

1 An introduction to buried remains

1.1 Questions of time

This is a book that deals specifically with buried remains of forensic interest – that is, remains which are germane to a modern criminal investigation; it is about finding these remains and recovering them. It is a book about clandestine burials and concealment, about what can influence search and recovery processes, and about what matters in a forensic sense. It is not a prescriptive manual or a set of standard operating procedures (SOPs) for the specialists involved. The Senior Investigating Officer (SIO) will not find a useful set of ‘tick boxes’ that will guarantee a successful enquiry; nor will the Crime Scene Manager (CSM) find a list of actions that a proper investigation ought to undertake. This book tries to examine how different subject areas interact when it comes to investigating the modern buried past. Successful forensic excavation requires awareness of the component evidential elements and what they signify, together with an understanding of formation processes and how to interpret them. Thus, this is a book about questioning, not about giving answers. This first chapter provides a general introduction to the chapters that follow.

Strictly, the word ‘archaeology’ is a misnomer in a forensic context because the subject of interest, although buried, is not ‘ancient’, which is the usual definition of the discipline. That said, the phrase ‘forensic archaeology’ appears to have become well cemented in forensic literature as well as within archaeological circles, and so this is the phrase used throughout this book. In any event, the approaches to studying ‘ancient’ (archaeological) buried remains and those used to investigate in a modern buried forensic context are largely the same. It matters not whether concealment in the ground occurred yesterday morning or in prehistoric times thousands of years ago. Not only are the processes of finding and recovering evidence from these two chronological extremes much the same, but the methods we use to make sense of that evidence are substantially the same too. It is not really the extent of elapsed time between then and now that is the issue (although it would be incorrect to maintain that it had no effect at all), but the critical difference that lies in the questioning or interrogation of the evidence recovered according to the answers needed.

Take, for example, carbonised grains discovered from a prehistoric hearth: they may tell us about crops grown and thus land use and clearance, while the weeds of cultivation from the same hearth have a direct bearing on harvesting methods and crop processing. Together these prehistoric grains enable us to enquire about a developing farming community and its

impact on the landscape. Grains caught in the trouser turn-ups of a victim buried yesterday will identify particular crops in a specific habitat harvested recently or growing naturally; they enable us to take the enquiry to particular landscape locations at a particular time. The physical evidence is much the same in both instances, but we need to ask different questions because of the different purposes to which the answers will be put. Equally, when a small piece of clothing fabric survives in a prehistoric burial, archaeologists will seek to ascertain what the material was, how it was woven and what dye was used in order to learn more about early textiles and dress. A similar piece of fabric found in a grave caught in a victim's clothes may belong to the offender. The forensic scientist will look to define the fibre mix and colour, the type of garment from which it originated and the commercial outlets from where it might have been purchased. The evidence can lead investigators in many different directions according to the nature of the questions posed. In such cases, elapsed time is not a major factor compared to what can be gleaned from the surviving evidence.

1.2 Questions of interpretation

Remains lying under the ground surface – buildings, pits, walls and so on (including the human dead) – become buried according to a host of different processes and are surrounded by, and integrated with, different layers of earth that relate to their deposition and formation. These layers and their study (stratigraphy) are raw materials to the archaeologist; their analysis is the method by which our archaeological sites and ancient landscapes are excavated and understood; their significance is basic to all archaeological textbooks (Figure 1.1) (e.g. Greene 2002, ch. 3; Carver 2009, ch. 11). The majority of these layers are human-influenced – actions such as building, occupation, fire, demolition or abandonment



Figure 1.1 Example of an archaeological matrix of layers during excavation.

can all leave archaeological traces in the form of layers of differing magnitude, colour and physical character. Other layers are created by natural processes, for example, silting in river valleys, soil formation over abandoned buildings, sand blow or volcanic activity such as at Pompeii. The two types – anthropogenic and natural – can often occur together (see Case Study 1.1, also Section 6.1).

Take a simple forensic example – a grave that has been dug and left open for a period of time might accumulate a thin layer of silt from wind-blown soil and leaves. Later, when the victim is buried, the grave may become sealed by natural soil formation, hill wash and vegetation. This combination of natural and cultural events, together form a tangible sequence that is revealed in the ground. Archaeologists identify the actions in that sequence by interpreting the layers that reflect them. This is fundamental to field archaeology; the investigation of layers and their relationships enables us to reconstruct what happened in a given place during a past time. The stratigraphic evidence that the archaeologist records is empirical; it makes no difference whether the buried event occurred yesterday or 6,000 years earlier, the same principles apply.

Understanding layers, beyond their physical attributes, is about interpretation; there are no hard and fast rules as to what a particular layer signifies and each archaeologist will have his/her own idea about the significance of deposits (e.g. Case Study 1.2). Archaeologists tend to work in shades of grey rather than in clear black and white (see Section 1.7). They tend to temper their remarks according to the nature of the evidence and hedge their bets accordingly. Understanding layers is as much about interpretation as fact, about probabilities rather than absolute certainties, and this may create tension or conflict in a forensic environment. Archaeologists are trained to have deductive opinions as opposed to fixed assumptions about what buried evidence means; this applies not just to remains that are chronologically distant, but also to those from yesterday. Layers can be defined and recorded quite objectively, and most archaeological organisations have their own process-driven systems that allow this to be carried out (e.g. MoLAS 1994). Relevant pro-formas will require information on soil type, inclusions, colour, texture and so on, but this clinical data is meaningless unless interpretation is derived from it. The data set can always be returned to by future archaeologists. This process can be summed up in the phrase ‘preservation by record’ used widely in planning circles as a result of mitigating against an archaeological site threatened by building development (PPG 16 1990; PPS 5 2010; DCLG 2012). Once data has been recovered from the ground and recorded in terms of plans, sections, photographs and a written record, those data can always be reviewed. One curious thing about being an archaeologist is that one’s interpretations cannot normally be deemed ‘right’ or ‘wrong’ and the evidence can be subject to continual reassessment; each interpretation has to be assessed against the data, and some will no doubt be considered more valid than others.

A famous experiment took place in the United States in the 1970s and involved the excavation of an indigenous Indian settlement known as ‘Millie’s Camp’ that had recently been abandoned (Bonnichsen 1973). The archaeologists duly collected the material remains and, on the basis of the character, distribution and location of these remains interpreted what activities had gone on, and where. They were astonished, when confronted with the former inhabitants, just how wrong their interpretations had been. It was a corrective exercise that provided salutary food for thought, given that archaeology traditionally concerns itself with timescales well beyond living memory and contemporary society. But it also emphasises

the caution needed in interpreting forensic remains that, like Millie's Camp, are also almost certain to be known to living witnesses. The following two cases illustrate this central issue.

Case Study 1.1

A small boy disappeared in the 1960s (Hunter *et al.* 1996, 54ff). He was subsequently found over 25 years later partly buried at the edge of a wood beside a collapsed dry-stone wall little more than half a kilometre from his house. Archaeologists excavated and recorded the scene, and identified that the wall had collapsed over the body but not before large stones had first been placed on the body in a probable attempt at concealment. The body had not been buried as originally thought by the police, but had been lying on the ground surface where it had become hidden by natural soil formation and organic matter over the intervening years. Moreover, the archaeologists were surprised to find that the skeleton was almost intact and had not been scavenged, even although it had been lying on the surface. As a result of their excavation the archaeologists suggested that the body must have been wrapped (hence the absence of scavenging) and laid on the ground below the wall. Large stones from the wall top had then been placed over the body. At some later point in time the wall collapsed and the boy's remains became further sealed by the wall rubble. The boy's stepfather, when arrested, was unaware of this interpretation, but when eventually charged with the boy's death he confessed to the murder. The confession matched the archaeologists' interpretation step by step. Apart from providing confirmation of the archaeologists' hypothesis, the case also demonstrates further the interaction of cultural and natural formation processes: the wrapping, the laying down of the body and the placement of stones reflect human activity, whereas the subsequent soil development and the collapse of the wall are natural phenomena.

Case Study 1.2

A pit was discovered in the flagged cellar of a house where two persons had gone missing, although their bodies were never found (Hunter *et al.* 1996, 53f). The pit had been cut through the levelling material under the stone flags, and then excavated deep into the natural clay that characterised the local subsoil. Some of the clay had been put back into the bottom of the pit, and the rest of the pit had then been filled in with rubble. The fact that the fill of the pit (rubble) was substantially different from the layers through which it had been cut (clay) suggested that much of the clay had been removed off site, and that rubble had been introduced from elsewhere. When archaeologists excavated the pit they found that various items of interest had been concealed at the bottom under the thin re-deposited band of clay. Their interpretation was that the pit had been dug and used as a temporary place of disposal: first, objects from the murder that the offenders wished to dispose of were thrown in and then sealed with some of the clay. The pit was then probably used to conceal bags of dismembered remains and then covered up. At some later date the bags were removed for permanent disposal; rubble was subsequently brought into the cellar to fill in the pit before the

floor was reflagged. The offenders never admitted to this, but equally they offered no alternative justification for the presence of the pit, nor for the character of its fill. The presence of a human fingernail below the clay at the base of the pit suggested that the archaeological explanation may have been reasonably accurate. The case illustrates well how archaeological layers can be open to interpretation.

This first chapter introduces key elements that will be pursued in the chapters that follow. The elements are undeniably archaeological even although they do not deal with ancient times, and it is difficult to deny that this book has an underlying archaeological theme. However, the authors have deliberately omitted the word ‘archaeology’ from the title. Archaeological techniques and thinking may be central to much that is discussed, but the spectrum is much wider than that. The forensic recovery of buried remains encapsulates, *inter alia*, aerial photography, psychology, cartography, geophysics, landscape analysis, fieldcraft, cadaver dog handling, ecology, botany, entomology, palynology, anthropology, pathology and conservation; it is about interdisciplinarity rather than multidisciplinary and, above all else, it demonstrates the extent to which seemingly different fields of endeavour meet up and rub shoulders under a forensic umbrella.

1.3 Forensic archaeology

The use of the word ‘forensic’, by definition, shifts archaeology firmly into modern, criminal scenarios, in which archaeological (i.e. buried) evidence may be presented in a court of law. Usually this will involve the investigation of clandestine graves by adapting standard archaeological techniques (aerial imagery, geophysics, field walking, etc.) in order to locate burial sites, and by employing excavation strategies to recover the human remains they contain. On occasions other types of buried objects/artefacts may be searched for and excavated, typically drugs, firearms, other weapons and, in one famous example, ransom money packed into a holdall (see Section 2.1). Archaeologists may also be asked to resolve issues of date when human remains are discovered during building operations, or when human disarticulated bones are encountered as ‘stray’ finds by members of the public. They may also be asked to take part in formal exhumations undertaken by the police in order for a post-mortem to take place. There have also been instances where archaeologists have been deployed in mass disaster recovery, or even in fire debris where stratigraphic investigation is required in order to ascertain sequences of events. In short, they may find themselves involved in any matter involving buried or sealed remains, or remains which may have been buried, and which become part of a criminal investigation, thus requiring expert operational input or opinion.

Although a relatively new discipline, forensic archaeology has become routinely accepted by police and courts in the UK and has now gained wider recognition in other parts of Europe, notably the Netherlands and Scandinavia (Marquez-Grant *et al.* 2012). The use of archaeological techniques at scenes of crime is now reasonably well established (see Hunter 1994 or Cox 2009 for history; Cheetham and Hanson 2009 for methodology; Hunter and Cox 2005 and Hunter 2009 for case studies). It also has a widely accepted role in the recovery of victims from mass graves where the scale of application has necessitated the development of new techniques and protocols (e.g. Haglund *et al.* 2001; Cox *et al.* 2007).

The breadth of involvement and the interdisciplinary nature of archaeology itself have generated novel research areas, notably in geophysics and remote prospection (e.g. Ruffell and McKinley 2008; Kalacska *et al.* 2009) and in taphonomics (e.g. Haglund and Sorg 1997, 2002a). That said, the discipline is still essentially ‘hands on’; it adapts conventional archaeological techniques and involves fieldwork and excavation.

However, unlike more conventional archaeology, forensic archaeology is normally part of a much wider picture of evidence capture: it requires integration with other, often unrelated disciplines from which other types of evidence are drawn. These can include a wide range of forensic interests, some of which will be familiar archaeological territory (e.g. pedology, palynology and diatoms), some of which may be less frequently encountered (e.g. entomology and DNA) and others that will be novel (e.g. fibres, paint, blood and pathology). Indeed, some of the processes involved in the analysis of evidential materials will be little different from those encountered in the archaeological science laboratory, notably in the referencing of samples to host standards. For example, an archaeologist might take samples from a pottery vessel and endeavour to source the clay, and a forensic scientist might take soil from a person’s clothing in order to demonstrate that they had been to a particular place.

However, the similarity largely ends there. In the more distant past the archaeologist who encounters human remains is dealing with an anonymous population and seeks clarification of generic factors, for example, disease, diet, trauma, longevity, mortality rates, etc.). In a forensic context, it is the determination of specifics which is necessary, not least of these being the identification of the victim whose remains have been recovered. Moreover, unlike the collection of evidence in conventional archaeology, the collection of forensic evidence normally relates to individuals recently deceased or still living, either as victim or as potential offender(s) respectively. As a result behavioural sciences are introduced (e.g. offender and geographical profiling), which archaeologists may need to understand and integrate into a larger evidential equation. The overall picture is a wide one: it draws on many disparate skills and areas of expertise of which archaeology is often merely one small element. Archaeology is an annoyingly connective discipline: while a science in its own right, it feeds upon, and integrates with, a host of other disciplines. As one eminent academic is reputed to have said ‘being an archaeologist is like working in the hedgerows, it lies in neither one field nor the other’. It is an impure discipline that has few firm boundaries.

The closest forensic links, however, are likely to be those with physical anthropology, particularly in contexts where the victims are substantially, or completely, skeletal, and where matters of identification and specific trauma require expert interpretation (Figure 1.2) (Natfe 2000; Blau and Ubelaker 2009). In some instances, notably in the excavation of victims from mass graves (below), practitioners will need to be highly experienced in both fields. There is sometimes confusion between the terms ‘archaeology’ and ‘anthropology’ particularly in discussion between US and UK practitioners (Steadman 2005; Komar and Buikstra 2008). In the USA archaeology emerged as a secondary discipline under the umbrella of physical anthropology, whereas in the UK archaeology and anthropology both emerged as primary disciplines but with anthropology being more dominantly ‘social’ as opposed to ‘physical’, hence the scope for confusion. A working definition might be that forensic archaeologists are expert in field skills but with an awareness of physical anthropology, whereas forensic anthropologists are expert in the examination of skeletal tissue, but with a basic understanding of excavation field skills. As all forensic work is



Figure 1.2 A grave requiring both archaeological and anthropological attention. Image by courtesy of K. Colls on behalf of Birmingham Archaeology.

open to cross-examination in Court, individual competence tends to be very skill-specific with practitioners taking care not to drift outside their field(s) of expertise. Staying within the limits of one's discipline competency (i.e. archaeology) is one of the pre-requisites of successful forensic investigation; as a consequence the former Council for the Registration of Forensic Practitioners (CRFP) in the UK held separate registers for the validation of both archaeologists and anthropologists.

Criminal investigation in the 21st century is properly concerned with protocol, quality, standards and accountability. In the UK the Office of the Forensic Regulator located within the Home Office is charged with oversight of these matters and is supported by other discipline-specific agencies. The Institute for Archaeologists (IfA) is one such body; this has peer validated levels of membership and specific codes of conduct for archaeologists. Under the IfA's wing forensic archaeology is a defined subject group (formerly 'Area of Competence') and has dedicated sets of standards and guidance to ensure appropriate practice (<http://www.archaeologists.net/sites/default/files/node-files/Forensic2010.pdf>). These cover, *inter alia*, standards and codes of practice for briefings, for search, for recovery,

for reporting and presenting evidence at Court. The document is comprehensive and, apart from generic issues such as health/safety and continuing professional development, includes codes for specifics such as pre-scene attendance, search management, the recovery of exhibits, the taking of samples, recording, the retention of spoil from field excavations and the prevention of contamination. Many of these individual codes differ significantly from those used in more conventional excavations, and it is the specifics contained in the forensic archaeology codes that effectively define the character of the subject. The codes of practice were established *not* to say that there is only one way to conduct a forensic search or excavation, but to emphasise that actions which circumvent or shortcut defined methodologies need to be flagged up and/or explained. Archaeology 'by the book' is not normally a feature of forensic work (see also Section 6.1).

The Forensic Regulator is concerned with the quality of forensic services both at and away from the crime scene, and especially with the provision of forensic science. Since the effective privatisation of government funded forensic laboratories in the 1980s, the provision of forensic science has developed into a substantial industry in its own right. Both large and small players provide services, some very specialist (e.g. geoforensics), others deal with more commonly required services (e.g. fibres, blood marks or DNA), or with the evidence from volume crime (e.g. fingerprints). Police forces are obliged, as part of the current market process, to 'bundle' their requirements for key services with a single forensic provider for a period of three years before review. However, archaeology and anthropology are considered insufficiently mainstream to sit within the present bundling system and are commissioned independently. But this does mean, for example, that any evidence recovered during excavation is likely to have particular specialist services to which the police force in question is committed. This can be inhibiting in certain archaeologically-connected disciplines, notably in ecology (palynology, entomology, etc.) where many archaeologists would prefer to utilise their own specialists with whom they have worked before and who in their judgement may better understand any archaeological issues involved.

Key to recovery work, either in or out of the grave, will be the seizing of exhibits (the recovery of finds in archaeological parlance). Seizing kick-starts a rigorous chain of continuity which ensures that the life story of any exhibit, once seized, is fully documented and its location secured. Some exhibits will simply be maintained in store in case they are required as evidence in Court; others will undergo more complex processes of analysis or further investigation. Exhibiting covers *everything* taken or removed from the scene and includes bulk soils kept for further work and any samples taken, as well as individual objects such as fibres or even hair (see Section 7.1). All require the same degree of rigour in their collection, maintenance and record keeping. Without this guarantee of continuous control the evidence may be vulnerable in Court, and this extends also to the keeping of bulk materials, for example soil kept for sieving if it has not been maintained in sealed, labelled containers and kept in a secure location.

1.4 Legal issues and procedures

In the UK, criminal investigation is subject to tight legal constraints, and barristers are quick to identify even the slightest technical breach of protocol. There are several relevant pieces of legislation, but there are two in particular of which any archaeologist at a crime scene, or at a potential crime scene, will need to be aware, the Police and Criminal Evidence Act 1984

(usually known as PACE; HMSO 1984a) and the Criminal Procedure and Investigations Act 1996 (usually referred to as CPIA; HMSO 1996a) and the Codes of Practice issued under the Acts. Both are complex pieces of legislation that are explained in more detail elsewhere (see Dilley 2005; Ozin *et al.* 2010).

Briefly, and as far as archaeology is concerned, PACE primarily introduces an unwelcome time factor, although it also stipulates issues as to how a search can be conducted. Essentially, it requires the police, having arrested an individual, either to charge that individual with an offence, or to release him/her without charge within a specific period of time (Dilley 2005, 185, figure 7.3). In England and Wales that span has a minimum duration of 24 hours and a maximum of 96 hours, subject to approval of a higher authority, ultimately a Magistrates Court, providing that grounds for an extension can be proven and justified. In Scotland there is a single period of 6 hours only. Under certain circumstances, therefore, archaeologists may be required to search and/or excavate and to provide evidence sufficient for the police to make a charge within the constraints of the timescale defined by the 'PACE clock'. This might necessitate, for example, geophysical survey, focusing of target locations, use of machine stripping, or the physical investigation of aerial photographic features either at short notice, or within a defined time limit. Moreover, a crime scene involves a relatively large number of personnel, typically a Senior Investigating Office (SIO), a Deputy SIO (usually a rank or two below), a Crime Scene Manager, Crime Scene Investigators, an Exhibits Officer, operational support officers (trained searchers), uniformed officers to secure the scene and, *inter alia*, a press officer and others with different roles. The resource implication can be considerable and much may rely on the interpretation and findings of the archaeologist. This is a new and highly pressured environment for an archaeologist, and one which often requires the archaeologist to innovate in order to satisfy the demands of time and situation. Crime scenes are not arenas for either the faint-hearted or the *prima donna*. Issues can be straightforward, such as the examination of a small piece of disturbed ground, or the more complex search of a large garden or woodland. An investigation will normally have been the subject of briefings before the arrest was made, but there is still pressure on the archaeologist to perform on a landscape of questionable history and substrate using methodologies designed to either (a) discover in a manner which is evidentially respectable, or (b) eliminate confidently. The two are not easily reconcilable, and archaeological purism can be thrown out of the window early on.

The CPIA offers a different type of constraint. This Act stipulates that all participants at a scene of crime are required to make their evidence available to the Court. This means that whatever the archaeologist produces in terms of making a written, graphic or photographic record must be made available to both defence and prosecution authorities. The archaeologist, like any other forensic scientist or expert witness is deemed to be a witness of the Court, not a witness promoting the interests of the commissioning body, either the prosecution or defence agencies. Archaeologists are in Court to provide objective scientific opinion on the issues in hand, not to support a particular side. The Crown Prosecution Service (CPS), set up through the Prosecution of Offences Act 1985 (HMSO 1985), was deliberately established to allow prosecution to take place quite separately from police investigation and to demonstrate its independence from policing processes. The police will consult the CPS to ascertain whether they have enough evidence to prosecute, or indeed whether it is in the public interest to prosecute, but the two bodies otherwise work independently. Thus, the archaeologist will need to submit to the court all aspects of recording,

including contexts sheets, primary plans and section drawings, sketches, tape recordings, photographs, daybooks, site logs, and the various lists of contexts, plans and images that characterise any modern excavation. Many of these, especially section and plan drawings, may typically be crossed out, erased, re-defined, or simply altered and amended as a customary part of creating the most accurate primary record. We all do this. But the Court may wish to know why these changes have been made, what levels of confidence or uncertainty are indicated by these changes, and how such alterations and revisions might reflect on the integrity, judgement and professionalism of the archaeologist concerned.

It is, of course, the tactic of the commissioning authority, usually the CPS, to bolster the credibility of the expert archaeological witness in Court. It is equally the role of the opposing side, usually the defence, to discredit the witness' evidence by identifying (for example) any perceived shortcomings in the work carried out, ambiguities in the statements presented or inadequacies in the previous experience of the witness. No matter whether archaeologist, blood spatter authority or entomologist, the expert witness tends to be a pawn in a much larger, essentially adversarial scenario. As such, his or her evidence is fair game for demolition, and the archaeologist needs to be prepared for that. The best preparation, of course, is at the crime scene itself, making sure that no questions are left unanswered, that every record is completed at a professional level, and that statements are produced that demonstrate competence. It is, however, also a salutary experience to have to present evidence to a jury whose members may be unfamiliar with archaeology and its terminologies, or whose perceptions of the profession (varying perhaps between Indiana Jones and the *Time Team*) may be misplaced. It is the jury that the barrister is attempting to convince; it is the jury that decides the verdict.

1.5 Decay dynamic

Conventional archaeology tends to deal with 'inert' materials of study, such as buried walls, ditches, pits, etc. However, forensic archaeology needs to consider the effects and timing of the human decay dynamic, particularly in terms of search methodology (and especially geophysics). This decay factor has implications for how and when a grave might best be found, and in what condition the body might be recovered. At death human bodies are subject to a decay process which follows a well-defined route – typically primary decay, putrefaction, black putrefaction, fermentation and dry decay (e.g. Clark *et al.* 1997; Vass *et al.* 2002; Galloway *et al.* 1989). The last of these (effectively skeletonisation) is the one most familiar to archaeologists, but is one which is rarely achieved in forensic timescales. The speed at which this complete process occurs depends on a plethora of factors involving both the physical characteristics of the individual (and clothing/wrapping), and the nature of the burial environment including, for example, depth, the pH of the soil, the moisture content, the presence of oxygen, temperature, the proximity of bacteria, and the accessibility of flies and scavengers, among others. This is a scientific process which is largely predictable, but not exact.

During the decay processes stages of temporary equilibrium can sometimes be achieved, such as is marked by adipocere formation (a greasy fatty state often caused by wetness, Figure 1.3), but decay is otherwise progressive and, unless the burial environment is particularly acidic, the process usually stalls at a stage of skeletonisation. Complete absence of



Figure 1.3 Example of adipocere formation permeating the ground after body removal.

skeletal survival, even over long archaeological timescales, requires very unusual environmental conditions. An interesting example occurred regarding the exhumation of Cardinal Newman, an eminent Catholic priest who died in 1890. His remains were exhumed from a private oratory in 2009 as part of his canonisation; this received some press attention (e.g. *The Daily Mail*, Tuesday 4 November 2008). At his own wish he had been buried in the same grave as his long term companion, Father Ambrose St John, who had died previously. To the apparent surprise of those involved no skeletal parts had survived, although pieces of metal coffin furniture and some fabric were still identifiable. The absence of human remains was ascribed to the nature of the soil, but tests on soil elsewhere in the vicinity (but not at the oratory itself) suggested that the burial environment was only moderately acidic and certainly not at a level that might cause a skeleton to vanish completely. Moreover, metal coffin furniture and textiles tend to be more susceptible to decay and are likely to have decayed first. There exists, therefore, some mystery surrounding Cardinal Newman's final resting place; it may possibly be due to Victorian attitudes to his perceived sexuality in wishing to be buried with his male companion, but equally there may have been other contemporary reasons. On the evidence available, however, the burial environment does not appear to have been the cause for the complete absence of any physical remains.

There are other taphonomic extremes, for example in the instances of 'bog bodies' where peat can provide an anaerobic preservative medium, or in dry, arid conditions where desiccation can occur, but such instances are rare (Brothwell and Gill-Robinson 2002; Steadman 2005). The presence of buried, soft decaying tissue, apart from being unpleasant to excavate, may also create other significant effects, but at particular time points in the decay process. These include the emission of heat, liquefaction, a propensity to attract scavengers and providing the impetus for surface vegetation change – all of which have implications for the types of techniques deployed to find a grave and the timescales at which

those techniques can be optimised during stages of the decay process (see Sections 2.3 and 3.1). Many researchers have used observations based on buried pigs as human analogues under controlled conditions in order to try and create a more precise equation that may allow these effects to be better predicted (e.g. France *et al.* 1992, 1997; Powell 2010).

Decay, defined more broadly in terms of ‘taphonomics’, has become the focus of considerable interest. For example, in even more complex scenarios, Courts may require guidance as to how ambiguity between the time since death – the post-mortem interval (PMI) – and the level of decay state might accurately reflect the removal of a body from one physical environment to another. Determining the PMI is a key factor in forensic investigation; some experimental work has also been carried out to assess the extent to which human remains might be spread by seasonal ploughing (Haglund *et al.* 2002), in much the same way that similar experimental work has been started on localised pottery spreads (Reynolds and Schadla-Hall 1980; Reynolds 1989). Scavenging, for example by foxes, badgers and rats, has also played a part in determining PMI, both in terms of using spatial extent of the distribution of surface scatter as a coarse indicator of elapsed time since death, and also (as a corollary) the predicted extent of surface distribution after a given time (see also Section 7.4). In addition, forensic science is now also concerned with the impact of human decay on associated grave materials which might be either identification-bearing (e.g. textiles, clothing, jewellery or contents of pockets), or forensically-related (e.g. fibres, cigarette butts or projectiles) (e.g. Janaway 1996, 2002, 2008).

1.6 Search methods and adaptations

The search for shallow sub-surface remains is especially suited to archaeologists who have an evolved experience in noticing topographical nuances and vegetation differences brought about by the presence of buried features, as well as utilising, adapting and developing techniques of geophysics, aerial reconnaissance and other methods of remote sensing for these purposes (see Cheetham 2005). Some of these methods are now particularly advanced, notably the use of LiDAR, digital terrain modelling (DTM) (see Section 2.3), the use of Geographical Information Systems (GIS) and the advances in gaseous detection used by earth scientists (Chapman 2006; Kvamme 2006). The potential of earth sciences has yet to be fully explored for forensic relevance and Ruffell has provided an introductory definition of pedology, geology, geosciences, geoforensics and soils for clarification purposes (2010; also Pringle *et al.* 2012).

However, not least of the overall search weaponry is the humble map in its many types, scales and editions which mirrors land use and landscape change over time as well as helping define useful factors such as accessibility, solid/drift geology and geomorphology (Ruffell and McKinley 2008). Some of these aspects are discussed in more detail in Chapter 2. Although the search processes adopted may be similar to those used in more conventional archaeological survey there are significant differences: first, the forensic targets are both small and very specific, and second the individual locations will need to be fully eliminated as deposition sites before the search moves on to another area. The use of aerial and geophysical techniques often yields a plethora of anomalies or possible disturbances which, in conventional archaeological terms, can often be interpreted without invasive action. In forensic procedural terms, however, the SIO is committed to eliminating each one, either by trial trench or, more often, by venting the anomaly (i.e. probing the ground to allow gasses



Figure 1.4 The use of heavy machinery in searching for burials.

to escape) to enable use of a cadaver dog. Forensic search normally operates its procedures sequentially from the non-invasive to the invasive in order to minimise potential loss of evidence. There is, however, often a ‘trade-off’ between method and speed which depends on the extent to which the SIO may consider one particular location to be of greater potential than another. For example, lower ranked sites might be stripped using machinery in order to eliminate them (e.g. Hunter and Cox 2005, case study 21), while higher ranked sites may be subjected to geophysical survey, cadaver dog attention and careful excavation in a defined sequence (e.g. Hunter and Cox 2005, case study 2). This is amplified in Chapter 4. The definition of relative site importance is a management decision, not an archaeological one, although archaeological opinion might be taken into account in identifying priorities. The use of heavy machinery in the search for human remains may offend some archaeological sensitivities but is usually a pre-requisite in the elimination of sites at the lower end of the confidence spectrum (Figure 1.4). Moreover, heavy machinery is sometimes an essential at the higher end of the same spectrum depending on surface conditions and geology. Archaeologists who have worked with experienced excavator operators will know just how subtly and cleanly a wide machine bucket can be used to strip thin horizontal spits of earth across a given area (see also Section 3.3). Under many circumstances machine stripping is equal to, if not better than, manual trowelling.

A key difference in the application of archaeological techniques lies in the decay chemistry of the buried human remains (above) in comparison to the inherently stable features that generally constitute more conventional archaeological targets, not least of these being the emission of heat during the active decay process itself. The rate of taphonomic change is not always predictable and can be affected by a host of natural factors (type of soil, climate, etc.); to some extent they can also be influenced by the actions of the offender (for example, the extent to which the body is wrapped, or the depth of the grave). Moreover, offender

profiling (the psychological analysis of an individual's behaviour), geographical profiling (the use of mapping to identify a person's spatial movements), witness statements, evidence of last sightings and cognate information may also need to be brought into the equation. There are now behaviour databases covering many thousands of abduction/deposition scenarios which provide statistically-based starting points for search on the basis of previous crimes (Francis *et al.* 2004). These take into account factors such as vehicle access, relationships (age/sex) between victim and likely offender, and distances travelled/walked, as well as deposition probabilities according to offender habits.

The application of archaeological techniques in search scenarios makes good sense, but the framework within which the application takes place has to be heavily geared towards logistical efficiency (Section 2.1). The level of search reflects not only the constraints of legislation (above), but also the resource implication of manpower, time and costs in relation to the demands of other simultaneous enquiries being handled by the same officers. Not least of this resource implication is the presence of in-house role-based officers (e.g. for exhibits, press, crime scene management, photography, etc.), specialist personnel (e.g. for child protection, community relations, etc.) as well as external specialists (e.g. archaeologists, geophysicists, dog handlers, etc.) who may be brought in from different parts of the country. There will almost certainly be an Operational Support Unit (OSU) which will be working on a shift basis between a variety of scenes and duties, and Police Search Advisors (PolSAs) to direct search strategy. The whole exercise requires extreme coordination and timing, extensive briefing for all concerned, and extensive de-briefing afterwards. The smoothest, most efficient operations result from everyone knowing who is doing what, when and how. A typical search may involve archaeologists, dog handlers, an OSU led by a PolSA, a geophysics team, a Crime Scene Manager, and detectives, and the command chain and decision-making process can become blurred to the archaeologist. The search of a house and garden for a concealed body with a team such as this, often involving clearance of one room or part of a garden at a time, requires search sequencing in an exact manner. This ensures that the property can ultimately be eliminated with confidence, that the individual elements of search dovetail neatly in a manner that allows the search methodologies of one group not to inhibit or negate the efficacy of the next group, and that personnel are not standing idly kicking their heels for hours on end waiting for their turn. The archaeologist has a focal role in this under the coordination of the PolSA, initially in assessing ground surfaces for subtle disturbances, and subsequently supporting geophysicists in the interpretation of data, identifying targets for cadaver dogs and, as a result, determining priority locations for intrusive work and, ultimately, investigating those locations by excavation.

1.7 Recovery methods and adaptation

All field archaeology, whether forensic or conventional, is undertaken according to design in order to answer specific questions. In the forensic arena these questions are often very different from those an archaeologist might normally ask. Common questions, for example, will bear on the identity of the individual buried, the manner in which the grave was dug, the presence of evidence within a grave that may link the grave to an offender, or the presence of material which might link the body to a different environment. The over-arching question, and one probably never posed in conventional archaeology, is 'who was responsible for the murder and burial of this victim?'

No two forensic excavations are ever the same and there is no 'by-the-book' solution to the recovery to the various types of potential evidence. Often it is not possible to define the spatial limits of the crime scene: unlike conventional archaeological graves, which tend to be sealed by subsequent layers, the forensic grave is normally cut into a contemporary ground surface which is likely to be part of the crime scene itself. It is here that the offender(s) stood and worked, that material may have been dropped, footprints or tyre marks left, and that the body may have been rested. In some mass burials the grave edge is known to have been used as the execution site, as witnessed by the presence and concentration of empty cartridges. Hence the area around the grave needs to be searched and cleared before any excavation commences; it is often best to treat the grave itself as a 'mini crime scene' within the framework of the larger crime scene.

As with search, there will be a range of different personnel offering differing skills and requiring coordination in the detailed examination of a crime scene, usually under the direction of the Crime Scene Manager whose responsibility it is to ensure that the record and collection of evidence (including the body) occurs in a manner which will allow the different strands to be processed (and/or analysed) and integrated into the larger evidential picture to provide the objective evidence that can underpin a prosecution case. At the same time a documented chain of actions will need to be maintained. Different cases sometimes require different weighting of evidence in order to prove specific points, thus briefings between all concerned are essential. Interested parties here will include the pathologist, entomologist, archaeologist, toxicologist and perhaps the anthropologist. One widely unrecognised role of the archaeologist is in providing a three-dimensional record of the grave into which the sampling of other specialists can be set and the location of exhibits defined.

Because archaeology is a destructive exercise and is not replicable in the same way as laboratory experimentation, there is always the need to make comprehensive records as the work proceeds, ideally using photographic, graphic and written methods. The type of photography used in conventional archaeology is well suited in that archaeologists normally use the camera to record specific 'events', i.e. changes in layer and visibility of features, or to reference staged processes during excavation. Crime scene photography is often more generalised and the crime scene photographer may need to be instructed as to when shots need to be taken, from what angle, and what the specific features of interest are. Photographic scales are essential for archaeological purposes, especially in detailed shots, but very few crime scene photographers seem to use them. Graves can be half-sectioned (i.e. one half removed first); this allows a vertical view of how the grave was constructed, how and with what it was infilled and where the body lies in relation to other layers (Figure 1.5). This procedure can be started when the grave cut is first identified, and can be concluded when the body has been removed. It would normally be planned at a scale of 1:10. The grave outline itself will also need to be planned, usually at 1:20 and tied into fixed points (e.g. fence posts or corners of buildings) in case the exact location of the site needs to be revisited at a later date. These procedures are evaluated in more detail in Section 6.2.

The precise removal of the grave fill is critical as it can contain the evidence that might link the grave and victim to the offender. In forensic cases burial fills are typically mixed and are best excavated in arbitrary 'spits' some 10 cm deep, unless clearly defined layers can be identified. Strictly speaking, it is the interface between layers that is critical for interpretation in conventional archaeology – that is the 'gaps' between stratigraphic events.

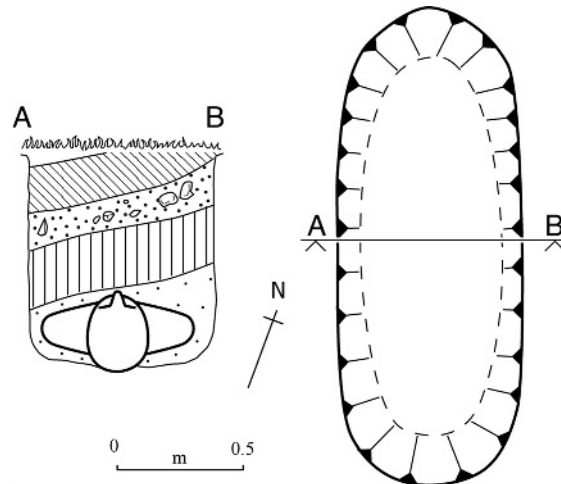


Figure 1.5 Typical scale plan of half-sectioned grave.

However, in many, but by no means all, forensic recoveries these interfaces are limited to the grave surface (usually the present ground surface) and the grave edges (i.e. the junction where the grave fill touches the cut edge of the grave). The latter is particularly important at the base of the grave as this is where evidence, for example for silting or footprints, might be found sealed at the bottom of the grave by the initial grave infill. The use of arbitrary spits provides some measure of control for re-locating the position of exhibits seized from the grave fill and provides some form of three-dimensional record, albeit a crude one. It also provides a more manageable measure of the former location of fills for any subsequent sieving of bulk spoil (see Section 7.1). More accurate three-dimensional control can be secured by using a total station system (electronic distance measurer – EDM) or a global positioning system (GPS). These would be the preferred choice of any archaeological purist, but archaeological purists tend not to work in the dense woodland, thick undergrowth or cluttered back yards where many forensic disposals tend to occur. Irrespective of limited sight lines, tree canopies, or the simple absence of space, which make electronic systems awkward to use, one might also question the level of accuracy required in any plan or record and how that might best be achieved. Under most circumstances, string, tape measures, local fixed points, a planning board and perhaps a dumpy level are the most effective (Figure 1.6). They always work, irrespective of circumstance. And they do not require batteries. In an age of increasing survey technology (see Chapters 2 and 3) they tend to be viewed as rather antiquated. However, one distinct advantage is that the image (plan) can be drawn up and checked at the scene without the need for later downloading and potential loss of data or, as experience has shown, confusion as to which way up the image should be, and which points should be joined up. Despite technological advances, field archaeology is still, thankfully, very much ‘hands on’ and visual.

Each spit is numbered uniquely and any exhibits (finds) that are seized (recorded) can be assigned accordingly. The exhibits will be different from the sherds of pottery, corroded

1.7 RECOVERY METHODS AND ADAPTATION

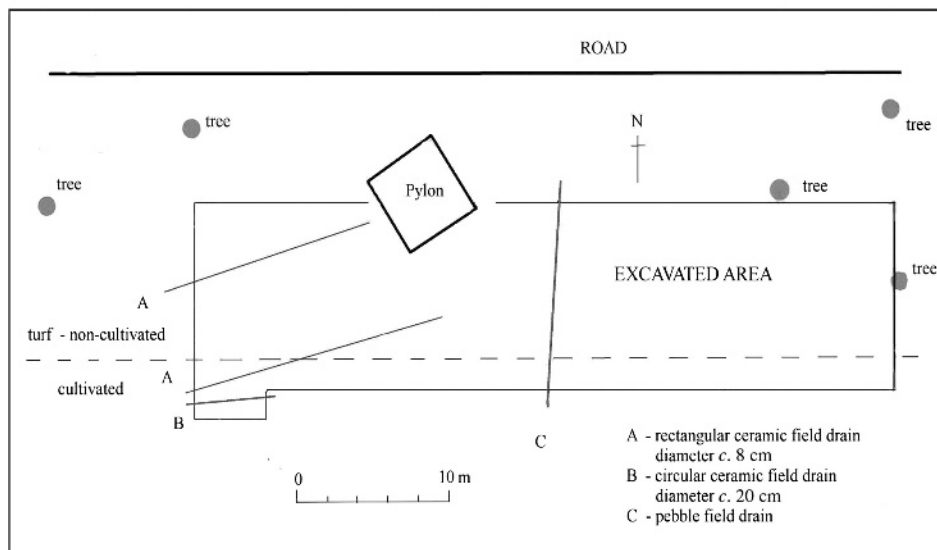


Figure 1.6 A site plan using local fixed points based on an electricity pylon and trees showing (top) machine stripping of site and (bottom) existing excavation plan to which this new cumulative stripping can be added as the enquiry continues.

metal and animal bone fragments that tend to frequent archaeological sites; the evidence is more likely to be in the form of material deliberately disposed of in the grave such as cigarette butts, newspaper, packaging, polythene, or even projectiles (bullets). Moreover, and alien to conventional archaeology, is the potential of contact transfer based on Locard's principle, namely that every contact leaves a trace, which underpins much contemporary forensic science (see Section 6.1). This includes evidence which has accidentally transferred from offender to grave, such as fibres, hair or even footprints. Equally, there may be material accidentally transferred from a vehicle to the grave with the body, or botanical evidence carried from a former location where the body had been kept. All this will provide intelligence for the SIO as to where further enquiries should be directed.

The nature of this trace evidence is such that (a) it can easily be contaminated by those working at the crime scene (which is why all work is undertaken wearing special suits or overalls and using new or sterilised equipment) and (b) it may not always be visible to the naked eye. The soil from the separate layers or spits may need to be sealed in large bags or containers to prevent contamination and taken to a controlled environment for detailed sieving and investigation. Moreover, in conventional work archaeologists pride themselves in having their excavated *in situ* remains, especially skeletons, clean and well defined for photographs. Such meticulous cleaning is avoided in forensic cases as it would serve to remove any contact trace evidence that might link the offender to the victim. It is important too that the archaeologist maintains control of the whole recording exercise so that it can be presented logically in a statement and in Court. During the recovery and at Court the archaeologist may also be expected to field a range of questions pertaining to these layers, and to the grave in general; typical questions might require an opinion to be expressed 'on the hoof' as to how long ago the grave had been dug, or the implements likely to have been used.

Archaeologists traditionally measure their comments with terms such as 'could', 'might', 'may' or other expressions of relative probability. Courts prefer a less elastic opinion, while police forces typically require a clear statement of distilled fact which will allow them to take the next step in an enquiry. Unlike conventional archaeology, which is an end point in itself in terms of a final report which sets out method, lists data and poses hypotheses for infinite future consideration, the forensic requirement is part of a larger spectrum of data. Its importance can be emphasised or diminished according to the scenario and its contributing weight in achieving a 'result'. Archaeological evidence is preferred in the form of linear historical narrative, a factor that sits uncomfortably with most current accepted archaeological theory, which prefers evidence to be open to complex and multiple interpretations. But such levels of theory are normally superfluous in determining the relationships between the few layers that tend to characterise most forensic excavations. They may conceivably be relevant in more complex circumstances involving (for example) mass graves, human remains discovered during building operations and similar circumstances, although these rarely approach the multiple-layered, multi-period types of site exhibiting vast data banks covering artefacts, ecofacts and stratigraphies. More awkwardly, the archaeologist may be drawn into uncharted waters in being required to comment as to whether a grave might have been dug hurriedly by a perpetrator, or whether it was more likely, or less likely, that a particular scenario occurred, in an attempt to fix opinion or likelihood into a particular spectrum of Bayesian probability. In short, the archaeologist can expect to be placed under some pressure to be specific.

1.8 Mass graves

Forensic archaeology has also found itself heavily involved in the investigation of mass graves resulting from genocide, particularly in South America and in the former Yugoslavia. These sites have been prominent not only in seeing the development of excavation techniques and strategies but also in providing experience for workers in a relatively infant discipline at the turn of the 20th and 21st century. There is now a reasonable literature on the excavation of mass graves; this has developed beyond the straightforward practicalities of methodology and logistics into less tangible concepts of social justice and human rights (Schmitt 2002; Skinner *et al.* 2003; Cox *et al.* 2007; see Chapter 8). Although the techniques applied are similar to excavating single graves, there are some significant innovations, for example the use of dedicated pro-formas and certain recording techniques. In addition, the way in which the interrogation of the remains is undertaken may differ: identification may be a less prominent factor in relation to human rights violations, particularly in some earlier work, where evidence was solely concerned with determining cause(s) of death. Each scene, whether a mass grave or an individual clandestine grave, will require its own set of questions and its own set of approaches.

The nature of the recovery exercise in mass deposits is usually made more complex by the intertwining and compression of victims, or by commingling of the remains in more advanced states of decay (Figure 1.7). Differential decay within the grave can also occur, caused by the differing taphonomic effects occurring in different parts of the mass of bodies. This can be exacerbated in secondary graves (i.e. where bodies have been moved from one buried location to another), a feature that characterised many of the burials in the aftermath of the Balkans conflict in the mid 1990s. There, most mass graves were originally created by mechanical excavators, which provided an easy method of concealing large numbers of victims in a short space of time. The largest were approximately 3 m wide reflecting the width of a typical excavator bucket and often over 2 m deep and 15–20 m in length with a ramp at one end to allow vehicle access. Mechanisation can also be extended to the interment of the victims, causing significant post-mortem injuries, especially in the case of bodies moved mechanically from one grave and shipped to another. Some bodies were also affected by the presence of vehicle movement above the bodies when the grave was subsequently infilled; this may create additional difficulties for the anthropologists and archaeologists at the point of excavation. These are circumstances when those involved in the recovery process will require both anthropological as well as archaeological skills (see also Section 7.4).

Mass graves are excavated for two main reasons: for humanitarian purposes in order to recover, identify and repatriate victims, or for forensic purposes in order to provide evidence to help convict a particular offender, for example a senior military figure whose orders were being carried out. In instances of genocide, when many thousands die and there are numerous graves, not all graves will necessarily carry the forensic potential, the viable witness accounts or other information available to implicate known individuals. For the majority of graves, therefore, the excavation process may have a more humanitarian focus and, given the number of graves likely to be identified, may take a considerable time, even if fully funded. The resources might be immense (archaeologists, anthropologists, pathologists, mortuary technicians, DNA sampling, storage facilities and security personnel); nor are investigations likely to be undertaken within the time frame expected



Figure 1.7 Mass grave excavation (top) and detail of commingling (bottom). Images by courtesy of Cecily Cropper.

by families and relatives desperate to have their loved ones returned and who may wish to embark on the process of excavation themselves (Hunter and Simpson 2007). Repatriation of bodies to families requires every bit as much attention to detailed excavation and recording as forensic work if the integrity of the process is to be maintained. This is especially the case with body parts as opposed to complete individuals. Presumptive identification

(i.e. using clothing, documentation found on the body and similar evidence) is a last resort. The use of DNA is the preferred method, but this also requires community involvement, outreach programmes of DNA matching and all the resources thus entailed in order to be effective.

It is sometimes difficult to understand that the level of forensic detail afforded to each individual victim in a given mass grave is not commensurate with the level of detail afforded to the single individual in a criminal clandestine grave. The view is necessarily a more generic one: the Court needs answers to simple questions and may often assume, for time and resource reasons, that the victims represented in the grave can be treated collectively. The answers to simple questions such as likely date of death and the cause/manner of death, linked to the disappearance of presumed individuals from place X and their discovered burial in place Y, may well be adequate for prosecution purposes. To pursue this in more detail would be legally unnecessary and, no matter how much the personal ethics of each archaeologist and the dignity of each victim might demand it, would not serve to make any difference to the outcome of the judicial process. The issue is one of answering specific questions within a legal system where the end justifies the means. Archaeologists in these circumstances are witnesses of the Court, not followers of moral crusades. Purists may not find this to be the most satisfactory of processes, but it is not the purists who set the resource budget, frame the legislation, nor undertake the practicalities of exhumation in hostile environments. Archaeologists do what they are asked to do; rather than pose questions formed within a conventional research design they are obliged to play out a role in someone else's agenda. They may not be morally comfortable with that agenda, nor indeed with the political environment in which the agenda was drawn up, but they also have to ask themselves what might happen if their specialist skills were not incorporated, if the remains were excavated only in part by others, or by machine, or by a hostile faction, or if they were invited in the capacity as observers with no authority to influence the mode of recovery at all. These are personal decisions to which the archaeologist may be subjected. Forensic archaeology is no easy ride.

