this scientifically acquired knowledge, the degree of degradation and the presence or absence of features or evidence can be explained. A forensic archaeologist at a crime scene might, for example, be able to help answer the following questions:

Dating

- When was this item, body, feature or evidence buried here?
- When was this item, body, feature or evidence deposited on this surface?
- How old is it?
- Why does it look like this?

Deposition

- How was this item, body, feature or evidence buried here?
- Which human actions just before, around of after burial can be reconstructed?
- How did the soil matrix, the local animals or the plants influence the buried item, body, feature or evidence?
- Is the item, body, feature or evidence in situ (in its original position) or has it been moved?

Relation

- Is this evidence?
- Is this evidence connected to the victim or the perpetrator?
- Can the context provide information for identification?
- What is the value of this piece of evidence given the context?

Casework

Forensic archaeologists can assist with a variety of casework such as:

Spatial analysis

One goal of forensic archaeological research is to contribute to a reconstruction of the human and natural activities that took place at and around a (possible) crime scene. Archaeologists are experienced in 3D spatial documentation and use GIS (Geographic Information Systems) to visualise and analyse the spatial information. A GIS analysis combines different sources of data and can include crime scene data, (aerial) photos, topographic maps, soil and vegetation maps, police testimonies and historical information.

Forensic survey for (buried) human remains or objects

A forensic survey is related to the question if a (buried) body, body part or object is present within a designated area. The purpose of the forensic survey is to locate the object, body part or body within the designated area or to exclude an area from the investigation. A survey can also provide presumptive evidence that an object or body had been buried within the search area, but was moved in the past.

A forensic survey consists of two phases:

1. Desk research during the preliminary phase: the available information regarding the study area is processed, analysed and visualised in a Geographic Information System (GIS).
2. Visual inspection during the fieldwork phase: the designated area will be visually inspected – in cooperation with police officers - for suspicious features and then further investigated using a range of archaeological, geographical and canine survey methods.

The evidential value of observations collected during the forensic survey depends heavily on the environment and the chosen search strategy and methodology. Thus, the predictive value of a forensic survey depends (among other things) on the local vegetation and soil structure, the elapsed time since a person disappeared, the decomposition of the remains, the size and depth of the (grave) pit and the applied survey methods.

Dating investigation

A major task in forensic science is to determine the time between the death of an individual and the discovery of the remains: the post-mortem interval (PMI). In addition, the interval since the deposition (TSD) is of interest. The TSD is defined as the time interval between deposition of the body or item at the location where it was found and the time of its discovery. Usually a dating investigation involves human skeletal material, but sometimes it involves buried items. In contextual dating the method is exactly the same.

Forensic archaeologists deploy three methods to estimate the date of an item or human remains:

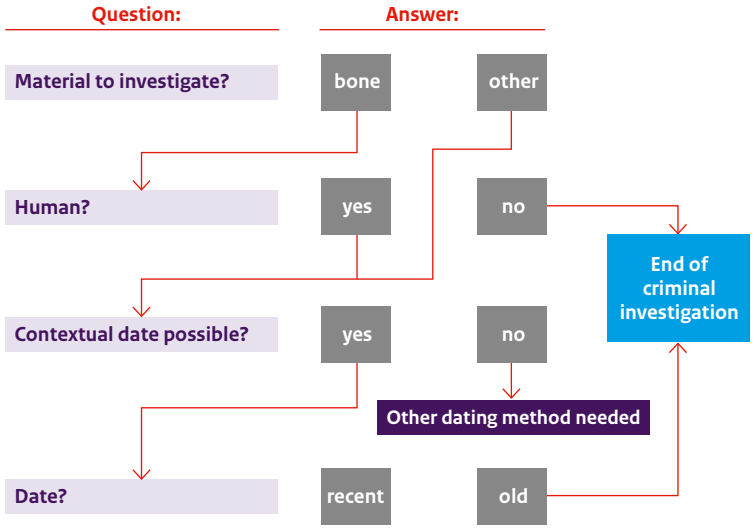
1. contextual dating
2. visual dating
3. radiocarbon dating

Knowledge of the context in which the body or item was found is essential for determining the PMI and the TSD. The forensic archaeologist may therefore investigate the location for the presence of soil features, associated finds and botanical trace evidence.

Field conditions can affect and limit certain dating methods. For example, the reliability of radiocarbon dating can be greatly influenced by the presence of humic acids in the soil.

Unfortunately the context of skeletal human remains or body parts is often unknown. In those cases visual and radiocarbon dating can help.

For any dating investigation the schematic below is followed:



In visual dating the forensic archaeologist inspects the wear patterns found on teeth (occlusal attrition) and the observable conservation status of the skeletal material. Using this method, a low probability statement can be made regarding the PMI of the (skeletal) parts. Visual dating has severe limitations; because of that, it can only be used as an additional dating method.

A ^{14}C laboratory can determine the age of organic materials to about 60,000 years through radiocarbon dating. This method provides certainty and probability statements on the time intervals within which the person must have died. The laboratory results must be interpreted in the context of the other dating methods and limitations. For example, the time intervals provided by the laboratory need to be corrected for the age of the individual to whom the bone belonged to. In addition, the NFI conducts several research projects in order to expand the number and possibilities of dating methods.


NFI

Forensic recovery of fragmented human remains above ground
Forensic recovery addresses the question of how fragmented skeletonised (or burned) human remains, found on a surface, are best documented, mapped, secured and recovered. Usually body parts are secured and their spatial distribution is recorded relative to other features (such as personal items) of value to the forensic investigation. A forensic recovery also focuses on the detecting, identifying, documenting, mapping and securing of forensic samples or traces within the designated area. During the investigation, several archaeological research and mapping methods and techniques may be used. Forensic archaeological recovery can be applied to any type of crime scene, including for example fire scenes with burned victims and air plane crash investigations.

Forensic excavation of a clandestine burial
A forensic excavation consists of systematically excavating a clandestine burial in a verifiable manner. The use of archaeological field techniques and methods ensures that

- the stratigraphy of the (grave) pit can be accurately mapped,
- the potential of identifying valuable finds can be maximised, and documented in situ and in context,
- sufficient trace evidence is sampled and secured.

Which excavation method is chosen depends on the specific objective and the physical environment. A multitude of techniques is available, for example trial trenches, horizontal layers, cross sections and a combination thereof. This choice is of crucial importance, since it determines the soil features and forensic traces that can be identified and later analysed and the likelihood that the physical remains or objects are uncovered intact during the excavation. Forensic archaeologists often collaborate with other forensic experts in securing the trace evidence.

Once the body or object is recovered from the (grave) pit, the walls and bottom of the pit will be further examined for the presence of tool prints, shoe prints, entomological and botanical evidence, for example by observing plant roots that were damaged during the digging of the pit. The time interval at which the roots' recovery occurs can be used to determine when the pit was dug.

Forensic exhumation in a regular cemetery
Forensic archaeologists conduct two types of exhumation:

1. Excavation, documentation and possible recovery of human remains buried in a regular cemetery for forensic follow-up investigation in a criminal case. The physical remains are secured ensuring the accurate 'chain-of-custody', i.e. the collection, custody, control, transfer, analysis and disposition of the evidence from the crime scene to the court room. If necessary, the stratigraphy can be documented in the grave and soil samples can be taken in situ and in context for additional toxicological research.
2. Exhumation for identification purposes. Remains of an unknown person or persons can be exhumed in order to sample their DNA for identification and for documentation of their biological profile (sex, age at death, stature and if possible pathology).

Equipment

The forensic archaeologists at the NFI have their own vehicle carrying tools in order to assist at any crime scene in the Netherlands, and if necessary abroad. For more complicated and extensive crime scenes, the NFI provides an additional technical and logistical support team. This team can handle any situation, including those on a national scale. Their truck is equipped for any crime scene and includes for example a generator and an electrical sieve, which is indispensable on clandestine burial sites, as all grave soil is sieved. Within the Netherlands, the NFI works together with the National Police on cases where 3D-scan equipment or a ground-penetrating radar (GPR) is required. These are supplied by the National Police's specialised forces.

Quality Standards and Accreditation

At the moment, the minimum requirements for a forensic archaeologist at the NFI include:

- a university Master's degree in archaeology,
- a minimum of six years' experience with (regular) archaeological fieldwork in Northwestern Europe,
- additional training in physical anthropology, pedology, botany and taphonomy,
- standard NFI forensic expert training, including court room training, report writing, Bayesian reasoning, penal law, criminalistics, completed by a formal oral exam.

The NFI itself is accredited under the ISO 17025 standard. However, this standard does not include work at the crime scene. Therefore the accreditation of all crime scene related work under the 17020 standard is currently in progress. The Quality manual for Forensic Archaeology (QFAR) is based on the existing norm for regular archaeologists: the Dutch Archaeology Quality Standard (KNA), standardising all archaeological work in the Netherlands.

Consultancy and Training

The NFI's forensic archaeologists provide casework advice and training to a broad range of governmental organisations. They teach courses at universities, to the Police, Public Prosecutor's Office and Defence forces, on a variety of subjects:

- Searching for and assisting at clandestine burial crime scenes for police officers
- Information on the possibilities of dating human remains
- General information on the possibilities of forensic archaeology
- Human taphonomy courses for universities
- Documentation and mapping of scattered (human) remains, finds and features (Total Station, GIS)
- Documentation and mapping of underwater crime scenes
- Tailor-made courses – whatever the requirements are

A NFI forensic archaeologist is available for consultation on casework on a 24/7 basis, and can be reached by calling the forensic intake desk: +31 70 888 68 88.
For general information by email: forarch@nfi.minvenj.nl.

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