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The Materiality of Roman Battle: Applying Conflict Archaeology Methodology to the Roman World.

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ABSTRACT

Over the last three decades a growing number of Roman battle sites have been identified across western Europe. Archaeological study of these sites has adapted methodologies developed from the Little Bighorn project onward to the material characteristics of Roman battle, and continue to be refined. Difficulties have been encountered in locating sites within a landscape, due to inadequacies in the historical record. Further issues have been encountered with the metal signature of Roman-period battle, particularly the high proportion of ferrous artefacts in the range of diagnostically-significant material. However, even greater problems are encountered in the post-excavation data interpretation of Roman battlefield assemblages, with many of the behavioural models used in wider battlefield archaeology proving less useful in an ancient context. This paper uses the examples of the known Roman battlefield sites to discuss the methodological issues in both field methodology and data interpretation in an ancient context, and considers the potential impact of behavioural models such as KOCOA in Roman-period assemblage interpretation.

Key Words: Battlefields, Roman Conflict, KOCOA.

1. INTRODUCTION

The rapid spread and adoption of 'battlefield archaeology' in the last three decades could barely have been predicted when the first surveys were undertaken at the Little Bighorn in 1984. The research potential provided by the spatial analysis of battle-deposited assemblages has been significant, and continues to develop and spread. Although the field methodology was initially developed to suit the material characteristics of C19 battlefields in the United States, the discipline now encompasses sites ranging from European prehistory to the Falklands War, located around the globe (Scott & McFeaters 2011). Although adaptations have been required to suit the material characteristics of battle in each period, the underlying principles of metal detection survey, excavation, and spatial analysis remain fundamental throughout the discipline. The unified approach in field methodology facilitates inter-site comparisons, which are now also extending into post-excavation data interpretation, particularly through the use of modern military theory, and behavioural models such as KOCOA.

If up until relatively recently few Roman battlefields had undergone archaeological exploration, the point has now been reached where monographs dedicated to the study of conflict archaeology in prehistory and antiquity are appearing (e.g. Fernández-Götz & Roymans 2017). The field methods of battlefield archaeology have, with adaptation, proved effective in a Roman context, but post-excavation data interpretation and behavioural modelling have proved more problematic. The interpretive models used in more modern battlefield archaeology, such as KOCOA, are rarely integrated into Roman battlefield study, and are employed ineffectively when they are used. This paper discusses the challenges which have been met in Roman battlefield archaeology, both in the field and data interpretation, particularly in modelling battlefield behaviour.

2. ROMAN BATTLEFIELD ARCHAEOLOGY

For much of the C20th, the only Roman conflict sites which had been conclusively identified (through more than conjecture based on the historical record) were the sites of long-term sieges, located predominantly in the Near East (Coulston 2001). These sites were identified through the often extensive earthworks and entrenchments constructed for the siege operations, and by the damage to the defensive fortifications of the site in question. Those built features in turn became the focus of archaeological exploration. While artefacts discovered during such work were noted, they were not viewed as significant discoveries, and the exact find-location was usually not recorded. When the Little Bighorn project began, not a single Roman battlefield had been conclusively located. Indeed, there was significant scepticism among many Roman historians and archaeologists that such assemblages ever could survive (e.g. Sabin 2007: 399-400). There was a long-standing, and entirely inaccurate, supposition that the Roman army, unlike any other army in history, was able to clear completely a battlefield of all battle-deposited detritus in the hours before it departed from the site. The archaeological record now demonstrates that this belief was incorrect.

In the late 1980s, a Roman battlefield was identified at the site of Kalkriese in north-west Germany. After several seasons in the field, it was identified as the probable site of the so-called "Varus Disaster" of AD9, in which three Roman legions were ambushed and almost totally annihilated in a surprise attack by a German tribal coalition. The site has since been subject to extensive archaeological investigation (Rost 2009). The spatial distribution of artefacts recorded at Kalkriese from the earliest stages of archaeological work, made it possible to integrate methods developing from the Little Bighorn project from an early phase. Following the work at Kalkriese, other Roman battlefield sites have been identified in the archaeological record (Fig. 1; Table 1). The sites which have been studied in the last three decades are exclusively located in the Roman provinces of western Europe.[1] Research has been particularly prolific in Spain, an area of intensive Roman military activity in the C2ndBC and C1stBC, and Germany.

Some of these engagements are documented in the historical record, while others can be associated with known campaigns, even though the individual engagements themselves are not specifically described. It is notable how many of the battles lack even a basic historical narrative, making them functionally proto-historic. Several sites were identified as Roman conflict sites during archaeological prospection for other purposes, typically ahead of industrial construction, although the number of specifically-located sites is beginning to increase. The identified battlefields represent a range of engagement types, from conventional pitched battle to small-scale battles characteristic of asymmetric warfare. This paper is not distinguishing between pitched battle and other field engagement types as there is no methodological necessity to do so. The term 'battle' is still commonly used in Roman contexts to describe large-scale pitched engagements only (e.g. Meyer 2017: 206-207), but this restriction does not reflect the reality of Roman warfare. Sub-categorising different engagement types seems, at this stage, to be counter-productive in exploring both field methodology and data interpretation, although may prove necessary at a future point of research.

[1] *Research into Roman battlefields in the Eastern and African provinces has been largely prevented by the current conflicts in those areas, but it is likely that Roman battlefield sites will also survive there. Provisional landscape survey has been undertaken in Tunisia at the probable battlefield of Zama (202BC; Ross 2005) but as-yet has not been accompanied by archaeological survey.*

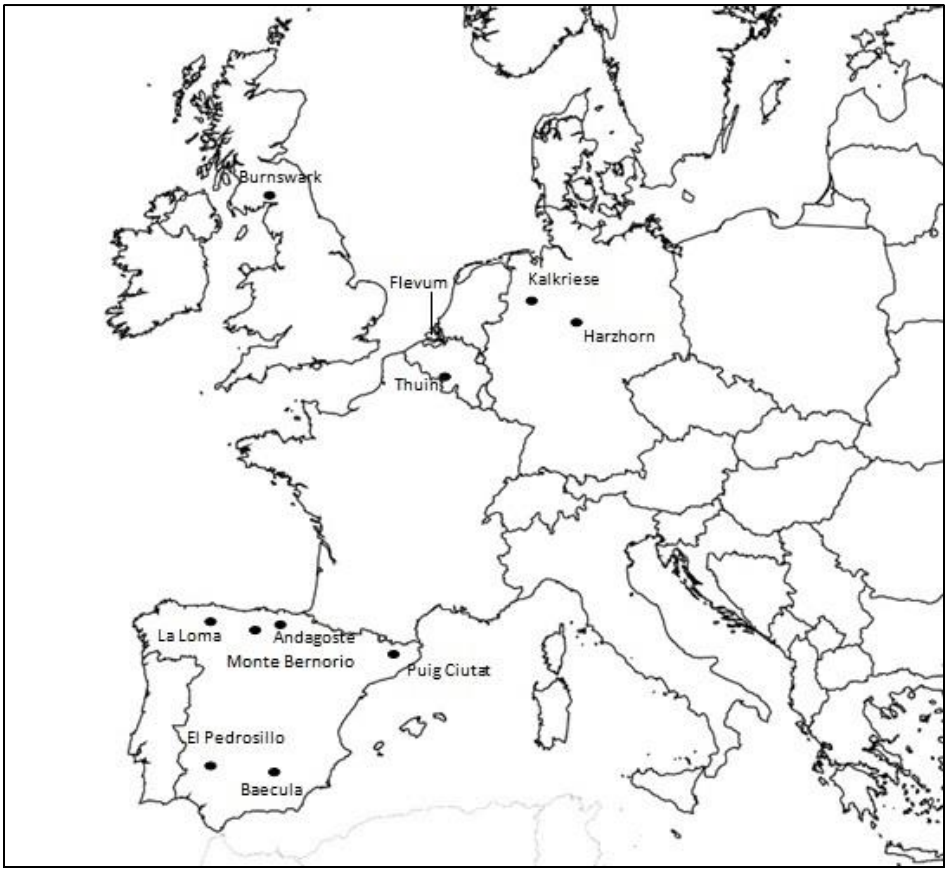

Figure 1: Identified Roman battlefields.

The assemblages recovered from these sites ranges from dozens to several thousand artefacts. As on later battlefields, there are artefact types which are consistently found on Roman sites, but likewise consistent with most battlefields, few to no complete weapons are recovered. Projectiles and missiles, the ancient equivalent of the munitions which dominate post-blackpowder sites, are found at all sites. Some of the projectiles are lead-based, particularly the distinctive oval-shaped *glandes* (slingshot) used by Roman slingers. *Glandes* are found in varying quantity at several sites, particularly Andagoste (Unzueta & Ocharán 2006), Thuin (Roymans & Scheers 2012: 22), and Flevum (Velsen) (Bosman 1999), but are minimal or absent at others. The majority of projectiles found on Roman battlefields are ferrous, including arrowheads, catapult bolts, and *pilum* (spear) points (Fig. 2).

The projectile assemblage is supplemented, often in substantial quantities, with fragments of military kit. Iron *caligae* (hobnails) worn lose from military sandals during a battle are the most common artefact type. Their distribution can therefore plot the movement of (Roman) troops across a battlefield landscape, in both the pre- and post-battle period as well as during the actual fighting. At some sites, caligae are the most numerous find, particularly Baecula (Sanz et al. 2015) and Harzhorn (Berger et al. 2010/13), although examples have been recovered from every excavated site.

Battle	Location	Date	Engagement type	Outcome	Narrative?[2]
Baecula	Spain (Cerro de las Albahacas)	208BC	Pitched battle	Roman victory	Yes
El Pedrosillo	Spain (Casas de Reina, Badajoz)	Mid-C2ndBC	Siege	Roman victory	No
Thuin	Belgium (Thuin)	Mid-C2ndBC	Installation assault	Roman victory	Yes
Puig Ciutat	Spain (Oristà)	Mid-C1stBC	Installation assault	Unknown[3]	No
La Loma	Spain (Santibáñez de la Peña)	Late-C1stBC	Siege		No
Monte Bernorio	Spain (Villarén)	Late-C1stBC	Installation assault	Roman victory	No
Andagoste	Spain (Kuartango)	Late-C1stBC	Skirmish/ambush	Roman defeat	No
Teutoburg Forest ("Varus Disaster")	Germany (Kalkrise)	AD9	Ambush	Roman defeat	Yes
Flevum (Velsen)	Netherlands (Velsen)	AD29	Installation assault	Roman victory	Partial
Burnswark	Scotland	Early-C2ndAD	Installation assault	Roman victory	No
Harzhorn	Germany	Mid-C3rdAD	Ambush	Roman victory	No
Abritus[4]	*Bulgaria (Razgrad)*	*AD251*	*Pitched battle*	*Roman defeat*	*Yes*

[2] A specific reference to or narrative of the engagement, NOT just attributable to a known conflict.
[3] Probably a Civil War engagement between the armies of Julius Caesar and Pompey; the force defending the installation was defeated.
[4] The battlefield itself has not been located or excavated, but artefacts deposited during and after battle have been identified in the archaeological record.

Figure 2: Iron spear point from Harzhorn.

Caligae are supplemented by smaller quantities of other kit, often highly fragmented, including armour fittings, buckles, brooches. Elements of horse-tack, either from cavalry or draft animals, have been found at some sites (Kalkriese, Harzhorn) but are not universal. Miscellaneous military artefacts, including entrenching tools and tent-pegs, found at some sites, are again not universal. Coins, pottery, and unidentifiable metal fragments are also found at many sites, although their deposition cannot always be directly attributed to the battle. Additional artefacts from the military baggage-train might also be recovered if the engagement had involved a direct attack on them, such as various camp-goods found at Kalkriese (including a bed, strong-boxes, and sculptures), and remains of a baggage-wagon at Harzhorn.

Roman battlefield assemblages are therefore not necessarily defined by a single signature artefact, but by a combination of several types, particularly projectiles and *caligae*, which are universally present in diagnostically-significant quantities on all identified sites. These signature artefacts are small and low-value, easily embedded in the topsoil during battle, and not worth the effort of recovering during post-battle looting phases (*cf.* Rost 2009). The high loss-rate of projectiles has been recently demonstrated in experimental firing at Burnswark. A number of *glandes* were fired, but in the recovery phase less than 10% of the shot projectiles could be recovered by eye alone, despite them having been painted bright orange (Fig. 3). The remaining 90%+ were only found with a metal-detector, and even then, a 100% recovery rate was not achieved (John Reid *pers. comm.* August 2018).

Figure 3: Orange-painted glandes fired in tests at Burnswark (image: John Reid)

The assemblages from Roman battlefields are frequently distributed over a wide area, and are not necessarily restricted to the core area of fighting. Their spatial distribution is often indicative of movement during retreat and pursuit, particularly in the defeat of a Roman army. Material looted from Kalkriese has been found in native settlements located within the battlefield landscape, with signs of attempted reprocessing and reuse (Rost & Wilbers-Rost 2016: 25-26). Similarly, high numbers of Roman artefacts have been found in native settlements near the battlefield of Abritus (Radoslavova *et al*. 2011). Establishing a battlefield boundary, or even identifying the core and periphery zones, is likely to prove problematic in a Roman context; however, it is arguably also unnecessary.

3. ROMAN BATTLEFIELD FIELD METHODOLOGY

Exploring a battlefield archaeologically involves a series of site-specific methodological challenges, many of which have developed from the Little Bighorn project. A battle represents a transient event, often taking place within a few hours, at most a few days, involving large groups of people over in an area which can extend to tens of square miles. They frequently have uncertain boundaries, both of areas of fighting and those of manoeuvring before and after the battle, particularly during the phases of disengagement, retreat, and pursuit. Assemblages are not evenly distributed across the battlefield, making it necessary to survey as much of the potential battle-related area as possible prior to excavation. On many more modern sites, survey can be targeted on particular areas of the battlefield based on the primary research aims, although this approach risks missing unanticipated evidence outside of the prospected areas. Most post-medieval battlefields are surveyed in non-ferrous mode, picking up the lead munitions and copper-alloy kit fittings which make up the majority of the assemblage without interference from unconnected ferrous artefacts (Foard & Morris 2012: 29). Transects are commonly employed in preliminary survey, with areas evident of high deposition rates often resurveyed in narrower transects (or, resources permitting, in entirety) to aid more complete artefact identification. The find-spots of all artefacts are now usually recorded using a Global Positioning System (GPS) to facilitate post-excavation spatial analysis. This field methodology has proved effective at most battlefields, making metal detection survey almost synonymous with 'battlefield archaeology' (*cf*. Connor & Scott 1998).

Consistent with wider practices, the initial stages of field methodology for Roman battlefield exploration involves metal detection survey over a large area of the site. On blackpowder battlefields it is possible to conduct survey in non-ferrous mode and still identify the munitions which dominate the battle-deposited assemblage, while excluding rusting iron artefacts deposited much later. On Roman sites, however, the diagnostically-significant artefacts can be made of either iron or lead, supplemented by copper and copper-alloy military kit. Assemblages at many sites are dominated by ferrous artefacts, particularly *caligae* and projectiles, while lead *glandes* may be minimal or even absent from the archaeology. In the surveys at Kalkriese, metal-detection was carried out in non-ferrous mode due to concerns about signal distortion and the detection of 'irrelevant' ferrous objects (Moosbauer 2005: 95-96). However, most subsequent Roman battlefield surveys have opted instead to survey in all-metal mode, despite the resulting complications (e.g. Bellón *et al.* 2012: 357-360; Berger *et al.* 2010/13: 323-325). Transects have been used, most notably at Baecula (Bellón *et al*. 2012), although they have not been used at many other sites.

However, the methodology developed by battlefield archaeology largely assumes as a prerequisite that the general location of a battlefield is already known, even if the exact landscape boundaries may be less than certain. Most post-medieval battlefields can be securely located through contemporary documentation, including campaign journals, letters, and maps, but for sites from the medieval world and earlier, locations are frequently unknown. The Roman historical record is almost invariably lacking in detail for the location of battlefields. As a broad characterisation, the further an engagement was fought away from the central Mediterranean, the worse the evidence becomes. Roman military geography is characterised by three types of space: geographic (the wider setting); strategic (the space in front); and tactical (the space immediately around). Further characterisation is provided by the use of the space; geographic provides the campaign setting, strategic the advance of the campaign, and tactical the battle (Riggsby 2018). Precise geographic details were therefore not always necessary in the writing of Roman military history. Some battles, particularly those in the central Mediterranean (particularly Greece, Italy, less commonly Turkey and the Near East), might be located with reference to a nearby topographic checkpoint, usually a settlement (Cannae, Pydna), water-source (Trasimene, Trebia), or notable landscape feature (Cynoscephalae). The checkpoints were not intended, however, as absolute geographical locators of a battle, but are frequently just the nearest or last topographic feature named in a narrative before a battle, and therefore lie at an unspecific distance from the actual battlefield. In Roman provincial warfare, even these checkpoints are almost universally absent from historical narratives, with the result that battlefields can be narrowed down to a region at best. Unnamed topographic features are only mentioned in the battle narrative where they had a tactical impact, although these are frequently so generic – forests, marshes, rivers, hills, valleys (Riggsby 2018) – that there can be difficulties using the descriptions to locate sites within the modern landscape.[5] In Britain, for example, the first battle of the AD43 Roman invasion is documented as being fought alongside a river somewhere between the south coast and the Thames, while the second can be located somewhere in the Thames estuary. A battle between the Roman army and a force of Britons in AD50 can only be located to having been fought on a hill somewhere in north Wales, while a major engagement between the Romans and rebellious Britons under the command of Boudica in AD60/61 took place in a valley somewhere between London and Anglesey. The Battle of Mons Graupius (AD83) fought by the Romans and the Caledonians can be narrowed down to a hill somewhere in Scotland north of the Firth of Forth, with a native settlement nearby. In all cases, numerous locations can be found within the specified regions which fit the topographic criteria, particularly for Mons Graupius (Fig. 4). Archaeological evidence has not been found at any of these sites, or any of those suggested for the battles of Roman Britain. In many cases, there is a notable absence of effort to look for any archaeological verification.

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[5] *With some exceptions, such as the battlefield topographies given by Julius Caesar in the Gallic Wars and Civil Wars, which provide detailed descriptions of the terrain.*

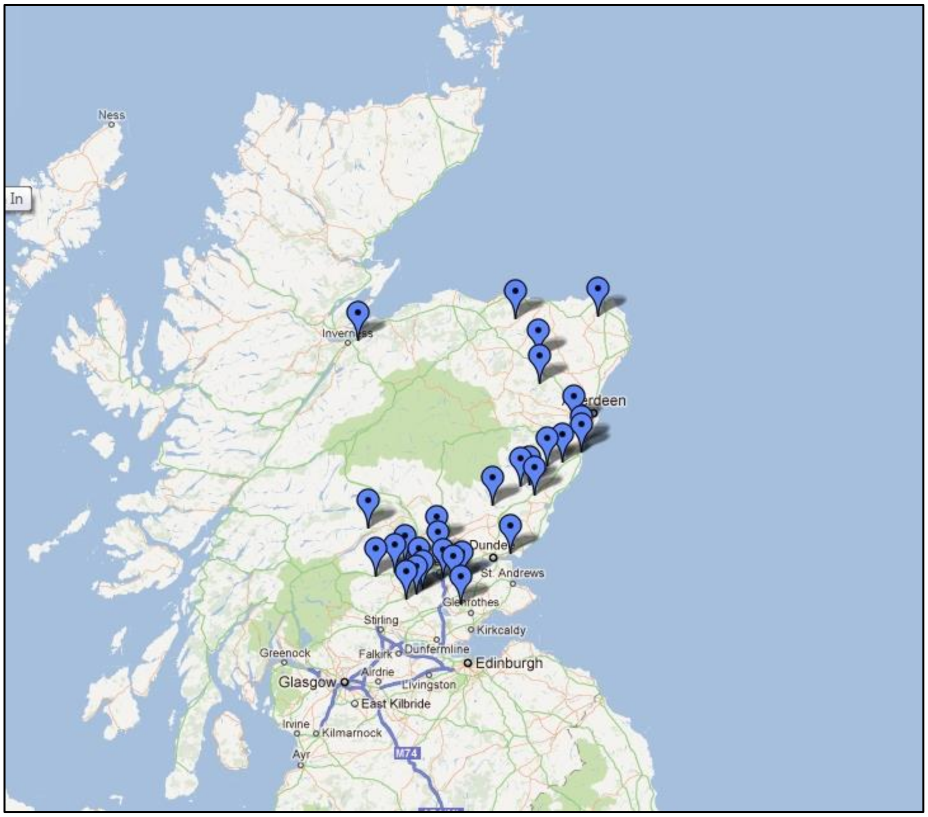

Figure 4: Hypothesised locations for Mons Graupius battlefield in Scotland.

The lack of detailed locational evidence from Roman-period historical sources does not mean that they cannot be found, and even the generic characterisations may provide some basis for narrowing down a range of sites. It does mean, however, that in many cases multiple possible sites may be shortlisted and undergo preliminary investigative survey to establish the presence, or absence, of Roman military artefacts before the 'correct' site is identified. The site of Baecula was identified in this way (Bellón *et al.*2009), with preliminary surveys undertaken at a number of possible sites, each excluded in turn when survey failed to identify any signs of Roman military activity. However, such a process of identification adds complications and numerous pre-excavation stages to Roman battlefield projects.

4. DATA INTERPRETATION I – LOCATION AND NARRATIVE

The inevitable question which follows any archaeological fieldwork is the issue of what to do with the collected data, and this is no different in battlefield archaeology of any period. A battlefield project will have specific research questions which it is hoped the assemblage will shed light on, although these issues range from the exact boundaries of a battlefield, or the location and extent of particular documented phases of activity, to the movement of different units across a battlefield landscape or the placement of artillery. Typically, these research questions result from problematic elements of the historical documentation.

In the case of Roman battlefields, the initial research aim is often simply to locate and/or verify a site within a landscape. As well as indicating where battles took place within a Roman landscape, the distribution of battlefield sites can be set within the context of the wider conflict landscape during an individual campaign, incorporating terrain, settlements, roads, and military installations. Reconstruction of the movement of the Roman army on campaign had previously been deduced from the distribution of marching camps. These temporary installations were built by the Roman army while in the field, constructed by building a turf rampart around an area big enough to hold the army and its baggage-train, and could be used for as little as a single night (Jones 2012). In theory, no camp should be located more than a day's march from the previous stoppingpoint, although not all constructed camps can or have been identified. Although broadly standardised in form, and usually rectangular, the exact layout of a marching camp was often dictated by the terrain. Although there is poor evidence for the date of most marching camps, many have been associated with a particular campaign through their wider archaeological context, although the process remains problematic (Jones 2012: 109-130). The distribution of marching camps provided a minimum possible extent for particular campaigns, but went little further in illustrating the operation of the Roman army on campaign. The identification of battle sites in the archaeological record has added a further dimension to the geography of Roman warfare, demonstrating how the Roman army defeated and pacified its enemies (e.g. Costa-Garcia 2017).

After identifying and verifying Roman battlefield locations, the assemblages can be used to reconstruct the narratives of the battles. The narrative detail present in Roman historical accounts varies dramatically, from detailed discussion of troop deployments in what were evidently considered to be 'important' battles, to much more cursory descriptions which do little more than document that a battle happened, and who won. The detailed descriptions have been used to reconstruct a model of how the Roman army 'typically' behaved in battle (e.g. Goldsworthy 1996). These models are generic to the point of almost complete uselessness, and give no allowance to outside factors which might influence battlefield behaviour, nor how it was adapted to fight in different scenarios or against different opponents. These issues have become particularly pertinent in light of sociological and anthropological research, alongside findings from historic battlefields, which indicate that soldiers commonly act in contradiction of their training when actually in an active conflict situation (Malešević 2010: 220-222).

Discussions of Roman battlefield behaviour are also, almost exclusively, concerned with pitched battle only, marginalising or completely ignoring so-called 'lesser intensity' engagements such as ambushes, skirmishes, and raids; the battles that as-yet make up the majority of the archaeological record. While there almost certainly was a consistent pattern of behaviour for the Roman army in battle, adapted around different engagement types, there has been insufficient evidence to reconstruct it from the historical record alone. Battlefield archaeology can provide a more accurate and independent account of where and what events happened in an individual engagement. For battles documented in the historical record, such as Baecula and Kalkriese, the archaeological narrative can be contrasted with that of the source(s). For the undocumented examples, the distribution of the assemblage provides the only basis from which to reconstruct the events of the battle. In all cases to date, it has been possible to reconstruct fundamental elements of the narratives, such as the armies involved, their respective positions at the start of the battle, manoeuvres during the battle, and which side won the engagement.

5. DATA INTERPRETATION II - BATTLEFIELD BEHAVIOUR

Identifying and making sense of the battlefield behaviour uncovered in the archaeological record has become one of the most valuable outcomes of battlefield archaeology. The battlefield actions taken by respective armies can be compared against what is known from the historical record about contemporaneous military training. The aim is to identify how the conditioned behaviour was enacted on the battlefield, and examine behavioural continuity - or lack thereof - across multiple engagements within a larger conflict (e.g. Scott 2001; Bleed & Scott 2011). A range of theoretical frameworks have been adapted from contemporary military studies to model archaeological battlefield behaviour, both in a predictive and interpretive contexts. However, the application of such models to battlefield behaviour in Roman-period conflict has, as yet, been limited.

This is not to suggest that Roman battlefield behaviour is not evident in the archaeological record from excavated sites. It has been possible to identify several battlefield behaviours documented by the ancient historical record in the archaeology of Roman battle. In both Greek and Roman pitched battle, infantry soldiers held a shield on their left arm which protected the soldier to their left, while they in turn were protected by the shield of the man to their right. The Greek historian Thucydides (*History* 5.71.1), writing in the C5thBC, observed that Greek battle-lines often became misaligned through soldiers edging closer to the soldier on their right for better protection, leading the lines to swing to the right. Although Thucydides was not directly describing Roman behaviour, the same phenomenon is visible in the assemblage distribution at Baecula, where the distribution of Roman *caligae* illustrates the same drift-pattern (Bellón *et al.* 2012). At Kalkriese, the artefact distribution suggests that the Roman army initially maintained combat cohesion after being attacked, but in the end-stages of the battle suffered combat disintegration after being herded into a 'kill-zone' at the Oberesch. Over 90% of the recovered assemblage comes from the Oberesch, but certain artefact types, particularly longer-range projectiles (*glandes*, arrows) are largely absent from this area (Rost 2009). This finding correlates with the description given by the historian Cassius Dio (56.19.5-22.2), who noted that at the end of the battle, the Roman soldiers threw away their weapons and waited for death, much as the Little Bighorn project found that some of Custer's men had at Last Stand Hill (Fox 1993: 48-49).

It is clear from the historical record that the construction of a battlefield camp by the Roman army was an important precursor to battle. The camp served as a tactical withdrawal point should the battle turn against the Romans, within which they could shelter from attack, and potentially sally forth at a later stage. The late Roman military writer Vegetius notes the importance of a battlefield camp in circumstances of defeat, noting that without one, soldiers had no choice but to flee and hope the enemy abandoned pursuit before they were caught (Vegetius *De Re Militari* 1.21). The camp presented a more tactical alternative, and as such, had to lie close to the battlefield. Camps have been identified close to most of the planned engagement sites, including Baecula, La Loma, Monte Bernorio, Thuin, and Burnswark.

The battlefield camp was of such importance that attempts were made by the Roman army to create one even whilst under unexpected attack. The historian Cassius Dio (*Roman History* 56.21.1) documents that the Roman army built at least one (more probably two) temporary camp during the Varus engagement, sheltering overnight before attempting to break free from the on-going attack.[6] The camp has not, as yet, been identified in the landscape around Kalkriese. However, archaeological construction of a camp while under attack is evidenced at Andagoste. In this engagement, after the Roman army had either been ambushed or suffered an unexpected reverse following an attack on a native force, they attempted to fall back and construct a camp to shelter in, the structure of which has been identified. However, the earthworks are incomplete and there is evidence of skirmishing within the camp, suggesting that the Roman army was overwhelmed before finishing the structure (Unzueta & Ocharán 2006).

The archaeological study of Roman battlefield behaviour does not, as yet, integrate many of the theoretical models used to analyse assemblages from post-medieval battlefields. There have been calls, in the interests of uniformity of study, for certain theoretical approaches to be adopted consistently across all periods of battlefield archaeology (Brown 2017). One such theoretical approach, in particular vogue at the moment, is KOCOA. Developed by the US Army as a terrain-analysis tool in the predictive planning of military operations, KOCOA explores five elements of military landscapes: Key Terrain, positions on the battlefield which must be taken or held; Observation, a view-shed analysis of what can be seen at different points of the battlefield; Cover and Concealment, features which can be used as protection from enemy observation and/or attack; Obstacles, features which directly impact the movement of troops; and Avenues of Approach, areas of passage between the protagonists, often lying between the attacking force and the key terrain (Babits 2014; *cf*. Scott & Bleed 2011: 48-49). With adaptations made for period-specific technological and cultural characteristics of battle, KOCOA is used in battlefield archaeology to model battlefield behaviour, and compare it against the archaeological evidence to assess the impact of terrain (Scott & McFeaters 2010: 107; *cf*. Bleed & Scott 2011; Babits 2014). KOCOA has become a standard analytical method used to study historic battlefields in the United States, particularly projects funded by the American Battlefield Protection Program (ABPP) which requires use of the analysis (McMasters 2011). However, aspects of the way KOCOA is used within battlefield archaeology have come under criticism (e.g. Sivilich 2014).

[6] *The construction of the camp(s) is further documented by the historian Tacitus (Annals 1.61), who says that remains of the walls, ditches, and layout were still identifiable when another Roman army returned to the site six years later.*

Although increasingly common on battlefields from the C18th onward, KOCOA has not been widely adopted as an interpretive method for sites from earlier historical periods, and there are on-going concerns over the relevance of the methodology on sites without extensive historical documentation (Bleed & Scott 2011: 62). This is not to say it is entirely absent. KOCOA has been used with some success as a predictive modelling tool for identifying potential locations of medieval battlefields, although it is reliant on having sufficient contextual knowledge about contemporaneous military use of terrain (McNutt 2014). Beyond locating sites, however, its impact has been limited. As yet, KOCOA has not been used in the Roman world in the context of predictive modelling to locate battlefields. The only use of the methodology has been in a study of the terrain in the Roman assault on Monte Bernorio (Brown *et al.* 2017). The analysis found that the spatial distribution of the assemblage correlated with the behaviour largely confirming the predictive KOCOA model in the context of both the attacking Roman army and the defensive Cantabrian garrison. However, the use of KOCOA itself added very little to the analysis, and rather than suggesting new insights into the battle, serving largely to confirm what was already known.

It is difficult to know how far KOCOA and other predictive behavioural models can positively impact interpretation of Roman battlefield archaeology. Predictive modelling more widely is also currently problematic in the context of Roman battle. Much of the assemblages at Roman sites can be interpreted equally well without behavioural modelling. That Roman pitched battles took place on open, flat landscapes is nothing new, nor is the observation that ambushes took advantage of restrictive terrain to entrap their intended target. At the installation assaults sites (Garcia *et al.* 2010; Cerdán *et al.* 2011; Roymans & Scheers 2012: 20-24; Fernández Ibáñez 2015), the concentration of heavy projectile firing on gateways is equally logical without theory, simply because a breach was most likely at the weakest point of the fortification, usually the gateway(s), while lighter projectiles are fired against the defenders. The distribution of *caligae* illustrate the movements of the Roman soldiers, and again, it is no surprise to find these clustered along the easiest approach routes towards and through a battle site. Similarly, at Harzhorn the *caligae* distribution illustrates the movement of the ambushed Roman troops as they advanced on the ridges from which they were being attacked, the hard terrain wearing loose thousands of hobnails (Berger *et al.* 2010/2013) - but again, identification of this behaviour was evident from the archaeology without any behavioural modelling.

It would appear, therefore, that some methodological adjustment will be required to models such as KOCOA to reveal any significant insights into battle in Roman antiquity. The issue of the relevance of KOCOA and the necessity of adaptation has, however, been recognised in other contexts. Sivilich (2014) has suggested that the use of KOCOA in battlefield archaeology must be adapted to consider not just the universal military characteristics of terrain (*cf.* Babits 2014), but also to factor in contemporary training, decision making, and knowledge about the landscapes within which the conflicts took place.

However, even these adaptations are problematic in Roman conflict. The main issue is that even adaptive KOCOA requires the use of historical sources in ways which can prove difficult, if not impossible, in a Roman context. The Roman historical record, in general, cannot be relied upon to provide any supplementary evidence on strategic or tactical objectives, the use of terrain, or the materiality of battle in any individual Roman battle. For any of these behavioural methodologies to be effective, a lot of contextual knowledge about warfare and battle in the period is needed, including strategic, tactical, technological, military training, and wider cultural characteristics. These subjects are almost absent from Roman written sources, beyond a few scattered and unrelated references. All the extant sources for Roman battle are written by elite Romans (and Greeks) for an elite audience, and almost invariably from a Roman perspective. There are rare exceptions, such as the account of the First Roman-Jewish War (AD66-73) by the Jewish writer Josephus, who fought against the Romans in the initial stages of the conflict before surrendering in AD67. However, after his surrender, Josephus became a Roman slave, and after being freed, a Roman citizen in the employ of the emperor; his account of the war, although from a Jewish perspective, was created for the same elite audience as other historical works. It is almost impossible to extrapolate the necessary contextual characteristics of battle from the non-Roman perspective from any of the known sources.

The historical sources provide very little evidence for how the Romans (or their opponents) conceptualised terrain in a battlefield context. Appreciation of all five fundamental characteristics of KOCOA can be found in Roman battle narratives. However, the sources give little detail about how terrain was actually used, how far in advance this was planned, and who was responsible for the decision making. Where terrain is described, such generic terms are employed - an open plain, marsh, forest, valley, river - that very little is revealed about the conceptualisation of terrain. Those elements which are noted, such as noting that ambushes were more likely in certain types of terrain (e.g. Vegetius *De Re Militari* 3.6), and that pitched battle should be fought in an open plain, are obvious even without theoretical terrain analysis models.

The strategic and tactical objectives of the Roman army are not always clear beyond the simple imperative towards victory. Much of the expansion of the Roman Empire in the Republican and earlier Imperial period looks, with two millennia of hindsight, to have been part of some overall strategic plan. In reality, the expansion was spasmodic, piecemeal, and driven more by the acts of ambitious individuals who were products of their values of their times. The campaigns of expansion show little evidence of an overall strategic objective, but rather conquest simply because the opportunity was there, in a process more akin to the moving colonial frontier line across North America than a long-running 'Grand Strategy'. Therefore, it is difficult to reconstruct the decision-making process in the context of Roman conflict, an insight which research in other contexts has demonstrated is vital to successful adaptation of KOCOA and behavioural modelling to conflict contexts.

Even the technological context of Roman warfare is far from clear. Very few sources describe Roman militaria, and far more is known about military equipment from archaeology than the historical record (Bishop & Coulston 2006). The technological context of non-Roman forces is even less clear, as very little non-Roman equipment has been recovered from conflict sites. This may indicate that both sides used Roman-style weapons, armour, and other kit, or that a more complex, and as yet unclear, process of deposition and survival was at play. In all cases, it is difficult to factor the impact of military technology into predictive models when those technologies are unknown.

Further complicating the issue of behavioural modelling in Roman battlefield archaeology is the prevalence of asymmetric warfare throughout most of the Late Republican and Imperial period (C1stBC-C5thAD). Pitched battle has become defined as the predominant engagement-type of the so-called "Western Way of War", originating in the Classical Greek world (Hanson 1989; *cf.* Goldsworthy 1996). This may well have been the preferred method of fighting for the Early and Middle Republican Roman period, defined by large-scale conflicts such as the Punic Wars, against opponents of comparable state-structure and technological level who were willing to fight in comparable manner. However, as the Roman Empire spread into more distant provinces in Europe, the Near East, and North Africa, it encountered opponents who did not share the cultural concepts of warfare and battle. They invariable chose not to engage in pitched battle, but instead preferred a range of small-scale, lower-intensity engagements, including ambushes, skirmishes, and raids. They met the Roman army in pitched battle only when unavoidable, and were usually comprehensively defeated when they did. Battlefield archaeology has highlighted how often the Roman army found itself fighting outside the parameters of conventional pitched battle, especially at Andagoste, Kalkriese, and Harzhorn. The victory of the native force at both Andagoste and Kalkriese indicates the advantages of engaging the Roman army outside pitched battle. However, the archaeological evidence from other Roman battlefields demonstrates that the Roman army was more adaptable in the field than the historical record suggests, able to engage in short but violent assaults to capture native fortifications (El Pedrosillo, Puig Ciutat, Monte Bernorio, Thuin, and Burnswark), engagements almost exclusively omitted from the historical record. Where these engagements were initiated by native forces, they demonstrate an evident preference to engage the Roman army outside pitched battle. This method offered the best opportunity to exploit the weaknesses of the Roman army, while also minimising the impact of its strength.

The underlying purpose of asymmetric warfare is to behave, and use terrain, in uncharacteristic and unpredictable ways. The terrain choices were no doubt influenced both by the advantages offered to the native attackers and the disadvantages to the Roman victims. However, without any context, it is difficult to model what the influential factors were, particularly if the native intention was to use terrain, and model their behaviour, in unpredictable ways. The battlefield behaviour of the Roman army may also have varied under such conditions. Modern sociological studies suggest that even well-trained armies often fail to perform according to their training in battles taking place within a ongoing period of asymmetric warfare (Suissa 2012). Their performance can improve, however, when the army adapts its behaviour to suit the individual circumstances (Suissa 2012: 57-129). It seems highly unlikely, therefore, that Roman battlefield behaviour remained consistent with standardised training throughout its provincial campaigning, but rather, adapted to circumstance. What these adaptations were, however, can only be found in the archaeological record.

6. CONCLUSION

As battlefield archaeology has been adopted more widely to study sites in the Roman world, the field methodology has been adapted around the material characteristics of Roman warfare. However, the behavioural models employed to interpret the assemblages of post-medieval battle have been less successfully employed, and indeed it is questionable whether the contextual evidence required for successful adaptation exist in sufficient quantity. The challenges inherent in adapting behavioural models such as KOCOA to the Roman world are substantial. However, many of these issues are not unique to the Roman world, but are found, in varying form, in many other periods of battlefield archaeology, particularly those associated with asymmetric warfare. As a result, the use of behavioural models such as KOCOA in battlefield archaeology is beginning to undergo a reflexive review. Period-specific adaptations to behavioural modelling are beginning to emerge, such as Sivilich's (2014) suggestion that KOCOA needs to incorporate contemporaneous characteristics such as training and knowledge about terrain, rather than blindly working around neutral terrain analyses carried out by modern archaeologists.

As yet, the conclusions which can be drawn from behavioural models such as KOCOA add little to our understanding of Roman-period battle, not least as the non-Roman perspective cannot be accommodated on the basis of the existing evidence. The paucity of evidence, however, makes it ever more important to work towards the creation of models which illuminate the battlefield behaviour of the Roman world; the most important element is making sure that the model is adapted to suit the evidence, not the evidence adapted to suit the model.Comparable adaptations will be necessary if such behavioural modelling is to have any relevance to battlefield archaeology in a Roman context; the next stage is to identify what they are.

REFERENCES

Babits, L.E. (2014). “METT-T, KOCOA, and the Principles of War: A Template Guiding a Better Understandingof Battlefield Behavior and Detritus.” InGeier, C.R., *et al.* (eds.)*From These Honored Dead Historical Archaeology of the AmericanCivil War*. (Gainsville):263–270.

Bellón, J.P.R. *et al*. (2009). ‘Baecula.An Archaeological Analysis of the Location of a Battle of the Second Punic War’. In Morillo, Á.,*et al.* (eds.) *Limes XX*. (Madrid): 253–266.

Bellón, J.P.R. *et al* (2012). ‘Un scenario bélico de la Segunda Guerra Púnica: *Baecula*’. In Remedios, S., *et al*. (eds.) *Aníbal de Cartago: Historia y Mito*. (Madrid): 345-378.

Berger, F., *et al.* (2010/2013). ‘Die römisch-germanischeAuseinandersetzungamHarzhorn, Lkr. Northeim, Niedersachsen’. *Germania* 88: 313-402.

Bishop, M.C., &Coulston, J.C.N. (2006).*Roman Military Equipment from the Punic Wars to the Fall of Rome.* (Oxford, 2nd Edition).

Bleed, P., & Scott, D.D. (2011). ‘Contexts for Conflict: Conceptual Tools for Interpreting Archaeological Reflections of Warfare’. *Journal of Conflict Archaeology* 6 (1): 42-64.

Bosman, A.V.A.J. (1999). ‘Battlefield Flevum.Velsen 1, the latest excavations, results and interpretations from features and finds’. In Schülter, W., &Wiegels, R. (eds.) *Rom, Germanien und die Ausgrabungen von Kalkriese.* (Osnabrück): 91-96.

Brown, C.J., *et al.* (2017). ‘Fought under the walls of *Bergida*: KOCOA analysisof the Roman attack on the Cantabrian *oppidum* ofMonte Bernorio (Spain)’.*Journal of Conflict Archaeology* 12 (2): 115-138.

Cerdán, A.M., *et al.* (2011).‘The Roman Republican battlefield at Pedrosillo (Casas de Reina, Badajoz, Spain).’*Conimbriga*50: 59-78.

Connor, M., & Scott, D.D. (1998).‘Metal Detector Use in Archaeology’.*Historical Archaeology* 32 (4): 76-85.

Costa-Garcia, J.M. (2017).‘Rediscovering the Roman conquest of the north-westernIberian Peninsula’. In Fernández-Götz, M., &Roymans, N. (eds.) *Conflict Archaeology: Materialities of Collective Violence from Prehistory to Late Antiquity*. (London): 141-151.

Coulston, J.C.N. (2001). ‘The archaeology of Roman conflict’. In Freeman, P.W.M., & Pollard, A. (eds.). *Fields of Conflict: Progress and Prospect in Battlefield Archaeology*. BAR Int. Series 958. (Oxford): 23-49.

Fernández-Götz, M., &Roymans, N. (2017) *Conflict Archaeology: Materialities of Collective Violence from Prehistory to Late Antiquity*. (London).

FernándezIbáñez, C. (2015). ‘Las armas del enemigo.Militariaromana de metal en la Guerra Cantábrica de Augusto’.In Mayor, J.C., *et al.* (eds.) *Las GuerrasAstur-Cántabras*. (Gíjon): 323-344.

Foard, G. (2012). *Battlefield Archaeology of the English Civil War*.(Oxford).

Foard, G., & Morris, R. (2012).*The Archaeology of English Battlefields: Conflict in the Pre-Industrial Landscape*. (York).

Fox, R.A. (1993). *Archaeology, history, and Custer's last battle: the Little Big Horn reexamined’*. (Norman, OK).

Garcia, E., *et al.* (2010). ‘Resultatspreliminars de la primeracampanyad'excavació al jaciment de Puig Ciutat (Oristà, Osona)’.*Ausa* 24 (166): 685-714.

Goldsworthy, A.K. (1996). *The Roman Army at War, 100 BC-AD 200*. (Oxford).
Hanson, V.D. (1989). *The Western Way of War: Infantry Battle in Classical Greece*. (London).

Jones, R.H. (2012). *Roman Camps in Britain*.(Stroud).

Malešević, S. (2010).*The Sociology of War and Violence*. (Cambridge).

McMasters, K. (2011). *Using KOCOA for a Better Understanding of the Battlefield Landscape*. Washington,DC: National Park Service, American Battlefield Protection Program.

McNutt, R. (2014). *Finding forgotten fields: a theoretical and methodological framework for historic landscape reconstruction and predictive modelling of battlefield locations in Scotland, 1296-1650*. Unpublished PhD thesis submitted to the University of Glasgow.

Meyer, M. (2017). ‘The Germanic-Roman battlefields of Kalkriese and Harzhorn: A methodological comparison’. In Fernández-Götz, M., &Roymans, N. (eds.) *Conflict Archaeology: Materialities of Collective Violence from Prehistory to Late Antiquity*. (London): 205-218.

Moosbauer, G. (2005). ‘Der römischeKampfplatzbeiKalkriese, StadtBramsche, Ldkr. Osnabrück’.*CarnuntumJahrbuch*: 89-98.

Radoslavova, G., *et al.* (2011). ‘The Battle at Abritus in AD 251: Written Sources, Archaeological and Numismatic Data’. *ArchaeologiaBulgarica*15 (3): 23-49.

Riggsby, A.M. (2018). ‘The Politics of Geography’. In Grillo, L., & Krebs, C.B. (eds.) *The Cambridge Companion to the Writings of Julius Caesar*. (Cambridge): 68-94.

Ross, D. (2005). *KhorKlib and the Battle of Zama*. BAR Int. Series 1399. (Oxford).

Rost, A. (2009). ‘The Battle between Romans and Germans in Kalkriese: Interpreting the Archaeological Remains from an Ancient Battlefield’. In Morillo, Á.,*et al.* (eds.) *Limes XX*. (Madrid): 1339-1345.

Rost, A., &Wilbers-Rost, S. (2016). ‘The Extensive Battlefield of Kalkriese (Varus Battle9 AD): A Challenge for Archeological Research and Monument Preservation’. In Smith, S. (ed.) *Preserving Fields of Conflict: Papers from the 2014* Fields of Conflict *Conference and Preservation Workshop*. (Columbia, SC): 25-30.

Roymans, N., &Scheers, S. (2012). ‘Eight gold hoards from the Low Countries. A synthesis’.In Roymans, N., *et al*. (eds.) *Late Iron Age Gold Hoards from the Low Countries and the Caesarian Conquest of Northern Gaul*. (Amsterdam): 1-46.

Sabin, P. (2007). ‘Land Battles’. In Sabin, P., *et al.* (eds.) *The Cambridge History of Greek and Roman Warfare Volume 1: Greece, The Hellenistic World and the Rise of Rome*. (Cambridge): 399-433.

Sanz, F.Q., *et al.* (2015). ‘El armamentohallado en el campo de batalla de Las Albahacas- Baecula’.In Bellón, J.P., *et al.* (eds.) *La Segunda Guerra Púnicaen la península ibérica. Baecula, arqueología de unabatalla*. (Jaen): 311-396.

Scott, D.D. (2001). ‘Battlefield Archaeology: patterns of combat in the American Indian Wars’.In Freeman, P.W.M., & Pollard, A. (eds.). *Fields of Conflict: Progress and Prospect in Battlefield Archaeology*. BAR Int. Series 958. (Oxford): 177-199.

Scott, D.D., *et al.* (1989). *Archaeological Perspectives on the Battle of the Little Bighorn.*(Norman, OK).

Scott, D.D., &McFeaters, A.P. (2011). ‘The Archaeology of Historic Battlefields: A History and Theoretical Development in Conflict Archaeology’. *The Journal of Archaeological Research* 19 (1): 103-132.

Sivilich, M. (2014).*Measuring the Adaptation of Military Response during the Second Seminole War Florida (1835-1842): KOCOA and The Role of a West Point Military Academy Education*. Unpublished PhD thesis submitted to the University of South Florida.

Suissa, R. (2012). *Military Resilience in a Low-Intensity Conflict: A Comparative Study of New Directions Worldwide*. (Lanham, MD).

Unzueta, M.P., &Ocharán, J.A. (2006).‘El campo de batalla de Andagoste (Álava)’. In García-Bellido, M.P. (ed.) *Los campamentosromanosen Hispania (27 a.C.-192 d.C.). Elabastecimiento de moneda, II*. (Madrid): 473-492.

The Netherlands during the Napoleonic Era (1794-1815). Using detector finds to shed light on an under-researched period.

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INTRODUCTION

This contribution argues that studying detector finds from private collections can help to shed light on a period that has received little attention from Dutch archaeologists, the Napoleonic Era. It further argues that by studying these private finds we can start to formulate research questions that are national, rather than local or regional, in scope.

First a brief summary is given of the main historical events during the French occupation of the Netherlands. This is followed by an overview of the key aspects of the Dutch heritage system, the role played therein by amateur archaeologists and metal detectorists, and the databases that exist to record their finds for academic research and heritage purposes. After this three case studies are presented that demonstrate how private finds have proved vital in the interpretation of two camps and the garrison of a fortified town. Finally, some preliminary results are presented of an ongoing project to map the nationwide distribution of Napoleonic military buttons in an attempt to trace troop movements.

THE NETHERLANDS DURING THE NAPOLEONIC ERA

In 1793 revolutionary France declared war on the Dutch Republic and its ally Great Britain. General Charles-François Dumouriez was tasked to conquer the Republic, aided by Dutch volunteers lead by Herman Willem Daendels. After some initial victories the Dutch and British forces managed to halt the invading French army and the campaign was abandoned (Sanders 2002, 16).

In 1794 General Jean-Charles Pichegru with his Armée du Nord made a second attempt. Defeating the combined Dutch-British forces again proved difficult, especially as Pichegru's advance was severely hindered by the rivers Meuse, Waal and Rhine. In the end he was aided by a particularly cold winter which caused the rivers to freeze over, allowing his army to cross and conquer the northern part of the Republic (Amsenga & Dekkers 2004, 23).

The Dutch Republic was quickly turned into a client state of France, first as the Batavian Republic (1795-1801) and later as the Batavian Commonwealth (1801-1806). The Republic kept its own army, but was also forced to finance a French occupational force (Van der Spek 2016, 38; Gabriëls 2003, 159). During this time the Republic was twice invaded by Britain in an attempt to remove the pro-French government and drive out the French forces. The first occasion was the Anglo-Russian invasion of Holland of 1799, the second the British invasion of Walcheren of 1809 (figure 1). On both occasions the Dutch now fought alongside the French against their former ally. Both times the invading army was repelled.

From 1806 the country was be ruled by Napoleon's brother, Louis Napoleon Bonaparte, as the Kingdom of Holland, before it was annexed into the French Empire in 1810. In 1810 and 1811 again there were small-scale British landings along the Dutch coast. These, however, were performed mainly to cause unrest and to bind Dutch and French troops to a particular region, not with the intent to drive out the French completely (Van der Spek 2016, 258-259).

In 1813 the Netherlands regained their independence and the last troops left the eastern part of the country the following year. Alliances changed and in 1815 the Dutch and Belgian troops at Waterloo fought against Napoleon as part of Wellington's army.

Figure 1: Map of the Netherlands with locations and events mentioned in the text. Source: author.

THE NAPOLEONIC ERA IN DUTCH ARCHAEOLOGY

The Napoleonic Era from an archaeological perspective is a little studied period, at least in the Netherlands. A welcome recent exception is the excavation of Camp d'Utrecht (figure 1).[7] This camp near the village of Austerlitz, named after the location of Napoleon's famous 1805 victory in modern-day Czechia, from 1804 to 1808 housed around 18.000 French and Dutch troops.

Usually, however, when features or finds from the Napoleonic Era are mentioned in site reports, they are a side note rather than the main topic. An example is the discovery of a small French temporary camp near Haelen during an excavation aimed at finds from prehistory and the Roman period (Schutte 2016).

When finds from the Napoleonic Era are the main topic of a site report, they are generally chance finds. One such chance find is a mass grave at 's-Hertogenbosch (figure 1) dated to 1794-1795 (Genabeek et. al. 2016). In the grave, discovered during the relocation of a tree, the bodies of 67 French soldiers were found. The discovery garnered a fair bit of media attention and a bilingual Dutch and French plaque was placed on the spot to commemorate the event. Other examples are a number of individual graves in the northern part of the province of Noord-Holland (figure 1) associated with the Anglo-Russian invasion of Holland in 1799 (E.g. Schooneman 2014; Dautzenberg 2015).

Whereas finds from the Napoleonic Era are seldom mentioned in site reports, they are uncovered on a regular basis by amateur metal detectorists. Their collections provide a large dataset that has yet to be mined.

[7] At the time of writing three trial trench campaigns have been published (Veenstra 2014; Mooren 2015; Van Heeringen & Vissinga 2016). Analysis of a large scale excavation of the site is currently undergoing.

DUTCH HERITAGE ACT

Prior to the Dutch Heritage Act of 1 July 2016 metal detection was the sole remit of professional archaeologists. Metal detection by private individuals officially was illegal, although this law was hardly ever enforced. In fact, private finds were incorporated into many academic studies and were even used in governmental heritage surveys. The 2016 Heritage Act has addressed this odd dichotomy between law and practice by making metal detection legal on a number of conditions.

The first of these conditions is that digging is restricted to the top 30 cm of the soil. Due to bioturbation, agricultural use and building activities no intact archaeological features tend to remain in the topsoil. Detectorists thus do no harm to the archaeological record if they keep to this depth of 30 cm.

Metal detection is prohibited on protected archaeological monuments and ongoing excavations. Individual municipalities can also forbid the use of metal detectors through a local by-law (Algemene Plaatselijke Verordening). The detectorist also needs to have permission from the landowner and should report his or her finds to the Cultural Heritage Agency (Rijksdienst voor het Cultureel Erfgoed) so they can be documented for research and heritage purposes.

If the detectorist abides by these rules, the finds remain in his or her possession and they cannot be claimed by the state. If the finds represent a considerable monetary value, such as for instance a coin hoard, the law states that the finds, or the value thereof, must be split equally between the landowner and the finder.

NATIONAL DATABASE: PORTABLE ANTIQUITIES OF THE NETHERLANDS

In September 2016 a new project was launched specifically for the recording of detector finds from private collections: Portable Antiquities of the Netherlands (PAN). The project is coordinated by the VU University Amsterdam and is a network of Dutch universities, governmental organisations including the Cultural Heritage Agency, the Nederlandsche Bank (numismatists) and associations of volunteer archaeologists and metal detectorists.

PAN has a staff of finds specialists and finds liaison officers (FLO's) that travel to visit the detectorists to photograph and record their finds. The finds are then published in an online database (www.portable-antiquities.nl), so they are available for academic research, heritage purposes and for the general public to enjoy. All photographs can be used under the Creative Commons license and the website is fully bilingual (Dutch and English) to facilitate its use by both Dutch and international researchers.

An important element of the website is the multi-level login. A regular visitor of the website can view all validated finds recorded in PAN and the municipality in which they were found. Exact find spots, however, are never published on the site, an important factor for many detectorists. Academic researchers can request access to the Science Portal to view the exact find spots, although they are not allowed to publish these in detail in their works.

The aim of PAN is to record all metal finds in private collections up to circa AD 1600, although some exceptions are made for well-delimited and informative finds that are non-metal or younger than AD 1600. These exceptions include glass La Tène bracelets, ceramic sling bullets, post-medieval seal matrices and Napoleonic uniform buttons. The PAN database, however, is set up to be flexible so it can be expanded in future to also include other finds such as flint objects, pottery and younger (metal) finds.

CAMP D'EYNDOVEN, AALST-WAALRE (1800)

Having addressed the way in which finds from private collections are incorporated into the Dutch heritage system, three case studies will be presented here that indicate how their study can further our understanding of the Napoleonic Era. The first of these is Camp d'Eyndoven at Aalst-Waalre near Eindhoven (figure 1 and 2).

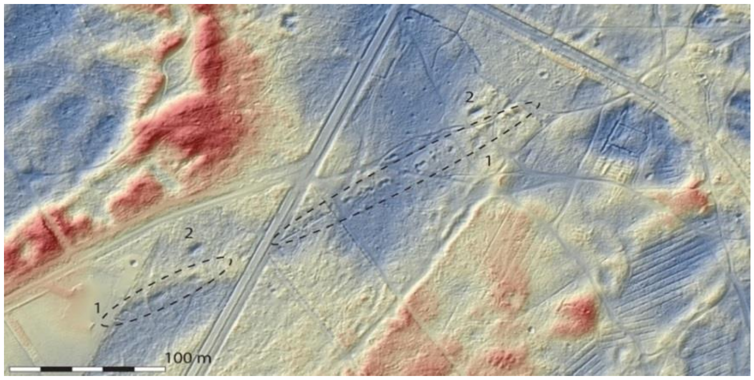


Figure 2: Lidar image of the camp at Aalst-Waalre. (1) rows of (cooking) pits; (2) deep pits, possibly watering places. Source: https://ahn.arcgisonline.nl/ahnviewer.

In the year 1800 the Armée Gallo-Batave, consisting of 12.000 French and 5.000 Dutch (known then as Batavian) troops, was moved to Bavaria to join a larger French force. In November and December it would fight against the Austrian army near Aschaffenburg, Würzenburg and the citadel of Marienberg (Gabriëls 2003, 166). In preparation of this campaign, the Armée Gallo-Batave was temporarily stationed near Eindhoven for regrouping and training (Andreossy 1802, 22).

According to Andreossy this was in the month of Messidor, which for the year 1800 corresponds to the period of 20 June to 19 July. Based on diary fragments and council bills the French and Dutch forces were probably stationed in two separate camps.

Based on this information amateur detectorist A.M. van der Weide searched the area south of Eindhoven for several years until he found the location of what appears to be the French camp. The area was estimated to be roughly 500 x 500 m. Within this area Van der Weide found several large shallow pits of approximately 2 x 4 m and 25 cm deep (Verwers 1988, 166). From these pits he recovered a great many finds among which fragments of weaponry, musket balls, coins and uniform buttons (figure 3). After Van der Weide's death the finds were donated by his widow to the municipality of Eindhoven in 2012. Here they were sorted and catalogued by volunteers and in 2013 I wrote my MA thesis on the subject (summarised in Van der Veen 2013 and 2014).

Figure 3: A small sample of the great many finds found at the camp at Aalst-Waalre. Top row: A flint-lock pistol and two French general service buttons (1792-1793 pattern). Bottom row, from left to right: buttons of the French 49th and 60th Line infantry demi-brigades (1793-1803 pattern), a badge of the French 1st Battalion (1RBON), and a Dutch uniform button of the Batavian Republic (1795-1801/6 pattern). Source: author.

The uniform buttons in particular would prove invaluable for the interpretation of the camp. A total of 168 uniform buttons were found, excluding plain ones. 77 of these belonged to the 49th demi-brigade d'infanterie de ligne (line infantry). All of these buttons were of a type produced from 1793 to 1803 (Fallou 1915, 83-85) and we know that after the 1803 army reforms the number 49 was no longer used (Smith 2000, 105). Andreossy gives a description of the composition of the Armée Gallo-Batave after the Battle of Hohenlinden of 3 December 1800. The Second Division of this army at that time included three battalions of the 49th demi-brigade (Andreossy 1802, 29-30). This makes it very likely that Van der Weide at Aalst-Waalre had found the location of the French camp.

It should be noted, however, that after the Armée Gallo-Batave had been stationed at Aalst-Waalre the French branch of this army had been supplemented by seven new infantry battallions and 300 cavalry. The regimental numbers of these new battalions are not mentioned by Andreossy, so it is impossible to ascertain the exact composition of the army when at Aalst-Waalre.

Among the 168 uniform buttons only a single button could be attributed to the Dutch army (figure 3). This is in line with the written sources that indicate that the French and Dutch forces were stationed in separate camps.

Since writing my thesis new lidar (Light Detection and Ranging) images have become available that clearly show that some of the features of the camp are still preserved in the landscape (figure 2). A single row of what are possibly cooking pits shows that the camp was of the linear type common for the period (e.g. Austerlitz, see references above; Bussum (figure 4); see Roymans, Beex & Roymans 2017 for similar Dutch camps of the period directly following the Napoleonic Era). The row of pits can be followed for approximately 300 metres, but may have extended on either side as the areas to the northeast and southwest have been destroyed through modern development.

CAMP DE NAARDEN, BUSSUM (1809)

A second example is Camp de Naarden near Bussum (figure 1 and 4). The area locally had long been known as Fransche kamp (French camp), although the name was generally thought to refer to a camp dating to the years 1672-1673.

Analysing lidar images Bazelmans found several features including an approximately 1 kilometre long row of groups of four to five shallow pits with diameters of between five and six metres. Through test coring it was found that these pits were backfilled with the original podzol soil mixed with small charcoal flecks. The pits were thus interpreted as cooking pits (Bazelmans 2016, 14). Other features included the ramparts and ditch of a defensive structure measuring about 20 x 20 metres, likely the garde du camp, and *possible watering places* (Bazelmans 2016, 14).

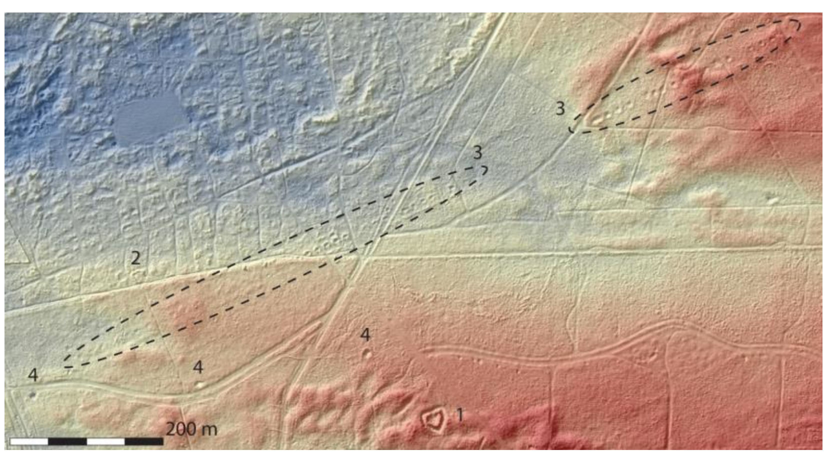


Figure 4: Lidar image of the camp at Bussum. (1) ramparts, garde du camp; (2) possible ramparts; (3) rows of (cooking) pits; 4 deep pits, possibly watering places. Source: https://ahn.arcgisonline.nl/ahnviewer with interpretations after Bazelmans 2016, 13.

Local amateur archaeologists had previously conducted a field survey, during which metal detectors were also used. Among the finds were several elements of the Dutch military uniform as worn between 1806 and 1810: shako cap badges and buttons with the number ‘3’, a button with the number ‘4’ and a Dutch general service button (figure 5). Other finds included a screwdriver-like musket maintenance tool (figure 5), two lead casings for gun flints, a tin spoon and a French centime coin of the year 1795 (Bazelmans 15).

These finds clearly contradicted the long-held assumption that the camp at Bussum dated to the period of 1672-1673. An examination of available written sources confirmed that the camp should in fact be dated in the Napoleonic Era, and more precisely the year 1809 (Bazelmans 2016, 17-18). At that time the Netherlands were ruled by Napoleon’s brother Louis Bonaparte as the Kingdom of Holland. Construction of the camp started around the end of May 1809 and in late July around 4350 Dutch troops were stationed there. These troops belonged to the Royal Guard (Garde van de Koning), the 2nd Regiment Hussars (Huzaren) and the 3rd Regiment Jagers. The previously mentioned shako cap badges and buttons can very likely be attributed to this last regiment. Most troops were hastily withdrawn on 30 July in response to the British invasion of Walcheren (figure 1). After this the camp was used by smaller units until it was finally disbanded on 12 September 1809.

Figure 5: A selection of the finds from the camp at Bussum. Musket maintenance tool, two shako cap badges and a uniform button likely of the Dutch 3rd Regiment Jagers, a button of the Dutch 4th Regiment and a Dutch general service button (1806-1810 pattern). Source: PAN.

THE GARRISON OF THE FORTIFIED TOWN OF GRAVE

The third case study deals with the Napoleonic uniform buttons found in the area surrounding the fortified town of Grave, located on the river Meuse (figure 1). Grave was besieged twice during the Napoleonic Era, first by the French and later by the Dutch. What makes this case study particularly interesting, however, is that the finds reflect the everyday activities of the town’s garrison in between these two sieges, not the composition of the armies during these two well-documented events.

In 1793 French troops gathered in the area for the first time. On 7 March the French force was defeated near the villages of Beers and Linden, a few kilometres east of Grave, and withdrew (Sanders 2002, 16). On 22 September 1794 the vanguard of a larger French army arrived in the area, but withdrew again after a brief skirmish with about 50 cavalrymen from Grave. Then, on 14 October of the same year the French returned with a force of about 6,000. Grave was besieged for several months before the circa 1,580 strong defending force surrendered on 26 December (Van Hoof & Roozenbeek 1998, 53-55). From this moment on the town was almost continually manned by French and Dutch (Batavian) troops.

After Napoleon's defeat at Leipzig in October 1813 Dutch independence was restored and most of the Netherlands was evacuated by the French. The French occupying force at Grave, however, refused to leave. In mid-January 1814 this led to a second siege, this time by Dutch forces, which ended on 14 May when the circa 1,600 strong French defending force marched out of the town (Van Hoof & Roozenbeek 1998, 59-62).

In total 226 Napoleonic uniform buttons were recorded from the area surrounding Grave, all but one from private collections. These 226 buttons could be divided into 14 types and 48 subtypes (for a full overview see Van der Veen 2017). Here some general remarks on the composition of the dataset will suffice. The main point is that, as said before, the finds reflect the everyday activities of the town's garrison in between the well-documented sieges and skirmishes, rather than these themselves.

Figure 6: Some examples of the button types mentioned in the text. (1) revolutionary buttons with fasces, Phrygian cap and caption République Française, 1792-1793; (2) buttons with regimental number and caption République Française, 1793-1803; (3) buttons with regimental number without caption, 1803-1814; (4) Navy, Equipage de Flotille, circa 1805; (5) Navy, 1809-1810; (6) Navy, Equipage de Hautbord, 1810-1814; (7-9) Gendarmerie buttons of the Département de la Roer, Département des Bouches de la Meuse and Département de L'Ems Occidental. Source: PAN.

For example, only one button type, represented by 89 individuals, can perhaps be associated with the hostilities of 1793 and 1794. This is the revolutionary button type with fasces, Phrygian cap and caption République Française, produced from 1792 to 1793 (figure 6.1). As is explained in more detail in paragraph ten, however, due to large shortages in supply these buttons remained in use for years after they had officially been replaced. It is therefore likely that many of these buttons were lost well after the 1794 siege had ended.

As explained at the end of paragraph nine, the find of a single button of a particular unit does not mean that that unit was ever there. Sufficient numbers are needed to make such claims when written sources are absent. At Grave buttons of two regiments are particularly well-represented, those of the French 56th (34 individuals) and the 54th (14 individuals) Line Infantry Regiments. From written sources we know that the 56th regiment formed part of the garrison of Grave from 1810 to 1814 (Geerts 2002, 195).

As all buttons of the 56th regiment at Grave are of a type produced from 1803 and 1814 (number without caption, see figure 6.3), the find evidence corresponds nicely to the written sources. Based on the uniform buttons found near Grave it seems likely that troops of the 54th regiment were also present there. All but one of the buttons of the 54th regiment are of a type produced between 1793 and 1803 (number with caption République Française, see figure 6.2). Perhaps the unit was thus already present at Grave before 1810, when it was replaced or supplemented by the 56th regiment.

When plotting the main battles of the 54th and 56th Line Infantry Regiments (figure 7), it becomes clear that Grave formed part of a complex web of troop movements that stretched across most of Europe.

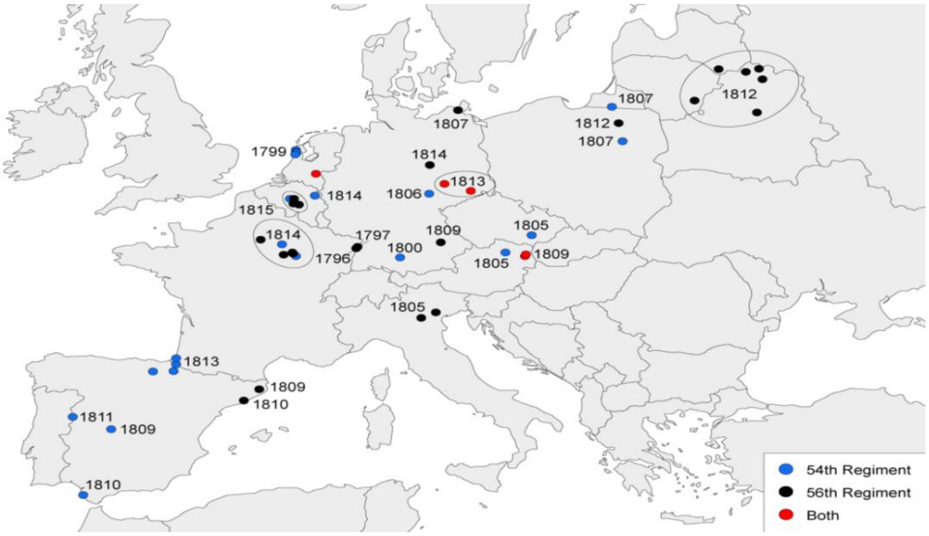


Figure 7: Locations of the main battles of the French 54th and 56th Line Infantry Regiments with year. Source: author.

NATION-WIDE DISTRIBUTION OF NAPOLEONIC UNIFORM BUTTONS

The above three case studies all were regional in scale. The ongoing project presented below takes a nationwide approach. By mapping the distribution of Napoleonic uniform buttons it will be possible to reconstruct the location and movements of the various French and Dutch regiments that were present in the Netherlands.

Historical sources can certainly help to trace such troop movements, especially for known battles or for army camps such as those discussed above. However, the Napoleonic Era spans a period of about 20 years and during most of this time the Netherlands were at peace. Less has been documented on the, possibly smaller-scale, troop movements during these prolonged stretches of peace. Mapping the distribution of uniform buttons can help to fill in these blank spots.

It should be stressed, however, that the project is still ongoing and that the results are only preliminary. The database currently contains 1,027 uniform buttons. Some of these buttons were published in excavation reports, but over 90% come from private finds (reported to PAN or directly to me). That in itself is clear evidence of the added value of private collections. Only buttons with regimental or other markings have been included, as undecorated buttons cannot be accurately dated or attributed to a particular army or regiment.

Just over 1,000 uniform buttons may sounds like a fair amount. To put this into context, however, there were between 52 and 55 buttons on a standard French line infantry uniform (Cardon & Lemaire 2014, 83 and note 22). The French forces in the Netherlands in 1795 numbered 25,000 (Van der Spek 2016, 38; Gabriëls 2003, 159) and in 1810 14,000 (Van der Spek 2016, 259). Between 1795 and 1810 the size of the Dutch army varied from 22,000 to 37,000 men (Gabriëls 2003, 160). Assuming that the combined Dutch-French army in the Netherlands numbered somewhere around 50,000, this would mean that 50,000 x 55 = 2.75 million buttons ‘circulated’ in any given year. Of course this is only a broad estimate, but it should be clear that the 1,027 buttons currently in the database only represent a fraction of the total number of buttons lost over a period of 20 years.

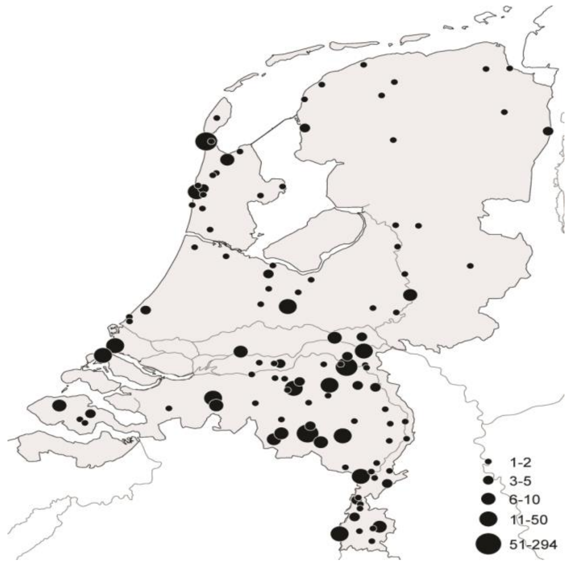


Figure 8: Distribution of all Napoleonic uniform buttons in the database up to June 2018. Source: author.

It should be clear that more data is needed, both to get a more representative sample and to get a better nationwide coverage (figure 8). The distribution now clusters to a large extent in the southeast part of the Netherlands which corresponds to my work area as a PAN finds liaison officer. Other large concentrations are the previously mentioned camps at Austerlitz and Aalst-Waalre.

There is also a large concentration in the northern tip of the province of Noord-Holland, the location of the 1799 Anglo-Russian invasion of Holland (figure 1). Manoeuvring and heavy fighting explain the relatively high number of early button types found here. After the invasion was suppressed, the area was fortified to prevent any new invasions, explaining the presence of button types postdating 1799. Another important factor is that local metal detectorists have taken a keen interest in the period. Several articles have been written on what is locally known as the 'forgotten war of 1799'and local museums frequently have exhibitions on the subject. In areas where Roman and medieval finds are more readily available, Napoleonic finds tend to be less coveted and less often reported.

Before turning to some preliminary results one more thing needs to be addressed: the matter of secondary deposition. After the Napoleonic Era many old uniforms were probably recycled. The textiles could be used in the paper industry and the copper alloy buttons could have been melted down or simply discarded. A single button therefore does not equal the presence of a regiment, nor a handful buttons the location of a battle or camp. Nonetheless, if the numbers are sufficient, it is possible to discern broad patterns.

PRELIMINARY RESULTS

The 1,027 buttons currently in the database can be divided into 32 types and 166 subtypes. Of the 32, three types form almost 80% of the dataset (Table 1).

The most common, both in absolute numbers and per year of production, is the type with revolutionary symbolism including a fasces, Phrygian cap and the caption République Française (figure 6.1). This is somewhat odd, as this button was only produced from 1792 to 1793 and thus was officially already obsolete before the Netherlands were conquered in 1794 (Fallou 1915, 82). Due to large shortages in supply, however, these buttons could remain in use for years after they had officially been replaced. Such revolutionary buttons have in fact been found in great quantities in the camp at Aalst-Waalre (1800) and, in fewer quantities, at the camps at Austerlitz (1804-1808; Mooren 2015, 53). Finds from Eastern Europe and Russia show that they were occasionally still worn during the Russian campaign of 1812 (Korolev 2014, 98). As these buttons are the oldest in the dataset, they simply have had more time to end up in the soil.

Furthermore, as they were worn by all branches of the army (Fallou 1915, 82), they were produced in greater quantities than buttons worn only by individual branches such as the cavalry or light infantry.

The second and third most common button types were produced for almost the same length of time, yet there is a distinct difference in their numbers (table 1). Buttons with a regimental number and no caption (figure 6.3) occur twice as often as those with the caption République Française (figure 6.2). This may in part be explained by the fact that the former were worn by both the line infantry and the cavalry (Fallou 1915, 86-88), while the latter were only worn by the line infantry (Fallou 1915, 83-85).

Table 1: The three most common button types in the database ordered chronologically with their production dates, number and number expressed per year of production.

Type	Production date	N	N per year
Fasces, Phrygian cap and *République Française*	1792-1793	384	384.0
Regimental number with *République Française*	1793-1803	138	13.8
Regimental number without caption	1803-1814	290	26.4

When looking into the distribution of the buttons, one pattern is starting to emerge. Navy buttons are on occasion found far from the sea (figure 9). In some instances they are found near the main rivers and can perhaps be linked to inland shipping. However, navy buttons are sometimes also found much further inland, far from any river. The number of navy buttons in the database is still fairly small, only 40 in total, and the current pattern is thus somewhat susceptible to distortion from secondary use or post depositional processes. However, there is historical evidence that in January 1814 French navy personnel was transferred to supplement the army (Smith 2000, 304). By then, most of the Netherlands had already been vacated by the French, but perhaps such transfers of navy personnel to the army had also taken place in earlier years.

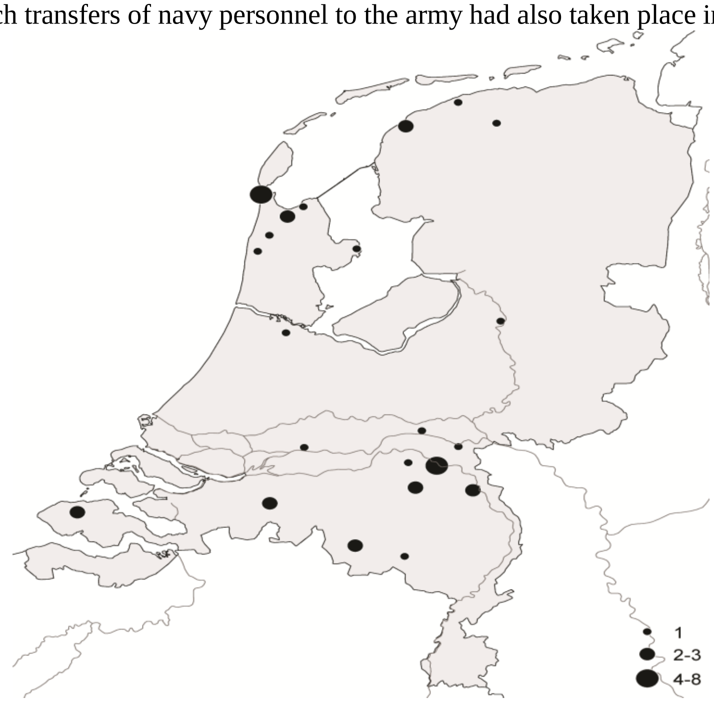


Figure 9: Distribution of all types of French and Dutch (Batavian) navy buttons. Source: author

CONCLUSION

Hopefully this contribution has shown how the analysis of detector finds from private collections can further our understanding of the day-to-day activities of the Napoleonic armies. Uniform buttons in particular are very useful in this, as these often feature regimental or other markings that can be attributed to a particular army or regiment.

In this paper two levels of research are presented: a local/regional and a national level. As the three case studies showed, analysis on a local/regional level greatly benefits from a combination with other sources of information such as written records and lidar images. This combination of sources proved vital for the interpretation of these sites. Although the results of the nationwide study are only preliminary, these seem to indicate that more is possible than simply showing that a particular regiment visited a particular location. The distribution of navy buttons as presented in paragraph 10, for example, might be evidence for the habit of supplementing army units with navy personnel.

Although a bit premature, it might also be interesting in future to expand the scope even further to an international level. Korolev 2014 could be regarded as a first attempt at this, as it deals with the Russian campaign of 1812 and thus covers multiple countries. However, the book does not give the find spots of the great many finds illustrated therein and so does not achieve its full potential.

For the moment, the preliminary results of the nationwide study seem promising. In this manner it will be possible to shed a new light on a period that, from an archaeological perspective, has so far received little attention.

REFERENCES

Amsenga, J. & Dekkers, G. 2004. *'Wat nu?', zei Pichegru. De Franse Tijd in Nederland, 1795-1813.* Hilversum: Verloren (Verloren Verleden 23).

Andreossy, A.F. 1802. *Campagne sur le Mein et la Rednitz de l'Armée Gallo-Batave aux Ordres de Général Augereau; Primaires, Nivoses et Pluviose an IX (1800 ct 1801)*. Paris: Barrois.

Bazelmans, J. 2016. Het AHN2 en het raadsel van het toponiem Bussum-Fransche Kamp. *Archeologica Naerdincklant Archeologisch Tijdschrift voor het Gooi en Omstreken* 2016(1), 11-23.

Cardon, T., & Lemaire, F. 2014. Les sous des soldats de Napoléon au camp de Boulogne (1803-1805). Étude des monnaies issues des fouilles des camps napoléoniens d'Étaples-sur-Mer et Camiers (Pas-de-Calais, France). *The Journal of Archaeological Numismatics* 4, 67-176.

Dautzenberg, S. 2015. Schagen-Callantsoog. Duingebied. *De Archeologische Kroniek van Noord-Holland 2014*, 85-6.

Fallou, L. 1915. *Le bouton uniforme Français. De L'Ancien-Regime á Fin Julliet 1914*. Colombes: La Giberne.

Gabriëls, J. 2003. Een klein land in het nauw (1763-1815). Tussen Groot-Brittannië en Frankrijk. De landstrijdkrachten van een onmachtige mogendheid. In J.R. Bruijn & C.B. Wels (eds.), *Met Man en Macht. De Militaire Geschiedenis van Nederland 1550-2000* (143-178). Amsterdam: Balans.

Geerts, G.A. 2002. *Samenwerking en confrontatie. De Frans-Nederlandse militaire betrekkingen, voornamelijk in de Franse Tijd*. Amsterdam: De Bataafsche Leeuw.

Korolev, A. 2014. *The Great Retreat. Napoleon's Grande Armée in Russia. The Contingents and the Artefacts*. London: Unicorn Press.

Mooren, J.R. 2015. *Austerlitz, Franse kamp. Een Legerkamp uit de Napoleontische Tijd. Inventariserend Veldonderzoek door middel van Proefsleuven*. 's-Hertogenbosch: Bouwhistorie, Archeologie, Architectuurhistorie en Cultuurhistorie (BAAC rapport A-15.0038).

Roymans, N., Beex, B. & Roymans, J. 2017: Some Napoleonic-style army camps from the period of the Dutch-Belgian separation (1830–1839) in the Southern Netherlands. *Journal of Conflict Archaeology*, 12(2), 75-93

Sanders, J.G.M. (ed.). 2002. *Noord-Brabant in de Bataafs-Franse tijd, 1794-1814. Een Institutionele Handleiding*. Hilversum: Verloren.

Schooneman, M. 2014. Een vergeten oorlog. Engelse en Russische soldaat uit 1799, *Archeobrief* 18(3), 8-13.

Schutte, A.H. 2006. *Haelen Windmolenbos, Vindplaats 2. Een Archeologische Opgraving*. Amersfoort: Archeologisch Diensten Centrum (ADC rapport 531).

Smith, D. 2000. *Napoleon's Regiments. Battle Histories of the Regiments of the French Army, 1792-1815*. London: Greenhill Books.

Van der Spek, C. 2016. *Sous les Armes. Het Hollandse Leger in de Franse tijd 1806-1814*. Amsterdam: Boom.

Van der Veen, V. 2013. De archeologie van een Frans legerkamp, *Archeobrief* 17(4), 8-12.

Van der Veen, V. 2014. "Au camp d'Eyndoven". Archeologie en geschiedenis van een Frans legerkamp, *Armamentaria. Jaarboek Nationaal Militair Museum* 49, 84-101.

Van der Veen, V. 2017. Franse uniformknopen uit de vestingstad Grave. Detectorvondsten vertellen over dagelijkse militaire activiteiten, *Archeologie in Nederland* 1(5), 34-39.

Van Genabeek, R.J.M., van der Linde, C., Kootker, L.M. & Buiks, J. 2016. *'s-Hertogenbosch Bastion Baselaar. Opgraving van een Massagraf van Franse soldaten uit 1794 en 1795*. 's-Hertogenbosch: Afdeling Erfgoed 's-Hertogenbosch.

Van Heeringen, R.M., & Vissinga, A. 2016. *Archeologisch Vooronderzoek in het Oostelijk Deel van het Camp d'Utrecht, een Frans Legerkamp uit de Periode van het Bataafs Gemenebest in Austerlitz. Een Inventariserend Veldonderzoek in de Vorm van Proefsleuven en Verkennende Boringen tussen Hubertweg 31 en Kamperlinie (Dorpsplan Austerlitz), Gemeente Zeist*. Amersfoort: Vestigia (Vestigia rapport V1359).

Van Hoof, J.P.C.M. & Roozenbeek, H. 1998. *Grave als militaire stad*. The Hague: Sectie Militaire Geschiedenis Koninklijke Landmacht (Brochure Reeks Nummer 19).

Veenstra, M.E. 2014. *Austerlitz Franse Kamp. Inventariserend Veldonderzoek door middel van Proefsleuven (IVO-P)*. 's-Hertogenbosch: Bouwhistorie, Archeologie, Architectuurhistorie en Cultuurhistorie (BAAC rapport A-13.0248).

Verwers, W.J.H. 1988. Noord-Brabant. Waalre. *Jaarverslag van de Rijksdienst voor het Oudheidkundig Bodemonderzoek 1987*, 166.

Musket Balls from the Boston Massacre: Are they Authentic?

Dan Sivilich and Joel Bohy

The Boston Massacre is a well-documented event, so a very brief synopsis will be presented of the events leading up to the incident. Due to civil unrest prompted by the Townsend Act of 1767, as many as 4,000 British troops were quartered in Boston. Citizens often had to unwillingly share their residences with soldiers. Tensions ran high amongst the citizens which led to several clashes with some of the soldiers. On the night of March 5, 1770 it culminated with a band of Bostonians taunting a sentry at the Customs House on King Street. The soldiers called for assistance and were joined by 7 regulars under the command of Captain Thomas Preston. The crowd began throwing snowballs and ice at the soldiers and eventually the British troops opened fire killing three people nearly instantly and wounding several others including one Edward Payne who lived across the street. A fourth person died later of his wounds.

The musket balls were reportedly retrieved and kept. They were mounted on a black velvet covered chip board which was mounted in a black wooden picture frame. Two handwritten notes in black ink, by either quill or dip pen, describing what each musket ball hit were in the center of the display flanked by the purported musket balls. Brass plates were under each note with a transcription of the notes with the following text:

> Left Plate: "This Ball was fired by the British Troops under Capt. Preston in State Street on 5th March, 1770- went thro (*sic*) the Shutter of Edwd Paynes Office & thro' a Partition & into the Entry."

> Right Plate: "This Ball was fired by the British Troops under Capt. Preston in State Street on 5th March, 1770- and went thro (*sic*) the Arm of Edwd Paynes Esq. And broke the small Bone of the Arm & then went into the Door Post."

This assembly was placed inside a shadow box which was donated to the Massachusetts Historical Society in June, 1940 by one W. F. Meredith. The question is: are they actually from the 1770 Boston Massacre? On December 9th, 2017 I was granted access to the artifacts to conduct a forensic analysis to attempt to answer that question. I brought the following team experts:

- Joel Bohy: Skinner Auction/Antique Roadshow military artifact expert
- Chris Fox: Skinner Auction, former curator at Fort Ticonderoga and 18th-century military artifact expert
- Bill Rose: Chemist (retired) and 18th-century military artifact expert
- Tim Riordan: Archaeologist and expert on 17th and 18th century lead (retired from Historic St Mary's City, Maryland)

Also in attendance was Anne Bentley, Curator of Art & Artifacts, representing the museum.

So how does one determine if these artifacts are possibly related to the Boston Massacre?

1. Visual inspection **-** any unusual discoloration?
2. Are the musket ball sizes consistent with those typically used by the British infantry?
3. Any blood residue?
4. Are the levels of deformation consistent with musket balls fired at the same distances and that hit hard wooden targets?

Boston Massacre specimens

Typical excavated musket ball

First let's look at the color of the artifacts. They are a typical dull grey lead color. When first cast, lead musket balls are shiny silver. Over time, the surface oxidizes to create a dull grey color. If exposed to moisture, a white lead carbonate will form creating a distinct patena. If the musket balls are left in the ground, the patena can also pick up other materials such as iron oxide which can change the color to various shades of tan all the way to a dark brown color. The musket balls in question appear to have never have had prolonged contact with moisture. This suggests that they were kept in some sort of isolation.

The first problem encountered was that the musket balls were fastened to the backing with copper wire.

Chris Fox volunteered to attempt to untwist the copper wire using pliers, but indicated that the wire was brittle and could break.

Anne allowed him to proceed and indeed one leg of each wire did break off.

The copper wire attached to the lead balls presented a challenge in determining the weights of just the musket balls from which their original diameters could be calculated using the Sivilich Formula (Sivilich 2016:25-27).

The wire appears to be attached by lead solder as seen on the right musket ball or was possibly melted into the bullet and/or soldered as seen with the left musket ball. Additionally, Chris Fox noted that the right musket ball appears to have been filed, which would also account for some lead loss. However, some of the loss in weight may have been offset by the addition of the solder used to affix the fire onto the bullet. Chris indicated that, based on his experience using 18th-century files on various metals, these markings appeared to be made with a crosscut file.

The wires appeared to be machine drawn. Their diameters were measured using a digital caliper and both found to be very uniform at 0.0433" (1.10 mm) which is consistent with copper 17 AWG gauge wire. This suggests that the wire was manufactured in the mid-late 19th-century to the 20th-century. Fortuitously both copper wires snapped and the broken segments could be used to calculate the overall weight of each wire based on the average weight per length of the segments:

Ball	Broken Wire Length (mm)	Broken Wire Weight (gm)	Weight/Length (gm/mm)	Length of Wire Still in Ball (mm)	Calculated Weight of Wire Still in Ball (gm)
Left	25	0.30	0.0120	71	0.8449
Right	22	0.26	0.0118	54	0.6426
		AVERAGE:	0.0119		

Using this information, the estimated wire weight could be deducted out and the weight of each bullet could be determined. From this data, the original diameter could be estimated using the Sivilich Formula (Sivilich 2016:25-27). With this information, the type of weapon used to fire the bullet could be estimated (Sivilich 2016:28-32).

Ball	Total Weight (gm)	Ball Weight Less Wire Weight (gm)	Estimated Original Ball Diameter (in)
Left	27.74	26.90	0.668
Right	29.88	29.24	0.686

The standard size for musket balls issued by the British military for a Brown Bess musket with an average 0.75" bore is 0.69" in diameter (Scott et al, 2017; Sivilich 2016). However, controlled experimental firings by Scott et al, using British 1756 Long Land pattern reproduction muskets show an average weight loss of 0.68 grams (n = 4 firings) due to slight melting and scraping off lead in the barrel. Additional losses can be expected by impact with hard targets such as wood.

Therefore, the calculated original diameters of the unfired musket balls are consistent with bullets used by the British infantry in Brown Bess muskets during the time period of the massacre.

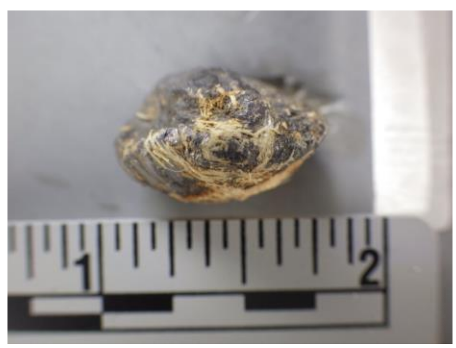
Both musket balls were tested for the presence of blood using Bluestar® Forensic latent bloodstains reagent. This test works by detecting the presence of iron ions such as is present in hemoglobin. Objects contaminated with blood will glow light blue when wetted with an aqueous solution of the active ingredients. Both bullets were dipped into the solution and examined in the darkened room and also checked with a black light. Neither artifact exhibited any luminescence. However, very little work has been done to determine if blood residue can be detected with this method on lead musket balls that are over 200 years old. It is unknown how these two artifacts have been washed, handled, heated during soldering, etc. that might interfere with the results.

Therefore, this test was inconclusive. However, human blood protein analysis, such as run by the Paleoresearch Institute in Golden Colorado, appears to be a more sensitive test.

One interesting note about the forensic analysis: after coating the musket balls in Luminol, I asked Anne if she had some distilled water that we could use to wash the musket balls. She said she did in the lab. I indicated one of us could follow her with the artifacts, while the rest of us packed up. She indicated that she could not leave us alone. We would all have to go to the lab together. I asked why and she said: "because the table we were working on belonged to Daniel Webster"!

Both musket balls were significantly deformed indicating that they were fired and hit hard targets at relatively close distances, probably less than 100 yards (Scott et al, 2017; Sivilich 2016).

The left musket ball is the one reported to have gone through a wooden shutter and into the building. In 2017 Doug Scott, Joel Bohy, **Nathan Boor, Charles Haecker, William Rose, and Patrick Severts** conducted an extensive live fire study of colonial era firearm bullet performance (Scott et al, 2017). The right musket ball is a reproduction 0.63" diameter ball from that study that was fired into a green oak paling at a distance of less than 100 yards.



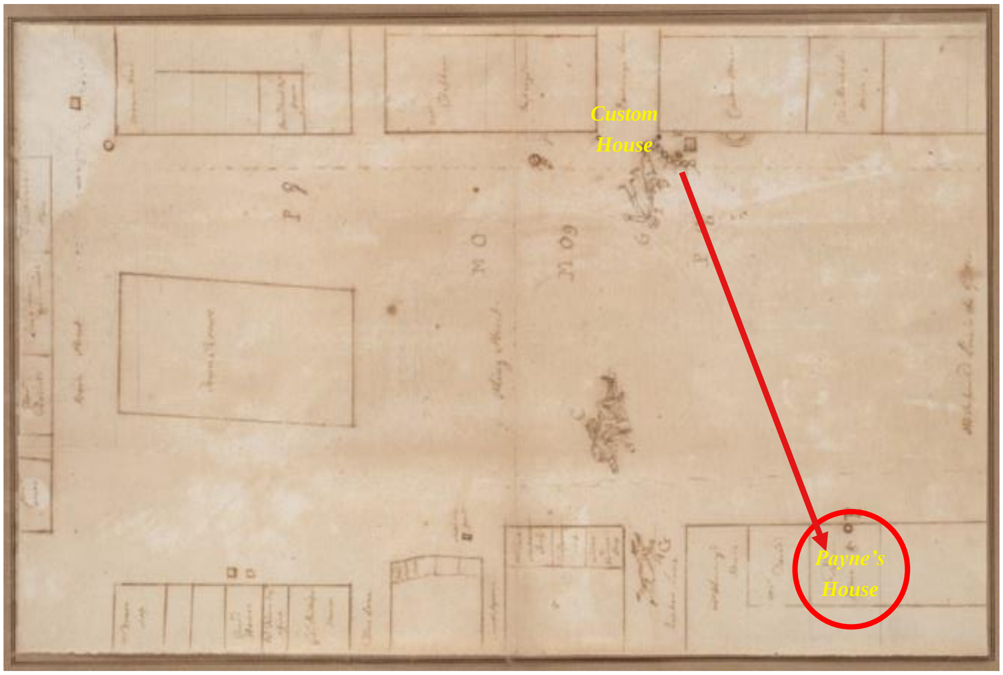
It embedded about 25mm into the wood. The level of deformation between the two specimens is similar and consistent with a high velocity impact with a resilient solid surface. So now the question becomes: what was the distance between the soldiers and Payne.

The following is taken from the proceedings of the trial of the British soldiers titled *A Short Narrative of the Horrid Massacre in Boston* published in 1770:

> Benjamin Andrews declares, that being desired by the committee of enquiry to take the ranges of the holes made by musquet balls, in two houses nearly opposite to the Custom-House, he finds the bullet hole in the entry door post of Mr. Payne's house (and which graz'd the edge of the door, before it enter'd the post, where it lodged, two and a half inches deep) *ranges just under the stool of the westernmost lower chamber window of the* CUSTOM-HOUSE (City of Boston 1770:15).

However, this does not give a distance.

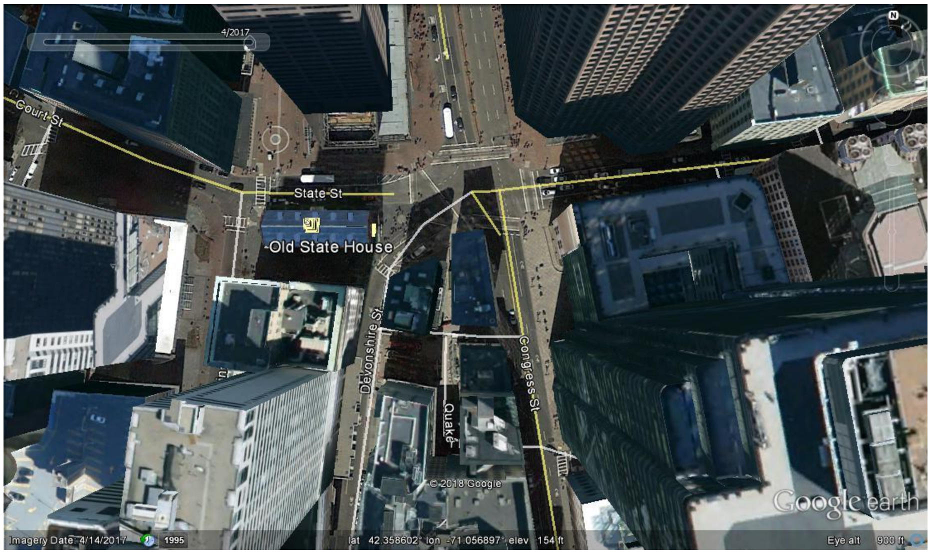
Paul Revere did a plan view sketch of the area to show where people were killed or wounded which I rotated 90º. He specifically shows Payne's house as being the third from Quakers Lane. He also shows the location of the soldiers, so we know the direction of fire. But unfortunately this is just a sketch and no dimensions are given.



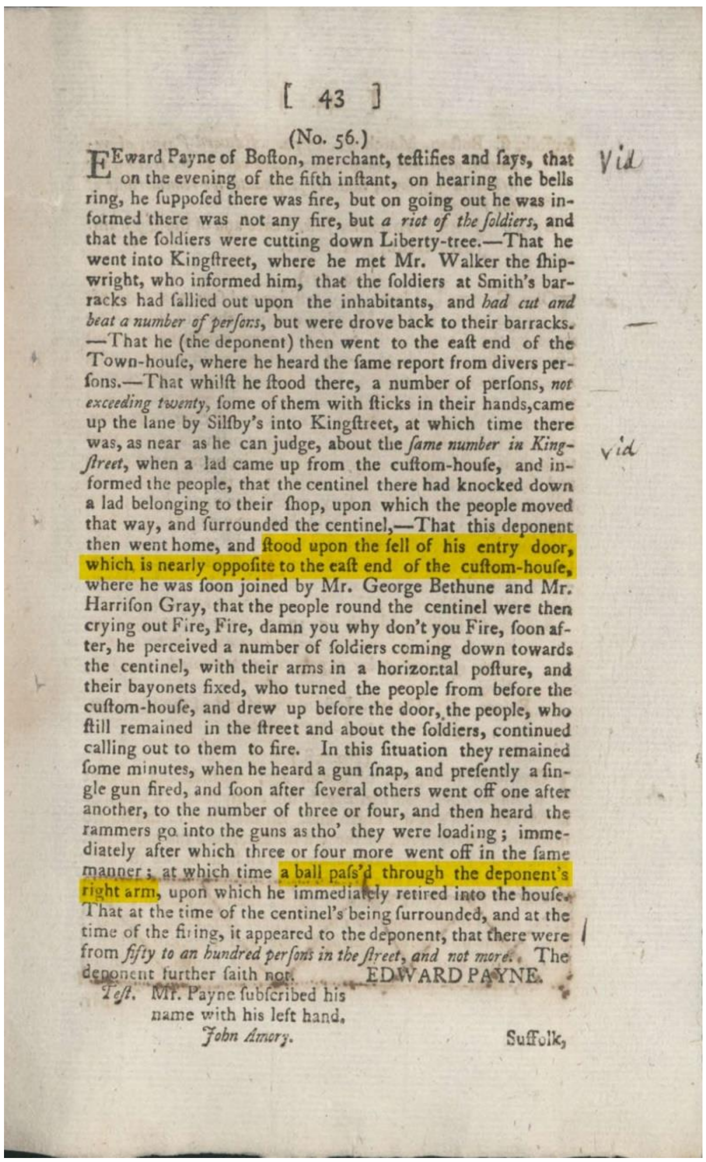
Payne's house can be seen in an 1801 painting by James B. Marston titled "Old State House". This painting is currently on display at the Massachusetts Historical Society.

Payne's front door and window are shown in the lower left corner of the painting. Payne's shutter was struck by one ball and a second struck Payne in the arm.

Both the Customs House and Payne's house are gone today, replaced with modern skyscrapers and sidewalks as can be seen in this Google Earth image. Therefore, accurate distances cannot be measured.



Specifically, while he was standing on the sill of his doorway, one ball hit Payne in the right arm as described in his testimony during the trial of Captain Preston and the soldiers under his command (City of Boston 1770:43).



[43]

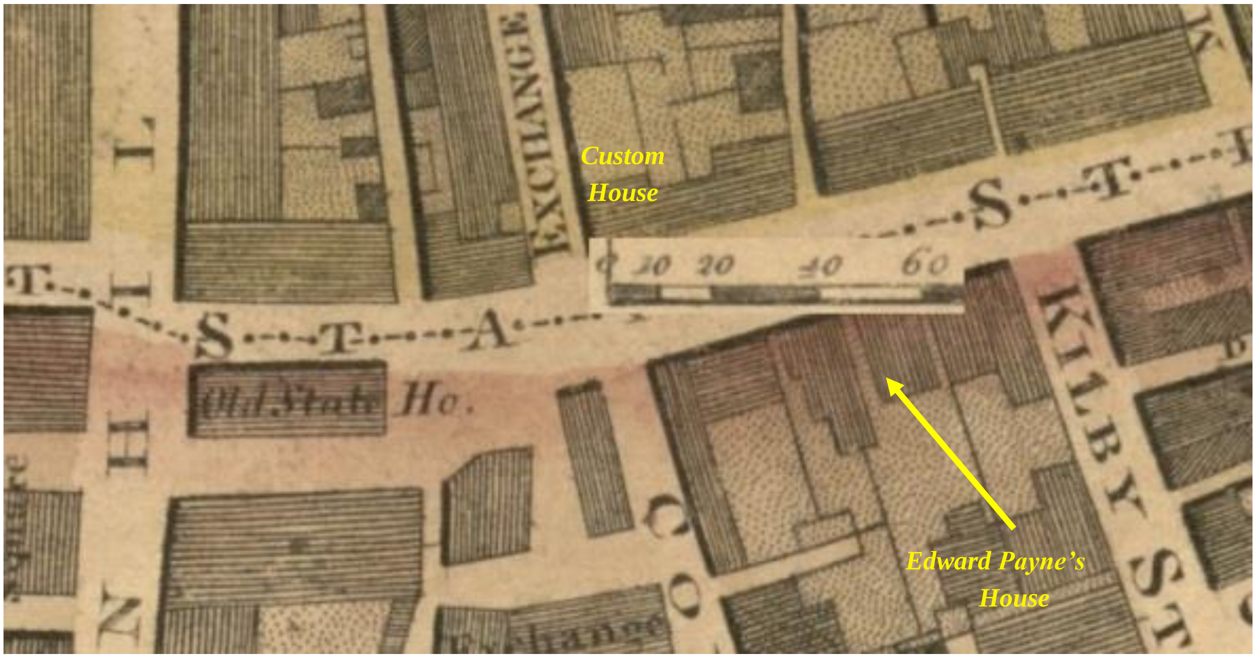
(No. 56.)

EDward Payne of Boſton, merchant, teſtifies and ſays, that on the evening of the fifth inſtant, on hearing the bells ring, he ſuppoſed there was fire, but on going out he was informed there was not any fire, but *a riot of the ſoldiers*, and that the ſoldiers were cutting down Liberty-tree.—That he went into Kingſtreet, where he met Mr. Walker the ſhipwright, who informed him, that the ſoldiers at Smith's barracks had ſallied out upon the inhabitants, and *had cut and beat a number of perſons*, but were drove back to their barracks.—That he (the deponent) then went to the eaſt end of the Town-houſe, where he heard the ſame report from divers perſons.—That whilſt he ſtood there, a number of perſons, *not exceeding twenty*, ſome of them with ſticks in their hands, came up the lane by Silſby's into Kingſtreet, at which time there was, as near as he can judge, about the *ſame number in Kingſtreet*, when a lad came up from the cuſtom-houſe, and informed the people, that the centinel there had knocked down a lad belonging to their ſhop, upon which the people moved that way, and ſurrounded the centinel,—That this deponent then went home, and ſtood upon the ſell of his entry door, which is nearly oppoſite to the eaſt end of the cuſtom-houſe, where he was ſoon joined by Mr. George Bethune and Mr. Harriſon Gray, that the people round the centinel were then crying out Fire, Fire, damn you why don't you Fire, ſoon after, he perceived a number of ſoldiers coming down towards the centinel, with their arms in a horizontal poſture, and their bayonets fixed, who turned the people from before the cuſtom-houſe, and drew up before the door, the people, who ſtill remained in the ſtreet and about the ſoldiers, continued calling out to them to fire. In this ſituation they remained ſome minutes, when he heard a gun ſnap, and preſently a ſingle gun fired, and ſoon after ſeveral others went off one after another, to the number of three or four, and then heard the rammers go into the guns as tho' they were loading; immediately after which three or four more went off in the ſame manner; at which time a ball paſs'd through the deponent's right arm, upon which he immediately retired into the houſe. That at the time of the centinel's being ſurrounded, and at the time of the firing, it appeared to the deponent, that there were from *fifty to an hundred perſons in the ſtreet, and not more*. The deponent further ſaith not. EDWARD PAYNE.

Teſt. Mr. Payne ſubſcribed his name with his left hand.
John Amory.

Suffolk,

But if we look at a map of this area done in 1814 by the prominent surveyors, John Groves Hales and Thomas Wightman, we can see both buildings and use the scale to estimate the distance that the musket balls travelled. This map shows about 50 yards give or take based on the accuracy of the actual street width versus the scale shown.



Note: the scale shown is in yards. Library of Congress G3764.B6 1814 .H31

So let's take this gentleman.

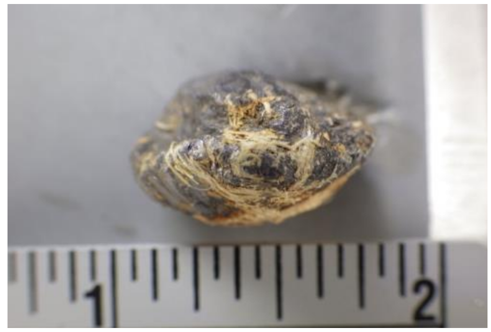
and make him Payne and move him onto the door step. We see that the proportions of the painting are not great, but they will work for this illustration.

From this drawing we can get an idea of the angle of fire, but the sketch has no scale so the distance the bullets travelled cannot be estimated.

The angle is very consistent with the one musket ball striking Payne specifically in the right arm and then traveling into the door post.

Going back to the comparison of the 1770 musket ball that hit the shutter and the reproduction musket ball fired into a green oak paling, if we look closely, we can see small pieces of wood on each.

1770 Boston Massacre



2017 Experimental Live Fire into Green Oak

Conclusions:

Based on all of the measurement data, these artifacts are consistent with 18th-century musket balls issued to British infantry troops for use with their standard issue Brown Bess muskets. Both show deformation from hitting hard targets such as wood and/or bone and the left bullet still has a fragment of wood embedded in the lead. Therefore, it is concluded that these artifacts have a strong probability of being associated with the March 5, 1770 Boston Massacre and the wounding of Edward Payne, as described in the notes associated with them.

However, the research continues. Probate records do not list any musket balls, but we would not expect them to be listed since at that time they had no monetary value. They were most likely given to Edward's son William. The paper that the two notes is written on are consistent with paper used after Edward's death in 1788. We are currently searching for a sample of William's handwriting to try to find a match.

References:

City of Boston (1770). *A Short Narrative of the Horrid Massacre in Boston.* Edes and Gill and T. & J. Fleet, Boston, Massachusetts.

Scott, Douglas D., Joel Bohy, Nathan Boor, Charles Haecker, William Rose, and Patrick Severts (2017). "Colonial Era Firearm Bullet Performance: A Live Fire Experimental Study for Archaeological Interpretation", Modern Heritage Foundation, Online publication: http://modernheritage.net/research.html.

Sivilich, D. (2016). *Musket Ball and Small Shot Identification: A Guide.* Norman: University of Oklahoma Press, Norman, Oklahoma.

Revisiting the US military 'Levels of War' Model as a Conceptual Tool in Conflict Archaeology: A Case Study of WW2 Landscapes in Normandy, France.

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ABSTRACT

This paper adapts US military concepts of 'Battlespace' and especially the 'Levels of War' (strategy, operations and tactics) to WW2 landscapes revealed by LiDAR-derived digital elevation models in forests of the Lower Seine valley near Rouen, France. Here, as in many forested areas of northwest Europe, the increasingly widespread availability of LiDAR data is presenting conflict archaeologists and heritage managers with the challenge of evaluating a vastly enhanced dataset of extant WW2 features. Many of these landscapes witnessed multiple actions over a range of timescales and involving one, or a combination of ground combat, artillery strikes and aerial bombing. In such cases the preservation of abundant impact craters can present a challenge for archaeological interpretation and assessment of heritage significance.

A case study from an area centered on Orival in the Forêt domaniale de la Londe illustrates firstly how impact craters associated with Allied aerial bombing and ground combat in the Normandy Campaign of summer 1944 have been mapped and interpreted using a combination of LiDAR, GIS and documentary data including air raid records, wartime crater analyses and aerial reconnaissance photographs. Secondly, craters are located within US military 'Battlespace' and 'Levels of War' models in order to link tactical events to their wider operational and strategic context. These show Allied tactical air raids at Orival to have been associated with the use of air power to impede German supply and reinforcement efforts both before and during the Normandy Campaign. The Orival landscape also preserves bomb and possibly artillery craters associated with the final stages of the campaign as Allied forces advanced towards the River Seine. It is argued that this approach is well-suited to assessing the context and significance of WW2 conflict landscapes and is likely to be of wider utility in evaluating the value of features such as impact craters as heritage assets.

Key Words: WW2 impact craters, LiDAR, Normandy Campaign, Levels of War.

1. INTRODUCTION

Conflict archaeologists are frequently turning to military concepts of geographical space and military decision-making to better understand the pattern and context of features and artefacts associated with combat (e.g. Bleed and Scott 2011: Babits 2015). The most widely used model to date was developed to frame the military evaluation of terrain features and is known by the acronym KOCOA (Key terrain, Observation and fields of fire, Cover and concealment, Obstacles, Avenues of approach). This approach has been adopted as standard practice in survey protocols set out by the American Battlefield Protection Programme (NPS 2016) and hence is a well-established method for framing interpretation of pre-20th C terrestrial battlefields (see for example the volume edited by Smith 2016). Extension of this approach to engagements with naval and aerial components is also beginning to yield valuable insights into the tactical dimensions of engagements (e.g. McKinnon and Carrell 2011; Frye and Resnick 2013; Babits 2015; Katz 2015), and in doing so is greatly expanding the geographical scale of analysis.

Opportunities to deploy concepts like KOCOA are poised to multiply with the increasing availability of highly-detailed LiDAR data in forested areas of former conflicts that have hitherto been difficult to survey using conventional techniques (e.g. Hesse 2014). This is especially the case with respect to landscapes of WW2 conflict that only recently have become a focus of attention in conflict archaeology yet are proving to be locally very well-preserved in European forests (Passmore et al. 2014). One of the most distinctive and abundant signatures of these conflict landscapes are impact craters, and particularly those associated with air-to-ground bombs (e.g., Passmore et al. 2014; Capps-Tunwell et al. 2016; Kobiałka 2017; van der Schriek and

Beex 2018). Here the potential of KOCOA to inform the analysis of tactical elements of these air raids remains to be explored. KOCOA is less well configured, however, to provide a framework for considering the broader context of air raids and especially the relationships between the individual missions and the aims and objectives underpinning the deployment of air power over the battlefield and wider theatre.

Two alternative theoretical approaches – both also featured in military training manuals (Department of the Army 2001; 2008) – offer a way forward in this respect and have been pioneered in conflict archaeology applications in analyses of 19th C North American Great Plains battles (Bleed and Scott 2011; Scott et al. 2016). The concept of "Battlespace" is intended to help commanders visualize a range of geographical and military variables in a model of the battleground and the wider area (Department of the Army 2001; see Scott et al. 2016 for a full discussion). Surrounding the immediate area of operations here is an "area of influence" and beyond that an "area of interest" that is partly or wholly occupied by enemy forces. It is in these zones and especially the area of interest that air power has the potential to shape the conduct and outcomes of military campaigns well beyond the traditional front lines. The second concept is termed the "Levels of War" and represents the modern threefold hierarchical differentiation of military decision-making and actions, respectively defined at strategic, operational and tactical levels (Department of the Army 2008; see also Scott et al. 2016). This provides a model of military activities that situates individual actions at tactical levels within an operational framework of mission planning and execution that in turn reflects high-level strategic command decisions.

In this paper we apply these concepts to WW2 conflict landscapes revealed by LiDAR in the Forêt domaniale de la Londe (hereafter FDL) in the Lower Seine valley, Haute-Normandie, northern France (Figure 1). The lower reaches of the River Seine between Melun and the river mouth (200 km downstream at Le Havre) effectively constituted the endline for the Normandy Campaign fought between June and August 1944. Prior to this the Seine had presented a potential barrier to reinforcement, supply and ultimately the retreat of German ground forces in the period shortly before the Allied invasion on 6th June, 1944, and subsequently during the three months of the campaign. The legacy of aerial bombing and ground combat in the FDL during this period is reflected in the abundance of well-preserved impact craters on the forest floors.

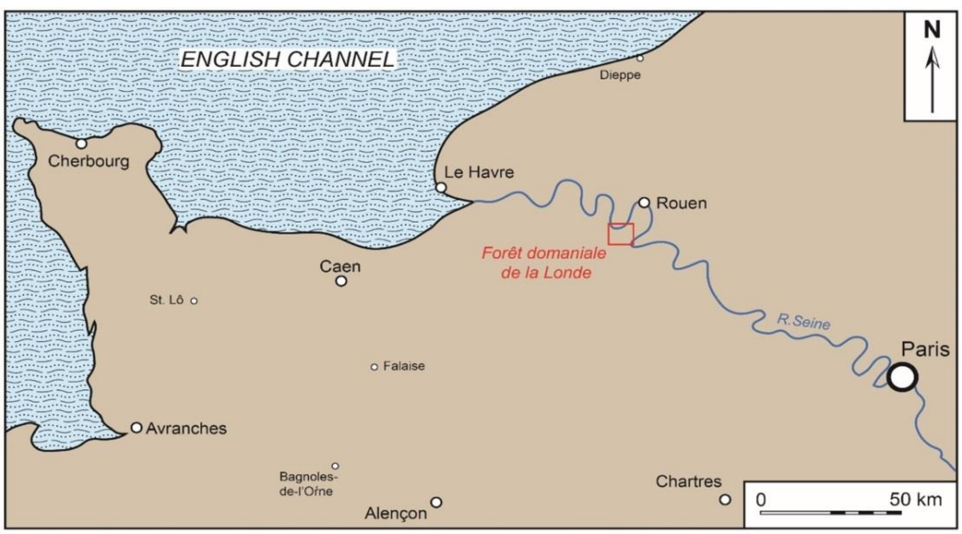

Figure 1: Map of NW France showing location of Forêt domaniale de la Londe

These landscapes are currently the focus of a larger study of the regional forests with respect to the full range of WW2 military landscapes (Passmore et al. forthcoming; unpublished data). Here we focus on the cratered landscape (or 'craterscape') of an area of 6.3 km^2 of woodland and narrow floodplain anchored on the town of Orival and the adjacent Port du Gravier (Figs. 1 and 2), and including the left bank abutment and approaches of the Orival railway bridge. Located 21 km upstream of Rouen, the Orival bridge was one of many in the Lower Seine that were attacked by Allied tactical air forces seeking to isolate Normandy from

German supplies and reinforcements in preparation for the D-Day invasion. During the subsequent Normandy Campaign military traffic on roads and railway lines cutting through the forest were attacked by Allied aircraft conducting armed reconnaissance patrols and, during the latter stages of the campaign as German resistance collapsed in late August, planned raids against troop concentrations and communications routes. This period also witnessed ground actions during the last phases of the campaign as advancing Allied forces sought to cross the River Seine and cut-off retreating German units.

Below we present the results of a LiDAR-based analysis of the study area craterscape and a range of historical documents and aerial photographs with two primary aims. Firstly, we seek to establishing the geographical arrangement, character and age of impact craters, and to differentiate (where possible) between bomb craters associated with specific air raids and those reflecting artillery impacts during ground actions later in the campaign. Secondly, elements of the craterscape are considered in the context of Battlespace and (especially) Levels of War frameworks with the intention of connecting tactical events to command decisions and responses to different phases and evolving circumstances over the Normandy Campaign.

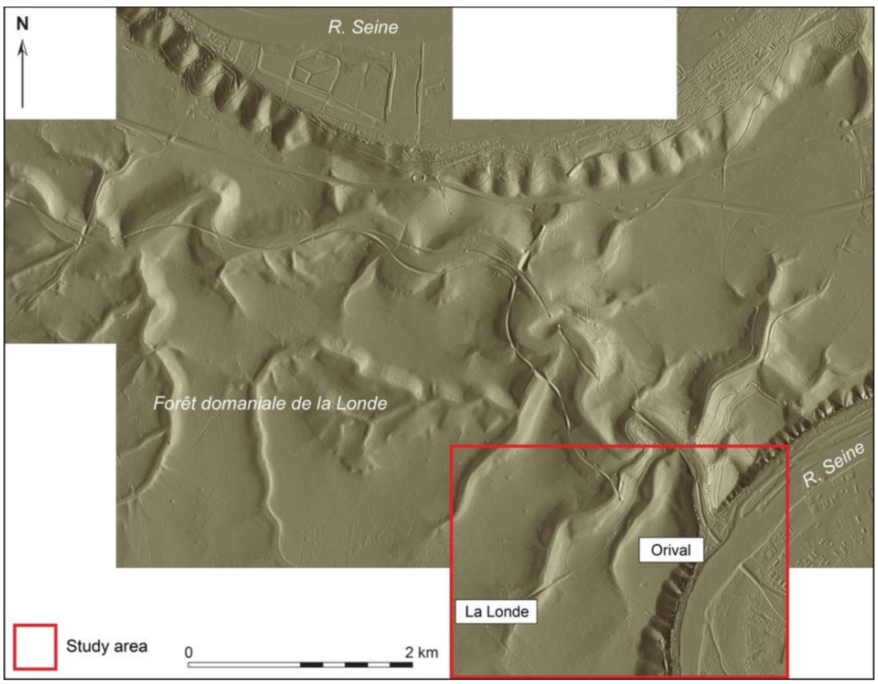

Figure 2: LiDAR-based DTM of the Forêt domaniale de la Londe showing Orival study area

2. DATA SOURCES AND METHODS

Data collection and analysis for this study and the wider Lower Seine project may be briefly summarised as follows (full details of the methodology will be developed in a dedicated paper). Mapping of impact craters in the FDL has been primarily undertaken as a GIS-based exercise using a digital terrain model (DTM) derived from LiDAR data (courtesy of the © GIP Seine-Aval, traitements Office National des Forêts). The DTM has a pixel resolution of 1m and this precludes the reliable identification of small-scale features below c.3m; here we focus solely on manual identification of distinctive circular impact craters with diameters in excess of 3m. Desk-based mapping has also been facilitated by vertical aerial photographs taken by Allied aerial reconnaissance flights between 1942 and 1944 (images consulted at the Laurier Military History Archive, Wilfrid Laurier University), and subsequently during the immediate post-war period for reconstruction purposes (accessed via the Institute Géographique National; see also Passmore et al., 2016) (Table 1). Photographs showing evidence of impact craters were georeferenced in the project GIS and, in the case of high-resolution images, have been used to corroborate crater diameter measurements. A short programme of reconnaissance fieldwork was conducted in the study area in order to verify the identification and dimensions of selected craters (Figure 3).

Figure 3: Large (13.8m diameter) crater associated with 2000lb GP bomb near Orival (Impact Cluster I – see below for details).

Previous work by the authors has shown that the interpretation and dating of bomb craters can be facilitated by contemporary documentary evidence (especially air raid mission orders and de-brief reports) and aerial photographs, and in some cases this can permit individual and(or) clusters of craters to be linked to specific air raids (Capps-Tunwell et al., 2016). Table 2 lists seven air raids known to have been planned and flown by Allied air forces at targets in or near the study area. All fall in the period May-August 1944, although this list excludes opportunistic attacks (e.g. by armed reconnaissance missions) that have yet to be documented. The availability of repeat photographic sorties for the period from May 1942 and especially between May-August 1944 (Table 1) has also permitted certain individual or groups of craters to be dated to periods bracketed by specific photographic sorties. This has proved especially useful for differentiation between craters associated with bomb and artillery impacts since craters that pre-date the ground actions of 26-29th August must be associated with air attacks.

A key challenge in analysis of impact craters in settings that have experienced both bombing and shelling is the differentiation of projectile ordnance type (e.g. bomb, artillery shell, mortar shell, rocket, etc) and size. Crater shape, planform size and depth will vary according to ground conditions, differing projectile trajectories and (for bombs) drop height and speed, and especially the type and reliability of fuzing. Furthermore, extant craters have inevitably experienced degradation by natural processes and both inadvertent and deliberate human action. Assessment of crater depth is particularly problematic where craters have been infilled by water or, as is often the case by wood, brush and other organic debris. Previous work by the authors has demonstrated, however, that interpretation of crater diameters can be guided by reference to analyses of impact crater characteristics conducted during the war (Capps-Tunwell et al., 2016). This study has used datasets from Terminal Ballistic Reports (Office of the Chief of Ordnance 1945) in order to help differentiate bomb craters associated with particular bomb types and fuzing (Figure 4). Equivalent data on WW2 artillery projectiles is not available, but Figure 3 does include some limited information on typical shell crater dimensions from both WW1 and WW2, as well as craters associated with air-to-ground rockets.

Table 1: Details of aerial photographs used in this study

Date	Reference	Scale	Study area coverage
LMH Archive	Box, Flight Code		
May 24th 1944	0118, 4/95	1/18,600	Complete
June 12th 1944	0125, 4/191	1/9400-11,600	Southern half only
June 22nd 1944	0129, 4/311	1/16,800	Complete
“	0130, 4/312	1/9500	Complete

June 24th 1944	0005, 4/330	1/10,333	Eastern half only
July 6th 1944	0028, US34/1095	c.1/10,000	Mid and eastern
August 18th 1944	0144, 4/628	1/16,800	Complete
August 25th 1944	0151, 4/681	1/7600	Eastern third only
August 26th 1944	0016, US33/401	c.1/10,000	Complete
"	0071, R4/707	1/7600	Complete
August 27th 1944	0067, 4/719	1/8000	Western third only
IGN	Mission		
April 1947	C1912-0051_1946_F1912-2113	1/25535	Complete
May 1955	C1911-0151_1954_CDP930	1/4973	Complete

Table 2: List of planned air raids occurring in or near the study area during May-August 1944. Sources: AAF - Army Air Forces; AFHRA - Air Force Historical Research Agency; THOR – Theatre History of Operations Reports.

Date (1944)	Air force / unit	Target	A/C	Source
7th May	9AF, 366 FG	Orival railway bridge	Fighter-bomber	AAF (1945); AFHRA IRIS Ref. B5656
10th – 24th May	No air attacks permitted on Seine River bridges (Allied Expeditionary Air Force directive)			AAF (1945); Russell (1999)
25th May	9AF, 371 FG	Orival railway bridge	51 x P47	AFHRA IRIS Ref. B5891
27th May	9AF, 387 BG 9AF, 397 BG	Orival railway bridge	24 x B26	AFHRA IRIS Ref. B5656
28th May	2 TAF, 439(CAN) & 440 Sq	Orival railway bridge	Typhoon	RCAF Operations Record Book: C-12318 (Canadian Research Knowledge Network)
29th May	9AF, 344 BG 9AF, 391 BG	Orival railway bridge	32 x B26 29 x B26	AFHRA IRIS Ref. B5656
13th Aug	8AF	Roads & vehicles in Rouen-Elbeuf area	109 x B17	Carter & Mueller (1991); THOR
20th Aug	9AF, 397 BG	Forêt de La Londe (troop concentrations)	29 x B26	AFHRA IRIS Ref. B5789

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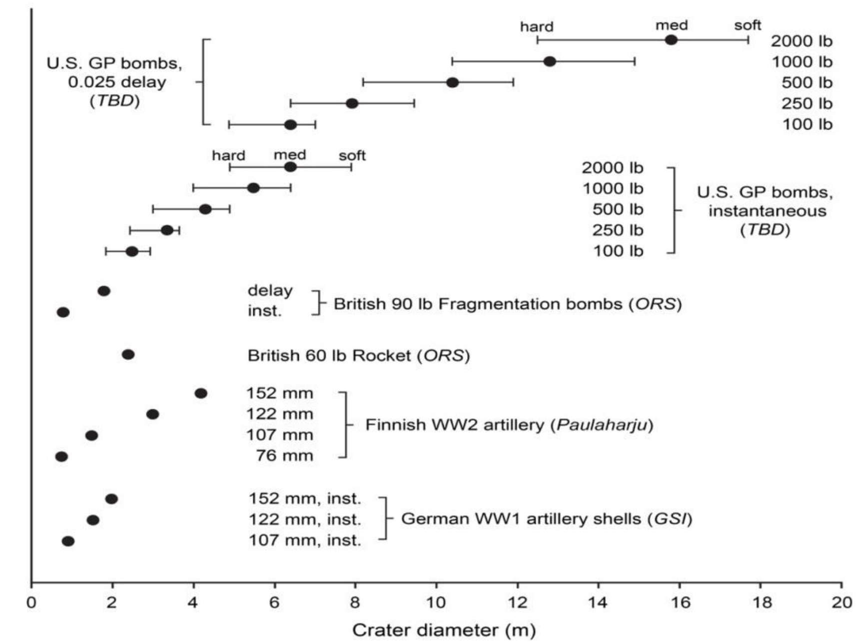

Figure 4: Comparison of crater diameters for a variety of projectile types and fuzing (delay or instantaneous). Hard / med / soft describes ground conditions. Sources: TBD - Terminal Ballistic Data (Office of the Chief of Ordnance, 1945); ORS - Operational Research Section (Copp, 2000); Paulaharju (1996); GSI - General Staff (Intelligence), 1918.

3. CRATER ANALYSIS IN THE ORIVAL STUDY AREA

A total of 413 craters have been identified in the Orival study area, ranging from 3.2-20.1m in diameter and with a mean / median size of 6.5m and 5.6m, respectively (Figures 5 and 6). Five examples are located in floodplain areas close to Orival Bridge (see below; Figure 6). All other examples are sited in woodland of the FDL that covers plateau / scarp surface at elevations between 10-120m asl (Figure 6). Most of these features are located on flat or gently sloping plateau surfaces, but distinctive impact craters may also be discerned on sloping valley sides of northeast-trending tributary valleys and larger examples are evident even on the very steep east-facing river cliffs overlooking the Seine above Orival (Figure 6).

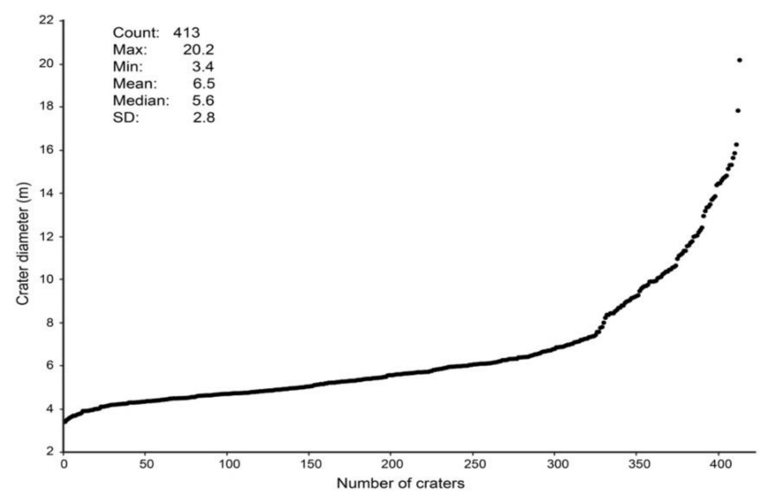

Figure 5: Plot of crater diameters and summary statistics for mapped impact craters in the study area

Of the 413 craters mapped by LiDAR, a total of 200 can be identified by aerial photograph analysis and assigned to a date range spanning from sometime before May 24th 1944 to the immediate post-war period

(Figure 7; Table 1). The vast majority of dated craters lie in distinct clusters respectively located (i) on high ground immediately west of Orival (Impact Cluster I), (ii) on high ground overlooking a small tributary valley in the northwest part of the study area (Impact Cluster II) and (iii) on either side of the valley in the northern extent of Port du Gravier (Impact Cluster III) (Figure 6).

3.1. Impact Cluster I

A total of sixty-one craters lie within the area bounded by Impact Cluster I. Thirty-five of these can be dated to the period between 24th May and 22nd June and are clustered on the steep valley bluff and adjacent wooded plateau surface 200-400m west of the western Orival Bridge abutment. On the June 22nd reconnaissance photo these impacts are registered by prominent craters and fresh debris fields, most likely reflecting the combination of relatively open contemporary woodland cover in this area and the chalk substrate yielding high contrast debris (Figure 8). Amongst these dated craters are 12 of the largest examples recorded in the study area and with diameters between 12.2-15.8m these lie in the size range that can be reliably associated with 1000lb and – especially – 2000lb bombs fitted with delayed action fuzes (Figure 3). The combination of geographical location, aerial photographic date range and large ordnance suggests that many of these craters, and certainly the larger examples, are the impacts of air

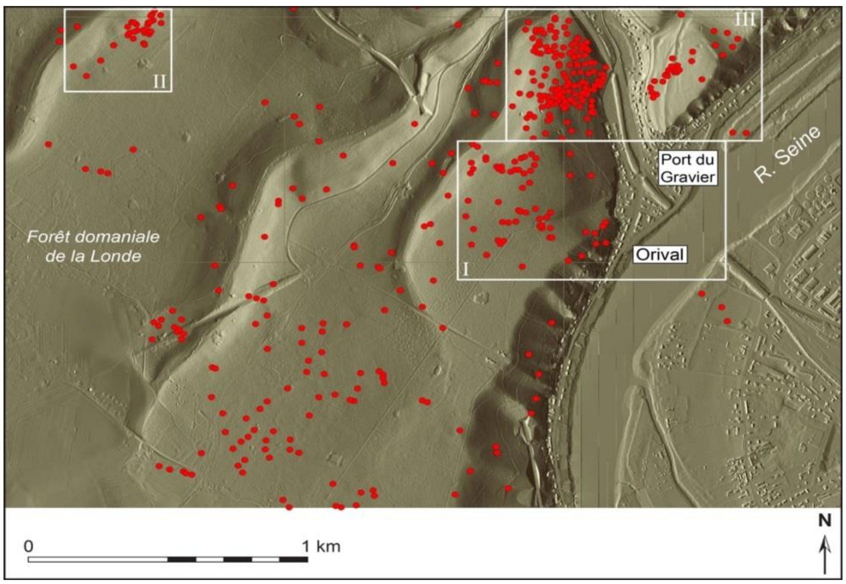

Figure 6: LiDAR-based DTM of the Orival study area showing location of mapped craters (red dots - not to scale) and Impact Clusters I, II and III.

attacks on the Orival Bridge in late May of 1944. Although the possibility of some impacts associated with fighter-bomber attacks earlier in May cannot be discounted, the most compelling case for specific crater attribution here can be made for 2000lb General Purpose bombs dropped by the medium bomber raids of the 27th and 29th May (Table 2). This interpretation is based on detailed air raid mission orders and de-brief reports, including in-raid photographs, and will be fully documented in a follow-up paper.

3.2. Impact Cluster II

Located 1.8km northwest of Orival, Impact Cluster II is a further distinct assemblage of relatively large (5.7-12.4m diameter) craters that can be dated on the basis of aerial photographs to the period between 22nd June and 18th August (Table 1; Figures 6, 7 and 9). Craters here form a tight grouping in an area of c.150m^2 that is sited on the southeast shoulder of a small tributary valley that hosts one of the forest roads connecting La Londe with axial roads to Rouen (Figures 1 and 2). The combination of crater size range in Impact Cluster II and its dating well before the onset of local ground combat precludes an artillery origin, and nor does this cluster correspond to any known (planned) mission by Allied medium bombers (Table 1). Accordingly, these impacts

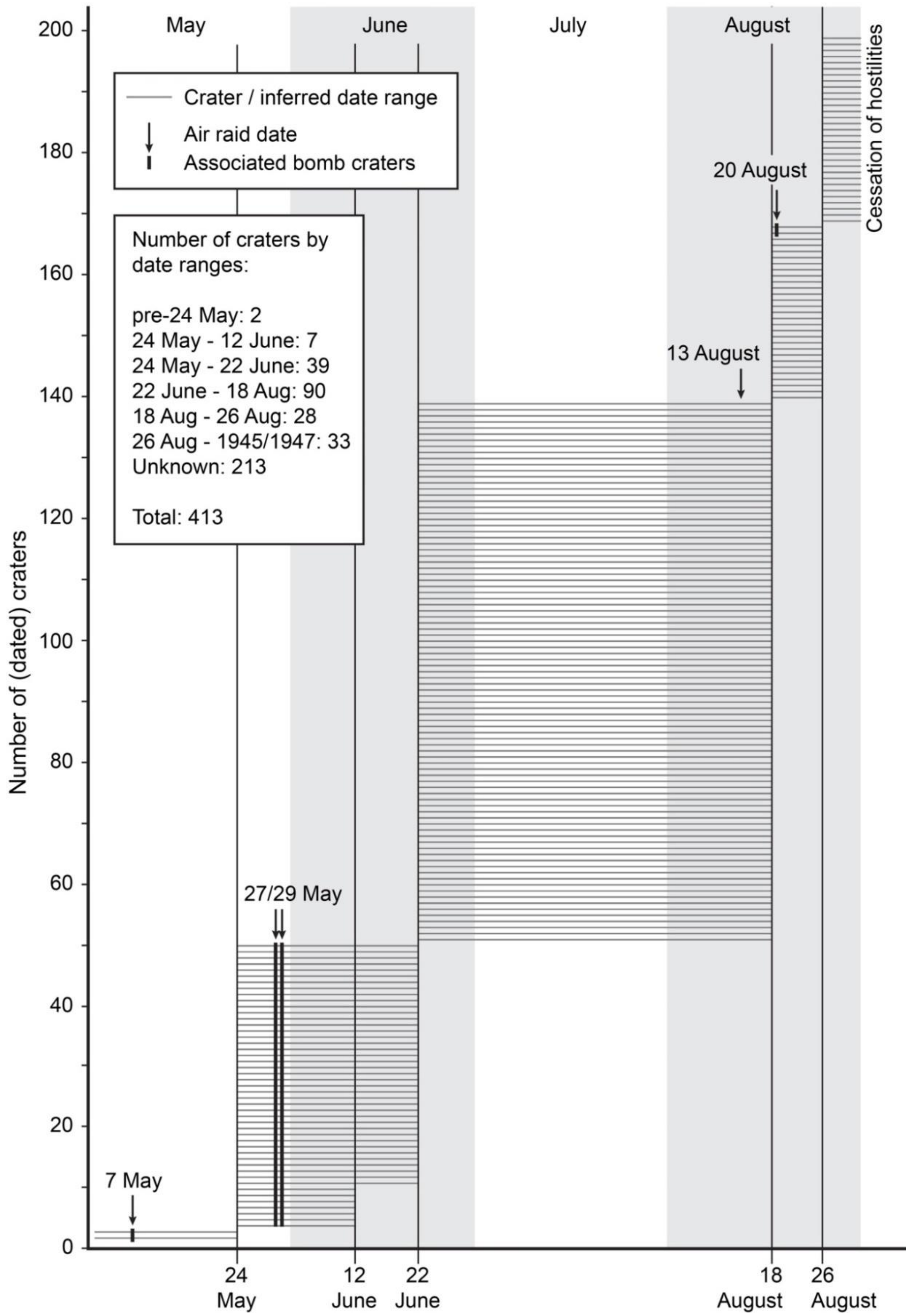

Figure 7: Plot of dated impact craters in the study area showing date ranges, dates of known air raids and interpretation of bomb craters assigned to specific raids (see text for details).

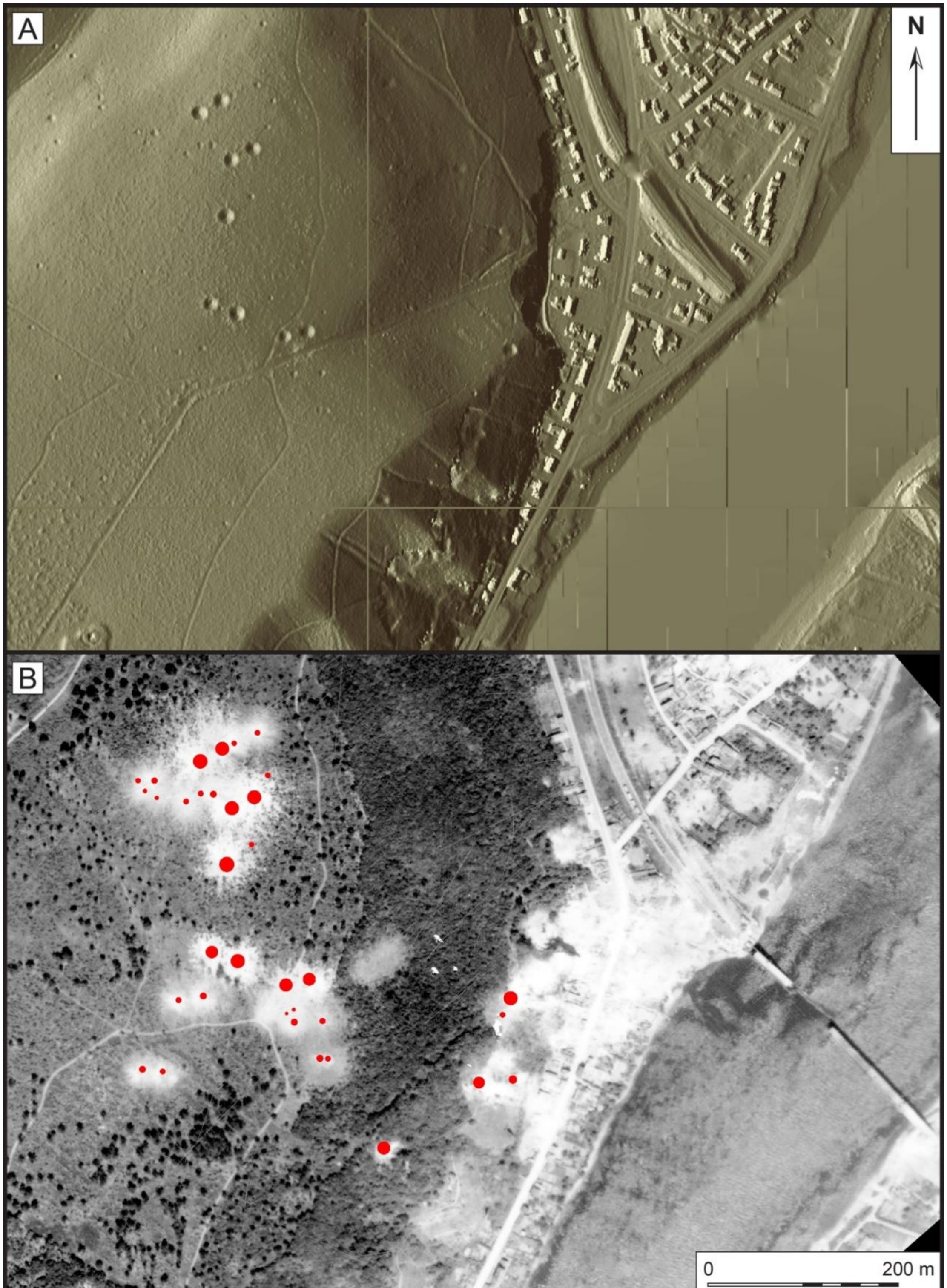

Figure 8: Scaled images of Impact Cluster I at Orival showing A) LiDAR DTM and B) aerial photograph of 22nd June 1944 (LMH 130/3102) with visible craters matched to extant examples highlighted in red. Note severe damage to Orival Bridge on aerial photograph.

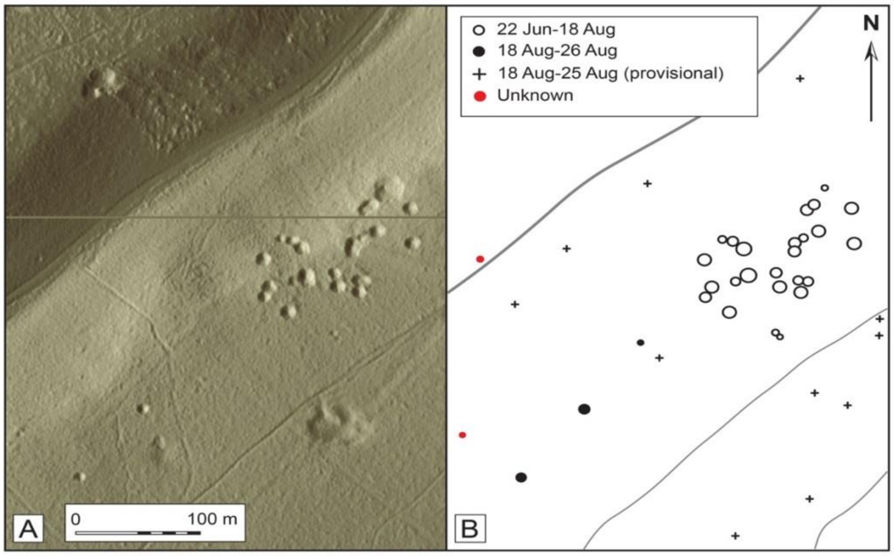

Figure 9: Scaled images of Impact Cluster II showing A) LiDAR DTM and B) interpretation of crater sizes and date ranges (see text for details)

are interpreted as reflecting an attack by Allied combat air patrols on German vehicle and(or) troop concentrations during the later stages of the Normandy Campaign, and most likely perhaps during the intense air activity during the Falaise Pocket battles between 12-20th August. The tight grouping of craters here and their size range would suggest an attack by fighter-bombers armed with 500-1000lb bombs using dive-bombing tactics.

Three further craters, including two with diameters between 8-9m, appear in a linear array to the southwest of the main cluster sometime between 18-25/26th August (Figure 9). During the same interval, aerial photographs record the appearance of numerous small impact craters (less than 3m diameter) forming a broad swath c.400m wide and parallel to the valley road. Some of these features are tentatively thought to be discernable on the LiDAR images but, since they are at the limit of resolution for this LiDAR point density they are recorded here as provisional pending field verification. Current research does not permit a definitive association to be made between these craters and a specific attack, but here we note the geographical arrangement, dating and crater sizes correspond well to a documented raid on 20th August by B26B Marauders of the 394th Bombardment Group (Table 2). Armed with 260lb fragmentation bombs (fuzed for instantaneous detonation and hence likely to yield craters with diameters less than 3m, Figure 3) and four 500lb GP bombs, this raid was targeting vehicle and troop concentrations along and adjacent to forest roads including those northwest of La Londe and Orival (AFHRA IRIS Ref. B5789; Figure 2).

3.3. Impact Cluster III

One of the highest density areas of cratering in the study area, Impact Cluster III is evident on the slopes and plateau surfaces flanking the valley floor site of Port du Gravier, located adjacent to the northern abutment of Orival Bridge and hosting both major railway lines and one of the main roads connecting Elbeuf-Orival-Rouen (Figures 1, 2 and 6). While Port du Gravier does not appear to have been specifically targeted for air raids before or during the Normandy Campaign, its proximity to Orival Bridge rendered the town well within the impact area of raids on the bridge during April-May 1944 (Figure 6). Subsequently, road traffic and possibly railway activity connecting ferry traffic to the front lines will also have attracted opportunistic fighter-bomber attacks during and especially late in the campaign. Aerial reconnaissance photos of 22nd June and 18th August testify to the degree of bomb damage in this area (Figure 10) and, while much of the valley floor and lower slopes were rehabilitated and urbanised shortly after the war (compare Figures 10 and 11), the surrounding wooded hillslopes and valley crests still preserve the scars of tactical bombing.

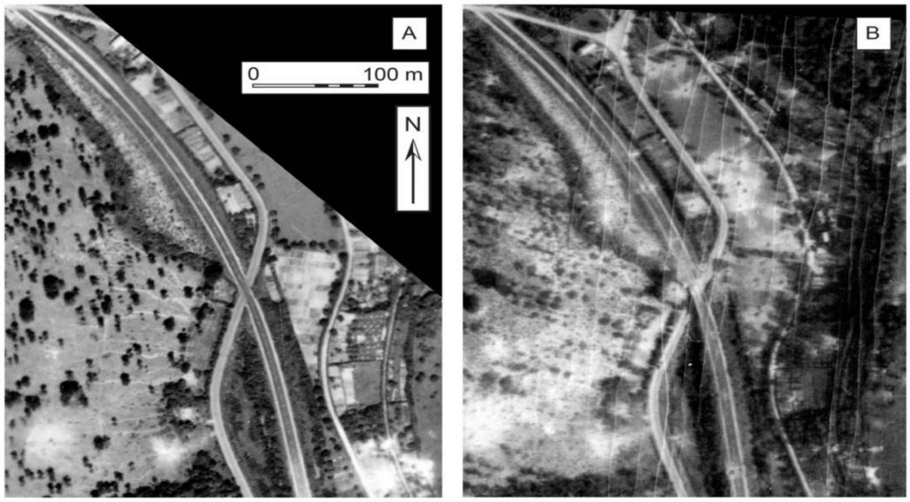

Figure 10: Aerial reconnaissance photos of 22nd June (A) (LMH 130/3102) and 18th August (B) (LMH 144/3152) showing bomb damage in the northern part of Port du Gravier and on adjacent hillslopes. For location see Figure 11.

A total of 174 craters have been recorded as extant in this area, mostly on the slopes and high ground to the west of the town and with a size range between 3.5-15.3m (Figure 11; Table 3), and 103 of these can be allocated to specific date ranges. Only five examples appear during the

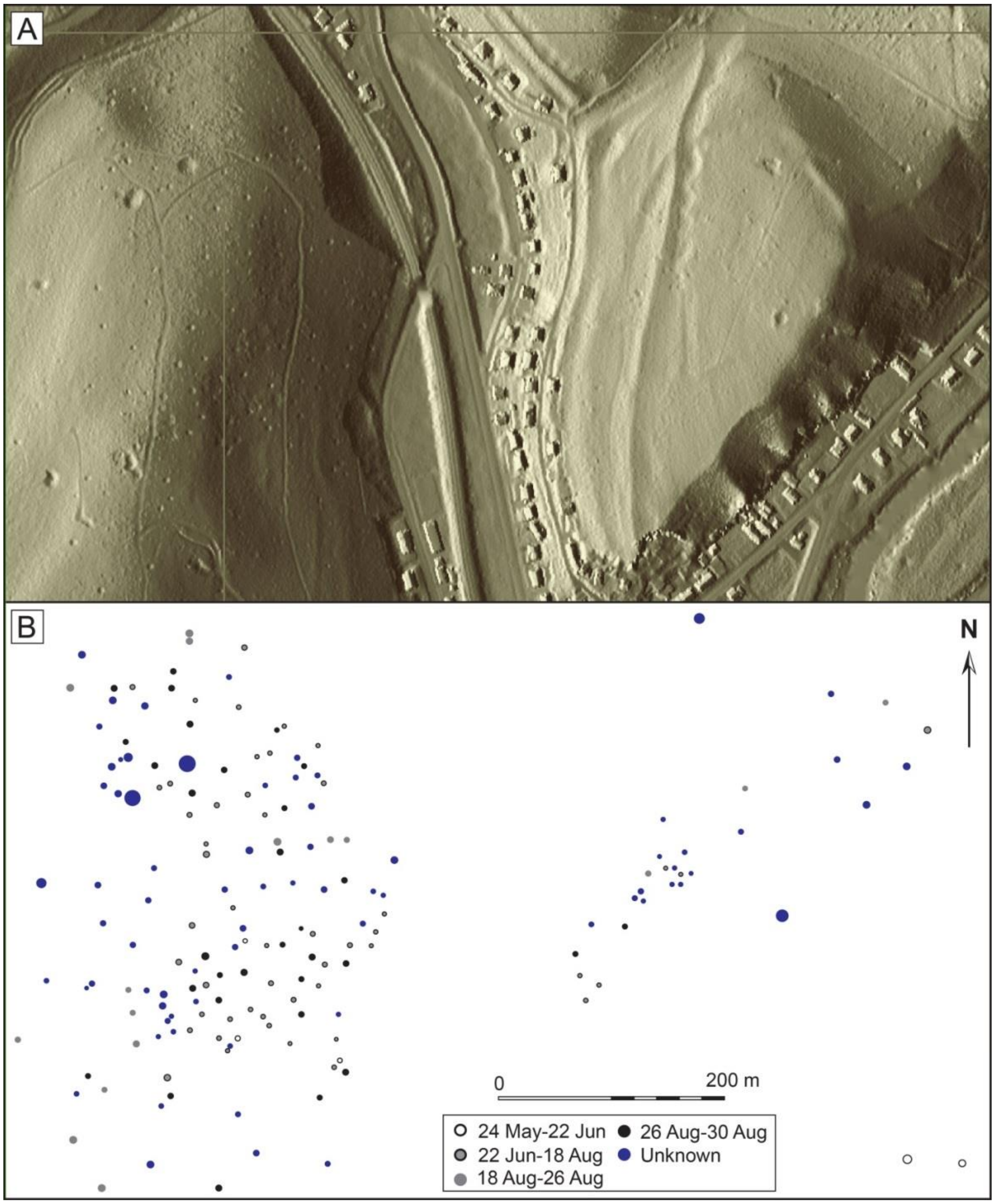

Figure 11: Scaled images of Impact Cluster III at Port du Gravier showing A) LiDAR DTM and B) interpretation of crater sizes and date ranges (see text for details).

period 24th May – 22nd June and these relatively large craters (between 8.8-4.7m) are most probably associated with the attacks on Orival Bridge. Two large sub-circular depressions of c.15m diameter the northwest part of the cluster are provisionally mapped as craters (pending

Table 3: Crater numbers and diameters by date range in Impact Cluster III

		Crater diameter (m)			
	No. of craters	Mean	Median	Max	Min
24 May - 22 June	5	6.2	5.2	8.8	4.7
22 June - 18 August	51	4.9	4.8	6.5	3.8
18 August - 26 August	16	5	5.1	6.1	3.7

26 August - 30 August	31	4.8	4.8	5.7	3.4
Unknown	71	5.2	4.7	15.3	3.5
Total:	174				

field verification) and may also be associated with attacks on the bridge or communications, but these lack any visual appearance on aerial photographs and are presently undated.

A further 51 craters are assigned to the period 22nd June - 18th August. With size ranges between 6.5-3.8m, these features are interpreted as the impacts of armed reconnaissance raids using bombs fuzed for impact detonation or smaller ordnance with delayed action fuses on road traffic and troop movements in and around Port du Gravier. Similarly-sized (but no longer extant) craters on the valley floor can be seen on the 18th August reconnaissance photo (Figure 10).

The periods 18-26th August and 26-30th August are associated with 16 and 31 impact craters, respectively, and sized between 6.1-3.4m (Table 3). These features fall within the timeframe associated with ground combat between advancing Allied troops and German rearguard forces seeking to protect the Seine crossing points. It is possible that some of these features can be attributed to fighter-bomber strikes prior to the arrival of American units in the area on the 24th August. However, with available image resolutions and overlapping size ranges it is difficult to differentiate between craters associated with relatively small bombs and those resulting from artillery shells fired in support of American, Canadian and German forces contesting the Elbeuf-Orival-Port du Gravier corridor. For example, some of the most heavily cratered terrain on the hillslope immediately west of the road and railway line was the focus of intense Canadian artillery fire preceding a flanking assault from the west on the 28th August, and subsequently came under German machine gun and mortar fire as the attack was stalled (Essex Scottish War Diary; McIntyre, 1998). Here it is likely that at least some of the smaller extant craters (less than 4m) are the impacts of 25-pounder field artillery and heavy mortars.

4. DISCUSSION

The craterscape in the Orival study area demonstrates that the efficacy of crater analysis and attribution is contingent on many factors including post-war preservation and the availability of primary photographic and documentary sources. In this case study, some 48% of the mapped craters may be robustly linked to specific time periods and events that fall within the timescale spanning May 7th – August 29th 1944. The remaining 52% are currently lacking dating control and context, either because they pre-date this period or cannot be discerned on aerial photographs (e.g. on account of ground conditions). The possibility of at least some examples reflecting stray or jettisoned bombs from earlier in the war cannot be excluded. However, in the absence of any documented targets or earlier history of WW2 combat in the FDL, it is likely that the majority of these undated examples also reflect actions associated with the Normandy Campaign.

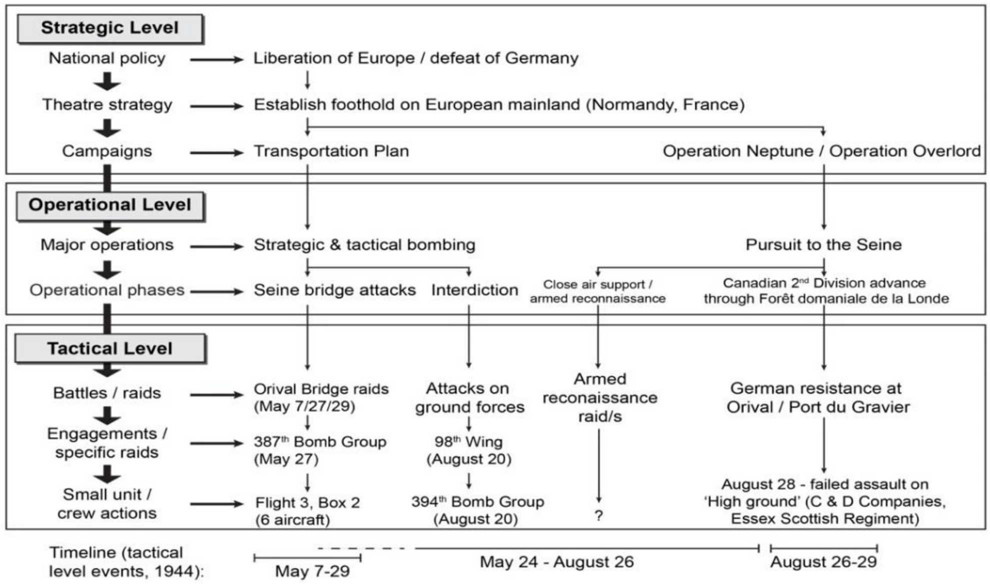

Figure 12: The Levels of War for Allied air strikes and ground combat in the Forêt domaniale de la Londe at Orival. See text for details.

In the following discussion we consider these landscapes and their associated events in the context of tactical, operational and strategic perspectives of conflict in Normandy during the summer of 1944. These are summarised in Figure 12 which adapts the original Levels of War model presented in FM3.0, and adopted for analysis of Great Plains warfare (Bleed & Scott 2011; Scott et al. 2016), with the addition here of a timeline for events identified in the study area over the summer of 1944. Impact craters in the archaeological record are the direct result of explosive force applied in combat using air-to-ground and artillery ordnance, and hence are expressions of the tactical level of war occurring over short timescales (minutes or even seconds) involving individual or small groups of combatants (and possibly also impacting civilians and non-combatants). The advantage of the Levels of War framework here is that it connects these tactical events to command decisions and responses to different phases and evolving circumstances over the Normandy Campaign.

Craters in the vicinity of Orival Bridge and the woodlands to the immediate west (Impact Cluster I) are distinctive in including the largest of examples that survive in this area, and also in shortly pre-dating the D-Day landings of 6th June. The majority of mapped examples can be attributed to a series of tactical level attacks on the bridge between 7th and 29th May, and in particular the B-26B medium bombers of the US Ninth Air Force conducting the decisive raids on the 27th and 29th May that were to destroy the bridge. Here the balance of evidence points to a specific flight of six aircraft (Flight 3, Box 2) of the 387th Bomb Group attacking on the 27th May at c.20:51 PM (AFHRA IRIS Ref. B5656; Figure 12), and this illustrates the finely resolved micro-histories possible in this aspect of conflict archaeology. From an operational perspective, Orival Bridge was one of many on the Seine attacked in late May as Allied strategic and tactical air forces conducted a programme of air attacks on important communications targets in NW Europe and especially the Normandy region in the run-up to D-Day (Figure 12). These raids were part of the Transportation Plan (Mark, 1994) which had the strategic objective of isolating Normandy from German supply lines and reinforcements. Destruction of the Seine bridges (and later attacks on the Loire crossings) were especially significant in this respect since denying the Germans efficient river crossings from the north and east helped to permit Allied forces to establish a foothold in Normandy and thereafter had an enduring effect on German combat power through the remainder of the campaign (e.g., Ehlers 2009).

In the days and weeks following the D-Day landings Allied tactical air forces maintained an operational programme of interdiction in both direct and indirect support of ground forces (Figure 12). These raids continued to attack communications and other military targets in rear areas, while also conducting wide-ranging armed reconnaissance raids behind the front line in search of troop, train and vehicle movements.

These activities continued to impede the movement and re-supply of German ground forces while having a significant long-term effect on mobility by denuding the road vehicle fleet (Hart 1996; Ehlers 2009). The archaeological signature of this phase of the Normandy air campaign is also present in the study area and most clearly with respect to Impact Cluster II. At present only tentative associations between selected craters and specific tactical events can be inferred, but these sites clearly demonstrate that even small clusters, pairs or isolated craters that are proximal to communications routes may have a broader significance than might first appear. From the perspective of the Battlespace model, craterscapes at both Impact Clusters I and II serve as good examples of 'shaping actions', being conducted at tactical levels in 'areas of interest' well beyond the zone occupied by friendly forces and in accordance with operational and strategic aims and objectives.

Many of the craters identified and dated on the valley sides and plateau surfaces adjacent to Port du Gravier probably also reflect opportunistic air strikes against German forces seeking temporary cover in off-road woodland sites (Figures 11 and 12). Those that post-date the 26th August, however, span the period of ground combat between German rearguard troops and elements of 2nd Canadian Division (2Cdn) advancing through the town towards Rouen (Stacey, 1960; Copp 2003). Since these areas came under periods of intense shelling from both Canadian and German field artillery and mortars on the 27th and 28th August (McIntyre 1998) it is possible that at least some of these craters, and especially those below c.3.5m in diameter, reflect the impact of artillery shells fired in local support of forces contesting Port du Gravier. The archaeological signature of tactical actions in the Orival-Port du Gravier area can be located in the context of a broader sweep of operations conducted by 2Cdn to clear the FDL and open the route to Rouen. In turn, and together with other Allied units advancing east to the Seine (termed the 'Pursuit to the Seine'; McIntyre 1998) following the climatic battles around Falaise over 12-21st August, these movements constituted the final stages of the Normandy Campaign and the successful culmination of Operation Overlord's final strategic objectives to clear German forces west of the Seine (Figure 12).

5. CONCLUSIONS

LiDAR-based analysis of impact craters in woodlands in the Orival study area has identified at least 413 extant examples with diameters greater then 3m, and an average crater density of 66 per km^2 that renders it as one of the most densely cratered areas of forest in this part of the Lower Seine valley. Analysis of documentary and aerial photographic records have enabled nearly half of these craters to be dated to May-August 1944, and associated either with Allied air raids conducted as a prelude to D-Day and as interdiction attacks during the subsequent Normandy Campaign, or as bomb and possibly artillery strikes during the final stages of the campaign as Canadian troops advanced towards the Seine and Rouen. The FDL in the vicinity of Orival therefore constitutes a rare example of a conflict landscape that bookends one of the great military campaigns of modern history.

Given the small scale of the landscape here (only 6.3 km^2) it is not surprising that the events themselves capture only tactical actions, and nor do they belong to the more famous battles of the campaign such as the D-Day landings themselves or the climactic closing of the Falaise Pocket. But the application of military models of geographical space (Battlespace) and the hierarchy of military decision-making and actions (Levels of War) to these landscapes permits even isolated or small clusters of features to be connected to the broader sweep of events. The Levels of War perspective offers particular advantages in this respect since it invites landscape evidence to be considered in the context of military command decisions and intentions that reflect the immediate tactical demands on combat units while also establishing their context in terms of an evolving military campaign. It is anticipated that these perspectives will have particular value when assessing the status of impact craters as heritage assets.

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REFERENCES

Army Air Forces. 1945. Ninth Air Force, April to November 1944. Army Air Forces Historical Studies No. 36. Washington DC: Headquarters, Army Air Forces.

Babits, Lawrence E. 2015. "The Principles of War and the 'Battle of the Barges." In The Archaeology of Engagement: Conflict and Revolution in the United States, edited by Dana L. Pertermann and Holly Kathryn Norton, 74–93. College Station: Texas A&M University Press.

Bleed, Peter, and Douglas D Scott. 2011. "Contexts for Conflict: Conceptual Tools for Interpreting Archaeological Reflections of Warfare." Journal of Conflict Archaeology 6 (1): 42–64.

Canadian Military Headquarters. 1947. "Canadian Participation in the Operations in North-West Europe, 1944. Part IV: First Canadian Army in the Pursuit (23 Aug - 30 Sep)." London.

Capps Tunwell, David, David G. Passmore, and Stephan Harrison. 2016. "Second World War Bomb Craters and the Archaeology of Allied Air Attacks in the Forests of the Normandie-Maine National Park, NW France." Journal of Field Archaeology 41 (3): 312–30.

Carter, Kit C., and Robert Mueller. 1991. U.S. Army Air Forces in World War II: Combat Chronology 1941-1945. Washington, D.C.: Center for Air Force History.

Copp, Terry. 2000. Montgomery's Scientists. Operational Research in Northwest Europe; The Work of No2 Operational Research Section with 21 Army Group, June 1944 to July 1945. Edited by Terry Copp. Waterloo, Ontario: Laurier Centre for Military Strategic and Disarmament Studies.

———. 2003. Fields of Fire: The Canadians in Normandy. Toronto: University of Toronto Press.

Department of the Army. 2008. Field Manual FM3-0, Operations. Washington DC: Headquarters, Department of the Army.

Ehlers Jr., Robert S. 2009. Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns. Lawrence, Kan.: University Press of Kansas.

Frye, Lori, and Benjamin Resnick. 2013. National Register of Historic Places Registration Form: Ewa Plain Battlefield. History.Idaho.Gov. Homestead, PA.

General Staff (Intelligence). 1918. Notes on German Shells, 1918. London: H.M. Stationary Office, 1918.

Hart, R.A. 1996. "Feeding Mars: The Role of Logistics in the German Defeat in Normandy, 1944." War in History 3 (4): 418–35.

Hesse, Ralf. 2014. "Geomorphological Traces of Conflict in High-Resolution Elevation Models." Applied Geography 46. Elsevier Ltd: 11–20. doi:10.1016/j.apgeog.2013.10.004.

Katz, C. Rachel. 2015. "Between Land and Sea: Surveying the Shoreline." In: Underwater Archaeology of a Pacific Battlefield: The WWII Battle of Saipan, edited by Jennifer F. McKinnon and Toni L. Carrell, 85-96. New York: Springer

Kobiałka, Dawid. 2017. "Airborne Laser Scanning and 20th Century Military Heritage in the Woodlands." Analecta Archaeologica Ressoviensia 12 (July): 247–69.

Mark, Eduard. 1994. Aerial Interdiction: Air Power and the Land Battle in Three American Wars. Washington, D.C.: Center for Air Force History.

McIntyre, Doug W. 1998. "Pursuit to the Seine: The Essex Scottish Regiment and the Forêt de La Londe, August 1944." Canadian Military History 7 (1): 59–72.

McKinnon, Jennifer F. and Toni L. Carrell. 2011. Saipan WWII Invasion Beaches Underwater Heritage Trail. Corpus Christi, Texas: Ships of Discovery and Exploration Research.

Office of the Chief of Ordnance. 1945. Terminal Ballistic Data. Volume III: Bombs, Artillery & Mortar Fire & Rockets. Washington D.C.: War Department.

Passmore, David G, David Capps Tunwell, and Stephan Harrison. Forthcoming. "WW2 conflict archaeology in the forests of northern Europe and the Nordic countries: recent progress and future prospects." Papers from Fields of Conflict 9, Dublin, September 2016.

Passmore, David G, David Capps Tunwell, and Stephan Harrison. 2016. "World War II Conflict and Post-Conflict Landscapes in Northwest France: An Evaluation of the Aerial Photographic Resource." In Conflict Landscapes and Archaeology from Above, edited by Birger Stichelbaut and David Cowley, 185–204. Farnham: Ashgate.

Passmore, David G, Stephan Harrison, and David Capps Tunwell. 2014. "Second World War Conflict Archaeology in the Forests of North-West Europe." Antiquity 88: 1275–90.

Paulaharju, Jyri. 1996. Field Guns in Finland, 1918 - 1995. Helsinki: Military Museum of Finland.

Russell, Edward T. 1999. Leaping the Atlantic Wall: Army Air Forces Campaigns in Western Europe, 1942-1945. U.S. Army. Washington, D.C.: Department of the Air Force (Air Force History and Museums Program).

Scott, Douglas D., Peter Bleed, and Amanda Renner. 2016. Battlespace 1865: Archaeology of the Landscapes, Strategies and Tactics of the North Platte Campaign, Nebraska. Oxford: Oxbow Books.

Service, National Park. 2106. Battlefield Survey Manual: American Battlefield Protection Program. Washington DC: National Park Service.

Shepherd, Elizabeth Jane. 2016. "Mapping Unexploded Ordnance in Italy: The Role of World War II Aerial Photographs." In Conflict Landscapes and Archaeology from Above, edited by Birger Stichelbaut and David C. Cowley, 205–18. Abingdon, Oxford: Ashgate.

Smith, Steven D. 2016. Preserving Fields of Conflict: Papers from the 2014 Fields of Conflict Conference and Preservation Workshop. Edited by Steven D. Smith. Columbia SC: University of South Carolina, South Carolina Institute of Archaeology and Anthropology.

Stacey, C.P. 1960. Official History of the Canadian Army in the Second World War. Volume III. The Victory Campaign: The Operations in North-West 1944-1945. Ottowa: Minister of National Defence.

Van der Schriek, Max, and Willem Beex. 2018. "The Application of LiDAR-Based DEMs on WWII Conflict Sites in the Netherlands." Journal of Conflict Archaeology. Routledge. doi:10.1080/15740773.2017.1440960.

A Decade of Community-Based Projects in the Pacific on WWII Conflict Sites

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INTRODUCTION

Over the course of a decade, Ships of Exploration and Discovery Research (Ships), Flinders University (FU) and now East Carolina University (ECU) have been working in the Pacific on WWII related terrestrial and underwater heritage in the Mariana Islands and more recently the Republic of Palau. The American Battlefield Protection Program (ABPP) funded most of this work; however, other grants were critical including NOAA's Ocean Exploration grant, NOAA's Pacific Region Grants Cooperative grant, and several small university grants from FU and ECU. Projects were largely multi-disciplinary and multinational in approach with partnerships from State and Federal agencies, universities, consulting firms, non-profits, and community groups from the mainland US, Australia, Japan, and Pacific Islands. The approach was community-based involving local descendants as well as stakeholders in the dive and tourism industry. This inclusive approach has allowed us to do more with less and value-add in many ways to the research and protection of WWII heritage in the Pacific. This paper provides an overview of several projects highlighting some of the achievements, findings, and challenges.

A TRAIL BEGINS

The development of a WWII heritage project originated in 2007 during conversations with the Commonwealth of the Northern Mariana Islands (CNMI) Historic Preservation Office (HPO). At that time, the HPO was interested in developing an underwater program. They were eager to have staff trained in underwater archaeology and to attract researchers interested in working in CNMI's waters. The HPO had already organized a NPS-funded contract to conduct remote sensing of the entire western lagoons (Tanapag and Garapan), which was carried out by Southeastern Archaeological Research, Inc., (SEARCH) in 2008. They organized a second NPS-funded contract to support the writing of a historical and archaeological maritime heritage context publication, which was carried out by Ships in 2009 (Carrell 2009). What was missing from the plans was a public outreach component that could provide HPO with a presence on the water, facilitate more interaction with the diving community, and promote the preservation of Saipan's underwater heritage. In addition to this missing piece, Saipan's weakening economy was foremost on the minds of government officials and community, and conversations at the very top levels of government were centered on tourism, in particular eco- and heritage tourism. As a result, it was agreed that the development of an underwater heritage trail to promote Saipan's diverse WWII resources would be an apt solution to all of the issues outlined above. As such an ABPP grant was submitted and funded, fueling the production of the trail

The WWII Maritime Heritage Trail: Battle of Saipan consists of nine stops with twelve vehicles. The trail is comprised of three US Sherman tanks, two Japanese landing craft, a Japanese Aichi E13A aircraft, a Japanese Kawanishi H8K aircraft, a US PBM Martin Mariner Aircraft, a US Avenger aircraft, a possible Japanese submarine chaser, a US Landing Vehicle Tracked (LVT), and a Japanese freighter. Their locations vary from very nearshore in shallow water (2–3 ft.) up to 30 ft. of water on the barrier reef. Some of the sites can be accessed from shore via snorkel, making it accessible to those who are not scuba certified. Site selection was informed by consulting with the diving industry as well as diversity in vehicle type and ethnic association (i.e., Japanese and American).

After much public and agency consultation, two types of interpretive products were selected for the heritage trail. Nine underwater guides inclusive of site plans, site descriptions, access information, and a conservation message were produced on 100 % waterproof, 100 % recyclable, and 100 % tree free paper. Four themed posters also were produced including: U.S. Aircraft, Japanese Aircraft, Shipwrecks, and Assault

Vehicles. The posters are 18 × 24 inches and double sided; the front includes a glossy photograph of a site and the back is populated with photographs as well as historical and archaeological information about the battle and the wrecks.

The posters are inclusive of multiple viewpoints and include quotes of several individuals from varying ethnic backgrounds involved (i.e., Chamorro, Carolinian, Korean, Japanese, etc.). They also include a message about the importance of protecting sites, examples of diver impacts through intentional and non-intentional behavior, and specific information about the legislation that protects underwater sites. The posters and guides were designed in such a way that additional sites can be added to the trail if future funding and interest is available. All products were printed in English and Japanese; funding was unavailable to print in Chamorro, Carolinian, Chinese, Korean, and Russian. The final PDF production prints of all the material were distributed to HPO, CRM, MVA, NPS, and NMHC so that reprints can be made based on local need. Copies of the posters were sent to the library and each school on the island to be used in education curriculum. Materials were also loaded onto a website for download and use.

Challenges

Anecdotal evidence from other areas of the world where similar trails exist suggests that the development and promotion of underwater heritage trails helps to foster an appreciation for local heritage and contributes to its preservation into the future (Scott-Ireton 2005). By involving and educating the public, a sense of ownership and stewardship begins to develop and the communities begin to rally behind protecting the resources for future generations. However, Saipan’s situation is different from other areas of the world where trails exist, in that the users that are attracted to and visit Saipan’s underwater heritage sites are primarily tourists, not locals. This created a challenge because local descendant community members were less engaged in the underwater heritage. Due to its out-of-sight-out-of-mind context and their lack of historical connection to it, the effort in creating ownership and stewardship was and still remains difficult. Descendant community members, in general, appear to be less interested in the WWII underwater heritage than sites on land such as the caves their families used for shelter and protection and for which they have an immediate story. The concept of “shared heritage” has been utilized specifically to draw out general themes of war as a human experience. However, this will always remain a challenge in colonial and post-colonial conflict contexts.

Locals regulate and maintain the tourism industry and their livelihood depends on the heritage’s sustainability. For this reason, we approached the development of the trail with an eye towards sustainability. Two Heritage Awareness Diving Seminar Trainings (HADS) were run in April 2011 in conjunction with the Florida Public Archaeology Network (FPAN). The training was developed to provide diving professionals with a greater knowledge of how to proactively protect shipwrecks, artificial reefs, and other submerged marine cultural heritage sites through acceptable diver behavior. The outcomes and benefits of HADS include increasing awareness of the fragility of submerged heritage; teaching proper anchoring, mooring, and diving behavior on such sites; and demonstrating the need for preservation of heritage for future generations and the economic benefits of heritage diving tourism.

The connection between economic gain and heritage preservation is a precarious one because heritage sites are vulnerable resources and may be harmed by tourism activities. We have observed various impacts on sites on the trail from tourism (McKinnon 2014). One of the ways we attempted to counteract and learn from the effects of development of heritage tourism was to collect baseline data on the trail sites and compare them with a defined control group. A second ABPP grant supported a plan to conduct additional archaeological survey and initiate in-situ conservation surveys. In-situ surveys and studies are critical to regions such as the Pacific because there are limited resources (i.e., funding, staff, and facilities) to conduct recovery and conservation of submerged objects and sites. Baseline conservation and archaeological data collected on new sites are critical for HPO’s understanding of the differential impacts of site visitation on those included in the trail. The in-situ conservation surveys were conducted on the trail sties and on control sites not on the trail for comparison purposes.

All of this conservation and archaeological data was incorporated into a preservation and management plan that was reviewed and approved by the HPO. The plan identified the natural and cultural threats currently impacting underwater WWII sites in Saipan and provided recommendations for mitigating these threats and managing the sites in the short and long term. Each recommendation was made based on discussions with managing agencies and the dive community tempered with knowledge of the sites, their historical and archaeological context, the environmental and cultural impacts affecting the sites, and the social, economic, and political conditions of Saipan. Further, it was written with the knowledge and awareness that the plan was funded by an American battlefield grant, which presented yet another layer of postcolonial complexity when "recommending" what a community should do with its heritage. It is disheartening to see sites damaged and wonder if it was the development of the trail or just a natural course of progression. However, a plan for tracking these impacts is in place and will help future archaeologists and managers with tough decisions.

One of the challenging aspects of interpreting underwater sites is that non-divers cannot visit the site or participate in the discovery of swimming up to a shipwreck and hovering on the sandy bottom covered with fish and corals. The second ABPP grant also supported was a collaboration with the National Park Service (NPS) Submerged Resources Center and Woods Hole Oceanographic institution (WHOI) to film all of the trail sites and create an interpretive film. The 18-minute 2D and RealD 3D film is narrated in English with Japanese subtitles. The film provides a mechanism for both divers and non-divers alike to visit the sites and learn about their history. It is shown at the NPS American Memorial Park on Saipan and War in the Pacific National Historical Park on Guam. Copies of the film were sent to all schools on the island of Saipan so that it may be used as an educational tool in the classroom, and the film is on YouTube for free viewing and download. As a result, hundreds of thousands of people will now learn the history of the battle and can visit the aircraft, shipwrecks, and assault vehicles as they lay on the seabed.

Other challenges included limited funding for a print run of trail materials. Once the brochures and posters were distributed, there were no more left. This was mitigated by placing them on a website for download and lamination. Considerations for sustainable distribution should be part of every plan. Another issue is that once the trail was completed, there was no one to champion it. Despite working with the Marianas Visitors Authority, HPO, and other marine agencies, once we left the island it was the island's to promote not ours. Over the years promotion of the trail has waxed and waned. We have had some pick it up including one tour operator that built a glass-bottom boat to show the sites to tourists. Most recently a high school teacher is using the most recent 3D models we created of the sites in a curriculum for building virtual reality experiences. While it seems to languish at times, when someone happens upon it, the information is readily available for use in many ways.

Out of the Water into the Caves

With more visitors, more development, and more spelunking and exploration, natural and human-made caves that hold remnants of both ancient Chamorro culture and WWII history are being heavily impacted on the island of Saipan. This activity was brought to the attention of the local community when videos and photographs of cave exploration, artifacts and rock art began appearing on blogs, Flicker, and YouTube. This concerned local community members and as a result, a project was created to assess community interest in protecting these resources. Funded by a third ABPP grant, the project consisted of community meetings, landowner consultation and interviews, archaeological survey of caves on private and public lands, development of radio and television PSAs and ultimately the creation of a preservation plan with input from the community.

Researchers from Ships and FU traveled to Saipan several times to evaluate the caves, conduct research, speak with stakeholders, hold community meetings, and produce PSAs. A preservation plan for the caves was written based on thorough evaluation of the resources. It also incorporated the ideas, desires, and needs of the community and stakeholders as expressed in the individual and community meetings concerning the future of the sites and battlefield. Protection for significant cave sites rests solely in the hands of local landowners and the government agencies charged with managing these resources. Outlined within the plan are strategies for addressing preservation through partnership opportunities and information about financial and technical sources of support.

The idea of a public service announcement came from a PSA project raising awareness about invasive brown tree snakes that had remarkable results in eradicating them from the island. Brochures or mailings are limited because they are generally viewed once and when they are distributed or out of print, they no longer exist. PSAs on the other hand can be aired and viewed repeatedly, reinforcing the content's message. When aired during peak time slots, such as the evening news, they can become even more effective. For a Pacific island that relies on television primarily for its news, PSAs serve to reach the widest possible audience. In addition, radio PSAs can reinforce and even reach a younger generation of stakeholders.

The creation of PSAs were only one part of the larger cave heritage project but their development built upon all aspects. Landowners who came to the public meetings to voice their opinions were invited to participate in the PSAs. They also opened their properties to the archaeological team who visited various caves to get a sense of what types of caves exist, what history they may hold, and what is impacting them. Finally, many community members participated in interviews during which they related their and their family's stories about caves use during WWII. Ultimately the message, "Our History, Our Stories" was chosen as the tagline for the PSAs to reflect the multiplicity of connections the community had to caves. Caves on the island of Saipan provided shelter to the ancient culture when they arrived thousands of years ago, they were the canvas on which the ancient peoples communicated through rock art and served as their burial grounds. During the war, families used the caves for shelter from bombs and bullets and today they still serve special purposes such as places of commemoration and memorialization. As community member Fred Camacho relates, "This has become part of our family album, and we have the obligation to protect it."

Challenges

A challenge of this project was the longevity of the PSAs, which cost money to air. A limited budget for airing the PSAs on TV and radio was included in the grant, but once that was depleted, the PSAs no longer run. Some of the stations committed to running them for free when they have air time, but there is no guarantee. We placed them on YouTube for full access by the general public with the hopes that if someone searched, they may find them. Unfortunately, no local group has formed to pick up the cause and become stewards for protecting the sites, nor has the HPO taken any of the steps outlined in the preservation plan.

Island Hopping

One recommendation of the 2011 management plan was to repeat the in-situ conservation measurements at a regular interval to gather additional data on cultural and natural impacts (McKinnon and Carrell 2011b:73-74). The super typhoon Soudelor that struck the island of Saipan in 2015 added urgency to addressing the impacts of natural impacts on shallow water sites. Additionally, the Battle for Tinian and its underwater heritage had received little to no archeological investigation. The next step in this multi-year effort to investigate, document, and preserve the WWII underwater heritage of the CNMI was the project, OPERATION FORAGER: Expanding Documentation and Research of WWII Maritime Heritage, funded by a fourth ABPP grant.

The project had two major objectives: first to expand our regional understanding of OPERATION FORAGER in the Mariana Islands by beginning baseline identification and documentation of WWII maritime heritage related to the Battle of Tinian and subsequent long-range bombing missions. The second was to continue to monitor the existing WWII Maritime Heritage Trail: Battle of Saipan through site assessments, in-situ conservation surveys, and comparing new photogrammetric data with legacy data for the purposes of identifying short- and longer-term impacts from natural disasters possibly related to climate change.

Revisiting the trail and control sites and collecting a second set of corrosion measurements provides a longitudinal picture of changes over time. Concurrently collecting updated information on natural impacts that affect site formation processes (i.e. scouring, sediment build-up) and cultural impacts (i.e., looting, vandalism, etc.) is useful to help differentiate between natural and cultural influences. This latter activity has been difficult to quantify. With the advent of 3D modeling based on photogrammetry, however, direct comparisons with legacy images may permit more controlled quantifiable assessments.

Photogrammetry has been repeatedly tested in archeological surveys and excavations in dry and submerged environments. The resulting images and models can be shown as animations, drawings, and orthogonal projections (Yamafune et.al. 2016). Among the benefits of 3D photogrammetry is the speed with which accurate data can be collected and, with the appropriate complimentary software, the ability to obtain accurate measurements. This is particularly important when monitoring the impacts to sites over time. All of the sites investigated during the trail project were re-photographed using photogrammetry and 3D models were produced. Legacy images from previous projects were useful for direct comparison.

Comparative analysis of the corrosion parameter data measured on the wreck sites in 2012 and 2017 in combination with the environmental and historical information revealed some conclusions regarding the deterioration and preservation of the WWII wrecks in Saipan. The corrosion rates of all iron shipwrecks have increased over this five year period. Furthermore, there is very little residual iron remaining on the LVT 1, LVT 2 and Daihatsu 2 sites and large sections of the Japanese freighter, subchaser, and the steamship also possessed very little residual metal. Therefore, these wrecks will be more susceptible to further structural collapse in the near future, especially during periods of extreme weather events, such as typhoons. Notably, in 2017 some sections of Daihatsu 2, Daihatsu 3, and the Japanese freighter had already collapsed and was probably due to the catastrophic effects of super typhoon Soudelor.

The corrosion rate of the Avenger aircraft has decreased and the corrosion rates of Jake, Mariner and Emily have not changed significantly over this five year time period. However, the corrosion rate of the Coronado aircraft appeared to have increased slightly from 2012 to 2017. It does appear that the corrosion mechanisms of different areas of the aircraft wrecks are slowly changing over time and this is probably due to galvanic corrosion of electrically connected areas in the aircraft manufactured with different aluminum alloy compositions corroding at different rates. In addition, the effect of extreme weather events, such as super typhoon Soudelor on these aircraft wrecks should not be under estimated. This results in an increase in water movement and the amount of oxygen reaching the aluminum alloy surfaces to increase considerably, causing increased formation of the passivating aluminum oxide layer and possibly slowing the overall corrosion rate of the aircraft.

The more surveys carried out, the better, as it will provide more information regarding the rate of deterioration and the inherent stability of a site, which will assist in recognizing which sites are a priority for future implementation of appropriate in-situ conservation management strategies. In this way, using a combination of information gathered from the archaeological, biological, conservation, and photogrammetric surveys over a number of years, it should be possible to prioritize these submerged sites with respect to their archaeological significance, individual long-term stability and overall in situ management requirements and the most appropriate management plans determined and possibly applied to each site if required.

The second component of the project involved a study of the events associated with the battle for Tinian from the military landscape perspective. KOCOA, one form of military terrain analysis, involves identifying Key/decisive terrain, Observation and fields of fire, Cover and concealment, Obstacles, and Avenues of approach/withdrawal within the military landscape was applied to this project. While KOCOA analysis was developed for terrestrial landscape analysis, it has been applied to maritime engagements (Babits et al. 2011, Sabick and Dennis 2011, Bright 2012, McKinnon and Carrell 2015). It is important to note, however, that KOCOA analysis of underwater and aviation battlefields can involve a different set of parameters including environmental conditions not always evident in terrestrial analyses. Babits et al. (2011) have outlined some of the new parameters for understanding naval engagements using KOCOA and we are currently engaging in the aviation aspect.

The landing beaches Unai Chulu (White 2) and Unai Babui (White 1) were the subject of our survey area. Within these areas we located the remains of an LVT2, a large Danforth style anchor, a large navy-style stockless anchor, sections of a second LVT scattered over a 100 ft. area offshore, and the remains of a possible DUKW. All sites were recorded and reflect directly the type of vehicles and methodology of an amphibious attack.

Challenges

The application of KOCOA is challenging for both amphibious invasions and battles that involve aerial combat. Adjustments have to be made to take into consideration these elements of warfare related to situational parameters or restrictions to naval or aviation technologies.

For example, within the amphibious context, key terrain must include navigable waterways, which are often condition dependent (e.g. tide/current) and dynamic (Babits et al. 2011:3) and the same could be stated about avenue of approach (Babits et al. 2011:4). Further, an avenue of approach may not be an avenue of withdrawal if environmental conditions do not permit it.

Cover and concealment in maritime engagements is often limited or absent, while cover is restricted to the vessels themselves (Babits et al. 2011:3). Obstacles are often fixed in terrestrial engagements; however, they can be temporally variable (e.g. low tide) within the maritime context. Furthermore, if vessels are engaged with terrestrial forces, the water itself may act as an obstacle to terrestrial forces (Babits et al. 2011:3).

Vessels' fields of fire were position dependent and were therefore episodic and condition dependent. Because vessels on water are high-visibility structures, Babits et al. (2011:3) note that observation has less of an impact in maritime contexts.

Throughout the war in the Pacific, carrier and land based aircraft played an increasingly significant role in augmenting observation of friendly and enemy forces and terrain features. As such, the incorporation of aviation technology will aid in better understanding observation. Technological considerations including aircraft restrictions such as fuel consumption limits, flight ceilings, and air traffic patterns can impact observation, areas of approach/withdrawal, and cover. Further, aerial engagements can take place over larger geographical areas requiring increased surveillance capacity and mobile fields of fire and the placement of marine and terrestrial support features, such as carriers or airstrips, anti-aircraft artillery by the enemy, and refueling and rendezvous points. Finally, weather, time of day, and topography are different from terrestrial parameters and should be considered. These are just a few of the considerations that have to be taken into account when applying KOCOA to amphibious and aerial engagements.

Active Projects

ABPP has recently supported a National Register nomination grant to list all of the sites on the heritage trail. We are in the process of conducting historical research and writing those nominations and hope to have a draft for circulation by October. The nomination will be a multiple property listing and include both US and Japanese sites.

We have also expanded our invasion beaches interest beyond the Marianas to the Republic of Palau and are supported by another ABPP grant to conduct the first comprehensive background survey of the invasion beaches at Peleliu. That research is currently underway and includes historical research into the battle which will create a predictive model for identifying sites on the battlefield. This is the first systematic survey of underwater portions of the invasion and supports an existing wealth of knowledge about the terrestrial battlefield (Denfeld 1988; Price et al. 2012) to complete the picture.

Finally, we are actively working on an update of ABPP's Submerged Battlefield Protection Manual to include more modern battlefield considerations as well as updates in theoretical and methodological approaches that we have learned over the last decade of refining our approaches to submerged battlefields. Considerations with regards to the use of KOCOA will be incorporated based on ours and other's applications.

Further, considerations for working in and with non-combatant and descendant communities such as the Pacific will be incorporated to demonstrate the depth and breadth of impact the student of underwater conflict heritage can have for a community.

REFERENCES

Babits, Lawrence, Christopher T. Espenshade, and Sarah Lowry. *Battlefield Analysis: Six Maritime Battles in Maryland Revolutionary War and War of 1812*. Stone Mountain: New South Associates, 2011.

Bright, John C. “The last ambush: an adapted battlefield analysis of the U-576 attack upon allied convoy KS-520 off Cape Hatteras during the Second World War” master’s thesis, East Carolina University, Greenville, 2012.

Carrell, Toni. L. (Ed.). *Maritime History and Archaeology of the Commonwealth of the Northern Mariana Islands*. Santa Fe: Ships of Exploration and Discovery Research Inc., 2009.

Denfeld, D. Colt. “Peleliu Revisited An Historical and Archaeological Survey of World War II Sites on Peleliu Island.” Saipan: Micronesian Archaeological Survey, Report Number 24, 1988.

Price, Neil, Rich Knecht, and Gavin Lindsay. WWII Battlefield Survey of Peleliu Island, Peleliu State, Republic of Palau. Washington, DC: American Battlefield Protection Program Grant, 2012.

McKinnon Jennifer F. “Memorialization, Graffiti and Artifact Movement: a Case Study of Cultural Impacts on WWII Underwater Cultural Heritage in the Commonwealth of the Northern Mariana Islands.” *Journal of Maritime Archaeology* 10, no.1 (2015). 11-27.

McKinnon, Jennifer, Julie Mushynsky, and Genevieve Cabrera. “A Fluid Sea in the Mariana Islands: Community Archaeology and Mapping the Seascape of Saipan.” *Journal of Maritime Archaeology* 9 (2014). 59-79.

McKinnon, Jennifer F. & Carrell, Toni L. *Saipan WWII Invasion Beaches Underwater Heritage Trail*. Santa Fe: Ships of Exploration and Discovery Research, Inc., 2011.

McKinnon, J. and Carrell, T. *Underwater Archaeology of a Pacific Battlefield: The Battle of Saipan*. New York: Springer Press, 2015.

Sabick, Christopher R., and Joanne M. Dennis *Submerged Battlefield Manual*. Vergennes: Lake Champlain Maritime Museum, 2011.

Scott-Ireton, Della “Preserves, parks, and trails: Strategy and response in Maritime Cultural Resource Management” PhD diss., Florida State University, Tallahassee, 2005.

Yamafune, Kotaro, Rodrigo Torres, and Filipe Castro. “Multi-Image Photogrammetry to Record and Reconstruct Underwater Shipwreck Sites.” *Journal of Archaeological Method and Theory* 24 no. 3 (2016). 703-725.

Avocational Detectorists and Battlefield Research: Potential Data Biases

Christopher T. Espenshade

INTRODUCTION

To many conflict archaeologists, the studies of the Little Big Horn battlefield stand as an important milepost in the development of the field. It is important to note that the success of those studies relied heavily on the participation of avocational detectorists (Scott and Fox 1987; Fox 1993). In the three decades since Scott's pioneering effort, archaeologists studying battlefields have increasingly recognized the many positives of including avocational detectorists in the research. Our discipline in North America has seen a shift – from adversarial to collaborative -- in relationships between the professional community and the avocationalists. Smith (2016:4) describes the goal of many battlefield archaeologists as "integrating the keen interest of private citizens in military history and militaria, and their detecting skills, into efforts to preserve archaeological data." The National Park Service and their American Battlefield Protection Program (ABPP) have been major drivers toward greater public participation in battlefield research.

The purpose of this paper is to discuss potential data biases that may be created by the use of avocational detectorists. In a 2017 article in *Advanced in Archaeological Practice*, Espenshade noted three types of possible biases:

1. *Find Rates*. Properly trained professional archaeologists may find significantly more artifacts than avocational detectorists. Espenshade cited data from his ABPP work at Bennington Battlefield (Selig et al. 2017), where the professional crew found 8.8 artifacts per personday, despite detecting some completely unproductive areas. The avocational detectorists averaged 3.7 artifacts per personday, despite being purposefully placed on the most productive areas of the battlefield. These data undermine what was once popular wisdom that it took 20-30 years to master detecting, and therefore avocationalists will always outperform professionals.
2. *Bias Against Iron*. Many avocational detectorists routinely ignore ferrous signals when detecting on their own. This well-entrenched habit may continue even when they are instructed to dig all signals. Unquantified observations from the Bennington. ABPP project indicated that certain avocational detectorists were digging no iron targets, even as those around them were finding many ferrous items.
3. *Poor Areas and Self-Fulfilling Prophecies*. In their hobby detecting, avocational detectorists focus their limited time on the most productive areas. Negative data is not important to them. In battlefield archaeology, it is important that all areas are covered with the same intensity so that we can properly recognize and interpret areas of high and low density. Again, unquantified field observations at Bennington indicated that care decreased and speed increased in areas perceived as unproductive. The avocational detectorists observed what was being found by others, surveyed the MDF flags, and adjusted their efforts accordingly. Such behavior creates a self-fulfilling prophecy and derives data that overstate the differences between good and bad areas.

Espenshade (2017) offered solutions to mitigate the biases, and also called for conflict archaeologists to be aware of the potential biases when using the derived data.

New Data

A limitation of the Espenshade (2017) article was the paucity of data to quantify these biases. This was especially true for the iron bias. Two additional episodes of detecting at Bennington Battlefield created a controlled experiment to yield such data. In October 2016, Espenshade supervised eight avocational detectorists in a morning of detecting a 100 x 90-meter area in the Surrender Field of the first battle (Figure 1). This was part of the post-ABPP effort to characterize different areas of the large battlefield. The data collection was regimented through the establishment of 1.5-meter wide lanes over the entire tract. The avocational detectorists were instructed to sweep the entire lane in one direction, excavating all targets.

Detectors were to be operated in the All Metal mode. Each find was assigned a metal detector find (MDF) number, and was tagged, bagged, flagged, and mapped by that number.

Figure 1. Avocational Detectorists, October 2016 (photograph by author).

In an opportune turn of events, Espenshade and his fellow instructors for Advanced Metal Detecting for the Archaeologist (AMDA) were able to supervise a re-survey of the same tract using AMDA students in August of 2017 (Figure 2). The AMDA class ultimately surveyed a much greater area over two days of fieldwork, but the effort began with the tract examined in 2016 by avocational detectorists. The efforts of the AMDA students allowed for further characterization of the surrender field from the first battle (see Espenshade and Severts 2016 for an introduction to the AMDA).

The parameters remained the same as in 2016; full coverage in one direction, with the excavation of all targets. The field had remained fallow in the interim since the first detection effort. As the land is posted state property, little to no illicit detecting was inferred over the interim. For the August 2017 class, the grass was mowed, the grid was reestablished, and detecting proceeded.

Figure 2. AMDA Class, August 2017 (photograph by author).

The experiment may be suspect based on the relatively small area examined by both efforts. Although only approximately100 x 90 meters (2.1 acres), the grid yielded a good sample of artifacts during both efforts. In 2016, 25 artifacts were recovered in the grid. Thirty-six artifacts were recovered in

2017. The differences in sample composition were so conspicuous that this researcher feels confident that the observed patterning would not have changed significantly with more land examined.

Results

During the 2016 survey, the avocational detectorists recovered 25 items (Figure 3). These included: 15 lead pieces (11 projectiles, 4 segments of lead pipe); five brass items; four iron artifacts (a buckle, a wagon part, a spike, and unidentified iron); and one pot metal buckle. No nails were recovered. The author noted that the advocational detectorists were sweeping too quickly, despite the author's effort to get them to reduce their speed. The artifact mix is not unusual for a battlefield that has also served as an agricultural field.

Figure 3. 2016 Metal Detector Finds on GoogleEarth Imagery.

The 2017 survey was conducted under similar conditions, under identical instructions. The mix of devices used in each effort was similar. The 2017 survey recovered 36 items including: 25 nails; one spike; five pieces of iron hardware; three unidentified iron objects; and two horseshoes. Only the two horseshoes were possibly battle-related. All of the 2017 finds were ferrous, and a conflict archaeologist would be hard pressed to recognize this artifact mix as representing a portion of a core battlefield.

When we compare summaries of the two samples, the differences are clear and understandable. Figure 4 shows that the 2016 sample is dominated by fine metal (brass) and lead, which compromise the target categories for most avocational detectorists working a battlefield. Figure 5 shows that the 2017 sample was all iron. To be clear, the iron artifacts discovered in 2017 had all been present in the effective range of a detector in 2016. These were not tiny ferrous items that would have been easily missed. The horseshoes could have been found by any device in the field in 2016. Instead, the results show a clear bias in 2016 against exploring and excavating iron objects, despite the clear instruction to dig all targets. There were sufficient "quality" targets (according to their mindset) available in 2016 that many or all of the avocational detectorists chose not to register and investigate ferrous signals. It is not clear if this was an active decision made on a target-by-target basis, or if this reflects a long ingrained habit to not excavate iron.

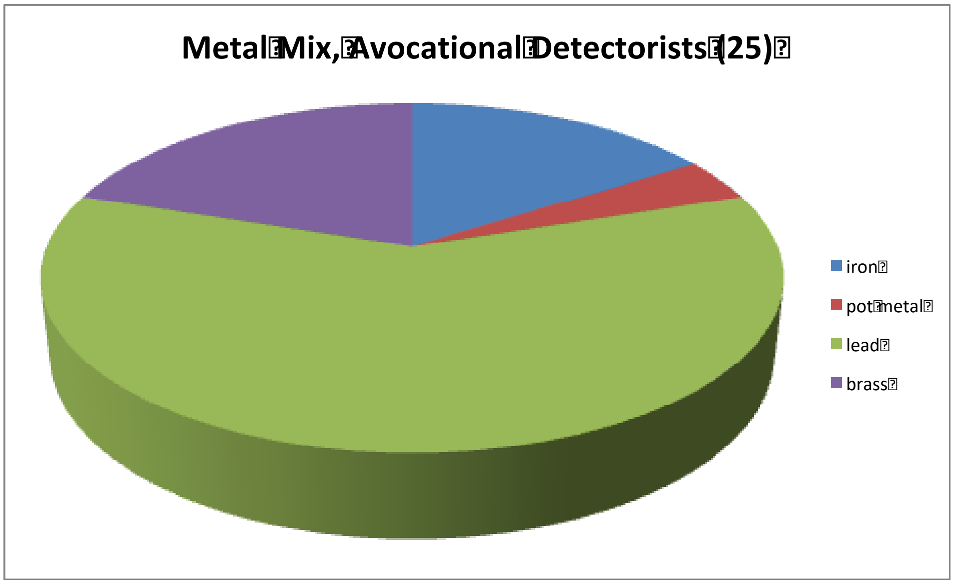

Figure 4. Metal Mix of 2016 Collection by Avocational Detectorists in 2016.

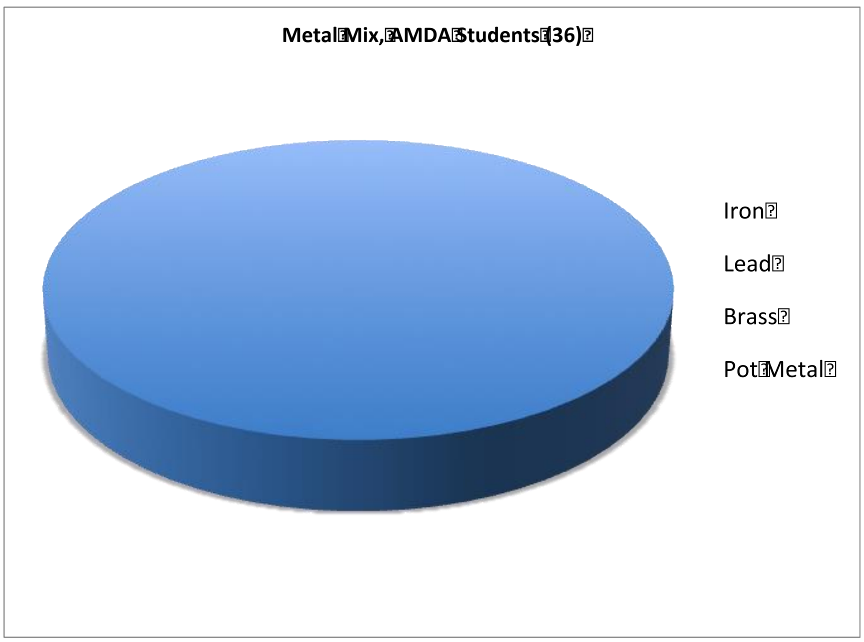

Figure 5. Metal Mix of Collection by AMDA Students in 2017 in Common Area.

Another way to judge the bias is to consider the metal mix from the AMDA survey of adjacent areas (Figure 6). These areas should have yielded a more representative material mix, what can reasonably be expected from a thorough examination. The metal mix from the adjacent areas surveyed by the AMDA students shows much iron (86% of the collection), but still has strong minority presence of lead (7%) and brass (5%).

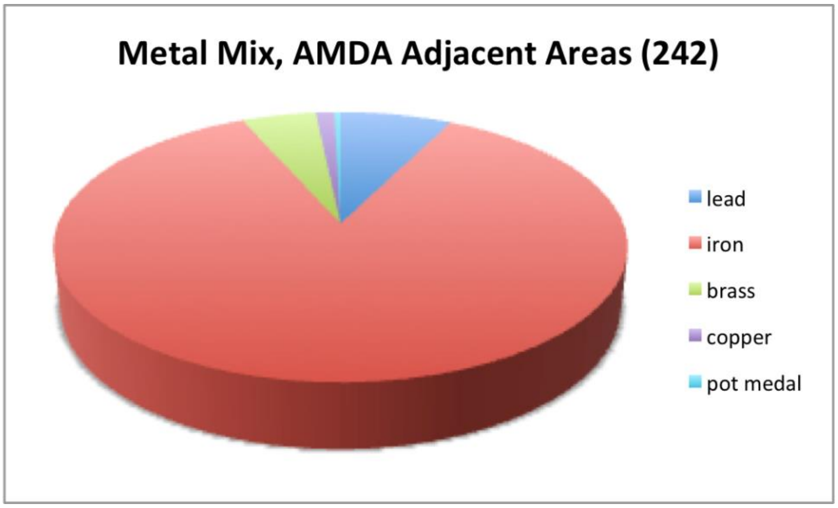

Figure 6. Metal Mix in Collection by AMDA Students in 2017 Beyond Common Area.

As an ancillary outcome, the results also highlight why it is preferable to refresh a plowzone population (or sample universe) by either replowing or by removing a portion of the topsoil if you suspect the site has been recently detected. A single episode of intensive detecting by volunteers in 2016 was sufficient to remove almost all the readily detected, battle-related artifacts from the search area. The AMDA students were left with the least diagnostic sub-set for battlefields of the American Revolution.

How might the overlooking of iron by volunteers affect our interpretations? There are two examples from elsewhere at the Bennington Battlefield that I think are good examples. The first example demonstrates how a single iron artifact can provide valuable data. During the survey of another portion of the fields by the AMDA class, one student discovered a ball from a British 6-pounder. Using the find location, line of sight, topography, and the historic road course, it is possible to suggest likely locations for the 6-pounder and the Colonials. This modeling allows us to suggest how far east the Colonials were pushed during the second battle, before their reinforcements arrived. This, in turn, identifies a new, specific location for future intensive detector survey, assuming the park can obtain land-owner permission. To protect this suspected locus of the battlefield, no illustration is provided here.

In the second example, volunteers were used in detector survey in the field of fire from the German breastwork, which saw action at the start of the first battle. The volunteers were instructed to excavate all targets, and those finding grape shot were congratulated loudly. However, it was clear that certain of the volunteers were not digging iron targets. We used the count and locations of grape shot to reconstruct three facets of this segment of the first battle: 1) only one or two rounds of grape shot were fired, which is consistent with archival reports of the rapid over-running of the breastwork; 2) the Colonials were not in a clear field of fire until they exited the tree line, approximately 60 meters from the breastwork, as also supported by the fired musket ball patterning, and; 3) the location of the three pounder could be estimated by working backwards from the central tendency ray and the observed spread. Because there was no record of who received but did not investigate a ferrous target signal, it is not possible to know if any, or how many, additional grape shot were omitted from the database.

DISCUSSION

In Espenshade (2017), it was argued that unquantified observations of avocational detector behavior suggested several potential biases in the resultant data. The present study quantified the results from a controlled experiment, and showed extremely low level of volunteer compliance in following instructions to dig iron targets.

As to solutions, Espenshade (2017) offered several possible means to mitigate the anti-iron bias among certain avocational detectorists:

1. Educate volunteers on importance of iron items. Show with specific examples how iron artifacts have proven valuable in battlefield studies.

2. Identify the specific type of iron artifacts expected. It may be possible to motivate volunteers to excavate iron artifacts if they know what they seek.

3. De-emphasize speed. Many avocational detectorists equate speed with thoroughness, but fast detecting is only effective if you are willing to only dig the glamour metals. In the field, stress that this is not a race, and repeatedly tell folks to slow down. I recognize that it is hard to put the brakes on, especially when we would like to cover as much acreage as is feasible. However, it is up to the professional archaeologist to recognize the difference between a lot of questionable data and a smaller collection of more reliable data.

4. Applaud those who find iron. Use positive reinforcement and peer pressure to try to get all the volunteers excavating all targets.

5. Monitor field behavior. We typically maintain a running field log of metal detector finds, with a preliminary description of each item. It may be productive to add the finders' initials, allowing the archaeologist to spot anomalies that may be related to the bias of specific detectorists.

6. If you perceive iron is being skipped, have the area re-surveyed by the same people. Make it clear that a volunteer cannot increase their chances of finding "goodies" (e.g., buttons and musketballs) by ignoring iron.

7. Be aware of the potential bias when using the data. The archaeologist should be explicit in the potential for a bias against iron, and should report the possible limitations of the data due to that bias.

8. Make volunteers work in pairs. Two people working together are less likely to ignore instructions than when folks are working solo. If you identify a pair that seem to be going too fast or seems to be finding suspiciously little iron, break up that pair and place each with another partner. Use peer pressure to make folks better follow instructions.

It must be noted that to this point, avocational detectorists have been discussed as a homogeneous mass, but that does not fully capture the group. In any group of avocational detectorists, there will be certain individuals who are better at following instructions and who better understand the importance of limiting data bias. The conflict archaeologist will profit from tracking the performances individual to individual, and creating rankings on a call-back list. The idea is to reward and reinforce positive behaviors (e.g., listening to instructions) while at the same time improving the volunteer corps project to project.

There can be little question of the value of involving avocational detectorists in battlefield research. The professional archaeologist has the three obligations of: 1) recognizing the potential data biases that may result from using avocational detectorists; 2) taking the steps necessary minimize the biases, as feasible; and 3) keeping the biases in mind when designing field work and analyses. As avocational detectorists are increasingly invited to assist in battlefield research, it is imperative that we acknowledge both the good skill and the bad habits they may bring to a project.

REFERENCES

Espenshade, Christopher T. 2017. Data Considerations When Teaming with Avocational Detectorists. *Advances in Archaeological Practice* 5(2):1-8.

2018. *Metal Detector Survey of Portions of the Surrender Field, Bennington Battlefield*. Advanced Metal Detecting for the Archaeologist, Wellsboro, Pennsylvania. Report submitted to New York State Office of Parks, Recreation, and Historic Preservation, Albany.

Espenshade, Christopher T., and Patrick Severts. 2016. Better Training = Better Battlefield Interpretation: The AMD and APP Classes. In *Preserving Fields of Conflict: Papers from the 2014 Fields of Conflict Conference and Preservation Workshop*, edited by Steven D. Smith, pp. 11-16. South Carolina Institute of Archaeology and Anthropology, Columbia.

Fox, Richard Allen, Jr. 1993. *Archaeology, History, and Custer's Last Battle*. University of Oklahoma Press, Norman.

Scott, Douglas D., and Richard A. Fox, Jr. 1987. *Archaeological Insights into the Custer Battle: An Assessment of the 1984 Field Season*. University of Oklahoma Press, Norman.

Selig, Robert, Christopher T. Espenshade, Wade P. Catts, Elizabeth LaVinge, and James Montney. 2017. *Cultural Resources Survey of the Bennington Battlefield, Walloomsac, New York.* Commonwealth Heritage Group, Jackson, Michigan. Report submitted the American Battlefield Protection Program, Washington, D.C., and New York State Office of Parks, Recreation, and Historic Preservation, Albany.

Smith, Steven D. 2016. Introduction to the Volume. In *Preserving Fields of Conflict: Papers from the 2014 Fields of Conflict Conference and Preservation Workshop*, edited by Steven D. Smith, pp. 1-6. South Carolina Institute of Archaeology and Anthropology, Columbia.

Battle of the Java Sea: Past and Present Conflicts

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Abstract

Three Dutch naval ships, HNLMS De Ruyter, HNLMS Java and HNLMS Kortenaer went down in the Battle of the Java Sea on 27 February 1942, claiming the lives of 915 sailors. In November 2016 an international diving team from the Karel Doorman Foundation discovered that the warships had disappeared.

The management and protection of shipwrecks from the Second World War is very complicated, because of the different values that different stakeholders attach to it. These WWII shipwrecks are often war graves, important to relatives as lieux de mémoire. The shipwrecks thus have an emotional, commemoration value, but they also have a historical, archaeological and intrinsic value. If WWII shipwrecks are investigated using archaeological methods, they can provide new information on the WWII period, but it can also change certain details. To the salvors the shipwrecks have an economic value, but they actually have several economic values as they also bring in diving tourists, and they are fishing spots for the local fishermen. These different values played a major role during the joint Dutch-Indonesian investigation that followed after the notification that the three Dutch warships had disappeared from the bottom of the Java Sea.

Only with proper understanding and consideration of the different values or significances the WWII shipwrecks hold to different stakeholders, new ways of managing these complex sites may be developed that will be effective in the long run. Countries and different stakeholder groups must work together on this.

1. Introduction

In the 1980's when underwater archaeology was still in its infancy, iron shipwrecks, especially those from the World Wars and after, were of no interest to professional archaeologists. They focused on wooden shipwrecks from before 1800. On the contrary sports divers were mainly active on these sites because they were large, sticking high above the sandy seabed and were also full of sea life.

The approach towards shipwrecks from these more recent periods has completely changed. Archaeologists nowadays see the benefits of studying these 'young' sites because they provide additional information to the historical information we already have from these extremely important periods, historically. Objective information from a time in which contemporary documents are almost by definition not objective.

The management and protection of shipwrecks from the Second World War is very complicated. First of all, this is because of what makes them interesting for divers: highly visible, protruding the seabed and being made of iron, which is difficult to preserve. But also because of the different and sometimes contrasting values that stakeholders attribute to it. Although the Second World War ended almost 75 years ago, there are still people alive that experienced the disasters at sea. Families are still dealing with the loss of (grand)parents, uncles, aunts, brothers and sisters or other relatives that died on these ships. People consider the wrecks to be war graves. In some countries these wrecks therefore have an official protection status while in other countries they don't. There these wrecks may be threatened by another value they contain: an economic value. Copper, lead and steel from the seabed are worth millions. Salvaging companies make use of that, destroying the wrecks and mining them on a large scale. By doing so they take away the only hard substrate from the seabed which has an effect on the biodiversity. They also take away the places for commemoration and dive enjoyment.

These different values played a major role in the joint Dutch-Indonesian investigation that followed after the report in November 2016 that three Dutch warships had disappeared from the bottom of the Java Sea. Relatives of the ones that died on board of the HNLMS De Ruyter, HNLMS Java and HNLMS Kortenaer reacted emotionally to the news. The media paid a lot of attention to this matter, making the subject even more politically focussed than it already was. To understand what might have happened scientists had to view, weigh and evaluate the available data from third parties. During this process the question arose: what is important in the management and protection of these shipwrecks? How can we establish a value and who determines that? The question is relevant because it affects an eventual management plan that needed to be drawn up. Both the Netherlands (as flag state) and Indonesia (as coastal state) were involved in the assessment. Eventually the management plan should be a cooperation and shared responsibility between the two countries as well. It is therefore important to also consider friction points when it comes to decisions about the management, in order to be able to overcome them. In this article, the case of the wrecks of the Battle of the Java Sea will serve as a guideline for the discussion about the complexity of valuing and managing World War II shipwrecks.

Figure 1: "Battle of the Java Sea", painting by J. van der Ven, 1970 (Navy Museum Den Helder).

2. The Battle in the Java Sea

On 27 February 1942 the Battle of the Java Sea took place between the American-British-Dutch-Australian Command (ABDACOM) and the Japanese Imperial Navy. The ABDACOM, was a combination of the American, British, Dutch and Australian forces in East Asia that aimed to stop the Japanese invasion of the British and Dutch colonies in the region. During this battle 915 sailors died when three Dutch navy ships were torpedoed by the Japanese Imperial Navy just north of Java in the Java Sea. These were the light cruisers HNLMS De Ruyter, flagship of the Rear-Admiral Karel Doorman, and the HNLMS Java, as well as the destroyer HNLMS Kortenaer. In addition to these, American, British and Australian ships also sank during the battle and the one that followed on the 1st of March in the Strait of Sunda.[8]

3. Timeline

[8] For a more detailed description of the Battle in the Java Sea see: Bezemer 1987; Bosscher 1986; Cox 2011; Cox 2014; Doedens/Mulder 2017; Helfrich 1950; Kroese 1945; Nater 1980.

In 2002, a group of sports divers, who operated from Bali with the diving ship MV Empress, discovered two steel shipwrecks identified by them as De Ruyter and Java. Two years later, the same team also discovered the Kortenaer (Denlay, 2004). After that discovery, a number of years passed, during which people sporadically dived on the wrecks. For the 75th year commemoration the Maritime Programme of the Cultural Heritage Agency of the Netherlands was exploring the possibilities of organising a joint management plan for all the wrecks of the battle, including the Dutch, Australian, British, American and Japanese wrecks and had contacted colleagues of these countries to start up discussion to do so. At the same time the Karel Doorman Fonds (KDF) wanted the wrecks to be filmed underwater and organized a diving trip to the Dutch wrecks. Ideas were raised to put the two initiatives together and approach the Indonesian government to obtain permission for diving. When this permission asked by the RCE and the Ministry of Defence remained unanswered, it was evident that an official Dutch dive expedition was not taking place.

In November 2016, the KDF went to the three wreck locations to capture them on film for the commemoration in February 2017. Diving would be executed by the same group who had been there a few times prior to that, with the diving ship that had taken them before. During that diving trip it was discovered that at the positions almost nothing was left of the shipwrecks. On the seabed, holes were found matching the size of the ships hulls (170 m and 155 m for De Ruyter and Java respectively) and small fragments of the ships were found sticking out of the clayish seabed.

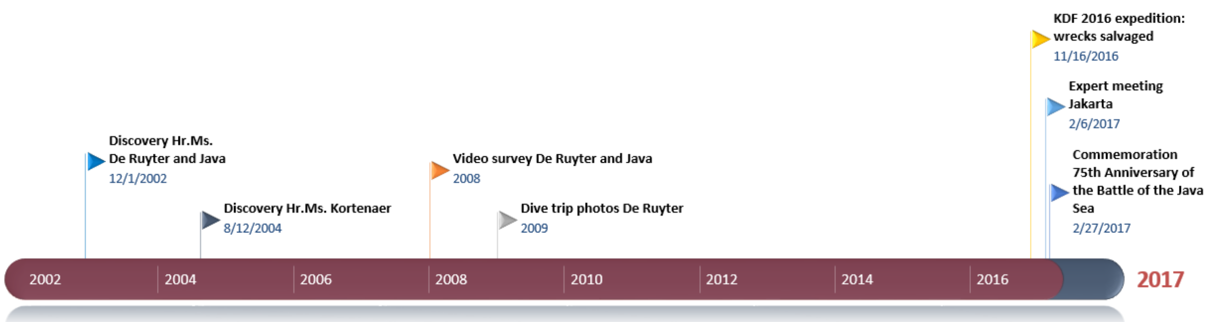


Figure 2: Timeline with the events since the discovery of HNLMS De Ruyter and Kortenaer in 2002.

From the Kortenaer only a small part, about 20%, of the previously discovered shipwreck remained. An inspection at the locations of a number of American and English ships that also sank during the Battle of the Java Sea showed the same: completely and partially disappeared shipwrecks (Fock, 2016). This discovery immediately caused a lot of tension between the government of Indonesia and the countries that had lost ships in the archipelago during the battle (Pearson, 2017). Particularly the tension with the Netherlands was very high for several reasons: the damage done to a place where so many lost their lives, because the Netherlands still claims the warships as property and also because of the historical relationship between the two countries, the Netherlands being the former colonizer of Indonesia.[9] This increased tension caused unprecedented media attention for the issue (Manders et al., 2017, p. 5).

4. Joint research

Through high diplomatic talks between Prime Minister Rutte (The Netherlands) and President Widodo (Indonesia), it was agreed to set up a joint Dutch-Indonesian investigation into the disappearance of the three Dutch warships from the bottom of the Java Sea. This lowered the tension between the two countries somewhat. The research that was set up by experts of the two countries focused on three tracks:

1. Joint verification on the location and condition of the disappearance of the Dutch warships;

[9] The Netherlands claims ownership of VOC, WIC, Admiralty and warships.

2. Joint assessment of the facts and a legal framework with regard to the missing wrecks of the Dutch warships;

3. Cooperation for future preservation of war graves and maritime cultural heritage.

In February 2017, the experts met in Jakarta to carry out the first track of the joint verification. The aim here was to find out whether the claim of the disappearance of the wrecks could be verified and whether the information collected by the divers could be validated. In the joint verification experts of relevant disciplines from both countries were present, including hydrography, underwater archaeology and cultural heritage management. Since the locations of the three shipwrecks were never reported to the proper authorities in the Netherlands as well as Indonesia, they were never officially investigated by any of the two countries. The purpose of the verification was therefore to gain clarity about the identification of the shipwrecks De Ruyter, Java and Kortenaer and the status **-** location and condition **-** of the shipwrecks. The experts were asked to draw their conclusion based on the claims made by the divers and the collected information provided by them and others. The experts did this with a combination of data sets: video, photos, multibeam data and descriptions of divers.

The conclusion was that the positions and ship characteristics are fairly consistent with the historical data regarding the battle, the ships and their sinking. These are almost certainly the shipwrecks of De Ruyter, Java and Kortenaer. However, it has become clear that the De Ruyter and Java are reversed in relation to the positions recorded earlier during the battle (Kroese, 1945; Helfrich, 1946). An analysis of video, photo and multibeam data from the KDF dive trip provides convincing evidence of systematic salvage at all three locations. The degree of salvage will ultimately also have to be checked on site, because it is unclear how much debris has been left on and in the seabed (Manders et al., 2017, pp. 31-32). The end result of the joint mission resulted in a report that can be found online.[10]

[10] Report of the joint mission is available online at: https://maritime-heritage.com/files/reportverificationmissionfeb2017javaseapublic210217pdf (on 01/08/2018).

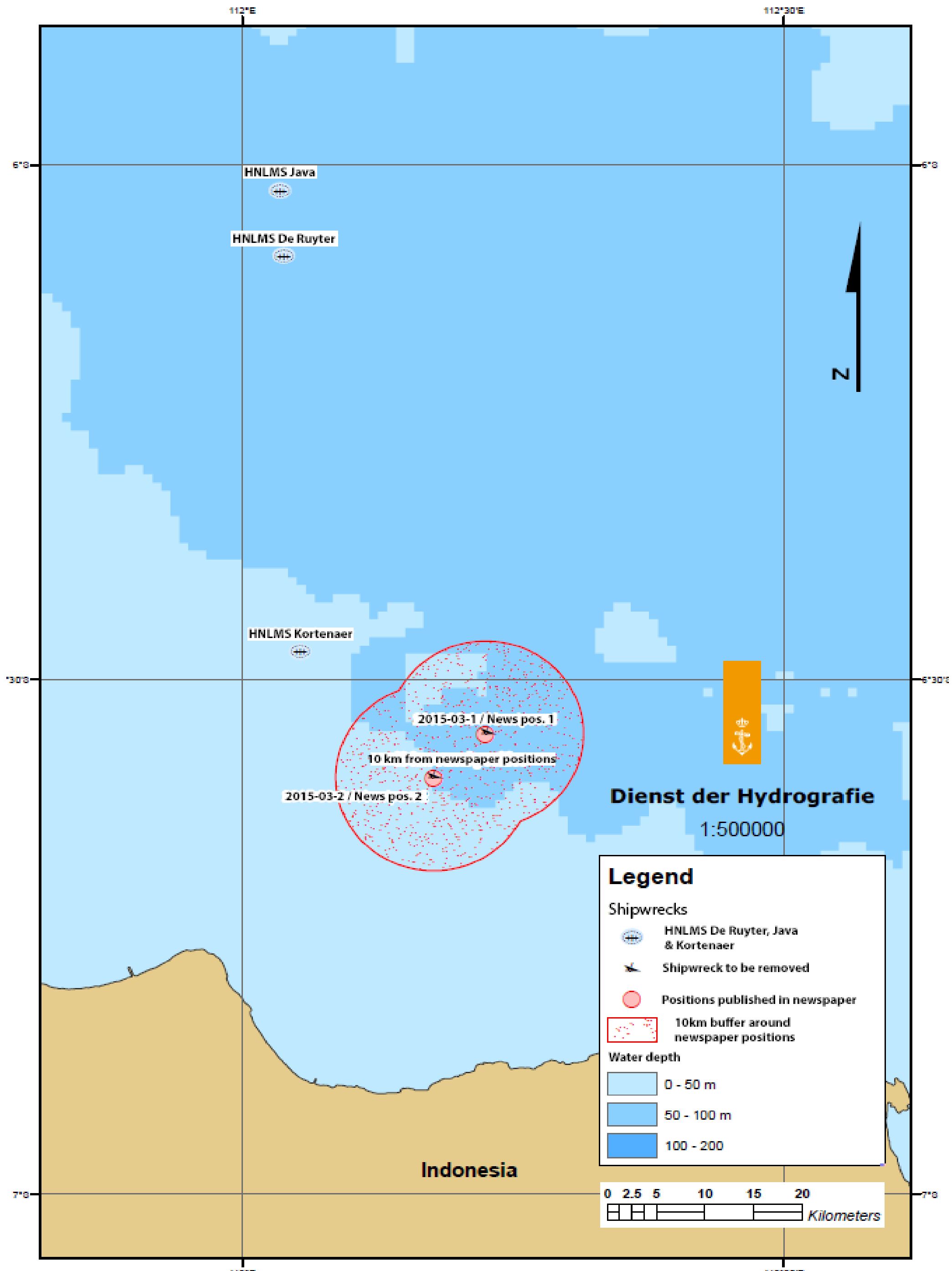


Figure 3: The locations of the three Dutch warships. © Dienst der Hydrografie (Hydrographic Service).

In August 2017 experts from the Netherlands and Indonesia met again in Jakarta to talk about track 2. The aim for this stage in the cooperation was to determine what could have happened to the Dutch warships and by whom. Before and after this meeting, there was contact between the Netherlands and Indonesia because both countries would do research for this track in their own country. In general, the expectation was that this track would be the most complex part of the investigation because the question of guilt would most probably come up. Pursuing the answers too much could influence cooperation - also in the longer term. The main conclusion of the meeting in August was that the warships were recovered in an industrial way, without permission from the Indonesian authorities. It proved to be impossible to establish who salvaged the warships.

Indonesian authorities stated that they did not observe suspicious situations in the nearest ports during the period in which the illegal disposal of these wrecks was presumably carried out. In Indonesia and the wider region there are more often (large-scale) illegal but also legal salvage operations (Holmes, Ulmanu & Roberts, 2017; Sudaryadi et al., 2012, p. 17). According to the Indonesian authorities there was, as far as can be ascertained, no scrap of these three Dutch warships offered locally ("Report of the joint expert meeting," 2018). After this research it was decided to close track 2, because more answers were not expected and the idea was that track 3 – jointly working together on the management of Dutch shipwrecks in Indonesian waters – would be a good follow up in order to prevent these kinds of illegal salvaging in the future. The finishing of track 2 was followed by reports in the media that were not directly based on hard facts, but were fuelled by the urge to find the guilty. Alleged evidence of scrap processing activities of the three Dutch warships were presented including eyewitnesses of the recovery of remnants of soldiers. According to the unidentified sources, these remnants would have been collected and reburied in a cemetery. This resulted in even more public outcry and even parliamentary questions and extra efforts to investigate these claims. The claims, however, proved not to be founded and often even untrue.[11]

During the writing of this article, the third track is just being set up. This track will develop future cooperation for the protection of Dutch warships in the Java Sea, as well as that of other Dutch shipwrecks in Indonesia. According to Indonesian sources, 245 Dutch ships have sunk in Indonesian waters. The majority has not yet been found (Sudaryadi et al., 2012, p. 15). In addition to war wrecks, these are also the wrecks of ships of the Dutch East India Company (VOC), the Dutch Trading Company (NHM) and other private Dutch ships. There are dozens of shipwrecks here that could be claimed by the Netherlands. Of these, 55 are related to the VOC and 46 to the Dutch East-Indies Government Navy (Gouvernementsmarine in Dutch).[12]

A first important step in the future cooperation has already been taken earlier during the visit of Minister Bussemaker of Education, Culture and Science to Indonesia in February 2017 with the signing of a Memorandum of Understanding (MoU) with the Indonesian Ministry of Culture for cultural cooperation. This MoU also contains a paragraph in which the cooperation in maritime heritage management is mentioned.[13]

At the request of the Netherlands, the three wreck locations of the De Ruyter, Java and Kortenaer were marked as 'historic shipwrecks' on the nautical maps of Indonesia on 7 July 2017. This means that it is no longer allowed to dive, anchor or fish on these locations.

Together with Indonesia it is currently being examined whether the point locations of the shipwrecks can be converted into larger protected areas by marking them as cultural heritage and places of remembrance ("Report of the joint expert meeting," 2018). It is hoped that instead of full closure of the areas, the sites may be opened up for these kind of respectful activities. In that way the locations still have a valuable function. Field visits will be part of this third track, but also the setting up of a long-lasting management plan for the area and making agreements about the way of sharing knowledge, capacity building in underwater archaeology and underwater cultural heritage management and doing joint research. In November 2018 a Letter of Intent was signed between the two governmental cultural heritage organisations, ARKENAS and RCE specifying the cooperation between the two countries in maritime heritage management in general.

5. Different values

During the Java Sea joint verification (track 1) it became clear that the Dutch warships in the Java Sea did not have the same significance for Indonesia and the Netherlands. For the management and protection of

[11] The investigation of the Salvage and Identification Service of the Royal Netherlands Army on the spot only produced animal bone material. A report is in the making from April 2018.
[12] Archive Maritime Programme RCE.
[13] https://maritime-heritage.com/files/moucultuurnederlandindonesieenggetekend2pdf (on 01/08/2018).

WWII shipwrecks it is therefore important to understand the different perspectives in appreciation that shipwrecks from the Second World War can have, since the coastal and flag states must be able to come to management measures together. This does not mean that the two countries need to agree on all levels, as long as they acknowledge different views. These different views or perspectives can be investigated and interpreted by gaining knowledge about the past. The relationship between the former coloniser and the colonised plays an important role in this case, but also the distance that history has to the local society nearest to the wrecks. However, we do not only see the difference in the valuation of the sites between the Netherlands and Indonesia, but also within the Netherlands itself. In recent years, a start has been made to investigate and appreciate the frayed edges of our own society as part of our identity. In fact, this is a form of conflict heritage but then a conflict with our earlier perception of who we are. This transition is new, but provides for an inclusion of both war archaeology, colonialism and other atrocities carried out by Dutch people against other people. These past relations influence the way we look at heritage. And therefore, we opt for multiple angles in research and appreciation. There is not just one history, there are multiple and we can only learn from the ones we do not know. Different views on the same events or periods, especially in times of war are essential for the real understanding of what has happened or how it could have happened. In the case of the Java Sea shipwrecks, both the Netherlands and Indonesia are learning a lot from each other and the way history is perceived.

6. Appreciation

The cultural historical value of the three Dutch warships could be determined with the Dutch KNA valuation system (Kwaliteitsnorm Nederlandse Archeologie, the Quality Standard of Dutch Archaeology).[14] The KNA was made to ensure the quality of archaeological research instigated after the implementation of the Treaty of Valletta (contract-archaeology) and it consists of standards and guidelines for archaeological research in the Netherlands. A site is valued on perception aspects and on physical and intrinsic criteria. A similar system is also available abroad, as is for example stated in the Burra Charter (Manders, Tilburg & Staniforth, 2012, p. 3). The perception aspects normally only play a marginal role, since the focus is on archaeological importance. However, with the three warships, it is precisely that aspect, in the form of 'memory value', that is the most important. Memory value is defined as the memory of the past that an archaeological or heritage site evokes. The memory value is high because survivors and relatives of soldiers who fought and died during the Battle of the Java Sea, consider the shipwrecks to be war graves and lieux de mémoire. Every year on 27 February the Battle of the Java Sea is commemorated in the Netherlands, but also in Surabaya, at the Dutch war cemetery Kembang Kuning, and at sea where the ships sank (Dissel, 2005, p. 120; Dissel, 2007, p. 9). The intrinsic value of the three wrecks however is not very high anymore, due to the recent salvage. This is also the case for the physical integrity of the sites.

The three shipwrecks therefore primarily have an emotional, commemorative value, but until recently they also had a historical, archaeological and intrinsic (information) value. If the shipwrecks were investigated using archaeological methods, this could have led to new information about the Second World War, things that we did not know before. An example of this intrinsic value that emerged during the joint research based on previously recorded information by divers was the above-mentioned differences between the sinking locations of the De Ruyter and Java warships described in historical literature and their find locations (Manders et al., 2017, p. 31). Also, the extra protection that was installed on the anti-aircraft guns on both ships just before the battle is an example of this. Originally the anti-aircraft gun did not have this extra protection. Research showed that the extra protection must have been added just before the start of the battle, probably between the 17 and 25th of February when the ships were in the harbour of Surabaya (Manders et al. 2017, pp. 21 & 24).

[14] https://www.sikb.nl/archeologie/richtlijnen/brl-4000 (on 01/08/2018).

Figure 4: In 2005 four ship bells and a trophy cup were gifted by Henk Visser to the Royal Netherlands Navy. Two bells were taken from the shipwreck of the HNLMS De Ruyter and two from the Java. After buying the bells, Henk Visser cleaned and conserved them. The bells now play an important part in the commemoration of the battle of the Java Sea. © Defensie Magazine

Besides the historical, archaeological and intrinsic value, there are several other values that can be attributed to the wreck sites of De Ruyter, Java and Kortenaer. To the salvors, the shipwrecks of the Second World War have an economic value because of the so-called 'low background steel'. The steel on the three Dutch warships contained fewer radioisotopes, because they sank before the first atomic bomb was thrown on Hiroshima in Japan. After the explosion of the two atomic bombs during the Second World War, the background radiation went up worldwide. Therefore, during the melting process of steel, the radioisotopes come into the steel. Since the steel of the three warships contains fewer radioisotopes, it is worth more than the ordinary recently produced steel. The 'low background steel' is – amongst others - used in medical tools and Geiger counters. This makes the light-cruisers with their thick steel plates very interesting targets for salvage companies. This may also explain why parts of the Kortenaer – a destroyer with much less thick hull plating – were left on the seabed. Besides the steel, there were also other valuable metals on these warships such as phosphor bronze (the propellers), brass, copper and high-grade aluminium (Allen, 2017; Geertsma, 2016; Miles, 2017; Perez Alvaro, 2013, pp. 41-43).


Figure 5: Left: Historical photo of the flagship Hr.Ms. De Ruyter in 1942 (Retrieved from Beeldbank Defensie). Right: Rubble on the seabed in November 2016 at the wreck site of the De Ruyter. © KDF 2016 expedition

But if we think about it, the three warships could have had other economic values in addition to the value of their steel. Over the years, the wrecks had become artificial reefs. This means a boost in biodiversity and the rich coral and marine life can attract recreational divers, which has a positive effect on (cultural) tourism at large. At least they must have been beneficial as fishing grounds for local fishermen. The economic value of the shipwrecks as diving and fishing spots and tourism at large could well have been more profitable in the long run than the one-off profit from salvaging the shipwrecks. We can however not measure this anymore. But even then, the commemoration value, isn't this worth protecting sites like this for future generations?

Figure 6: Shipwrecks can become artificial reefs, boosting biodiversity which attracts recreational divers. © Richard Swann.

Although the wreck locations of De Ruyter and Java no longer have a high archaeological, intrinsic and economic value and these values of the Kortenaer are also strongly affected, the commemoration / remembrance value remains and is what and the Netherlands strives to protect.

7. Protection of WWII shipwrecks

The salvage of historic shipwrecks in the Asian seas seems to be an increasing problem. Especially WWII shipwrecks disappear at an alarming rate. In recent years, Australian, American, British, Dutch and Japanese warships were sometimes legally, but more often illegally salvaged. This is especially painful because the wrecks are not only important historical locations, but quite a few of them are also war graves. The salvage activities will therefore continue to lead to indignation. However, salvors see these shipwrecks as an opportunity to earn a lot of money relatively easily and quickly and don't seem to care about the historical, archaeological, intrinsic and emotional values that the warships also have. The conflict of interest therefore remains and only a cooperation between the different governments involved and the raising of awareness on all levels may prevent such actions in the future.

State ships, including warships, enjoy sovereign immunity at all times. This is stated in the UN Convention on the Law of the Sea (UNCLOS).[15] That immunity will remain in force even after sinking, as long as the ship is considered to be a state ship or a warship by the flag state.[16] Immunity of warships is a generally accepted principle in international law and is usually not disputed.[17] Unfortunately however, this was the case with these three Dutch warships. The three Dutch warships are located in Indonesian waters where Indonesia enjoys sovereignty. The Netherlands takes the position that the wrecks of warships still enjoy sovereign immunity in accordance with the UN Convention on the Law of the Sea, while Indonesia takes the position that wrecks under the UN Convention on the Law of the Sea enjoy no immunity but fall under the Indonesian legal system. However, according to international law, the flag state and the coastal state must

[15] Article 29 of UNCLOS 1982:
http://www.un.org/depts/los/convention_agreements/texts/unclos/part2.htm (on 01-08-2018).
[16] TK 2013-2014, nr. 996. Aanhangsel. Answer to question 2 and 3.
[17] United Nation GA resolution 71/257 (2017) paragraph 314.

agree to all activities aimed at these wrecks, including conservation. With this starting point, both countries are now also committed to achieving long-term cooperation in track 3 of the research (Fink, 2017, pp. 4-5).

Some shipwrecks are regarded as war graves. This is usually based on an 'emotional appeal'. However, it is possible to find international law in the UN Convention on the Law of the Sea (UNCLOS) that supports this. None of the Dutch ships that were lost during the Second World War were claimed by the Netherlands as a war grave, while there are still ten shipwrecks in Indonesian waters that probably contain the remnants of the Dutch sailors.[18] However, unfortunately there is still no regulation for war graves at sea in the Netherlands, while on land it is common practice. Britain has protected several WWII shipwrecks under the 'Military Remains Act'. The protection of the Dutch WWII shipwrecks therefore depends to a great extent on local national legislation whereby only a claim on ownership by the Netherlands can be transferred to the coastal state, in the hope that it will also accept this. The Netherlands and Indonesia, both take note of the United Nation GA resolution 71/257 (2017) paragraph 314, which was accepted after the discovery of the disappearance of the wrecks in the Java Sea. They also both expresses concern about the disruption of graves at sea and the plundering of shipwrecks that are war graves. This resolution thus will be a good start to jointly arrange the issues with the war graves at sea and to come up with a joint management regime.

Indonesia has an obligation under the UN Convention on the Law of the Sea (UNCLOS) regarding the supervision of the commercial exploitation of the seabed. She is also responsible for the activities of her citizens in relation to that exploitation. These can be aimed at cultural sources, such as the salvage of shipwrecks and thus the disruption of the graves at sea. The steel of the war wrecks may have ended up in processing plants on Indonesian soil. Combating illegal looting and the selling of molten steel is therefore primarily the responsibility of the Indonesian government, just like the illegal trade in arms, people and endangered species (Campbell, 2016). The Netherlands can only be available for support when asked.

8. Public awareness

The management of WWII shipwrecks involves specific issues such as human remains and repatriation, unexploded ordinance, and potential pollution by oil spill. Implementation of a management of WWII shipwrecks can even be more difficult due to site visitors and wreck divers. This puts pressure on the sites and their behaviour can damage the sites and, in some cases, even disturb site stability (Emesiochel et al., 2017).

A public awareness programme can help educate source communities on the value of historical sites in their region and also provide guidelines on how to protect and exploit historical (dive) sites in a responsible way. A restriction on the movement of fishing trawlers near wreck sites and registration or permits for boats that enter the areas could be of help to at least have an idea what is going on in the area. A community-based management system can also be set up, where local villagers, boatmen and divers assist with various government agencies to record, monitor and regulate diving activity and the presence of boats near these historical dive sites. By doing so, through tourism additional money can also flow into the source community, which in return will enforce the urge to keep protecting the sites.

An example where the source community sees how important a wreck can be for their livelihood, is the USAT Liberty in Bali. The source community there has been protecting the site with their customary law (called Awig-awig), which is fully obeyed by the villagers. Included in this law is a restriction on fishing activity around the site and it is also not allowed to take anything from the site. The source community are aware that the site, if well-managed, will improve living standards for people in the vicinity of the site and act as guardians of the site (Ridwan, 2011, pp. 5-8).

9. Law enforcement

[18] Archive Maritime Programme, RCE.

The Indonesian navy is one of the largest in the region and has 150 ships. But Indonesia is also the country with the second largest coastline in the world. Even with 150 ships, the navy is spread quite thin over the 108,000 km long coastline and the 13,600 islands of the country (Sudaryadi et al., 2012, pp. 18-19). This makes it virtually impossible to monitor and protect all shipwrecks that have sunk in Indonesian waters. This is why the help of the source community is so important. That successes can be achieved in the law enforcement, became clear in April 2017 when the crew of the Chaung Hong 68 was arrested by an Indonesian naval patrol boat. They are suspected of salvaging the Swedish supertanker Seven Skies and the Japanese warships Sagiri, Hiyoshi Maru, Katori Maru and Igara (Wargadiredja, 2017). However, successes remain small. Without an increase in patrols or the use of new detection methods, such as the use of satellites for tracking and as evidence, illegal salvage will probably continue because chances of being caught remain small.

Indonesia is not the only country where the salvage of shipwrecks is a problem. The salvage of shipwrecks is also a major problem in Malaysia and other countries in the Far East. Recently, also the Netherlands and Great Britain have repeatedly failed to prevent shipwrecks from being illegally (partially) salvaged in the North Sea (Brockman, 2018). We can therefore say that this is a worldwide problem that can only be solved by international cooperation. And cooperation is what we need to focus on now.

10. Conclusion

WWII shipwrecks disappear at an alarming rate all over the world. In recent years, Australian, American, British, Dutch and Japanese warships have been illegally salvaged, especially in the Far East. This has created a lot of commotion, because they are not only important historical locations, more values can be attributed to them. These sites are often war graves, important to relatives as a lieux de mémoire, however, salvors see these wrecks of warships as an opportunity to make money and attribute an economic value to them. If seriously considered over a longer period of time, we can also attribute ecological and touristic values to them. Only with proper understanding and consideration of different values or significances the sites hold to different stakeholders, new ways of managing these complex sites may be developed that will be effective in the long run. Countries and different stakeholder groups need to work together on this. The partly disappeared shipwrecks in the Java Sea served in this article as an example of the complexity in cultural heritage management we are facing regarding this group of relatively young wrecks that have gained so much interest in the last couple of years. The Netherlands and Indonesia now strive for a closer cooperation in the area of maritime heritage management. And this is the only way to go forward. Coastal and Flag State need to act together in this. The MoU of February 2017 was a first step in this. The joint investigation – which was caused by the illegal salvage of three wrecks of Dutch warships from the Second World War – a second step to learn from and understand each other better. Track 3, the continuous cooperation in underwater and maritime cultural heritage management and the signing of the Letter of Intent between the two culture departments will be the next step that has to have the aim to prevent future salvaging of sites in Indonesian waters. Underwater cultural heritage can only be protected when countries cooperate together. Time will tell.

References

Allen, M. (2017). Why do we build medical scanners from sunken battleships? Retrieved from http://www.sciencemadesimple.co.uk/curriculum-blogs/engineering-blogs/why-do-we-build-medical-scanners-from-sunken-battleships

Bezemer, K.W.L. (1987). Zij vochten op de zeven zeeën. Zeist.

Bosscher, P.M. (1986). De Koninklijke Marine in de Tweede Wereldoorlog deel 2. Franeker.

Brockman, A. (2018). Revealed: Royal Navy submarines and German cruiser hit by Dutch based divers in new military wrecks scandal. Retrieved from: http://thepipeline.info/blog/2018/02/04/revealed-royal-navy-submarines-and-german-cruiser-hit-by-dutch-based-divers-in-new-military-wrecks-scandal/

Campbell, P. (2016). Wartime shipwrecks are being illegally salvaged. Are we powerless to stop it? Retrieved from: https://www.theguardian.com/science/blog/2016/dec/20/can-anything-be-done-to-stop-the-vanishing-wwii-shipwrecks-of-java

Cox, J. (2011). A Turn Too Far: Reconstructing the End of the Battle of the Java Sea. n.p.

Cox, J. (2014). Rising Sun, Falling Skies: The disastrous Java Sea campaign of World War II. New York.

Denlay, K. (2004). Cruisers for Breakfast: the discovery of the Dutch cruisers Java and De Ruyter, Advanced Diver Magazine, 16-2004, 26-30.

Dissel, A.M.C. van (2005). De Javazee. De slag in de Javazee. In W. van den Doel (ed.), Plaatsen van herinnering. Nederland in de twintigste eeuw, 110-121.

Dissel, A.M.C. van (2007). Scheepsbellen krijgen passende bestemming. Kareoler, 2-2007, 8-9.

Doedens, A. & L. Mulder (2017). Slag in de Javazee. Oorlog tussen Nederland en Japan. Zutphen.

Emesiochel, C., B. Jeffery, H. van Tilburg, J. Kimura, J. McKinnon, S. Ngirmang & A. Viduka (2017). Report on good practice in the protection and management of WW II- related underwater cultural heritage in the Pacific. Paris.

Fink, M. (2017). Bescherming van gezonken oorlogssschepen, Marineblad, 1-2017, 4-8.

Geertsma, P. (2016). Vooroorlogs staal van de zeebodem bevat minder radio-isotopen dan jonger staal. Retrieved from: http://www.technischwerken.nl/nieuws/vooroorlogs-staal-van-de-zeebodem-bevat-minder-radio-isotopen-dan-jonger-staal/

Fock, A.W.H. (2016). Report - Survey of Naval Wreck Sites Java Sea 2016. Melbourne.

Helfrich, C.E.L. (1950). Memoires. Eerste deel. De Maleise barrière. Amsterdam/Brussel.

Holmes, O., M. Ulmanu & S. Roberts (2017). The world's biggest grave robbery: Asia's disappearing WWII shipwrecks. Retrieved from: https://www.theguardian.com/world/ng-interactive/2017/nov/03/worlds-biggest-grave-robbery-asias-disappearing-ww2-shipwrecks

Kroese, A. (1945). Neerland's Zeemacht in Oorlog. London.

Manders, M.R., R.W. de Hoop, S. Adhityatama, W.A. Barten, B. Budi Utomo, O. Dwiyana, A. Kusno, J. Rechar & Z. Tahir (2017). Joint verification of the location and condition of Hr.Ms. De Ruyter, Java and Kortenaer, 6 to 9th of February 2017. Jakarta.

Miles, K. (2017). The Thieves Who Steal Sunken Warships, Right Down to the Bolts. Retrieved from: https://www.outsideonline.com/2168646/how-does-entire-shipwreck-disappear-bolts-and-all

Nater, J.P. (1980). Koers 300 vaart 25. De slag in de Javazee. Haarlem.

Pearson (2017). Indonesia says not to blame for missing WWII shipwrecks. Retrieved from: http://www.dailymail.co.uk/wires/afp/article-3944960/Indonesia-says-not-blame-missing-WWII-shipwrecks.html

Perez Alvaro, E. (2013). Experiments on Particle Physics Using Underwater Cultural Heritage: The Dilemma, Rosetta 13.5, pp. 40-46.

Ridwan, N. N. H. (2011). The Importance of Empowering Local Community in Preserving Underwater Cultural Heritage in Indonesia: Case Study in Tulamben, Bali and in Taka Kappala, Selayar-South Sulawesi, Manila.

Sudaryadi, A., J. Wahjudin & M. Manders (2012). Het beheer van het maritiem Erfgoed in Indonesië, Vitruvius 18, januari 2012, pp. 14-20.

Wargadiredja, A.T. (2017). Pirates Are Looting Sunken WW2 Boats Off The Coast of Indonesia For Scrap. Retrieved from: https://www.vice.com/en_id/article/pirates-are-looting-sunken-ww2-boats-off-the-coast-of-indonesia-for-scrap-metal

A Battleship in the Wilderness: The Story of the *Chippewa* and Lake Ontario's Forgotten War of 1812 Naval Shipyard*

Timothy J. Abel

INTRODUCTION

During the War of 1812, control of Lake Ontario tipped back and forth several times based solely on the balance of firepower. When one side launched a warship, the balance shifted and the other retreated back to the safety of port until their own new ship was completed. Aside from a few skirmishes, squadron engagements were rare on Lake Ontario.

Figure 5. Commodore Isaac Chauncy, USN. Oil on Canvas by Gilbert Stuart (1775-1828), circa 1818, in the possession of the U.S. Naval Academy Museum Collection. Photo: Wikipedia Commons (http://en.wikipedia.org/wiki/File:Isaac_Chauncey.jpg)

In the fall of 1814, what had become a "carpenter's war" for dominance on Lake Ontario was escalating. The United States launched the frigate *Superior* from its Lake Ontario naval station at Sackets Harbor in August. Carrying 58 guns, she was the largest American warship to see service during the war. In October, the British at Kingston (just 30 miles away, ironically) launched the 102-gun ship-of-the-line *St. Lawrence*. This time, however, neither launch was effective at lifting the stalemate for control of Lake Ontario, for both ships entered port for winter after only one uneventful cruise each. But each signaled the shape of things to come.

The American ship-building plan over the winter of 1814-1815 included three new warships. Two of the new ships would be 106-gun ships-of-the-line, the largest warships the nation had ever built and each measuring 200 feet long. The last would be a 58-gun frigate identical to *Superior*. There was only one problem: the existing shipyard at Sackets Harbor had room enough to build only one of the first-rates in time for the spring sailing season. If the effort was to succeed, additional shipyards would have to be procured and put into operation. To solve the problem, Commodore Isaac Chauncey (USN) (Figure 1) decided to build the first-rate *New Orleans* and frigate *Plattsburgh* at Sackets Harbor. The other first-rate, *Chippewa,* was to be constructed nearby at a new shipyard called Storrs Harbor. Construction began on the two massive vessels in January 1815, but with the war ending just a few weeks later, neither was completed. The Storrs Harbor shipyard was maintained by the Navy for several decades following the war. Falling into ruin, however, the *Chippewa* was sold and scrapped in 1833. Since then, both ship and shipyard have all but vanished from the historical record. The details of this dramatic closing episode in the war could have been forgotten but for the research of local historian Dr. Gary M. Gibson, who resurrected the story of the *Chippewa* and Storrs Harbor (Gibson 2014). Based on his research, a successful effort was initiated in 2005 to relocate the site of Storrs Harbor. From 2005-2012, archaeological testing documented a rich cultural record of Lake Ontario's forgotten naval shipyard.

* revised and adapted from "Storrs Harbor: Archaeology of a War of 1812 Naval Shipyard on Lake Ontario", by Timothy J. Abel. *The Bulletin (Journal of the New York State Archaeological Association)* 129:19-35, 2015.

Location and Site History

Storrs Harbor is located on the south shore of Black River Bay, 6 km (3.6 mi) northeast of Sackets Harbor and 11 km (6.6 mi) west of Watertown, in the Town of Hounsfield, Jefferson County, NY (Figure 2). It lies on a small upland plateau rising 280 ft amsl, overlooking a gentle slope to the bay which housed the *Chippewa* on her stocks. Chaumont limestone shelves outcrop around the rim of the plateau, and in terraces sloping toward Black River Bay. To the northwest, the limestone forms a steep bluff 30 ft above the water. To the east of the plateau is a shallow-waterinlet formed by a narrow peninsula known locally as Catfish Point.

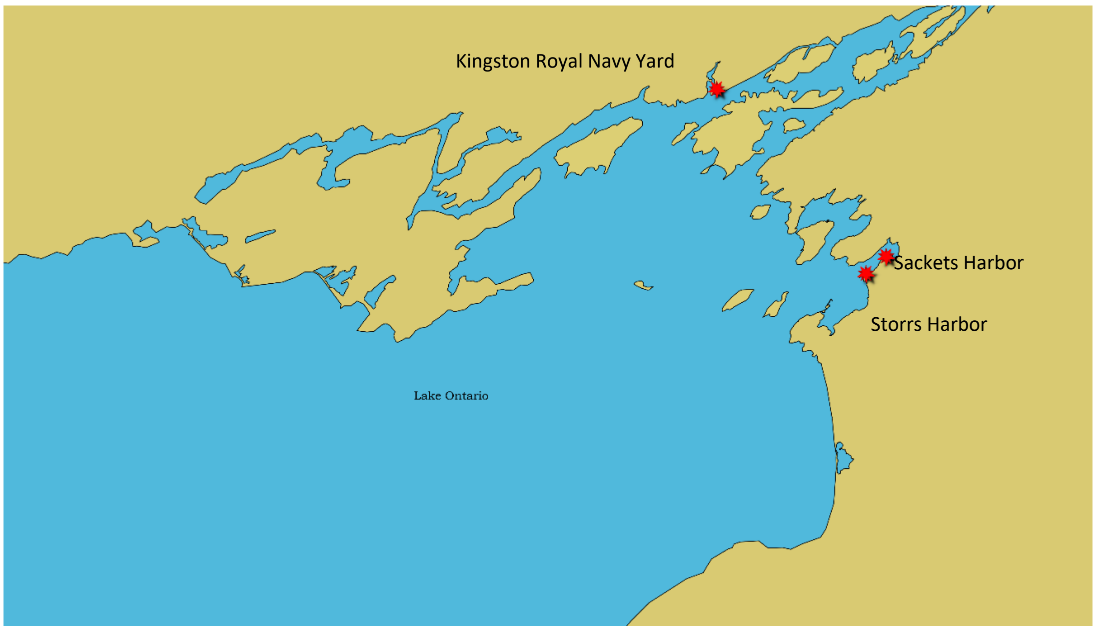


Figure 6. Location of the Storrs Harbor and related sites.

Prior to development, Catfish Bay was an open body of water, with a draught deep enough to accommodate several large armed barges in 1815. Deforestation and commercial farming has led to the silting in of the bay over the last 180 years, to the point where there is hardly a Catfish Bay today (Ford 2009). Most of it has turned to vegetated wetland. Only a small portion of the extreme northern end remains open water.

The land here (Lot 52 of Macomb's Great Lot 5) was owned in 1812 by Lemuel Storrs and Henry Champion, who directed Jonathan Crary to survey it for subdivision and sale. All but the most remote and undeveloped of these lots were sold off between 1797 and 1814. Storrs and Champion apparently envisioned a city at Storrs Harbor, directing John Mitchell to lay out village lots on the eastern border of Lot 52. Realizing the futility of their effort in 1814, however, they looked for a buyer.

Serendipitously, Isaac Chauncey was looking for a new shipyard in 1814, and Storrs Harbor fit that bill. He had considered Henderson Harbor, which would have been better suited for building the two liners, but several factors eliminated that option. The entire Navy post would have to be moved there to provide adequate protection, and the land would have to be acquired from its owner, who was not willing to support the war. Storrs Harbor could be better defended, and the land was for sale. But despite needing only a few acres upon which to build a shipyard, Storrs and Champion refused to subdivide. In 1815, Storrs and Champion sold lots 12, 13 and 14 amounting to approximately 363 acres, to Henry Eckford and Adam Brown (Jefferson Deeds G:93). They in turn sold a 1/4 share of this land to Elisha Camp (Jefferson Deeds G:200).

Three days after signing the contracts, Eckford and his partners, Adam and Noah Brown dispatched workmen to Sackets Harbor to begin construction. But upon arrival, they realized immediately that Storrs Harbor was a harbor in name only. Before they could even consider laying down a ship-of-the-line, they needed a shipyard and a means to provision over 400 workmen and soldiers. Until these facilities were constructed, the men lived in tents… in northern New York… in January. Needless to say, the shipyard, including the stocks, a mouldboard shed, a blacksmith shop able to accommodate 30 blacksmiths, a joiner's shop, two barracks for 200 men each, a mess hall and two blockhouses were completed in the span of two weeks. The keel for the *Chippewa* was likely laid in early February 1815.

Construction of the *Chippewa*

The *Chippewa*, and her sister ship, the *New Orleans* were unlike anything the Navy had ever built. At a length of 183'6" on the keel, a breadth of nearly 57' on the beam and 2,948 tons burthen, they were larger than any ship of the day, even on the oceans (Figure 3). In fact, there were no plans for such vessels- the largest warships then in the US Navy topped out at 2,243 tons burthen and 87 guns. This was pioneering ship construction; Eckford's specialty.

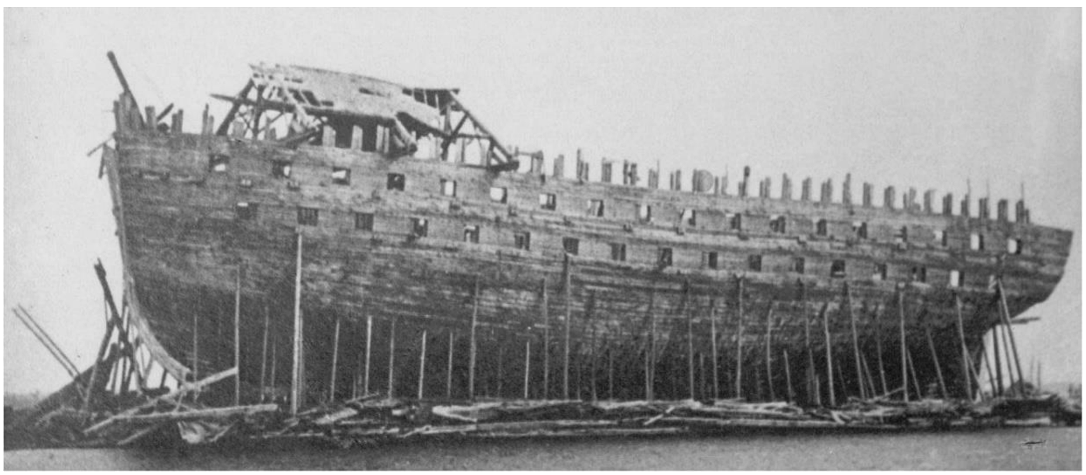


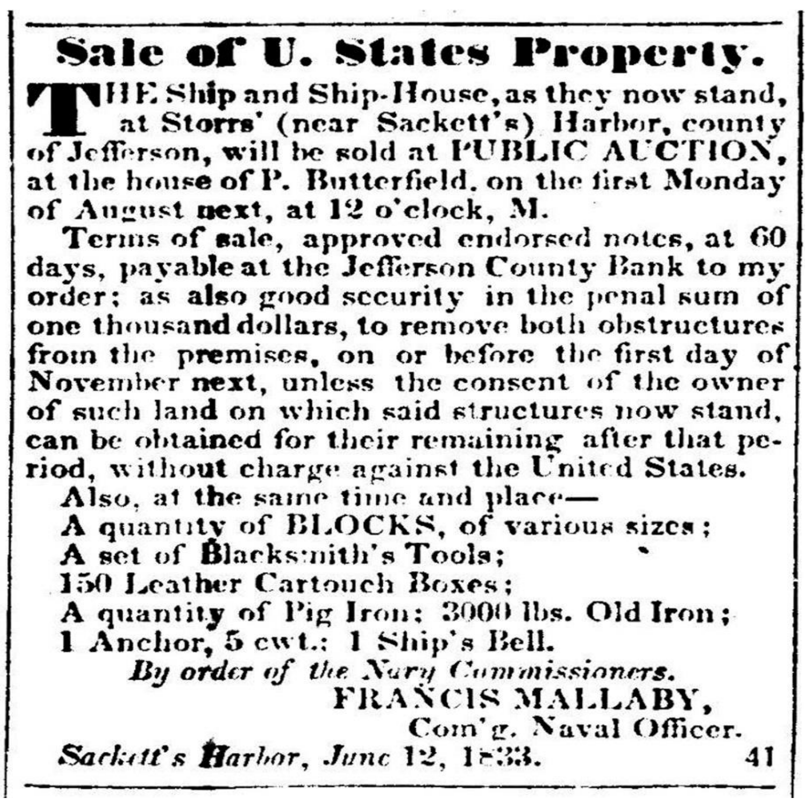
Figure 7. Daguerreotype photo of the ship New Orleans, the Chippewa's sister ship, as it stood in the spring of 1881, after the shiphouse was destroyed in a storm. Photographer unknown. Photo: Gary Gibson from a glass plate negative in the collections of the Jefferson County Historical Society, Watertown, NY.

Building on the massive liner got underway by early February 1815. Of course, the Treaty of Ghent had been signed more than a month earlier (on December 24, 1814) but since word of it had not yet reached Chauncey, construction proceeded. As fate would have it, the winter of 1815 was especially harsh. Construction lagged for a lack of men and supplies. Chauncey had already known the new British "package" warship *Psyche* (56) would be ready to launch by January. In February, he learned of British plans to lay down two new liners of 106 guns each. His plans for controlling Lake Ontario were in ruin unless he could finish his ships first and take Kingston (which seemed doubtful), or unless Congress ratified the treaty. In all likelihood, Chauncey would begin the 1815 campaign for control of Lake Ontario at a nearly 100-gun disadvantage. By February 23, news had reached Sackets Harbor that Congress had ratified the Treaty of Ghent, ending the war. Chauncey was ordered to cease all construction immediately and dispatch the workers back to their homes. This was more complex than it first appeared, however. There were not enough transports to conduct nearly 1000 workmen home in a timely manner, so Chauncey had them continue construction in a diminishing capacity until all the workmen had gone. This meant that building continued on the *Chippewa* for about 30 more days, for a total of about 60 days construction. By estimates, she was about 50% completed (Gibson 2014). According to a post-war survey, she was all in frame and planked to her lower gunports. By late March, however, the *Chippewa* likely stood silently on her stocks and Storrs' Harbor lay abandoned.

The End of the *Chippewa*

The end of the war saw the liners at Sackets and Storrs' Harbors in an unfinished state, silently standing on their stocks and exposed to the spring elements. Most leaders in Congress agreed that something should be done with them, just in case the war resumed. What they could not agree on was "what?" One plan called for completing the hulls, launching them, then sinking them in the shallow harbor for preservation. That plan did not pass, and the two ships laid exposed for the entire summer. In the fall of 1815, the Navy contracted with William Vaughan to construct two shiphouses to protect the vessels from further deterioration. These structures were also extraordinary, being some 240' by 80' and four stories high.

By 1817, the need for large warships on the lakes was abated by the Rush-Bagot treaty. The two liners stood silently in their shiphouses for several decades, becoming somewhat of a tourist fascination. By 1824, the question of what to do with them came up again, especially since they had just received Eckford's extraordinary bill for leasing the land at Storrs Harbor. A survey of the vessels the next year found the *Chippewa* in a state of decay, noting rot in two places. The Navy struck the ship from its list of vessels under construction and recommended scrapping it. But Congress didn't agree, and the ship and shipyard stood for another decade- as did Eckford's bill to the United States.Finally, in 1833, the Navy took the initiative. While Congress was in recess, the Navy listed the vessel and shipyard accoutrements for sale (Figure 4). On August 5th, 1833 the *Chippewa*, all shipyard buildings, blacksmith tools, scrap iron and wood were sold at auction. Over the next few months, she was quietly dismantled and likely sold off for lumber. Legend in nearby Sackets Harbor is rich in stories about ship timbers being used in local house construction, but most of it was likely



Sale of U. States Property.

THE Ship and Ship-House, as they now stand, at Storrs' (near Sackett's) Harbor, county of Jefferson, will be sold at PUBLIC AUCTION, at the house of P. Butterfield, on the first Monday of August next, at 12 o'clock, M.

Terms of sale, approved endorsed notes, at 60 days, payable at the Jefferson County Bank to my order; as also good security in the penal sum of one thousand dollars, to remove both obstructures from the premises, on or before the first day of November next, unless the consent of the owner of such land on which said structures now stand, can be obtained for their remaining after that period, without charge against the United States.

Also, at the same time and place—
A quantity of BLOCKS, of various sizes;
A set of Blacksmith's Tools;
150 Leather Cartouch Boxes;
A quantity of Pig Iron; 3000 lbs. Old Iron;
1 Anchor, 5 cwt.; 1 Ship's Bell.

By order of the Navy Commissioners.

FRANCIS MALLABY,
Com'g. Naval Officer.

Sackett's Harbor, June 12, 1833. 41

Figure 8. Ad placed in the Watertown Eagle on June 20, 1833. Photo: Gary Gibson from microfilm.

turned into furniture.

Much of the shiphouse was probably used, however, to build the farm that stood on the property after the shipyard was dismantled. In 1838, Henry Eckford's estate sold the property at Storrs Harbor to Elisha B. Camp, the son of Elisha Camp (Jefferson Deeds). By 1840, he had constructed a farmstead on the property that once was the shipyard. That farm remained in use until the 1960s, when the farmhouse burned. Following that time, the old milking barn was renovated into a seasonal cottage. The farm's outbuildings remained intact to be used as storage. In the 1990s, a two-stall garage was added, and the seasonal cottage was upgraded to a year-round residence. Examination of the beams used in the construction of the barn point to their having been cut for another building and repurposed. Tree ring dating may be used in the future to solve the mystery.

Figure 9. Magnetic gradiometer survey conducted by Dr. Michael Rogers.

Archaeological Investigations

Efforts to relocate the site of Storrs Harbor began in the fall of 2004, when the author and Gary Gibson compared period and historic maps with modern U.S.G.S. topographic maps. That comparison left little doubt in either of our minds where the site was, despite modern maps which locate "Storrs Harbor" well inside Muskalonge Bay. There was really only one place it could be- at the head of a small inlet known locally as Catfish Bay. Prior to any archaeological testing, in the spring of 2005, students under the direction Dr. Michael "Bodhi" Rogers (Ithaca College) conducted a gradiometer survey of two parcels on the site totaling 0.45 ha (1.125 ac) (Figure 5). The survey highlighted a large magnetic anomaly on the eastern end of the site, and several spot and linear anomalies distributed around the entire tested area. The linear anomalies appeared to follow bedrock crevices that had presumably accumulated metallic debris in them. The large anomaly on the north end of the site, and the spot anomalies, remained to be explained. Archaeological investigations began in 2005 and continued until 2012. During that time volunteers under my direction excavated 30 1x1 meter test units and 52 35x35 cm shovel tests (Figure 6). Our testing concentrated in three localities based on the gradiometer results and the presumed layout of buildings on the site. We anticipated the location of the enormous shiphouse, and the *Chippewa*, but did not conduct any testing to locate its remains. The area where the shiphouse likely stood has been subjected to ice scouring and landscaping over the years. The present landowner informed us that he had to place considerable rip-rap and fill in the area to restore the shoreline. In addition, we judged early in the investigation that while interesting, a search for the shiphouse would reveal no diagnostic artifacts that would allow us to identify the site. We did place a datum in the area, however, for future reference.

Site Stratigraphy and Features

The stratigraphy of the site is relatively uniform and shallow. The profile of the north end of the site, documented in Test Units 1-3 (Figure 6), consists of a shallow, dark greyish brown silty loam topsoil (A^1) 10 cm (4 in) in depth above a dark brown loam midden (A^2) an additional 10 cm (4 in) in depth. The topsoil contained a moderate density of 19th century to modern artifacts including horse shoe nails, common modern cut nails, wire nails, glassware and window glass, whiteware and tin can fragments- all believed to be part of a sheet midden associated with the occupation of the Elisha Camp, Jr. farmstead. An underlying second midden layer contained a dense concentration of brick, cut nails, charcoal, scrap iron and forging slag indicative of the Storrs' Harbor blacksmith shop. No structural features were documented. The second midden layer terminated at a depth of approximately 20 cm into a sterile, dull yellowish-brown silty clay subsoil (B). Bedrock (R) was reached in all units at a depth of 30-35 cm (12-15 in).

The profiles in the middle and south end of the site (documented in Units 4-10 and 11-30 were similar but lacked a clear distinction of two cultural horizons witnessed in Units 1-3. The upper 10 cm (5 in) consisted of a crumbly dark greyish brown silty loam designated as Stratum 1. Beneath this was a dark brown silty loam that ranged in thickness from 15-36 cm (6-14 in) designated Stratum 2.

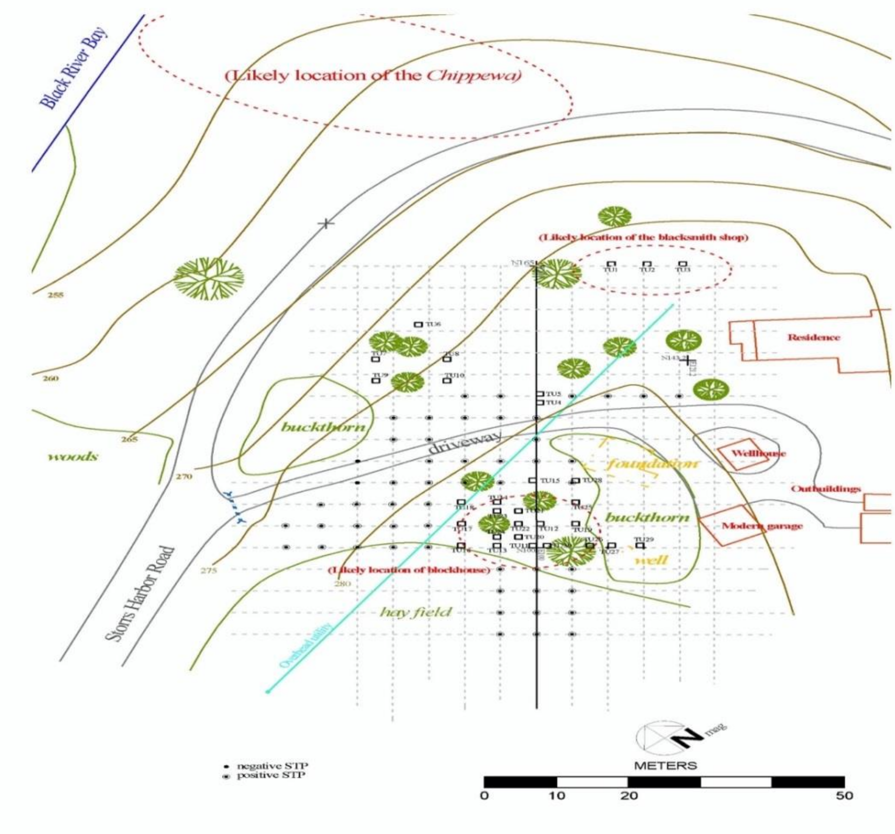


Figure 10. Archaeological investigations, 2005-2012.

Both strata contained artifacts of all time periods represented on the site, from prehistoric ceramics to modern (c. 1950s) artifacts. While there was some vertical stratification of artifacts within Stratum 2 (older artifacts tended to be located deeper), modern artifacts could be found at all levels, indicating severe disturbance. Historically, this area was a livestock yard which in spring likely became a muddy mess. Upper soil horizons would have been frequently pushed into deeper ones by walking animals. As such, only diagnostic artifacts could be associated with the shipyard occupation. Below Stratum 2 in all units was a dark yellowish-brown clayey loam sterile subsoil that extended at least 20 cm to the limits of excavation, designated as Stratum 3.

Few features were documented across the site. Lenses of brick and wall plaster were common near the foundation of the Camp house (which is located on the south end of the site), but there were no shaft or pit features documented. The only shaft features known to exist on the site are the extant open house foundation and well, on the south end of the site. Excavations near the well suggest it is contemporary with the Camp house and not a reused feature of the shipyard occupation, as had been hoped.

The lack of features has been the single-most troubling aspect of the project. But when the conditions and haste of the shipyard construction are considered, it is perhaps not at all surprising that features are rare if nonexistent. The shipyard construction began in January. At that time in northern New York, the ground is typically frozen solid to a depth of several feet. The year 1815 was noted as a particularly harsh winter throughout the northeast, so it is reasonable to expect that conditions at the site were typical if not even more severe. That meant that digging any kind of feature outside would have been impossible. Refuse was likely discarded over the hillside.

The structures of the shipyard were likely built directly on the ground, perhaps on foundations of laid fieldstones, but not on prepared foundations. Most likely, they used sill stones, laying sill beams on top and burying the whole from inside once the structures were enclosed and heated. Soil from the floors may have also been taken outside for fill around the outer foundation as well. In short, the structures were likely superficially built, at best. There is some archival evidence for the likelihood of this scenario. The Navy contracted with Samuel Alden and Oseas Hoisington to each build one of the two blockhouses on the site. Records show that they were fined a combined $100.00 off their payment for shoddy construction (cf. Gibson 2014:41). After the shipyard was abandoned, accounts show that the buildings deteriorated very rapidly, some becoming ruins in the span of only a decade. By 1833, only one blockhouse remained, and that demanded repair (cf. Gibson 2014:67). Such accounts, in addition to the evidence of disturbance, make it plausible that we should expect to find few, if any features.

The distribution of diagnostic artifact classes, however, makes it very likely that at least two structures have been relatively located. On the north end of the site, Test Units 1-3 (Figure 6) produced a large amount of scrap iron, slag and brick, making it the obvious location of the blacksmith shop. An 1815 survey of the shipyard states that the blacksmith shop housed 30 blacksmiths. That number suggests a building of considerable size with approximately 5-7 forges. A working example of a blacksmith shop of this size at Colonial Williamsburg measures 22' x 80'. Although the fate of the Storrs Harbor blacksmith shop is unknown, it is assumed that it was among the buildings decayed beyond repair by 1821. The entire tool inventory was among the accoutrements sold in 1833.

The association of the military-related artifacts at the west end of the site make it likely that one of the two blockhouses was in this area (Figure 6). The blockhouses were built to protect the shipyard from an overland attack. One of them was allowed to decay while the other was used as the ship-keeper's quarters after the war. Both were torn down when the shipyard was scrapped in 1833. No records survive about their size or configuration. All we know about them is that they were poorly constructed, since their builders Samuel Alden and Oseas Hoisington were fined for their shoddy construction.

Artifacts

Archaeological excavation and testing at the Storrs Harbor site produced more than 5,236 artifacts and over 66kg of building and activity-related materials (inventory work is ongoing). Much of the artifact assemblage can be related to the 19th century Camp farmstead, while numerous prehistoric artifacts add valuable information about Middle Woodland settlement and subsistence in northern New York. These assemblages will not be discussed here.

Artifacts diagnostic of the shipyard include an 1814 British half-penny, iron slag deposited from the blacksmithing operation, infantry and artillery coat buttons, gaitor (legging) buttons, iron and lead shot, gunflints, and several wrought "ship spikes" (Figure 7-9). Nails and other building materials may also be associated with the shipyard component, but their association is much less secure.

Figure 11. Diagnostic military artifacts.

Coins

Shovel testing on the south end of the site produced the only coin found, an 1814 British half-penny token minted in Halifax (Figure 7J). This coin displays an Eagle motif on one side with arrows and olive branch, bearing the date and words "HALFPENNY TOKEN." On the reverse is a motif depicting Britannia holding an olive branch, encircled in laurel. It was found in the area that is believed to have housed one of the two blockhouses.

Buttons

Test units on the south end of the site produced a large assemblage of artifacts from the 19th century Camp farmstead. In addition to these, however, archaeologists recovered a small assemblage of buttons that document occupation of this area by martial forces. Seventeen buttons were recovered in total, of which six could be identified as diagnostic military buttons. Most of the remaining buttons are suspected to be of the war period as well, though this cannot be established with any certainty. Three of the buttons are of Albert's (1976) type GI36 (Figure 7A-C).

One is of variant A1 (Figure 7A), another is of variant A2 (Figure 7C) and the last is of variant B (Figure 7B). Variant A1 is a coatee button measuring 2cm diameter, while the A2 variant is probably a weskit or pantaloon button 1.5cm diameter. Variant B is a coatee button 2cm diameter. These are flat, one-piece pewter cast buttons produced between 1812-1815. They are plain, save for a foliated or script 'I', for Infantry, and an oval cartouche underneath bearing a star. They have no backmark identifying the maker.

One of the buttons is of Albert's type GI38, variant B (Figure 7D). This is a one-piece pewter cast button with a convex face bearing the American Eagle motif with arrows and olive branch. A shield on the eagle's left breast displays a script 'I' for infantry. These buttons were produced in the last year of the war and remained in use until 1821. It is a coatee button 2cm diameter.

One button is of Albert's type GI41, variant A. This is a convex, one-piece pewter cast button bearing the American Eagle motif with an olive branch forming a cartouche. Inside the cartouche is a star. Encircling the motif are the words "UNITED STATES INFANTRY." These buttons were produced from 1812-1815. It is a coatee button 2.2 cm diameter.

The last of the diagnostic buttons is of Albert's AY58, variant B (Figure 7E). This is a flat, one-piece brass cast button bearing an eagle seated on a cannon with 10 cannon balls. The name "CORPS" appears below the insignia. These are believed to have been in use by militia artillery from 1814-1821. Local resident Elisha Camp is known to have captained a company of light artillery militia during the war, and it would not be surprising to find them here. This button is likely a weskit or pantaloon button 1.5cm diameter.

In addition to the above, archaeologists recovered a small, 1cm diameter one-piece hemispherical pewter button typical of gaiter buttons worm by the military during the war. A plain, flat, one-piece pewter cast button and a plain, flat, one-piece brass cast button may have come from non-military trousers or coats of the war period. They also recovered one flat pewter button with an iron eye, one bone button and two brass 2-piece buttons that may or may not be associated with the war period. Two iron rivet buttons appear to be post war, as does a glass button and a 4-hole one-piece pewter button.

Firearms

Excavations produced a total of 21 artifacts related to firearms, however, only a handful of these can be securely associated with the war period. Two of these that are diagnostic are musket or cannon-sized gunflints. One is a blade-variety flint made of British Brandon flint (Figure 7F). The other is a spall flint made of honey-colored French Grand Pressigny flint (Figure 7G). These would have been used with the 1794 Springfield musket or perhaps on locks attached to cannon. They were recovered in stratigraphic association with the military buttons at the south end of the site.

A total of four lead round balls were recovered from the southern end of the site. Two of these are .30" in size and the other two are .67." The two 30 caliber round balls (cf. Figure 7I) were likely used in "buck and ball" loads that were common among the American Infantry during the war. The remaining two were likely used in single-shot loads for the 69 caliber Model 1794 Springfield musket. All four round shot were in an unfired condition. Archaeologists also recovered one misshapen round ball of roughly 69 caliber. It is cleaved almost in half and badly deformed, but does not appear to have been fired. It may have been taken out of the mold prematurely, and discarded or dropped.

One iron ball shot was recovered (Figure 7H). It is approximately 2.5cm in diameter and would have likely been used in a half-sized three pounder cannon or perhaps a swivel-mounted hand cannon. Alternatively, it could have been used in grape or case shot on a larger 7-12 pounder cannon.

Scrap Iron and Slag

Excavations in Test Units 1-3 (2005) produced an assemblage of scrap iron, brick, charcoal, and slag that are undoubtedly from the blacksmithing operation at the Storrs Harbor shipyard (Figure 8). Archaeologists recovered 3.5kg of iron scrap, the clear majority of which (all but 48g) came from Test Units 1-3. Half of this material came from Test Unit 3, which may indicate a storage/disposal area. Little of this material was identifiable in terms of any standardized form.

Several small 'buttons' of scrap are likely to have been blanks for making nuts. Other long, slender pieces may have been destined to become fasteners such as bolts or nails. Other pieces appear to have been leftover stock in rod or sheet form. At least two of these stock pieces displayed cleave marks used to cut pieces off them. No spectrographic testing has been done to determine the source of the iron, though such testing may be possible in the future.

Figure 12. Sample of Iron scrap (A), slag (B), brick (C) and fasteners (D).

Excavations produced nearly 6kg of slag, again, much of which (5.8kg) came from Test Units 1-3. More than half of this material (3.8kg), again, came from Test Unit 3, while 1.4kg came from Test Unit 1. The slag is diagnostic of a forging operation, rather than a smelting operation, consisting of mostly small, porous pieces. None of the pieces display the glassy appearance typical of smelting slag.

Test Units 1-3 produced 12.3kg of brick fragments, comprising one-quarter of the brick fragments recovered across the site. 9kg of this brick came from Test Unit 3. The brick is soft-fired and very dusty, which would have been typical of cheap bricks produced during the war period. While testing has not been done to determine the source of this brick, historic documents record a brick yard just 2.5km distant owned and operated by Benjamin Barnes in 1812, and later sold to Abraham Jewett (Massey 1981). Jewett was producing bricks in nearby Watertown as early as 1806 and purchased the Barnes operation in 1818. The Jewettville operation produced bricks as well as potash and waterlime; and was in use well into the 1850s. It appears on the J.H. French map of Jefferson County, drafted in 1854.

Nails and Other Fasteners

As could be predicted, nails are the most abundant of the architecture-related artifacts found at Storrs Harbor. Assigning nails to specific buildings, occupations and functions, however, remains problematic, stemming from the contamination of the second 19th century Camp farmstead component. Therefore, only the early, transitional and wrought nail types could be reliably associated with the shipyard. These only made up 22% of the nail assemblage (N=263). Of these, transitional cut nails are more abundant, followed by early cut and wrought nails.

There is every likelihood that some modern cut nails made their way to Sackets Harbor by late 1814, but their overlap with later components makes their provenience problematical. Modern cut nails made up 35% of the nail assemblage (N=404). Cut nail fragments made up an equal proportion of the nails at 34% (N=391).

Figure 13. Wrought iron "ship spikes."

There were also a few intrusive wire nails, as well as one copper and one pewter nail.The most diagnostic of the fastening artifacts are nine wrought "ship" or "boat" spikes. These are large square nails with rose heads reflecting 1-4 facets (Figure 9). The shortest was about 15cm in length, while the longest was almost 30cm. Curiously, they were evenly distributed across the site- perhaps an indication that they were used in architectural construction, rather than nautical construction.

Kitchen

Artifacts related to domestic functions are few across the site except for the area near the Camp residential site, and it is impossible to associate them with either the shipyard or farmstead contexts. It is certain, however, that the 400 workmen employed at the shipyard, and the military, conducted subsistence activities. These activities are undoubtedly reflected in the recovered artifact assemblage.

There were four pieces of flatware recovered from the southern end of the site in the vicinity of the blockhouse. Two of these were fragments of carved bone handles, one was a rat-tailed knife blade fragment and the last was a pewter spoon.

More than 1200 pieces of ceramic ware were recovered from excavations, most of which came from the south end near the Camp residence foundation. Among the assemblage were 11 pieces of Jetware manganese-glazed redware, 105 pieces of pearlware and 2 pieces of creamware that may be associated with the war period. The rest is made up of whitewares, porcelain, ironstones and stonewares that are ambiguous in context. Even the cream and pearlwares would not be out of place in an 1840s component.

CONCLUSION

Following a successful effort to relocate the site of Storrs Harbor, avocational archaeologists under the author's direction have recovered a modest cultural assemblage of a site related to the naval shipbuilding effort on Lake Ontario during the closing months of the War of 1812. This assemblage is unique in its precise association with an identifiable historical context, rather than the war in general, or the war period. There can be no doubt that this site contains yet more evidence of the war and its participants, the latter of whom we are particularly more interested in as anthropologists. The ephemeral nature of the site and its later contamination by 19th and 20th century occupation, makes the task of isolating cultural assemblages difficult. It is unfortunately the case, then, that future excavations are much more likely to recover evidence of the later component which is admittedly very well preserved.

In 2012, we officially ended our investigation of the Storrs Harbor site as other projects have become more important. With such a rich assemblage of sites in and around Sackets Harbor related to the war, it is extremely difficult to focus on just one. We may return to Storrs Harbor in the future, but for now the site lies protected from development.

REFERENCES

Albert, Alphaeus H. 1976. Record of American Uniform and Historical Buttons. Fairfax, VA: SCS Publications.

Ford, Benjamin L. 2009. Lake Ontario Maritime Cultural Landscape. PhD Dissertation, Texas A&M University.

Gibson, Gary M. 2014. Wilderness Battleship: Storrs Harbor and the Chippewa, Lake Ontario's Forgotten Naval Station. Pp. 71

Massey, Solon. 1981. Links in the Chain. Watertown, NY: Junia Fitch Stanton.

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