



FORENSIC IDENTIFICATION OF HUMAN REMAINS



ICRC



INTRODUCTION

The identification of human remains is important for both legal and humanitarian reasons. This document provides a brief overview for non-experts of the scientific process by which human remains are identified. It does not set out guidelines or standard operating procedures for carrying out forensic investigations, and must not be understood as doing so. The ICRC recommends the use of standardized policies and procedures in all contexts, which should be developed by the pertinent authorities (courts, investigators, medico-legal institutes, etc.).

Forensic identification of human remains generally involves three main stages of investigation:

- background research
- recovery of remains
- laboratory analysis and reconciliation.

When a missing person is believed to be dead, two complementary lines of investigation must be pursued:

- tracing the whereabouts of that person once he or she has been reported missing by his or her family or other reliable sources
- forensic identification of human remains.

The forensic identification of human remains is a **legal determination** (sealed by the jurisdictional authority's signature on a death certificate) based on the scientific matching of information on missing persons with unidentified human remains. Identification requires a holistic approach that takes into consideration all available scientific and contextual evidence. Each line of evidence must be weighed and treated on its merits. The scale of the identification project must also be considered and the identification strategy adjusted accordingly.



BACKGROUND RESEARCH

Preliminary investigation is needed to locate, assess, collate and organize all available information on missing persons and the whereabouts of human remains. This information can enhance the identification process in a number of ways, for instance, by:

- corroborating witness statements about where and when the missing person was last seen
- providing specific details for comparison with characteristics noted on recovered remains
- helping investigators locate possible gravesites.

It is important to collect information pertaining to the person before he or she went missing. This information, called *ante-mortem data* (AMD),¹ can be obtained from family members and sometimes from close friends and colleagues. AMD on a missing person generally include the following types of information:

- general personal/social information (name, age, home address, place of work, marital status, etc.)

Background research can draw from various sources, such as interviews or written records. All information should be thoroughly documented and the documents maintained in a central registry.

Oral sources (interviews)

- family members
- witnesses
- friends
- activists
- dentists
- doctors
- perpetrators
- others

Written records

- legal reports
- police and military reports/archives
- autopsy reports
- fingerprint records
- photographs
- death certificates
- cemetery records
- satellite photographs
- press reports
- NGO reports
- other

¹ The ICRC, in consultation with experts from around the world, has drawn up an Ante-Mortem Data (AMD) Collection form, available from the ICRC's Forensic Services, gva_op_assist_forensic@icrc.org.

Witnesses can also be a source of information on missing persons, providing data such as:

- circumstances of disappearance
- information on the burial of remains
- data regarding the discovery of remains from
 - demining activities
 - construction or agriculture
 - other accidental discoveries
- third-party/hearsay information on graves.



- physical appearance (height, weight, eye colour, hair colour, etc.)
- medical and dental history (fractures, diseases, missing teeth, dental crowns, fillings, etc.)
- distinguishing features (habits [e.g. pipe smoking], unique characteristics, like scars, birthmarks or tattoos)
- clothes and other personal items the missing person was wearing or carrying when he or she was last seen
- any circumstances related to the disappearance.

In addition, biological samples from the relatives of a missing person (and/or samples from the missing person acquired before his or her disappearance) may be collected for use in the identification process (see below).

Persons without specialized forensic skills may collect AMD and biological samples, but they must be trained in advance and should follow standardized procedures to ensure that the data are complete, of high quality, and reliable.

Mistakes in the data-collection process may lead to problems in the identification process.

The families and friends of missing persons are often the most valuable sources of background information. Usually, family members will have undertaken a great deal of research on their own, to uncover as much information as possible about the missing person, especially if several years have passed since his or her disappearance. While doing so, they sometimes come across information about other missing persons (not related to them), the location of burial sites, etc.

Any individual who was in contact with a missing person is a potential source of vital information. Although generally regarded as the first step in forensic investigation, background research can begin at any time (although the sooner the preliminary investigation begins, the better) and should continue until the missing person is found or until his or her remains are identified and returned to the family.



Boris Heger/CRC

RECOVERY OF REMAINS

Proper recovery and management of remains and associated evidence (e.g. clothes, personal belongings, and other pieces of evidence) are vitally important in forensic identification and can help clarify the fate of the person in question. Ideally, forensic archaeologists should conduct this process, especially when the circumstances of recovery are complex (clandestine burials, mass graves, extensive surface scatter as can occur in plane crashes, etc.). Their specialized skills and knowledge help ensure the proper recovery of remains and the gathering of as much additional information as possible for use in identification and other related activities. Improper recovery of remains and disrespectful handling can result in the loss of important data and may be extremely traumatic for families, and thus seriously undermine the humanitarian aims of forensic investigations.

Proper recovery makes possible, among other things:

- the recovery of *all* biological and associated physical evidence for assistance in identification
- less mixing when the remains of several individuals are found together, at the same site (“commingling”)
- identification of disturbed graves and differentiation between primary and secondary burials²
- less post-mortem damage to the remains
- proper documentation of findings.

Note: Archaeological methods are destructive and irreversible. *Once the recovery process is completed, that site is lost forever.* Therefore, it is critical that remains be recovered properly and procedures and evidence documented thoroughly.

² A primary burial is the first place where remains were buried. A secondary burial indicates that the remains have been exhumed from at least one previous site.



Broadly speaking, the recovery of remains involves three main phases:

- **locating** the remains
- **mapping** the remains and the entire site and **documenting** all relevant information
- **retrieving** the remains properly, labelling them, and **securing** them for transport, which can be particularly difficult if the remains are of many different individuals.

Human remains can be found in any setting, indoors (e.g. within buildings or amidst the rubble of destroyed structures) and outdoors (e.g. burial sites, on the ground, in watery surroundings, wells or caves). There are many

methods and tools for finding them. However, there is, as yet, no device for detecting bones. Often, the best information about the location of remains comes from witness statements.

Proper mapping and documentation make it possible to re-create the site, should it be necessary to return for any reason, and to create a physical or 'hard-copy' map (and/or an electronic one) for evidentiary, archival and analytical purposes. Mapping and documenting data, and ensuring their proper handling and management, are essential in the recovery process and should be carried out by trained individuals.



LABORATORY ANALYSIS AND RECONCILIATION

After the remains have been properly recovered, they should be sent for laboratory analysis and reconciliation, which involves answering five main questions:

- Are the remains human or non-human?
- Are the remains related to the conflict/disaster/situation in question?
- How many individuals do the recovered remains represent?³
- **Who are they? What are their IDENTITIES?**
- What is the cause of death?⁴

The first step in laboratory analysis and reconciliation is preparing and examining the remains. This must be done by specially trained experts (forensic pathologists, anthropologists, odontologists, etc.) who gather information – *post-mortem data* (PMD) – about the remains themselves and any circumstantial evidence.

PMD may include the following types of information:

- general information about the remains (age range, sex, height, etc.)
- medical and dental facts including unique characteristics of the remains (signs of old bone fractures or evidence of surgery, condition of the teeth and presence of any dental work such as fillings, etc.)
- trauma and post-mortem damage to the remains (both intentional and accidental)
- fingerprint information
- DNA data
- clothes and personal items found with the remains
- circumstantial information about the remains (where they were found and how they came to be in that location, including witness testimony, etc.).

³ Answering this question is particularly important if the remains of many individuals are found together.

⁴ Analysis for establishing the cause of death is standard procedure for forensic experts working in the laboratory and is a crucial component of legal investigation, including the identification process.



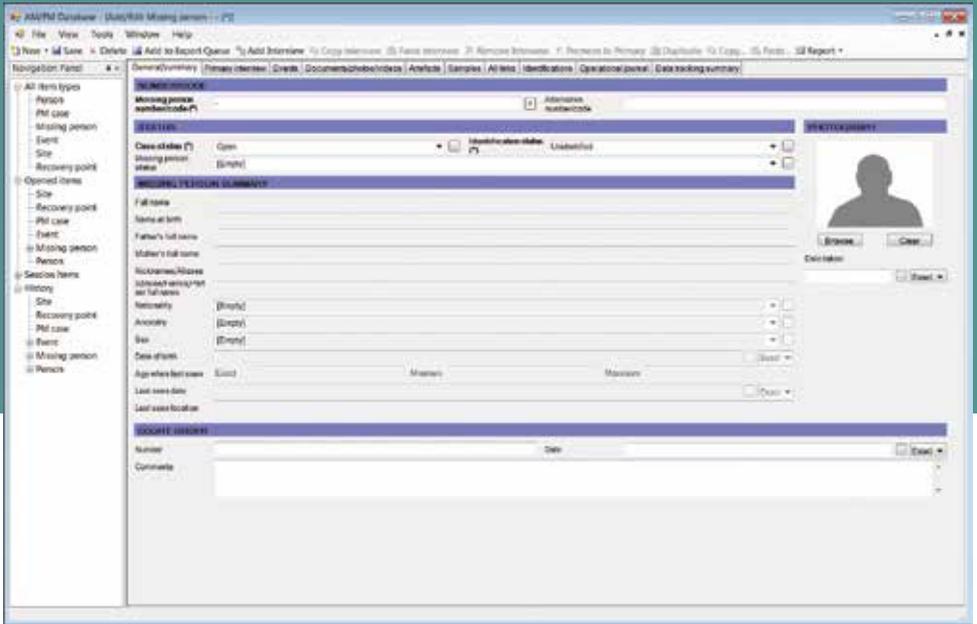
The PMD must then be "matched" with the AMD of a missing person (*AMD-PMD matching*), which must also be carried out by qualified experts. For example:

The family of a missing person reports that he:

- was 21 years old when he disappeared, was 175 cm tall, had a gold crown on an upper middle tooth, broke his left arm when he was twelve
- was wearing a blue-and-white striped shirt, black trousers with gold buttons and a gold wristwatch when he went missing
- that he was last seen in December of 1992.

The forensic experts and investigators know that:

- the remains are those of a male who was approximately 18–25 years old and 172–178 cm tall when he died, with a gold crown on the upper left central incisor; and there is evidence that he broke his left humerus (upper-arm bone) several years before he died
- a witness reports having seen the body of the missing person buried in February of 1993 in XX village
- the remains were found with a blue-and-white striped shirt, black trousers with gold-coloured buttons and a yellow metal wristwatch, in a grave in XX village that the local villagers report was dug in February of 1993.



AMD

PMD

Male ↔ Male

21 years old ↔ 18–25 years old

175 cm ↔ 172–178 cm

Gold crown on upper, central tooth ↔ Gold crown on upper, left central incisor

Broke left arm at age of 12 ↔ Old, healed fracture of left humerus

Was wearing blue-and-white striped shirt, black trousers with gold buttons and a gold wristwatch when he went missing ↔ Found with blue-and-white striped shirt, black trousers with gold-coloured buttons and a yellow metal wristwatch

Last seen in December of 1992 ↔ Witness reports having seen the body of the missing person buried in February of 1993 in XX village/remains found in a grave in XX village, which, according to local villagers, was dug in February of 1993



AMD-PMD MATCH

The greater the number of matching characteristics between the AMD and the PMD, the greater the likelihood that the remains are indeed what they are believed to be. For example, if the only characteristics that match the AMD with the PMD relate to general information about the remains, such as those listed above in black, then it is highly probable that many missing persons will “match” the unidentified set of remains. But, logically, there can be only one true match. These coincidental matches can be particularly common and problematic if many of the missing persons are soldiers missing in action or if a large number of persons are missing.

Electronic databases with automated matching and other application tools, such as the ICRC’s Ante-Mortem/Post-Mortem (AMPM) Database,⁵ can be of assistance in providing hypotheses of identity, particularly in large-scale investigations of missing persons and unidentified remains.

Typically, an identification is made when the AMD and PMD match in sufficient detail to conclude that they are from the same individual, to the exclusion of all other reasonable possibilities. Highly discriminating scientific means of identification, which are also part of the AMD-PMD matching process, may be conclusive to a degree that would be considered beyond reasonable doubt in most legal contexts. These means include:

- matching ante-mortem and post-mortem dental data
- matching ante-mortem and post-mortem fingerprints
- matching other identifiers, such as unique physical or medical traits, including skeletal X-rays and numbered surgical implants or prostheses
- matching DNA profiles from remains with reference samples.

The final step in the laboratory analysis-and-reconciliation stage of forensic identification involves consolidating all the available data (field data, AMD-PMD matching data, etc.) to

⁵ Further information on the AMPM Database is available from gva_op_assist_forensic@icrc.org.

achieve a positive identification in which one set of remains is conclusively matched with one missing person.⁶ A reasonable explanation should be furnished for any inconsistencies between the AMD and PMD. The forensic identification of human remains must take a holistic approach: all information that could help identify a body or set of human remains should be considered. As a general rule, the

more reliable (i.e. correct), complete, detailed and specific the data, the better the chances of correctly identifying the remains.

Forensic practitioners have a duty to keep the parties concerned abreast of developments in the identification process; the conclusions of analyses should be communicated clearly and intelligibly.

⁶ In some situations, reconciliation (consolidation of data and final identification) is a separate stage of investigation that is carried out by an external, authorized panel, sometimes known as an "identification commission."

ANNEX – A FEW WORDS ABOUT DNA

A person's DNA is inherited directly from his or her parents, and no two people (except monozygotic, or identical, twins) share exactly the same DNA.⁷ The uniqueness of each person's DNA makes DNA analysis a powerful tool in identifying remains.

In forensic identification, DNA data may be used to:

- **provide scientific evidence to confirm an AMD-PMD match**
or
- in DNA-led programmes, **provide scientific identification, which is then confirmed with AMD-PMD matching** (when a large number of persons are missing, it is critical to confirm a DNA match by ensuring that all the AMD and PMD data match, not just the DNA profiles, because of the possibility of coincidental DNA matches or human error.)

DNA direct reference analysis involves comparing DNA information from the remains of a missing person with that from samples left behind by that person before he or she died, such as hair (e.g. from a brush or a comb), fluid samples (e.g. as retained by a physician), teeth (e.g. baby teeth), etc.

DNA kinship-reference analysis – the most common type, especially when people are missing as a result of armed conflict or other violent situation, or during a natural disaster – involves comparing DNA information from the remains of a missing person with that from samples (e.g. blood, saliva) given by biological relatives of the missing person. Nuclear DNA cannot easily be used for matching with relatives other than close family members. Ideally, children and parents would be used for comparison. Reference samples from non-blood relatives cannot directly provide information on the genetic identity of the missing person.

DNA reference samples can be collected from family members at the same time as other AMD. Persons without specialized forensic skills may collect reference samples, but they must be trained in advance and should follow standardized procedures.

After the DNA from the missing person's remains and the reference samples are processed, DNA experts can compare and evaluate the significance of a match between the DNA from the remains and that from the reference sample(s).⁸

⁷ This refers only to autosomal nuclear DNA.

⁸ For more information on the use of DNA for identifying the remains of missing persons, see *Missing People, DNA Analysis and Identification of Human Remains: A Guide to Best Practice in Armed Conflicts and Other Situations of Armed Violence*, 2nd ed., 2009, ICRC, http://www.icrc.org/eng/assets/files/other/icrc_002_4010.pdf



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