# Chapter 8
# Methodology of Forensic Soil Examination in Russia and a View on the World Standardization Process

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**Abstract** A survey is given of the current status of forensic soil examinations in the Russian Federation, emphasizing the uniformity of the methodology that has been developed and implemented in Russia. The methodology is outlined, as well as the training of forensic scientists to work according to this methodology. Next attention is paid to the difference in the interpretation and presentation of the results of forensic examinations in Russia and elsewhere. In Russia courts do not accept probabilistic evidence and results are to be given in a categorical form. To further elucidate the consequences of this the separate stages in the process of conducting a forensic soil examination are depicted. Finally the practice of soil forensics in the Russian Federation is illustrated by presenting the questions asked and the answers given in six real cases.

## 8.1 Introduction

Experts and expert activity differ greatly from what we can see on TV screens in different shows and serials. To our minds the real expert activity is best of all described by Collins and Johll (2006). In their publication on forensic chemistry they state that forensic scientists do not directly solve crimes but simply analyze the physical evidence, that is combined with all the other evidence by the detective assigned to the case. It is the detective who attempts to solve the crime, forensic scientists do not work for the defense nor for the prosecution but are advocates of the truth under all circumstances. As we see it this view can be adopted as a manifest for forensic scientists.

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H. Kars, L. van den Eijkel (eds.), *Soil in Criminal and Environmental Forensics,*
Soil Forensics, DOI 10.1007/978-3-319-33115-7_8

## 8.2 Methodology of Forensic Science in Russia

In our country the status of forensic examination and forensic experts (rights and duties) are given in the Codes of Criminal and Civil Procedure of the Russian Federation. Not long ago a special Federal Law on State forensic activity, which covers all state and private expert activity within the Russian Federation, was adopted. By now a number of State Forensic Laboratories of the Ministry of Justice cooperate in a network, with the Russian Federal Centre of Forensic Science in Moscow as its parent organization.

Already in 1980 a discipline of theoretical forensics was developing markedly in Russia, providing a uniform approach in the formalization of concepts and working out a general methodology for forensic examinations. From the first days of its foundation the Russian Federal Centre of Forensic Science seeks to develop manuals and training programs, to provide quality assurance systems and to harmonize methods and techniques in all laboratories for all forensic disciplines.

In accordance with the *uniform* requirements, adopted by the Ministry of Justice, special training programs and a special proficiency testing procedure along with a number of manuals were developed for applicants for a state forensic expert job for different forensic disciplines. In addition *uniform* requirements for forensic expert reports were developed and adopted by the Ministry of Justice.

We want to outline the uniform system of management for providing forensic soil examination that exists in Russia since the 1980s. Below let us see its main components.

## 8.3 Training Programs: Certification and Recertification of the Expert

The training program focuses on the development of theoretical and practical knowledge, skills and abilities that are necessary to the forensic examination of objects of soil origin. The training usually lasts about 6–12 months depending on the education, skill and ability the applicant already possesses.

All persons employed should have at least a bachelor's degree in soil science or geology and it is very desirable for them to be skillful in the examination of macro and micro soil structure, soil classification, soil mineralogy and microscopic analysis.

The program comprises a whole number of topic areas concerning general forensic science theory, criminalistics legal documents and standard acts as well as special knowledge about the examination and analysis of soil. It also includes guidance on forensic science procedures and working as an expert. A list of references for self-learning is given to the trainee.

The training process consists of the following consecutive stages in which the applicant is carefully guided to learn working as an independent forensic expert:

- Self-learning of the literature as specified in the training program.
- A course of lectures on the theory of forensic science and ABC of criminalistics
- Test work: writing a review of methodological approaches in forensic soil examination on one of several suggested topics.
- Contact training hours in a laboratory setting.
- Control tasks.
- A proficiency test.

The goal of "Contact training" is to give applicants the specific skills required of the forensic soil scientists. For this purpose it is considered to be very desirable that an applicant is involved in a real case examination process together with an experienced soil expert.

To demonstrate that the ability to carry out an examination independently has been acquired, an applicant should fulfill control tasks (mock cases) and present them as expert reports according to the requirements for reports as adopted by the Ministry of Justice.

Control tasks mimic real case scenarios as closely as possible. Each applicant should complete at least five control tasks involving questions about the provenance of questioned soil samples and their relation to a specific source that is relevant to the crime.

Then an applicant must pass an exam, where he must answer questions on three topics: general forensic science theory, the ABC of criminalistics and his specialty (i.c. forensic soil examination). After passing such exam successfully an applicant will get the diploma of the additional special education on forensic soil examination and will become the certified forensic soil examiner.

Recertification of an expert takes place every 5 years. This procedure involves an external reviewing of five expert reports that were made in the last 5 years. The review has to be positive for the expert to pass the proficiency test and be recertified.

## 8.4 Manuals for Forensic Soil Examination

The first manual on forensic soil examination was published in 1978. It was revised and republished in three parts in the beginning of the 1990s. The first part was devoted to theoretical aspects: "The Basic Scientific Principles of Complex Criminalistic Soil Examination (A Manual for Experts, Case Investigators and Judges)" and the following chapters are included:

- Objects of forensic soil examination.
- Subject of forensic soil examination.
- Classification of forensic soil examination tasks.
- Forensic soil examination: management and procedures.
- Collection and packing of materials. Recommendations for sampling.

– The work of an expert on a scene of crime.
– Sorting of soil characteristics in complexes (“ensembles”) as being generic, grouping or individualizing.
– Analysis and collection of results, interpretation of results.
– Conclusions (the actual formulation of the answers to the questions posed).

The two other books are “Forensic Soil Examination. Methods of Complex Criminalistic Soil Examination (A Manual for Experts, Case Investigators and Judges)”. They are devoted to the examination of mineral constituents and organic constituents (plant materials and organic matter). In these two books are described a wide variety of special techniques for analyzing small soil samples by simple routine methods as well as by the most modern physicochemical techniques of the time. The methods described in the manual were newly developed or borrowed and modified from different fields of science.

These books till now remain the main manuals for all forensic soil experts in Russia.

As stated in the Federal Law about expert activity, the forensic expert has to conduct an examination using special knowledge, techniques and equipment to answer questions posed by the case investigator. Experts have the right to use any method and procedure that they deem necessary, but they must provide the reasons for their choices in their examination reports. All forensic investigations begin with a careful study of case papers, especially reports from the scene of crime. Sometimes it is necessary to visit a crime scene to examine its physical environment (e.g. relief, nature and homogeneity of the soil and the vegetation). When a visit is not possible, experts usually request photographs which were made during the examination of a crime scene. Then the expert examines items and chooses a scheme according to which he will conduct an investigation. Of course, every case is very individual, but after many years of experience a number of the most typical schemes were described and adopted for forensic soil examination in our laboratory. These schemes are depicted in the above mentioned manuals.

## 8.5 International Forensic Science Communities and Standardization Process

Nowadays a number of international communities all over the world are actively involved in drawing up best practice manuals, setting up collaborative tests and education and training programs and are working towards increased harmonization and standardization of methods and techniques in forensic science. In Table 8.1 the most important networks involved in this process are summarized.

The standardization process and the harmonization of national standards with global standards nowadays proceeds markedly in Russia. We very much want to keep up with the global standards. In the context of the globalization process our organization attempts to contribute to global consistency. Our organization has

**Table 8.1** Forensic science networks

| Full name | Acronym | Website | Orientation |
|---|---|---|---|
| European Network of Forensic Science Institutes | ENFSI | www.enfsi.eu | Europe |
| American Society of Crime Laboratory Directors | ASCLD | www.ascld.org | USA/Global |
| Senior Managers Australian and New Zealand Forensic Laboratories | SMANZL | www.nifs.com.au | Australia/ New Zealand |
| Academia Iberoamericana de Criminalistica y Estudios Forenses | AICEF | www.2itad.or2 | Spanish-speaking countries |
| Scientific Working Group for Materials Analysis | SWGMAT | www.swgmat.org | USA/Global |
| Asian Forensic Sciences network | AFSN | www.asianforensic.net | Asia |
| The International Union on Geological Sciences (IUGS) Initiative on Forensic Geology | IUGS-IFG | www.forensicgeologyinternational.com | Global |

always been a member of ENFSI working groups, such as Animal, Plant and Soil traces (APST), Textile and hair, Document, Handwriting and some others. We are very glad, that the APST working group of ENFSI and the International Initiative group on Forensic Geology were founded and it is very important for us to be involved and that our organization and Russia as a whole, takes part in these global initiatives.

Considerable work has been done by international communities in developing different documents to this moment. A review of periodic literature and documents highlighted that the procedure of forensic examinations and the techniques and methods used in various countries are practically the same in general. The major difference between the approaches in Russia and in other countries is found in the way the results of examinations are presented in courts or in how the strength of evidence is expressed.

The probabilistic approach is used in a number of countries. In that approach the value of the likelihood ratio could quantify the degree of probability or the strength of the evidence. It is well known that a large part of forensic soil examinations is based on examination of morphological (pattern) characteristics and there is still no uniform doctrine on how soil experts should interpret them and present the obtained data in reports. In most cases the interpretation and presentation look like a subjective opinion of an examiner which cannot be easily formalized and valued with the help of likelihood ratio. We fully agree with Aitken (2009) that there are a lot of

difficulties to develop a procedure using likelihood ratios for soil forensic analyses in the nearest future. Even in instrumental analysis where statistical analysis seems to be possible, an expert encounters difficulties in estimating accuracy. Statistical estimation in most cases is also a puzzle that still needs to be solved. It differs completely from that in DNA analysis. Usually only semi quantitative or even qualitative data can be obtained for soil traces. That is the consequence of having small amounts of substance under consideration that originate from a large, divers and heterogeneous soil cover.

Since the numerical form of the likelihood ratio cannot be easily calculated or interpreted for the court, translating it into verbal scales according to the subjective expert's opinion was proposed by the Association of Forensic Science Providers (Standards for the formulation of evaluative forensic science expert opinion 2009) and is adopted in a number of European countries (for example The Netherlands, Ireland and Sweden). We much appreciate the tremendous work of the ENFSI group on development the "ENFSI guideline for evaluative reporting in forensic science", and consider it to be a great step forward.

In Russia courts do not accept any probabilistic evidence. This leads to the fact that the evidence should be expressed in the categorical way, or in other words the answers to the questions posed by the case investigator should be given in the categorical form. If results are given in the probabilistic form to our Courts that is *de jure* equal to the answer that it is impossible to solve the task of forensic identification.

Though probabilistic results are not accepted by Russian courts, the answers given in the probabilistic form, sometimes, may be very useful for case investigators in the inquisition process, in the search process to evaluate leads and for verification of the reliability of somebody's testimony.

## 8.6 Forensic Identification and Inference of Identity in Soil Forensics in Russia

We have described once very briefly the basic tasks in soil examination in relation to the forensic context (Gradusova and Nesterina 2009), but in this work we would like to pay attention to the *identification task* (sometimes in literature called *individualization*) since it is the most complicated task to solve as well as to present in courts. The ultimate aim of all forensic identification science is the inference of identity. Two broken fragments of glass that physically fit together and were once one piece are known to be the classical example of identity.

In the late 1970s the method of "identification of the whole by parts" in the absence of an interface or a common boundary line has been developed in Russia by Mitrychev (1976). This method was borrowed from forensic medicine, forensic portrait examination and archeology. It became the uniform method in the practice of forensic science in different disciplines where identification of different objects (including those of natural origin) should be established.

It is considered that a source can be examined like a set being composed of a number of subsets (structural components) which are identically equal with known samples. When comparing known soil samples with questioned soil samples an expert should state the identity of a source. It is accepted that a source is identically equal to known samples. Then, questioned samples are accounted to be an identifiable object and known samples are accounted to be an identifying object.

The principle of forensic soil trace investigation is based on the following. A forensic examiner should identify the scene of crime (top soil, soil covering or burial) or other appointed place (the whole) by structured examination of the parts (for example, soil layers taken from items which might depict the features of the whole, and/or complex of different constituents of soil traces).

The identification is considered to be a multistage process. It can be discontinued in every stage when:

- There are no soil traces
- There are soil traces, but they are unusable for examination
- Individual characteristics are absent or a complex of individual characteristics is absent

Identity may be established only when the soil (or soil covering) at the crime scene possesses individual characteristics or an individual ensemble of characteristics and they have been depicted in the traces.

An expert can never be sure that a characteristic or complex of characteristics is individual until he has observed all relevant objects (places), or knows the frequency of their appearance. Of course it is virtually impossible to inspect large territories. It will enlarge the time of investigation significantly. Therefore, as a rule, the frequency of appearance of such complexes is unknown and in those cases experts rely on their experience and skill and also on different data taken from literature.

After the investigation process begins the process to establish identity. Here all results should be thoroughly analysed, summarized and interpreted and finally, conclusions are to be made.

Stoney (1991) imagined the mechanism of the identity establishing process as a "leap of faith". Sierps and Berger (2012) wrote: "The reasoning process leading to a conclusion often requires more than just 'common sense' and basic logic". As a joke we say that in the result of investigation first of all "an examiner himself should be satisfied that he has arrived to the truth" before he begins the inferential process, writing an expert report the end point of which is to answer the questions posed by the customer (the case investigator).

## 8.7 Questions and Answers in Forensic Soil Examinations

Questions posed by a case investigator are usually as follows:

- Are there any soil traces on the questioned items?
- If "yes", then: do they have a general group belonging with the crime scene (soil or top soil on the crime scene)?
  or

– If “yes”, can they originate from that place?

Conclusions can be as follows:

– There are, or there are no soil traces on the items.

If the identity is established, then:

– The soil traces on the items are derived from the place appointed by the case investigator and characterised by comparison samples

BUT, usually (in the majority of cases) there are no individualizing characteristics for soil matter in any place. In these cases we give conclusions like:

– The soil traces have general group belonging with the soil covering or “soil material” on the place (crime scene) appointed by the case investigator.
– To answer the question whether the soil traces originate exactly from that place is not possible due to the absence of individualizing features or an individualizing ensemble of characteristics.

Experts should explain or clarify in the experts report (not in the conclusions!) what it means “to have a general group belonging”. **General group belonging** does mean that “A soil trace on a questioned item is derived as the result of contact of the item with the top soil or soil material on that place or on another place with the same ensemble of characteristics”. It is just the same as to say “The fact that the soil traces on the item really originate from that place can not be excluded”.

When there are no similar or common characteristics at all, or there is a significant difference in the ensemble of characteristics, the conclusion should be:

– The soil traces on the questioned items are not derived from that place.

If an expert has conducted an examination but could not come to any of the above mentioned conclusions, then the following answer should be given:

– It is not possible to answer this question for the reasons described previously in the research part of the report.

## 8.8 The Structure of the Expert’s Report

According to the instruction, developed by the Ministry of Justice every expert report should consist of the following main parts: a written undertaking (on a separate page), Introduction, Research, Comparative study, Summary (Results and discussion), Conclusions.

Every part, mentioned above, by-turn should comprise the following points respectively.

### 8.8.1 A Written Undertaking

- Name, title, education, qualification, data of the initial and the last accreditation of an expert
- Corresponding chapters and points of the Criminal (Civil) Code which should be signed by the expert
- A date and the expert's signature

### 8.8.2 Introduction Part

- Identification number of the report
- Identification number of a criminal case
- Day, year, time when an examination was begun
- Day, year, time when an examination was completed
- Data, when it was received and registered
- Identification of a case investigator/customer
- List of items which were presented and are to be examined
- List of materials (photos, reports from the scene of crime and so on) which were presented along with a request
- Questions posed by a case investigator/customer
- Short case story, if necessary to explain the further examination procedure

### 8.8.3 Research Part

- Description of wrappings, labels, seals and so on
- Description of the consistency of wrappings
- Description and photos of exhibits if necessary
- Localization of traces on the items and photos if necessary
- Ascertainment of the soil nature of these traces
- If there are objects of another nature (paint, fibers, glass, etc.) the expert should inform the case investigator and, if necessary (if there is a question of a customer/case investigator), make a complex examination together with an expert of the appropriate other competence
- Recovering of the questioned soil substance/soil traces from the items if possible or/and if necessary
- Selection of a scheme to carry out the comparative examinations
- Citation on literature which was used during the examination

### *8.8.4 Comparative Study*

Examination of the bulk comparative sample(s):

- Determination of characteristics

Examination of the questioned object:

- Determination of characteristics

During the separate examination of comparative and questioned soil samples the expert should determine as many independent characteristics as necessary and enough to discriminate questioned and comparative soil samples, or to determine group belonging of the questioned sample to the source, or to determine the identity of the source. In every case a whole ensemble of independent characteristics has to be established and compared to each other.

### *8.8.5 Generalizing Part (Results and Discussion)*

When generalizing the results of the comparative study, the expert should ascertain the discriminations and similarities in ensembles of characteristics of both questioned and reference soil samples. The expert should describe the characteristics he considers to be in a group or individual and explain why that is so.

## 8.9 Conclusions

Conclusions should be formulated exactly in compliance with the questions posed by a case investigator.

The written expert report must be verified by the head of the laboratory and then by the Assistant Director on expert work.

The investigation should have a real scientific base, nevertheless the expert report should be written very clearly in simple language. Explanations and interpretations of results must be understandable also for the non-specialist. We consider the interpretation of results and the formulation of answers or conclusions to be one of the most complicated problems in forensic soil examinations. The ability to analyze and interpret characteristics of the soil during forensic soil investigation is a skill, gained by training and testing and by many years of experience.

To our mind however, the mechanism of the identification process in forensic soil examination can hardly be formalized and standardized any time soon. So, as we see it, the assessment of what is, and what is not meaningful or significant and whether an ensemble of characteristics is individual or not, depends mostly on the quality of the forensic examiner.

Owing to national, traditional peculiarities in legal systems and therefore in forensic examination procedures, reporting and presenting results, we deem that verification of professional competence of forensic soil examiners in different countries nowadays may be fulfilled best of all only by their participation in collaborative trials and also by accreditation according to ISO/IEC 17025 and ILAC-G19:08/2014.

We hope very much, that international communities all together will work out a uniform strategy and develop a uniform quality assurance system which will aid to strengthen the evidence of forensic soil examinations and contribute to the acceptance of forensic soil examinations by courts and protect experts from distractions that can be made by lawyers.

Very briefly by giving examples from our practice we'll try to demonstrate the way we come to conclusions and the forms of conclusions we give in our reports.

### *8.9.1 CASE I Attacks of People of Non–slavic Appearance by a Group of Guys Armed with Pocket Knifes*

Two men were attacked in broad daylight by a criminal group of guys armed with pocket knives. It happened in two different sites of one local region. One man died virtually at once on the crime scene from fatal hemorrhage and another was terribly injured but survived.

As we later learned (after requesting the materials of the case) a group of young perpetrators, so called fascists, was walking along one region in the south-west of Moscow looking for victims of non–Slavic appearance.

The surviving person was from Uzbekistan, but he refused to give any witness account and very soon left Russia. The autopsy revealed multiple stab wounds on the body of the murdered man, but only one of them was considered to be mortal. Many people witnessed the criminal fact but all of them affirmed they could not make out the assailant's appearance. One of the guys seriously injured his arm when he was working with his knife and applied to a clinic for a medical advice. All clinics had been informed about the criminal assault to that moment and the young man was detained right in the clinic. Neither knife nor blood or any other evidence that could have been subjected to DNA analysis was found. The case investigator brought us the sport boots taken from the apprehended person and four comparative soil samples, taken nearby the murdered man. Questions posed by the case investigator were:

– Are there soil traces on the boots presented for investigation?
– If so, have they general group belonging with the soil on the scene of crime (the place of murder)?
– Were these soil traces generated at the scene of crime?

Twelve larch (Larix) tree needles and fragments of moss in the questioned soil sample were found. We visited the region where it happened and found out that it was a rather large territory with asphalt roads between multi-storey housing and places with open soil covering. Somewhere soil was covered with grass and moss. Different trees were growing there in the gardens near by the houses. Fourteen larch trees grew along all the way the group of young perpetrators had taken, one of them stood very close to the place of the murder. Samples of needles from the 14 larch trees and samples of moss which was found along the way were collected. Fourteen additional reference soil samples (only samples consistent with the questioned sample in color and granulometric composition) were collected along the entire route of the criminal group.

The characteristics which were taken into account in the comparative investigation were: soil color, texture, degree of carbonate activity (calcareous or not calcareous soil), granulometric composition, mineralogical composition, composition of the pollen-spore complex, anthropogenic particle composition (we call them 'inclusions'), plant remains and plant fragments and DNA analysis of the larch needles.

The results of the comparative study demonstrated that all 14 reference samples were similar in the biggest part of the characteristics with the questioned sample. Two reference samples, one of which was taken just from the scene of crime, had a completely similar ensemble of characteristics as the questioned traces. We made an attempt to differentiate sites with the aid of DNA analysis of the larch needles, but unfortunately DNA analysis gave poor results. So there was no individualizing ensemble of characteristics.

The following answers were given in the report:

– Yes, there are soil traces on the boots presented for investigation.
– he soil traces on the boots have general group belonging with the soil on the scene of crime (the place where the murder took place).
– It is not possible to answer the question "were they generated from the scene of crime?" because of the absence of individualizing characteristics.

### *8.9.2 CASE II Rape of an 11 years Old Little Girl*

According to a girl's testimony she was walking nearby her house in the garden. A young man whom she did not know before and whose appearance she could not remember asked her for a mobile phone to make a very important call. Then he told her that he would return the mobile phone if the girl would follow him. When they reached a remote place near by train tracks and heat supplying pipes, the man threw the girl on the pipes and hit her on the head. The girl blacked out and couldn't remember what had happened after it.

The items for examination were the girl's clothing. The posed question was:

– Are there soil traces on the girl's clothing?
– If so, do they originate from the crime scene?

– What is the localization of the traces?

We requested photos from the scene of crime and analyzed them. Then an investigation was conducted and the following answers were given:

– There are no soil traces on the clothing. There are a lot of small fragments of glass, fibers and fragments of insulating materials.
– It is not possible to answer the question "did the traces originate from the crime scene?" for the reason that such small particles are widespread on urban territories.
– The localization of the traces is very unusual for normal use of clothing and is shown on photos (see the attachment to the report).

### *8.9.3 CASE III Fall of a Young Lady from the Eighth Floor*

A young lady was in the company of two guys. According to the guys testimony the company was sitting in the kitchen. The young lady was drinking a lot. Then the guys went out to the balcony and left the lady alone. When they returned, the kitchen was empty.

The guys found the lady lying facedown on the ground near by the wall of the house and close to the tree. Brunches of the tree were broken and some of them were lying over the body. The lady was dead. Questions posed by case investigator were:

– Are there any soil traces on the lady's clothing? If so, do the traces originate from the place where she was found?
– Are there any soil traces of another origin, if so, what is the region where they might have originated from?

After examination we concluded that the traces on the dress might have been formed as a result of falling through tree foliage, however the quantity of the soil traces was not enough for comparative study. This was all depicted in the research part of the report. The answers given were as follows:

– There are traces of soil and plant nature on the lady's clothing.
– It is not possible to answer the questions "do the traces originate from the place where the girl was found?" and "are there any soil traces of another origin and what is the region where they might have been originated from?" for the reasons described in the research part.

### *8.9.4 CASE IV The Rape of a 16 years Old Girl*

It happened in one of the Moscow regions. A 16 years old girl, covered in mud, came to the police and stated that she was raped when returning home from her friends in another village in the late evening. The girl told that when she was

walking along the road near by a forest somebody attacked her from the backside, grappled her neck and dragged her into the forest. Then the malefactor threw her down on the earth and raped her. To check the girl's words the police officer asked the girl to show him the place where the accident has happened and clarify how she was lying on the earth. The questions posed by the police officer were:

– Are there soil traces on the girl's clothing (jacket and jeans)?
– If yes, then, what is their localization?
– If yes, do they have a general group belonging with the top soil on the crime scene?

The items were thoroughly examined and it was stated that there were really soil traces on the girls clothing. Their localization fully corresponded with the girl's testimony. The quantity of soil traces was very small, but we could make a comparison on a number of characteristics, including a very specific ensemble of small particles, which was extracted from them. It was established that the set of characteristics of the reference sample was similar with those of the soil traces. We could not confirm that the whole complex of determined characteristics was individual. So the following answers were given:

– Yes, there are soil traces on the girl's clothing (jacket and jeans).
– The localization of the soil traces is described in the research part of the report and is shown on photos that were included as an attachment to the report. The localization of traces on the girl's clothing fully correspond with her testimony.
– Soil traces on the girls clothing have a general group belonging with top soil on the crime scene.

### *8.9.5 CASE V An Auto Theft with the Murder of the Owner*

Three years ago, in the beginning of June, a woman came to a police officer and said that her husband went to a lake in his car for fishing and disappeared. A month later he was found murdered. The corpse was found in a pit, which was situated in a forest on the slope of a hill. The case investigator got information that the man was the victim of criminal gang members that stole expensive autos for spare parts and killed their owners. Soon two offenders were detained. A shovel and an axe with soil traces and plant fragments were found in their garage.

The questions posed by the case investigator were:

– Are there soil traces on the shovel and the axe?
– If yes, do they generate from the pit where the murdered man was found?

When visiting the crime scene we examined the pit where the corpse of the victim was found. We took reference soil samples from the walls of the pit at different depths. Also we examined the vegetation and noticed that the pit was dug near a birch tree. We saw that roots of this birch tree were damaged very specifically, most

likely as a result of using a shovel and axe as tools for digging. Soil traces and soil samples taken from the scene of crime were similar in the whole ensemble of characteristics: color, micro texture, lack of carbonate activity, granulometric composition (very specific and typical for wash-inwash soils), mineralogical composition, content of decomposed organic matter, chemical composition of the clay fraction. Also they were similar in the composition of plant fragments and pollen and spore spectra. The parts of roots of birch tree in the traces had the same type of damage as the roots in the pit.

Though we had a wide specter of similar independent characteristics we could not establish identity in that case, because the offenders denied the murder of the man. They insisted that they did not see the victim at all, but saw only a car with open doors and a murdered dog lying near by it. They said they used shovel and axe when burying the dog's corpse. The dog's burial place has not been found. So it was impossible to prove or disprove this declaration. The following answers were given:

– Yes, there are soil traces on the shovel and axe.
– To answer the question "do the traces generate from the pit where the murdered man was found?" is not possible because there are no known samples from the dog's burial place.

### *8.9.6 CASE VI A Murdered Man on a Snow Cover*

A murdered young man with a fractured skull was found in winter lying on a snow cover nearby an asphalted road in the Moscow region. Soil traces were easily seen on his jeans, though there was no place with soil covering around the corps. These soil traces seemed to be very unusual for that season. Questions posed by the case investigator were:

– Are the traces on the jeans really soil traces, if so, what are the characteristics of the soil covering on that place?
– How did the traces on the jeans get there?

After examination we gave the following answer:

– The soil traces might be the result of the jeans contact with a wet soil, contaminated with indoor anthropogenic particles.

Two years passed and the case investigator found two suspects and the place where it might have happened. The fact of the matter was as follows. Three men were sitting in the kitchen in the cottage of the future victim drinking spirit. After they drank a lot they began to quarrel. One of them took a bottle and hit the owner of the cottage on the head. The man fell down on the floor and seemed to be dead. The fellows were frightened and hid him till night in the cellar, the entrance to which was situated in the floor of the kitchen. At night they brought out the body to the forest by car and threw it on the snow. The posed question was:

– Do the soil traces on the jeans really originate from the cellar of the cottage situated at the appointed address?

Apart from soil traces small particles of a different nature were determined in the traces on the questioned jeans. Forensic experts of different disciplines were involved in the process of this examination. A complex, interdisciplinary examination was conducted. It was stated that soil samples, taken from the cellar and soil traces taken from the questioned jeans had the same complex of particles with the same characteristics. It was possible to state that this complex of characteristics was individual and the following answer was given:

– Yes, the soil traces on the jeans originate from the cellar of the cottage situated at the appointed address.

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