

Chapter Six: Discussion on the Archaeology, Anthropology and Artefacts as Evidence for Identifying the Missing Soldiers

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SUMMARY

The archaeological investigation undertaken at Pheasant Wood represents the first large-scale recovery and analysis of First World War soldiers, employing modern techniques. It is also the first large-scale attempt to employ evidence that has been recovered archaeologically and subsequently analysed in the identification of First World War soldiers. Prior to the investigation, there was limited knowledge of what had survived in the graves, although it was anticipated that no identification papers and/or inscribed items such as dog tags or personal effects would be present. This was found to be largely the case. However, perhaps surprising is the considerable amount of other information that survived, more specifically the overall excellent preservation of the skeletons, elements of uniforms and non-army issue items, in secure association with each other, as detailed in the previous chapters. On the whole, their inherent biases and weaknesses considered, these are arguably powerful forms of evidence that can contribute to the determination of the identities of the buried soldiers, provided they are used appropriately.

INTRODUCTION

This volume has described the methods and results of an excavation of eight First World War mass graves at Pheasant Wood, Fromelles. The primary aims of the project were:

- i. Starting in May 2009 and finishing in October 2009, to fully excavate and analyse all graves in a manner that ensured the integrity of the evidence.
- ii. To collect samples from the human remains for DNA analysis during excavation employing a system that ensured the scientific and scene of crime integrity of all samples.
- iii. To examine the human remains and associated artefacts for evidence that assisted with the identification of the individuals.

- iv. To compile the findings so that they could be combined with other data outputs (for example, DNA and ante-mortem data) by the Data Analysis Team (DAT) to be presented to the Joint Identification Board (JIB) by 7th January 2010.
- v. To compile a post-excavation client report on the works.

Excavation and analyses, including the sampling of skeletons for DNA, were completed within six months. All evidence was then entered onto the Fromelles Database, analysed and outputs compiled into a case report for each individual (see Chapter Two). These case reports, giving the burial context (location, position, relationships to other bodies), a catalogue of all associated artefacts, with interpretations, and a full biological and pathological profile (age, sex, individuating characteristics, ante-mortem trauma and pathology and peri-mortem trauma) for each individual, were completed and delivered to Australia House on 7th January 2010, along with the Fromelles Database and all primary records (photographs, recording forms and spreadsheets).

The following discussion was completed shortly after the delivery of the case reports but before the announcements of any identifications. It therefore does not take account of information that has come to light during the identification process, which is considered in the following chapter.

RELIABILITY AND POTENTIAL OF THE EVIDENCE FOR IDENTIFICATION

The personal identification of human skeletal remains is a comparative process which requires the reconciliation of post-mortem information (anthropological and finds analyses) of the unidentified with ante-mortem information of known individuals to establish points of congruency. The more reliable, complete and individualistic the post-mortem and ante-mortem information, the greater the possibility that a successful identification can be made.

The reliability and potential of the evidence recovered at Pheasant Wood has been discussed at

relevant points throughout this report, with particular reference to the anthropological and finds analyses. All evidence, archaeological, anthropological and artefactual, is considered together here.

The collective identity of the buried soldiers as a match with the collective identity of the Missing

Prior to the announcement of the first identifications, there was the possibility that some or all of the buried soldiers comprised individuals who had fought and died in a previous battle that was fought over the same ground on 9th May 1915. This earlier battle (the Battle of Aubers Ridge) resulted in the burial of many British soldiers in unmarked graves, and these soldiers are still missing. Although the announcement of identifications since 2010 by the JIB have confirmed the identification of the Pheasant Wood graves as those that contained soldiers who fought and died in the Battle of Fromelles 1916, it is worthwhile summarising the archaeological evidence that supports this.

In Chapter One, the collective biological profile of the Fromelles Missing was discussed as being that of a predominantly Caucasoid all male cohort aged between 18 and 45 years, with a stature of at least 5'2" (1.58m). The 250 skeletons from the six mass graves are biologically consistent with this, comprising an all-male group with likely ages at death of between 14 and 50 years. The majority were of Caucasoid ancestry, with the exception of at least one individual who was judged to have been of mixed European and Aboriginal ancestry. The buried soldiers are consistent with those associated with a catastrophic event, such as a battle, and therefore they differ greatly from an attrition assemblage. In addition to being an all-male group of fighting and enlistment/recruitment age, 93% exhibited peri-mortem trauma, consistent with combat injuries such as those caused by explosive artillery and small arms. Further, many of the associated artefacts can only represent military paraphernalia of the First World War period, such as uniform accoutrements, and ballistics, including shrapnel balls and artillery casing fragments.

The excavation has established that the burials in the six graves are from a single depositional event with no evidence of incursion or tampering during the post-depositional interval, with the exception of the documented trial excavations in 2008 (Pollard *et al.* 2008). The depositional event has a *terminus post quem*, a date equal to or after the deposition of the human remains, of 1916. More specifically, two items were found with the date 1916 on them, securely associated with two individuals. They include a compass with the date inscribed on it (3887A, found with 3147B) and a coin, minted in 1916 (3560A, found with 1084B). In addition, time interval evidence is provided through the plethora of associated First World War Australian military paraphernalia, such as AJBBs and rising sun lapel badges. Not only do these artefacts indicate that

many of the deceased are Missing in Action (MIA) Australian soldiers, but their presence can only be attributed to a date after March 1916, when the first Australian troops arrived on the Western Front (Bean 1941, 71).

Other evidence that supports the identification of the graves are artefacts with names or inscriptions (for example, identity tags), the preponderance of Australian items, and the condition of the skeletons. Several artefacts were found which denote personal identification and these were recovered in secure association with discrete skeletons. These personal effects belonged to individuals on the lists of soldiers MIA from the 1916 Battle of Fromelles. Also, at the assemblage level, the artefactual record is biased towards items that denote individuals who fought for the Australian Imperial Force (AIF) (see Chapter Five), and therefore lends further credibility to the human remains being those of soldiers from the 1916 battle. This is because First World War soldiers fought together in territorial units, and in this instance one would expect clusters of Australian or British soldiers in particular areas of the battlefield. A number of published texts detail the circumstances of the battle and the likelihood of which troops reached and occupied the German front line trenches (Bean 1941; Knyvett 1918; Cobb 2007; Lindsay 2008). The architecture of the theatre of operations and the difference in distances between the British and Australian front line trenches (Knyvett 1916, 74) and those of the Germans are consistent with Australian forces mainly having occupied the German trenches.

Lastly, the relative completeness of the skeletons, the complete absence of macro-fauna (animal) scavenging or surface weathering, evidence of putrefactive insect colonisation and the limited number of non-reconciled complex body parts (for example a limb or substantial part thereof) are consistent with the burial of fleshed remains (bodies) in the immediate post-mortem interval. This evidence is wholly inconsistent with the burial of any human remains from prior battles, such as the 1915 Battle of Aubers Ridge, as it would be expected they would present evidence of prolonged surface exposure, animal scavenging and dissociation of body parts.

In conclusion, the historical, archaeological, artefactual and anthropological evidence are all consistent with the physical remains recovered from Pheasant Wood, being MIA soldiers from the 1916 Battle of Fromelles. Furthermore, there is a complete absence of evidence to the contrary.

The circumstances of burial

Analysis of the graves in terms of how they were dug and filled by the Germans and activities prior to and following interment was not a primary aim of the present work. It was for this reason that mechanical excavation removed the sides of the graves, which were excavated in plan, detailed soil



Fig. 6.1 A contemporary grave, similar to the Pheasant Wood mass graves described as being near Vimy, but said to be Fromelles 1916

analysis was not undertaken,¹ sections of the graves were not explored and non-identifying artefacts, such as fabric and wire, were given lowest priority. Nevertheless, in order to evaluate the potential of the anthropological and artefactual data, some consideration of the contextual evidence to the circumstances of burial, with interpretations, is important.

Overall, observed burial patterns correspond to those depicted in extant photographs which show dead soldiers in contemporary mass graves, similar to those at Pheasant Wood (Fig. 6.1). At Pheasant Wood, bodies had been buried in two layers, one on top of the other and lying across the width of the graves, some head-to-toe, or head-to-head or feet-to-feet. Bodies were predominantly lying in a prone or supine position and some bodies were lying along the length of the graves. The positions of hands, feet and AJBBs suggest that the majority had been lowered into the graves, with their jackets open and/or pulled up under their arms, by two people standing on either side. Thus, the overall organisation of the burials reflects the observance of protocols, corresponding to those detailed in German archives (Barton 2007).

Exceptions to this were observed in graves five and six. In Grave Five, the bodies were less well organised, the overall impression upon excavation being of a jumble of bodies, particularly in the western end of the grave. This suggests that burial may have been hurried here. These burials did not take place during peaceful times and therefore the hurried nature could reflect the impending sense of danger that would have prevailed so close to the frontline. The decay of bodies and inherent risk of disease, in the height of summer, also must have played a part in hastening burial.

Just three bodies were encountered in Grave Six, lying one on top of the other. It is possible that these

were buried at some point subsequent to the backfilling of graves one to five. However, this can not have been too long after because fly pupae found with the skeletons indicate that the bodies had been buried, or the graves backfilled, up to 10 days following death. Based on an Allied aerial photograph, taken nine days after the battle, which shows graves one to five backfilled and graves seven and eight open, Pollard *et al.* (2008) concluded that it was possible that the western end only of grave six had been backfilled. The fact that three skeletons were recovered from the western end would argue in favour of this interpretation. It is interesting to note that none of the individuals buried in this grave had preserved soft tissues, as was seen in other graves that were open over a shorter period of time.

Like Grave Six, fly pupae were recovered from all of the other graves containing bodies and again suggests that the burial or backfilling of the graves took place up to 10 days following the battle, in keeping with other evidence (German orders and aerial photographs; see Chapter One). None of the bodies were exposed for long enough to be scavenged by animals, because no evidence for gnawing, or other changes associated with scavenging, was observed on any skeletons. In addition, unlike assemblages that have been scavenged, all skeletons were relatively complete and intact.

Two further burial practices documented in the German archives (Barton 2007) and also observed at Pheasant Wood are the wrapping of bodies and liming. Evidence for wrapping was in the form of wire and the remains of groundsheets. Some of individuals that were found in association with these had received significant trauma, with skeletal lesions that suggested the integrity of the affected body parts would have been very compromised. Thus, the groundsheets and wire may have been utilised by the Germans to preserve the integrity of certain bodies during transportation and deposition in the graves. Groundsheets and wire may also have been used to cover up particularly distressing trauma (in the case of groundsheets), hasten burial and facilitate the movement and lowering of bodies into the graves (see Chapter Three).

Evidence where the integrity of a body may have been lost at the time of burial was rare. For example, in graves three and five body parts had been interred separately to their respective bodies as a result of peri-mortem trauma. Otherwise, bodies were intact and complete when they were buried, the integrity of these probably being maintained by a combination of clothing and connective tissues, even though a great many had received extensive trauma.

It is known that the Germans sanitised graves with lime (Barton 2007) and therefore it was not

¹ The exception here is soils that have been sampled by a team from the University of York as part of a wider study on soil micromorphology and chemistry in the study of human remains (see Chapter Two).

surprising to identify this practice at Pheasant Wood. In the burial layers, the lime had gone into solution and re-solidified, forming concretions on and around bones. Lumps of chalk were also encountered in grave fills and macroscopic analysis of these suggests that naturally occurring chalk may have been used as a substitute for chloride of lime due to a supply shortage. The different types of calcium carbonate encountered – lumps, scatters and concretions on bones – may reflect different responses of the chalk to the different post-depositional micro-environments, with that in closer contact with bodies showing a particular reaction to their chemical decomposition. Alternatively, differences in the appearance of the calcium carbonate may be explained by the fact that the Germans used chloride of lime in direct association with the bodies and naturally occurring chalk in the grave backfills (although this is unlikely). Further chemical analysis would be required to explore this, which is beyond the scope of the present work.

None of the anthropological data or artefacts provided convincing evidence to support the suggestion that individuals were sorted according to rank before being buried. For example, officers' items were associated with individuals from different graves (but see below and Chapter Five on issues relating to portability) and there was no particular clustering of individuals according to their age or dental treatment. Rather, these and other data (perimortem trauma) suggest that individuals were buried alongside those with whom they fought. For example, this was suggested as an explanation for the observed tendency for Grave Two to have a higher frequency of young individuals, and individuals with multi-trauma, compared with other graves. These particular individuals were perhaps from a particular battalion that had a young demographic, were fighting together and were subjected to a particular type of trauma, possibly an explosion in a confined space. In addition, a similar scenario may explain the preponderance of individuals associated with knee patches in Grave One.

The German orders issued by Major-General von Braun were very strict with regard to removing only items of identification and identity discs from individuals (that is, looting was strictly forbidden). Very few items detailing names of the individuals were found, the exceptions being three identity discs, a few items that had been inscribed with names or initials and a dental prosthetic that bore the name of the wearer. It is highly unlikely that the burial environment has biased the preservation of such identification information because the survival of paper (for example, the train ticket and, in particular, the more vulnerable paper from bibles) demonstrates the potential for any identification papers to have survived the burial environment. Rather, what has survived is considered to be a true reflection of the treatment of the bodies prior to burial and shows that the Germans closely observed their orders.

Despite the Germans' thoroughness, and the removal of most primary evidence of identification, the soldiers were nevertheless buried fully clothed (with the exception of their boots and headgear, see below). Secondary evidence, such as badges and AJBBs, was therefore left behind. Duplicate badges (for example, the rising sun badge) of varying sizes formed part of both uniforms. Often where only one was required by the Germans, two or more survived. The three identification discs that were found are also likely to have been duplicate discs worn or carried by the soldiers with whom they were found, because none was standard issue and all were private purchases.

Few soldiers were buried wearing their boots. This is consistent with what is known historically about this time when leather was in short supply and the removal of boots from dead soldiers was common to supplement this. As discussed in Chapter Five, the few boots that were found are likely to have been left by the Germans because they were associated with considerable trauma involving the lower leg and were probably too difficult to retrieve from the bodies.

Anthropological evidence

A fundamental weakness of any anthropological analysis is that it employs methods that have been devised using reference populations that are not specific to the population being studied (Cox 2000; Cunha 2009). This point was demonstrated at Pheasant Wood by the observation that the shape of the sciatic notch of the pelvis, which is routinely employed in the estimation of biological sex, was markedly different among the buried soldiers to that of reference populations (see Chapter Four). Another shortfall associated with estimating biological profiles from skeletal remains relates to the fact that current methods tend to overage the young and underage the old (Molleson and Cox 1993). Considering the skeletons at the assemblage level, biases such as these are considered to have had limited impact on the reliability of biological data, because statistical comparison between the age at death and stature profiles of the buried soldiers with those of the Missing showed good agreement (See Chapter Four). However, when each soldier is considered as an individual (as is the case when individual ID is the primary aim of the project), the degree of bias increases, the methods being unable to accommodate individual variation. In order to minimise this, the analyses have employed multiple indicators in the estimation of all biological parameters; they have selected methods that are based on populations that most closely approximate the Pheasant Wood soldiers and all estimations have been recorded with an error margin, or as a broad range. The recorded error margins or broad ranges are of particular importance, because they allow the level of reliability with which an age or stature was estimated to

be factored into any potential match between a buried and a missing soldier (see Chapter Seven).

Despite the fact that a high level of biological data was obtained from the skeletons overall, there were nevertheless some skeletons where data retrieval was hampered by poor preservation. More specifically, high fragmentation as a result of trauma sustained around the time of death and post-depositional fragmentation in the ground, caused by cycles of water saturation and drying out, prevented some observations from being made. This was particularly the case for those individuals buried closest to Pheasant Wood, especially Grave Two, where the properties of their bones were markedly different to those recovered from graves furthest from the woods. Data that could not be captured includes age (one), ancestry (27) and stature (one) estimations for the indicated number of individuals. Five individuals did not have relevant anatomical locations surviving for the assessment of handedness, facial attributes could not be recorded for 27 individuals and 360° videos could not be obtained for 96 individuals. Despite these shortfalls, observations could be made for the vast majority of indicators of sex, ancestry, age, stature, facial attributes and handedness.

Full observations on ante-mortem pathology and trauma could be made for the vast majority of individuals, and this was greatly assisted by the availability of radiography on a full-time basis. Unfortunately, suitable ante-mortem comparative data, such as radiographs, do not exist, and therefore this limits the application of this post-mortem evidence for identification. Further, not all observations could be conclusive owing to the limited way in which bone responds to disease (that is, it does not respond to acute conditions) and trauma. This may be as new bone, loss of bone, or as a combination of both. There are extremely few bony changes that are pathognomic of a particular disease, osteoarthritis being an exception. This means that it is often not possible to assign changes seen on bone to a specific diagnosis, which relies on observing the distribution of changes across the skeleton, and their appearance (for example, porous/smooth/spiculated). Thus, pathological changes observed on several of the buried soldiers were assigned non-specific diagnoses (for example, non-specific infection). Fortunately, this applied to the minority and, in the main, more specific diagnoses could be achieved, facilitated at Pheasant Wood by the fact that skeletons were very complete and well preserved and radiography was available full time.

Not all diseases and trauma will involve the skeleton, and those that do are not necessarily a direct reflection of the soft tissue changes and symptoms caused by them. For example, clinical evidence has shown that a certain type of fusion of the spine (called diffuse idiopathic skeletal hyperostosis) does not usually cause significant pain for individuals with the disease, despite its spectacular appearance (Rogers and Waldron 1995). Thus, a

conservative approach has been employed in the analysis and interpretation of disease and trauma. Only eight individuals were highlighted as having sufficient skeletal changes to suggest disability in life.

Other skeletal changes that were observed during the course of analyses proved to be too ephemeral to be useful for identification. In particular, this includes musculoskeletal markers of stress (MSMs), which were routinely recorded for several sites around the skeleton. However, scoring these is very subjective and, because significant inconsistencies were noted between observers, it was decided not to employ these changes in any data analysis of the assemblage. Opinion is currently divided regarding the reliability of MSMs as indicators of occupational stress (for example, Hawkey and Merbs 1995; Robb 1998; Stirland 1998; Klepinger 2006; Weiss 2004) and this was also reflected among the team examining the Pheasant Wood bodies. For these reasons, conclusions, beyond the basic assessment of overall skeletal constitution (see Chapter Two), were considered inappropriate. There was also the possibility that misleading or overly prescriptive information would be provided in attempting to use MSMs for identification. Data recorded on these are, however, available in the primary records for future reference.

Head hair was found in association with a number of individuals and records of its colour, texture, length and coverage were made for comparison with records. Head hair colour was of particular note, because this is recorded in enlistment records and therefore had potential to assist with identification. However, it was often difficult to say what the colour was, because this varied between light and dark depending on the lighting. Further, the shades/colours observed are as likely to be a reflection of taphonomic processes and degradation of ante-mortem hair colour, as they are of original hair colour (Wilson 2008). According to Wilson (2008), all hair recovered from buried environments is likely to have undergone colour alteration. This begins immediately after its deposition and is a function of environmental effects on the biochemistry of the melanin, where the black and brown pigments are more readily affected than the more stable yellow and red pigments, although both pigment groups are susceptible to differential chemical change (*ibid.*). Thus, in the same depositional environment one set of pigments will be more readily affected than the other (*ibid.*). Other important factors that influence post-mortem hair colour discussed by Wilson (2008) are that different colours degrade differently, even in the same or similar depositional environments, because in living individuals they are the product of the ratio of black and brown and yellow and red pigments. In addition, changes in hair colour are more rapid in anoxic wet environments than in dry ones. This is therefore of particular relevance to Pheasant Wood where the graves furthest from the woods were generally wet, while those closest to the wood were generally dry.

Further, hair colour is also influenced by fungal ingress into the hair shaft, which can leave dark deposits, thereby altering its light reflective properties. Lastly, ultraviolet (UV) and visible light, are known to alter the physical and chemical properties of hair, causing changes in the pigmentation. Thus, even in the relatively short space of time between recovery and analysis, there is the possibility that hair colour had altered by the time it was examined in the mortuary at Pheasant Wood. That said, it is worth noting that subsequent to the recovery operation, work undertaken during the DAT noted that a large number of individuals did have the same hair colour as was noted at the point of enlistment.

As expected, peri-mortem trauma was abundant on the skeletons and was observed in the form of projectile, sharp- and blunt-force lesions resulting from fire arms, explosives and, in once case, bladed assault. At the time of data collection it was anticipated that individual peri-mortem trauma patterns would be extremely limited for use in identification, and at best would provide exclusion type data (see below). Although eye-witness testimonies compiled by the British Red Cross record the fatal wounds that were sustained on the battlefield (see Chapter One), they are entirely dependent on the memories of those who were on the battlefield, where confusion and extreme distress prevailed. Further, it is not possible, osteologically, to distinguish between wounds that were sustained by fighting soldiers during life from those inflicted after death to bodies lying on the battlefield. Thus, it was expected that skeletal trauma would contradict the testimonial evidence, considered largely to be anecdotal. Subsequent to the excavation and analyses at Pheasant Wood, the patterns of peri-mortem trauma have been considered in a separate article (Loe *et al.* 2014). At the assemblage level, this provides a surprisingly good correlation between the Red Cross eye-witness data and the anthropological data. In particular, both datasets showed that explosive munitions were the most frequent wounding mechanisms, followed by firearms and then sharp force trauma, and that the head and thorax were wounded more frequently than the extremities (see Loe *et al.* 2014). The use of the two datasets in the identification of individuals is discussed in further detail in Chapter Seven.

Information pertaining to dentitions and dental work was abundant at Pheasant Wood and provides a rare insight into dentistry during the early 20th century. In light of the preponderance of Australian soldiers in this cohort, the majority are probably associated with civilian and military treatments available in Australia, or via the AIF. Interesting though this is, it is unfortunately of very limited use for identification because no dental records have been identified for the Missing; they most likely never existed (see Chapter One). Unique patterns of oral health, pathology and dental work were observed and would have been primary forms of identification evidence, had dental records been

available. Unlike the skeleton, teeth are a much more reliable when it comes to diagnosing disease. The dental arcade is so individual (in terms of morphology, anomalies and treatments) that it is routinely employed in modern forensics to name individuals of unknown identity (Hunter and Cox 2005); in fact, it is one of the criteria used to determine a positive identification.

While the prospect of ever finding ante-mortem dental records to compare with the dental data collected at Pheasant Wood is extremely slim at best, some observations have been made that may be useful for identification. The most informative of these was the denture which recorded the name of the wearer, but other dental work configurations and anomalies (for example, pipe facets) could provide useful information when compared with evidence preserved in ante-mortem records. In particular, enlistment records for the Missing refer to soldiers having initially been turned away when they tried to enlist on account of their poor dental health; this information can be compared with information on dental health and treatments observed among the buried soldiers (this is discussed further in the following chapter). In addition, further study and a historical review of early 20th-century dentistry in Australia and Britain may provide fundamental assessment or exclusion criteria for future identifications (individual or nationality) of First World War soldiers recovered on the western front. A future review of the wealth of recorded data (radiographs, written and image record) by an odontologist and a historian may provide additional information in this regard.

Artefactual evidence

Overall, the preservation of the artefact assemblage was excellent and, aided by radiography, it was possible to obtain a large amount of identification information from it. Further, the identification information was secure because a strict system for making physical associations between artefacts and bodies was employed in the field and was supported by thorough photographic, radiological, survey and written documentation, all available in the archive and demonstrated in the case reports. In addition, there was limited migration of artefacts in the graves, the vast majority still holding close associations with bodies owing to a combination of their structural properties, the heavy clay and their intimate relationship with the clothing with which they were found. This was unlike a minority of small bones and bone fragments, which had migrated in the grave deposits, probably because of their spongy, light structure and morphologies which predisposed them to transportation in water (Boaz and Behrensmeyer 1976; Duday 2006).

A large number of the artefacts were generic, being the remains of uniforms and equipment that was issued to all soldiers (particularly in the case of equipment), regardless of which army they were

fighting for. As discussed previously (see Chapters One and Five) uniforms are problematic, because although each army issued its own uniform, it is known that in some cases Australian uniforms had to be substituted with British ones or elements of British ones in times of short supply. In this sense, a large proportion of the 'individuality' of associated artefacts was absent. However, several artefacts had the potential to assist with identification to a more informative level, including to the army for which each soldier fought, to battalion or regiment and even to name, and these have been discussed in Chapter Five.

Besides the generic nature of many artefacts, another factor that has biased the potential of the assemblage to assist with identification is the removal of identifying items by the Germans before they undertook the burials. This has been discussed at some length in Chapters One and Five, but it is worth commenting here on the irony of this: the historical attempt to assist an identification process that took place almost a century ago (at a time when only one dog-tag was issued to each soldier; that was changed to two later in 1916), now makes the present task of identifying the fallen soldiers more difficult. It is also very likely that items such as steel helmets, weapons or boots, or other items that would have been considered useful and/or in short supply within the German army were also removed.

However, perhaps of most relevance to the potential of the recovered artefacts to assist with identification is the inherent portability of items, discussed in Chapter Five. This applied to all artefacts, no matter how high their ID score, as exemplified by one of the ID discs that was recovered from the trouser pocket of an individual; although a primary item for identification, its location makes the association between the name and the individual uncertain. Further, while individual items suggested an association with a particular rank or army, other items found with the same individual sometimes did not support this, or may have suggested the opposite. For this reason, combined with the other limitations described, analysis has placed great emphasis on the relevance of examining the overall context of the artefacts, their location on individuals, and their association with other artefacts. The assemblage of items found with each soldier tells a personal story that other types of evidence cannot. They therefore offer enormous potential to provide supporting evidence for identifying the soldiers.

Methodology

From the outset of the project it was known that anywhere between 225–450 skeletons might be recovered. The design of the methodology had to contend with several factors that are worth repeating here. Firstly, there was a limited period in which all works could be undertaken (maximum six months) and that none of the bodies or artefacts

could be revisited once the analysis phase was complete (due to their re-burial). In contrast, the period of time allocated to identification is five years (ending in 2014), during which time ante-mortem data and DNA data continued to be collected as new families came forward to assist. Therefore, analysis of the bodies and artefacts had to take into account the possibility that new data (for example, dental records) might come to light. Secondly, the works were undertaken under close media and public scrutiny. With this in mind, the methods employed in the project were developed to ensure the maximum retrieval of evidence in the minimum amount of time, while ensuring the integrity of all bodies, artefacts and data, the latter being achieved through a thorough chain-of-custody protocol, comprehensive record keeping and strict protocols for the movement of personnel and evidence on site and in the mortuary. This was substantially aided by the inclusion of individuals on the project team who had participated (at senior level) in mass grave archaeology and forensic archaeology and anthropology previously, and by a review of the current methods available for this work (for example, Cox *et al.* 2008).

Fingertip searching, metal detecting and soil sampling were all employed to maximise the recovery of artefacts and bone, but these methods detected only an extremely small number of both (see Chapters Two, Four and Five). This confirms that the recovery methodology was suitable and was employed to the highest standard.

This work has also benefited from the application of innovative techniques, including the 360° digital imagery of the skulls, overhead cameras and three-dimensional survey. In addition to the comprehensive records that have been created, these have helped to preserve identification information in a way that will allow it to be interrogated by the application of new techniques and/or data (for example, photographic superimposition, photographs and dental records) if they become available, and should this be required. In addition, the close proximity of the field and mortuary operations to each other, and the availability of live-data between them, was pivotal to the success of the work. This underpinned key processes, including chain of custody, facilitated the transferral and flow of information between the graveside and the mortuary and facilitated 'real time' decisions.

Finally, the conviction of the project team was 100%, and this has undoubtedly contributed to the capture of reliable and scientifically robust data, its importance should not be underestimated. Despite the wealth of documents, including personal letters, diaries and photographs that relate to the Battle of Fromelles, the artefacts and skeletons perhaps tell the most personal stories about what happened on the 19th/20th July 1916. For the team undertaking the work, this prompted periods of deep reflection on the battle and warfare in general and fostered a strong determination to do justice to the evidence

and ultimately to the individuals themselves. Along with the rigid scientific methodology, the enormous responsibility of recovering, analysing and interpreting the soldiers' remains was keenly felt and this was translated in the manner the work was undertaken.

Realising the potential of the anthropological and artefactual evidence for identification

A large body of anthropological and artefactual data was gathered, and this assisted with the identification of individuals, especially when combined with other forms of evidence, such as DNA. However, the correct handling of this data was imperative if its inherent strengths and weaknesses (as described above) were to be appreciated, and its full potential realised.

In other mass casualty situations where primary identification records (for example, ante-mortem radiographs) are absent, identification using anthropological and artefactual evidence, such as that described here, employs the principles of exclusion and failure to exclude (Baraybar 2008). Here, multiple points of concordance, in particular individuating criteria shared between a body or artefacts with information on a missing individual, can lead to a presumptive identification. Congruence, or shared characteristics, between the profile of bodies and known individuals results in a failure to exclude, thus the bodies may represent the remains of known individual(s). On the other hand, a lack of congruence results in the exclusion of the bodies from the group of known individuals. When employed in this way, anthropological and artefactual evidence will make an important contribution to the identification process.

CONCLUSIONS AND FURTHER WORK

With the exception of mass graves arising from modern atrocity crimes, the work undertaken at Pheasant Wood represents the largest mass grave excavation to date. The human remains and artefacts were generally very well preserved and as a result many details, anthropological and artefac-

tual, could be captured about the individuals who were buried there. These details have formed, and will continue to form, a very important part of the identification process.

The narrow time-frame in which the work was undertaken and the uniqueness of the methodology employed have made this a landmark project in the disciplines of archaeology and anthropology. The data present enormous potential to contribute to these disciplines through wider dissemination of the results in academic journals. The artefacts are also a unique and rare educational resource that offers enormous potential for outreach activities.

The skeletons, with their associated artefacts, represent a unique Killed in Action (KIA) group from the First World War period, being the largest assemblage of this type to have been excavated to date. Further study and analysis of the artefacts (the majority of which are curated at the Australian War memorial, Canberra but see Chapter Two under 'Archive') would make a considerable contribution to existing knowledge, in particular of social history, military manufacturers, and uniform use and provision during the First World War. Similarly, knowledge of the effect of explosive munitions on the human skeleton in the published literature is currently very limited and the data collected at Pheasant Wood makes an important contribution to this (see Loe *et al.* 2014). Further, this project offers the unprecedented opportunity to test existing and new osteological methods of identification, by comparing the results of archaeological and artefactual analyses with ante-mortem data of individuals who have now been identified. In addition, broader research (that has been beyond the scope of this project) on the details of some uniform elements, such as stamps and styles, may trace manufacturers who have hitherto not yet been studied or recorded. In both cases, this would have positive implications for the identification of as yet unidentified Pheasant Wood soldiers, as well as make an important contribution to the identification of First World War-era soldiers, especially Australian soldiers, recovered from the Western Front and the identification of unknown individuals in general.