Transition, 1450 – 1599: the origins of firepower

In the second half of the 15th century a fundamental transition began in the technology of battlefield weapons that was to have a far-reaching effect on the nature of warfare. This has been the subject of much debate amongst historians, some of whom promote and others challenge the idea of a 16th-century military revolution, and argue about its chronology.[1] However, with the exception of study of the surviving ordnance of the internationally important 15th-century Burgundian army and the military equipment on the *Mary Rose* almost all the evidence has been taken from written records. [2] The impact on this subject of the longbows discovered on the Mary Rose cannot be overestimated, yet the ship also provides a snapshot of the transition in progress, with hundreds of lead bullets and composite roundshot preserved alongside the more famous longbows. Yet there is more that archaeology can contribute, particularly from fields of conflict, if the character, location and potential of the archaeological evidence is recognised. Battle archaeology can provide new evidence about the actual use of the new technology.

Battlefields of the late 15th and 16th century have a high research potential because of the contribution that they might make to the understanding of the introduction of firearms. The introduction of lead ammunition for small arms and some artillery in the early modern transition had a major impact on what kinds of evidence for battle archaeology actually survive. From the work at Flodden and Pinkie in 2005-2007, lead and composite lead/iron bullets for hand held weapons and roundshot for artillery would appear to be the main classes of finds from 16th-century battlefields. This is important not only in its own right, but also because it might contribute to the study of earlier warfare. If distribution patterns can be recovered where both lead bullet and iron arrow were used in significant numbers then the survival of the former may assist us in understanding the survival potential and significance of distribution patterns of the latter. In Britain battlefields of the 16th century are rare (see table) and thus any battle of this period will have a particular importance and may justify far more intensive study than the political or strategic importance of the action might otherwise imply.

The humble lead bullet offers a unique perspective on one of the most important cultural developments in the early modern period. Deposited in millions across the world by Europeans between the mid 15th and the mid 19th century, the

[1] Eltis, 1998
[2] Smith and DeVries, 2005. E.g.: Strickland and Hardy, 2005; Walker and Hildred, 2000

Table: rating the archaeological significance of 16th-century actions

action	year	bullet potential	arable modern	arable 1930s	State of development	professional judgement
Sampford Courtenay	1549					3
Fenny Bridges	1549					3
Flodden	1513	3	4	3	1	3
Solway Moss	1542	3	3	1	2	3
Clyst St. Mary	1549	0	0	0	3	3
Dussindale	1549	2	4	4	3	3

bullet is the archaeological signature of firepower, and firepower was arguably a, if not, the main instrument behind European domination of the world in the 19th century. Yet perhaps the most important element in this story, the development of firepower in the fifteenth and sixteenth century and particularly its implementation on the battlefield, has hardly begun to be examined through physical evidence. Aside from the limited work at Flodden and Pinkie, and other work now underway on contemporary sites in Sweden, there has been no substantial archaeological investigation of any 16th-century European battlefield.

Because of the importance of the transition, and given the small size of the resource in England (below, p.121-22), the 16th-century fields of conflict have been taken here as the pilot sample for assessment of the full range of sites, from battles down to small actions, in so far as this is practicable within the scope of the present project.

Although gunpowder weapons were in use in Europe from the first half of the 14th century, it would appear that they were not used in quantity or to any real effect in open battle until at least the mid 15th century, and that they only began to take a decisive, battle-winning role once the technology of gunpowder manufacture had been perfected by the mid 16th century. It is this interaction between the development of gunpowder manufacture and the development of small arms and ordnance to use it that presents a most important challenge for archaeology. Advances in hand-held firearms were first and foremost a response to the opportunities that arose as gunpowder technology advanced up to the mid sixteenth century, culminating around 1550 with the introduction by the Spanish of the musket, which was to become the dominant battlefield firearm for the next three hundred years.

Already, the first stages of analysis of bullets and related small arms and artillery firing experiments for the seventeenth century hint that bullet and roundshot

assemblages from fields of conflict might offer a unique perspective on this iterative process in the evolution of firepower. The evidence of temperatures and pressures left on the lead projectiles as a result of firing, together with the damage on the projectiles and on the impacted surfaces resulting from impacts, provide potential evidence for changing efficiency in weapons technology. To explore this fully it is essential to identify the sites, conserve their archaeological assets, and sample the evidence. Hence, a signal finding of this project is that until secure sample assemblages of fired bullets and other data are recovered from fields of conflict, complemented by new experimental work, it will be not be possible to establish the potential or to effectively manage the resource.

While fields of conflict tend to be relatively few in any given period compared to most other archaeological site types, in England those of the 16th century are particularly rare, because this was not a period of intensive warfare on English soil. English armies were most often engaged abroad, particularly in Ireland and to a lesser degree in Scotland, the Low Countries, and France, including the Battle of the Spurs in 1513, Henry's only real continental action which was little more than a cavalry skirmish.[3] Thus in this period, more than any other, battlefields in England should be viewed not as a discrete group but as just part of a wider resource that needs to be assessed on an international scale, focusing in particular on the actions of English armies abroad as well as at home. From what were probably gunpowder weapons' first battlefield use in Britain at St Albans in 1461 to their decisive influence on the outcome of Pinkie in Scotland in 1547, and from the unique assemblage of the 1545 wreck of the Mary Rose, Britain should present an unusual archaeological perspective on their introduction to the battlefield.

Of all European countries, England traced a distinctive path in the transition from bow to bullet. It is often viewed as a backwater in which, through a high degree of inertia, the longbow was retained against the international trend. Perhaps equally important, because of the degree to which English armies continued to use the longbow side by side with gunpowder weapons long after the transition from the crossbow was completed by most other military powers, these battlefields may offer unusual potential for the archaeological investigation of the bow in battle, with the lead bullet providing the battlefield patterning within which the evidence for the ferrous arrow and other artefacts distributions can be sought with confidence of location and context.

[3] Cruickshank, 1990

One type of evidence not yet located in England but which might exist on siege sites, having apparently been located on at least one Scottish site of the sixteenth century,[4] is bullet impact scars, which are discussed below for 17th-century sites.

Assessment

At St Albans II, in 1461 and followed at Barnet in 1471, companies of Burgundian handgunners were engaged. There is also limited documentary evidence to suggest that small arms were used in small numbers of other battles in the Wars of the Roses (above: p.00).[5] While some sites such as St Albans II have been largely dismissed as archaeological sites because the physical evidence across so much of the site has been destroyed, this is an issue which is of such importance, and where the archaeological evidence is so rare, that even a small area of surviving battle archaeology could be of great significance and is consequently worth the extra, fine-grained search.

Another transition battle, Flodden (1513), involved some 40,000 English and Scottish troops and was of international scale and significance. Firearms and artillery were used, though compared to the impact of the English archers not on a scale or with sufficient efficiency to have had a critical effect on the outcome. Flodden does, however. offer the potential to define a baseline against which to assess the introduction of firearms on later battlefields.

The other major English battle, Solway Moss (1542), was of much smaller scale and a rather unusual type of action, being dominated by English light cavalry, but it did see the arquebus play a substantial role. The terrain evidence in the primary accounts is too sparse to delineate the area of action, especially given that the English cavalry engaged in loose order to fire at the infantry. The extent of the action will only be determined by a survey of battle archaeology. Such a survey will need to take account of the fact that the archaeology of cavalry action in this period will be even more problematic to locate and interpret than that of infantry, chiefly because of the far lower density, and possibly smaller calibre, of bullets.[6] The Scottish forces as

[4] Bullet impact scars are visible on the walls of Crichton castle (East Lothian), which has a series of 16th-century gunports, and also on the church there. The site was besieged in 1559 and the scars are thought to come from this attack, though it is possible that the site also saw later action.

[5] Foard, in preparation-a

[6] The archaeology of cavalry action in the 16th century awaits study. In principle, the 'caracole', the standard cavalry tactic of the period in which ranks of horsemen trotted or walked up to the enemy infantry or cavalry, discharged their pistols at very close range, before wheeling to the rear to reload (in effect, a mounted version of the infantry counter-

well as the English were probably using significant numbers of firearms, but it may well be possible to isolate the bullets from the mounted harquebusier on the basis of calibre. Given that the action was largely one of light cavalry skirmishing, then the distribution of bullets and other artefacts in the main action may be expected to be unusually light. Moreover, there is no indication of artillery, and thus the most distinctive 16th-century munitions, seen at Flodden and Pinkie, are unlikely to be present. All this adds up to a likelihood that the evidence to determine the extent of the action may not be recoverable from a given development evaluation, and in the absence of this it is impossible to determine the degree of threat from further encroachment of development on the south side of Longtown. Even if the Registered area does encompass the whole battlefield, it is important that a reconnaissance survey is undertaken to establish whether battle archaeology can be located and if so where and of what character.

Two more English 16th-century battles, Dussindale (Norfolk) and Sampford Courtney (Devon), are largely ignored by national battlefield studies and were apparently not considered for the Register. Both involved between 5-10,000 combatants and seemingly included substantial numbers of mercenaries firing arquebus alongside or against the longbow. They also saw significant use of artillery. Where the two weapons were used in quantity in a single battle then that battlefield may offer a unique opportunity to assess the potential of ferrous arrows as a viable resource for battlefield study. This may also enable the wider character of the archaeology of late medieval battles to be assessed with confidence as to where in the action one is looking. The only battlefield in Britain so far to produce small arms bullets is Pinkie in East Lothian, Scotland in 1547, where they appear to be present in significant numbers.[7]

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march) could produce a significant and possibly distinct signature. This remains to be ascertained.

[7] Foard, 2008a

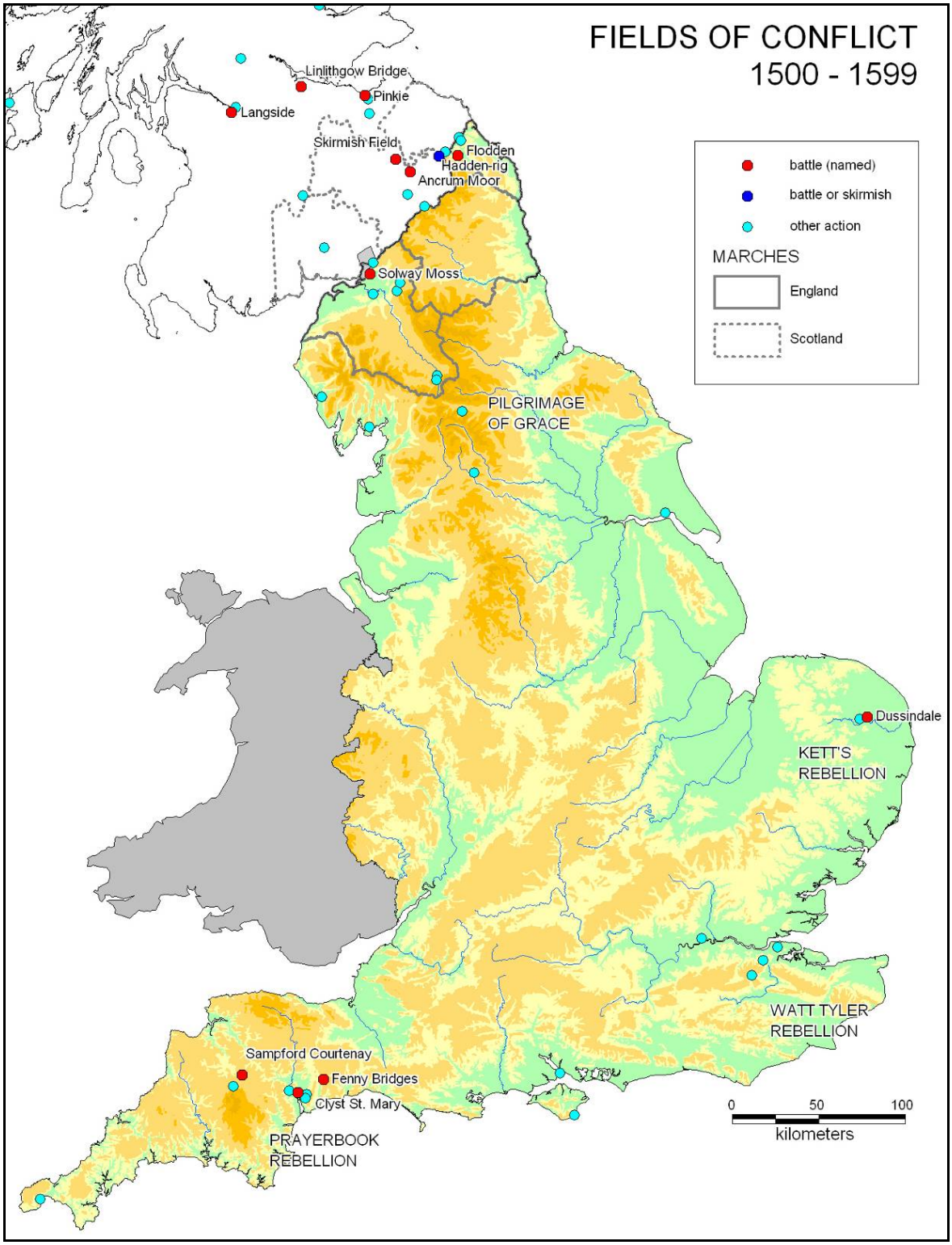


Figure 35: Sixteenth-century fields of conflict

The Scottish Border

The greatest concentration of military action in 16th-century England was on England's only land border, with Scotland. Here on both sides of the border were military administrative territories or Marches which organised border protection through garrisons, several of which were besieged and taken during the period. In

addition to the battles of Flodden and Solway Moss there were lesser actions, mainly developing out of large border raids.

Border raids, sometimes on a very large scale involving substantial Scottish forces also occurred in this region during periods of tension, while lesser raiding – for example, stealing cattle – was a way of life.[8] Most, such as the 1537 raid on Muncaster, were small scale actions and have not been a priority for database enhancement. Only three were added for the 16th century (these being thrown up as a result of the intensive review of Cumbria (p.00)), so it is likely that this evidence is underrepresented in the database.

The more substantial cross-border raids could lead to significant engagements, as at Grindon in 1558, which supposedly took place on Battle Moor. The area is wholly undeveloped but under intensive arable. Another large raid through the Debatable Lands precipitated the battle of Solway Moss in 1542. A further substantial skirmish took place at Gelt Bridge / Naworth in 1570, though there is uncertainty about location. While the minor raids may yield little of relevance, the larger actions may provide a useful perspective on the character of warfare and the weapons in use. The same is true of the small number of sieges of garrisons and fortified sites along the border. Wark Castle, Northumberland, besieged in 1513 and1523, is a Scheduled Ancient Monument with earthwork survival and a substantial part of its environs undeveloped. Liddel Strength, Cumbria, besieged in 1528 and 1583, is another intact Scheduled earthwork with unbuilt environs comprising arable, wood and pasture. Both thus have potential for bullet scatters and other artefact patterns arising from any fire fight. Other sieges included those in 1513 at the important Carlisle garrison, and at the castles of Norham and Etal.

While it is clear from limited work already undertaken that there is substantial archaeological potential in the investigation of siege sites, no work has been undertaken on 16th century sieges in England to ascertain if historically useful information may lie within the structures or in surrounding ground.

[8] Fraser, 1974

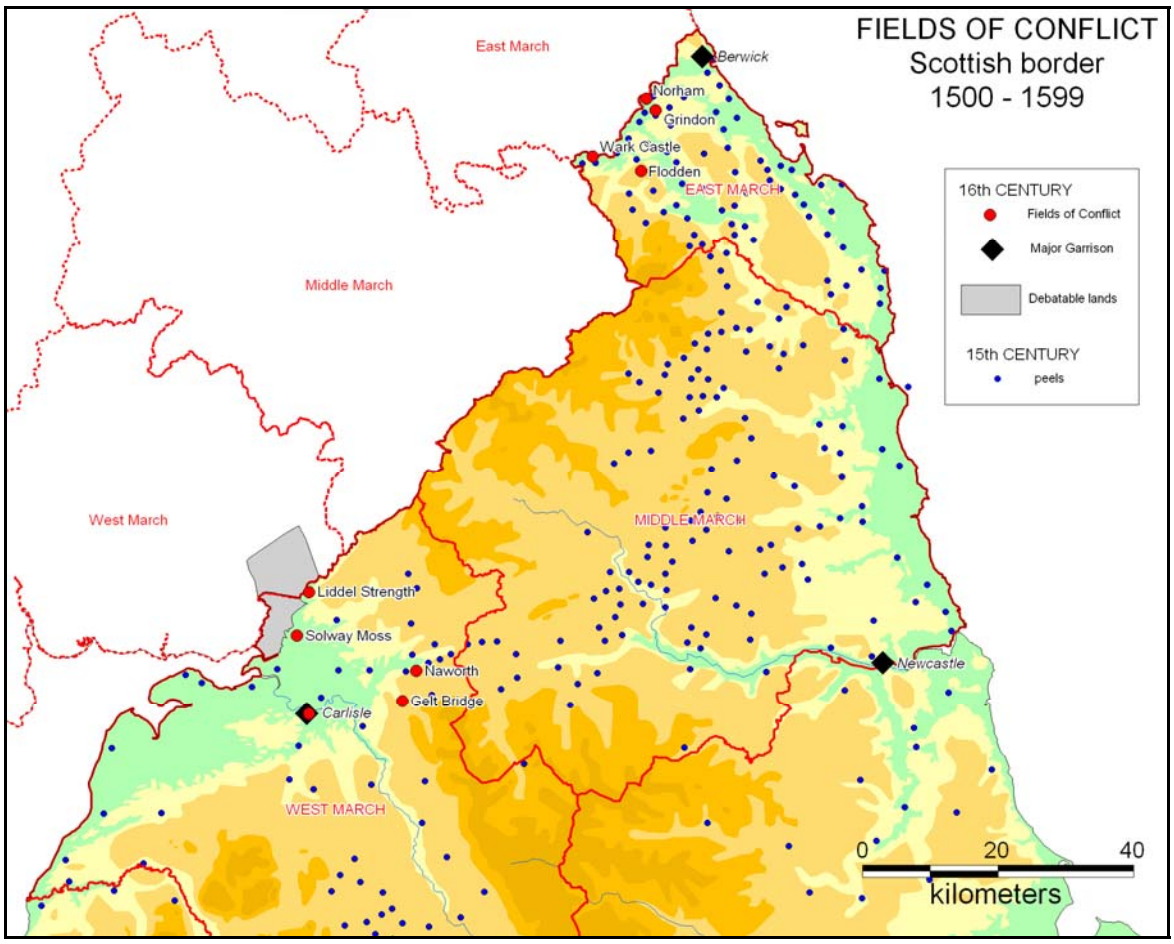


Figure 36: Fields of conflict on the Scottish border viewed against the military administrative areas, the major garrisons and supply bases, together with the distribution of lesser fortified sites of the 15th century, used in the absence of identification of an easily accessible 16th-century data set

Multiple sieges on some of these sites may complicate the study of actions of transitional character because of the superimposition of patterns of artefacts from different actions. At Carlisle, the urban location probably means that little if any evidence survives outside the defences, though excavation may reveal useful evidence of bullet scatters if the potential is realised and metal detectors are systematically used. At and around Berwick, the potential seems to exist, particularly in the town's hinterland, for a major landscape-scale study integrating the physical and documentary evidence for Flodden with that for the various sieges, skirmishes and raids. If pursued as it should be in as a cross border study, then the range of sites will also include Ancrum Moor and Haddon Rig, together with skirmishes at Sclaterford, Grindon and Gelt Bridge/Naworth. Such a project could logically be extended to include the Pinkie campaign and thus build up a coherent regional picture of the archaeology of warfare in the 16th century.

The nature of warfare on the border was such that a somewhat different character may be expected to the training, equipping and leadership of the troops engaged, and the nature of the action, than was seen elsewhere in the country. Action can clearly be seen to focus on the main routes between the two countries: that on the east coast – the one most frequently used by major armies – controlled by the Berwick garrison of the East March, supported by lesser strategic sites including Norham castle; the other on the west coast, controlled by the Carlisle garrison of the West March; with Newcastle in the Middle March as the major fortified rearward supply base and port for logistical support.

The written record for Anglo-Scottish Tudor warfare has been studied in detail, particularly by Phillips.[9] There is, however, no satisfactory account of any of the battles and lesser actions that is married to an adequate understanding of the fields of conflict themselves. If these sites are to be effectively managed, and their research potential realised, this needs to be remedied.

Naval raids, rebellions and civil unrest

Apart from conflicts along the Scottish border the sixteenth century was a largely peaceful period in England. There was just a handful of naval raids on the south coast ports by the Spanish and French. Only a handful is identified here, such as the Spanish raid on Penzance and Newlyn in 1595. These actions appear to be mainly urban in character and unlikely to yield significant battle archaeology. Other minor events of civil unrest were noted with monks at Cartmel resisting the dissolution of the priory in 1537 and other private conflicts at Wharton in 1549 and in Ryedale; others of this kind were certainly missed in the enhancement process and will come to light in due course. At this stage, however, none appears likely to have particular archaeological potential and they are not considered further here.

However, in the mid-16th century there was a series of rebellions linked to grievances which led to substantial armed conflict. The first was the Pilgrimage of Grace in 1536-7, which included sieges of Carlisle, Hull, and Skipton castle in 1536, and a skirmish at Kirkby Stephen in 1537. All the garrisons saw action at various times in the sixteenth and seventeenth centuries, while Hull and Carlisle in particular are probably now too heavily developed for any significant archaeology related to the 16th-century events to survive.

[9] Phillips, 1999

1549 saw two armed insurrections. In south west England the Prayerbook Rebellion led to a siege of Exeter and several skirmishes of which Clyst St Mary and Fenny Bridges might be classed as battles. The former site, if correctly located, was largely developed in the late 20th century, though negative evaluations on peripheral developments raise questions about the accuracy of location. The Fenny Bridges site also appears to have been severely affected by a railway and bypass. Apparently more substantial was the action at Sampford Courtney, a largely undeveloped site, where as many as 5-10,000 were engaged.

1549 also saw Kett's Rebellion in Norfolk. The major action was at Dussingdale, immediately east of Norwich, but there was also skirmishing within the city itself at St Andrew's Plain and Palace Gate. Twenty-five lead bullets were found by metal detecting in 16th-century garden soil in a small (4 x 4m) excavation. This was a very high density of bullets for the area examined, and association with other mid-sixteenth century artefacts could relate to the 1549 action.[10] However, the deposits were stripped without significant investigation in preparation for full excavation of Anglo-Saxon deposits below. In the absence of published data on the bullet weights it is not possible to assess how the calibre of the assemblage relates to other assemblages form the period. The lesson here is that while in many urban settings there is little or no potential for significant archaeology of urban actions, on some sites useful data do exist and could be retrieved if there are clear and justified research priorities.

Wyatt's Rebellion in 1554 resulted in skirmishes at Wrotham and Cobham, a siege at Cooling Castle and a larger engagement at Temple Bar in London. The site of the Wrotham action, which involved about 1,000 combatants and included firearms as well as archers, is suggested in Black Sole field. Part of the area is developed but the rest remains agricultural land.

Priorities

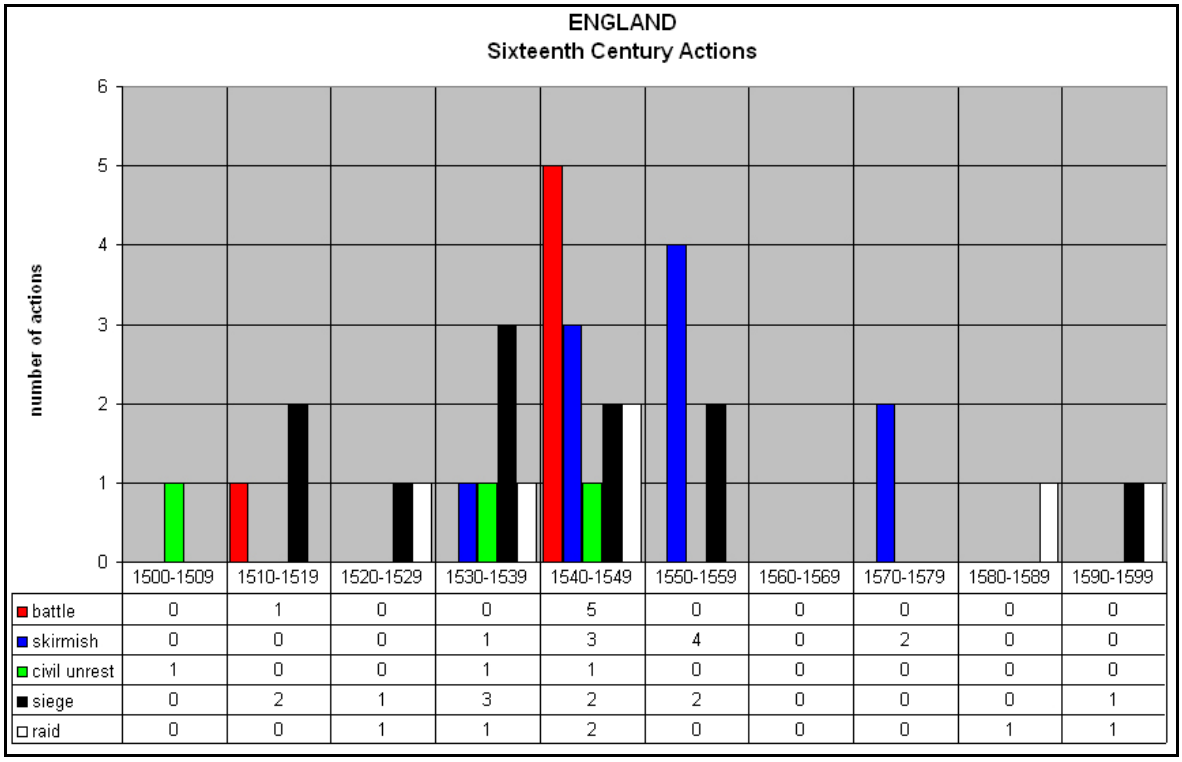
The general argument in this report is that, at least in the short term, the investigation of skirmishes and raids should not be a priority, because much more information can be retrieved and many more priorities addressed through the investigation of battles and sieges. In the case of the sixteenth century, however, we argue that sites of these lesser actions should be a priority. This is partly to compensate for the paucity of 16th-century sites in general, but also because of the

[10] Emery, 2000

- importance of the origins of firepower as a research theme
- potential for archaeology to add significant data, and the
- possibility of examining the penetration of firearms into the militia

Lesser sites accordingly need to be located, assessed for survival and then tested for surviving battle archaeology. As such they could also represent a pilot for the investigation of lesser sites in other periods. But given the limited extent of firearms use in this period the difficulties of investigating such sites should not be underestimated.

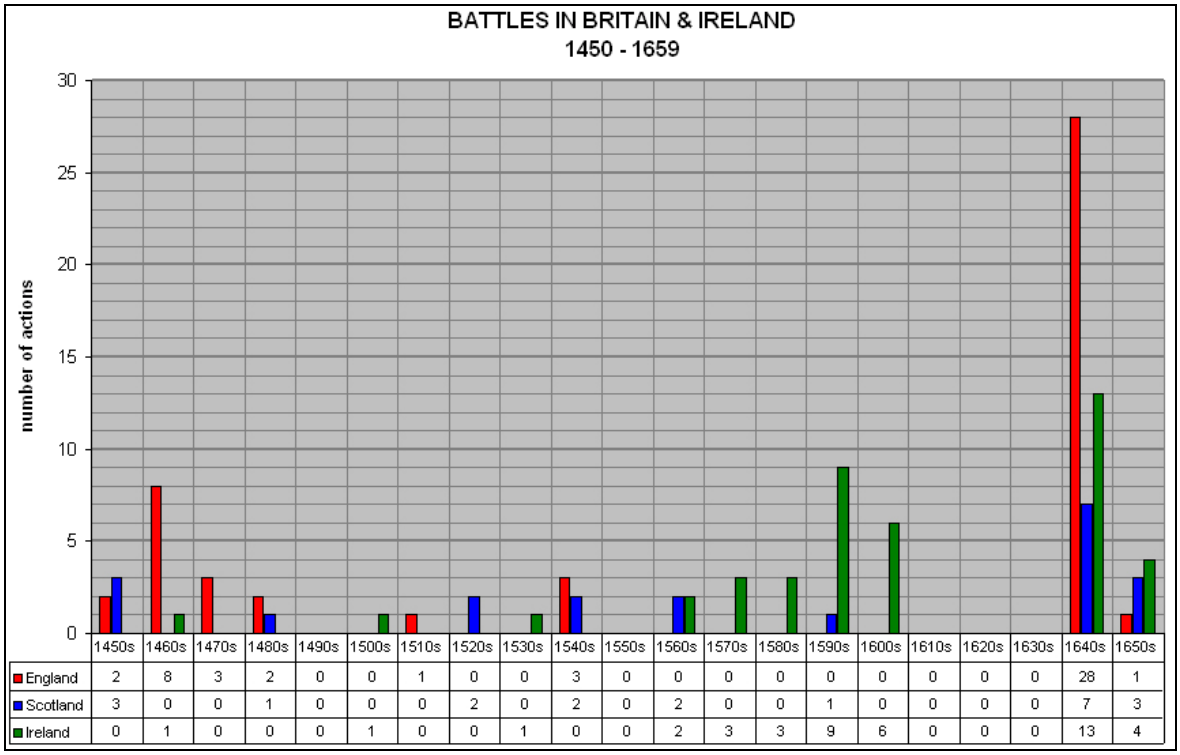
The lesser actions in English regions, mainly from the rebellions against Henry VIII, each with well under 5000 combatants, where mercenary harquebusier appear not to have been used, warrant classification as skirmishes rather than battles. These actions may have a potential which far outweighs their scale, or their military or political significance at the time. This is because they may provide evidence of the degree to which firearms had been adopted by the militias, and the nature of those firearms. They would thus provide a valuable comparison with the archaeological evidence to be expected from the battles where mercenary harquebusier were involved.



	1500-1509	1510-1519	1520-1529	1530-1539	1540-1549	1550-1559	1560-1569	1570-1579	1580-1589	1590-1599
battle	0	1	0	0	5	0	0	0	0	0
skirmish	0	0	0	1	3	4	0	2	0	0
civil unrest	1	0	0	1	1	0	0	0	0	0
siege	0	2	1	3	2	2	0	0	0	1
raid	0	0	1	1	2	0	0	0	1	1

Figure 17: All actions in 16th-century England recorded on the database. Sieges, skirmishes and especially raids are under-represented, probably by a wide margin

Figure 37 shows that not only were 16th-century English battles few in number, but also that their chronological spread is uneven. As this is a period of fast moving technological change, it is important to see as broad a chronological span as possible. Thus it is essential to assess the actions in England in the context of English military action in Scotland and Ireland throughout the century (Figure 38). Significant differences are to be expected in English armies as time passed and also between forces suppressing rebellions within England, forces defending the frontier and English armies fighting major international actions at home or on foreign soil. Finally, it will be important to make comparison with the activities of contemporary military powers elsewhere in Europe to see if, as historians argue, the Tudors really were using the arquebus far less, and bringing it much later to the battlefield, than other European powers. Here it is even more important that the chronological span is extended, to reflect leading military powers such as the Burgundians and the Spanish who were introducing gunpowder weapons to the battlefield by the mid fifteenth century.[11]



	1450s	1460s	1470s	1480s	1490s	1500s	1510s	1520s	1530s	1540s	1550s	1560s	1570s	1580s	1590s	1600s	1610s	1620s	1630s	1640s	1650s
England	2	8	3	2	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	28	1
Scotland	3	0	0	1	0	0	0	2	0	2	0	2	0	0	1	0	0	0	0	7	3
Ireland	0	1	0	0	0	1	0	0	1	0	0	2	3	3	9	6	0	0	0	13	4

Figure 28: Battles in Britain and Ireland 1450s-1650s (interim data only for Ireland: not collected to same standard or validated)

This is an important research theme that requires a major research project. This work must be done quickly, so that the evidence can be recognised and effectively

[11] Smith and DeVries, 2005

conserved for future study. The need for swift action arises because at present the eviodence is not recognised for what it is, and where it is being found it is usually misunderstood, often being mistaken for material of much later date. The problems are compounded by the fact that the transitional munitions are present in small numbers compared to the more prolific bullets and roundshot on seventeenth-century battlefields. Thus they are probably currently being lost amongst the background noise of the very low density bullet scatters left by sporting activity from the 16th to the 19th centuries.

Munitions of the fifteenth and sixteenth centuries

Lead bullets were used in guns in China by the early 14th century and in Europe before the mid fourteenth century. In 1337 the English ship the *All Hallows* carried an iron weapon firing quarrels and lead pellets using gunpowder, while in 1384 Chaucer could write: 'as swift as pellet out of gonne when fire is in the poudre ronne'.[12]
Though there are records of their use in sieges it was not until the 15th century that they became significant weapons andused in battles by the leading European military powers. There were handcannon in the arsenal of the Dukes of Burgundy throughout the fifteenth century, for which the ammunition was almost solely lead ball, in addition to a bewildering array of artillery, large and small, for which the ammunition was mainly of stone or less often of iron.[13] In the late 15th century the cumbersome and inefficient handcannon with its large calibre ball was rendered obsolete by the introduction of the arquebus, which had the same basic form as later muskets but was of a smaller calibre. This was made possible by developments in the technology of the manufacture of gunpowder which dramatically altered the rate, degree and consistency of energy release as well as its stability prior to use.[14]

As we have seen, the archaeology of battle in the 16th century has hardly begun to be studied and there is no characterisation of the nature of battle archaeology of the period anywhere in Europe. Since an understanding of the nature of the munitions is central to any assessment of the archaeological potential of fields of conflict, it has been necessary here to define the current state of knowledge for Britain. Following the lessons learnt from the study of 17th-century battle archaeology (below: p.00), the present analysis began with an assessment of the munitions on the *Mary Rose*. The data from the wreck have then been used when examining the material from recent fieldwork at Flodden and Pinkie, and will also provide an initial a guide for material from other sites such as Solway Moss and Dussindale. It is less

[12] *The Hous of Fame*; Kelly, 2004, 92
[13] Smith and DeVries, 2005
[14] Strickland and Hardy, 2005, 398-407

clear whether these data are relevant to weapons in use in 1513, as this was a period of rapid change in small arms technology.

The *Mary Rose* sank in 1545 while engaging the French fleet. While best known for her complement of longbows, the *Mary Rose* also exhibits the origins of firepower. Her magazine originally contained a large number of roundshot for artillery, hailshot in the form of flints in wooden boxes, as well as more than 1000 lead bullets for small arms. Of the latter only a small number have so far been retrieved from the wreck, representing just 6 per cent of the total supply of bullets recorded in the vessel's inventory. The bullets came from various locations within the ship and it is unclear at present whether they were intended for a few specific weapons rather than providing a representative conspectus of the calibres available in the ship.[15] Indeed, the relatively small sample of munitions from the *Mary Rose* need not be wholly representative of the period as a whole or even of English armies of the mid 16th century. There is therefore the need to examine other collections of munitions from 15th- and 16th-century wrecks, and other magazines of whatever country. Ultimately, however, the reality of the use of gunpowder weapons in the 15th and 16th centuries can only be determined by study of the fields of conflict themselves.[16]

Lead bullets for arquebus

The methodology developed for the study of lead bullets from the seventeenth century appears directly applicable to the study of those of the sixteenth century, though the problems are greater because the quantities are much smaller and comparative data sets are not at present available. Examination of the lead bullets for small arms from the *Mary Rose* demonstrates that they were manufactured in a similar way to those of the 17th century but that the calibre signature of the assemblage as a whole from a site may prove distinctive to the period.

Just one potentially distinctive attribute of some of the *Mary Rose* bullets is the presence of multiple cuts caused during sprue removal, a feature which has not been recognised on other later material. However, this is not visible on all the bullets and may prove to have no relevance to the dating of the bullets.

[15] Information from Hildred. Calibre and character detail are from the author's analysis of the assemblage

[16] Gardiner, ed., 2005

Figure 39: Lead bullet for use in a 'hackbut' otherwise known as an arquebus, showing the mould ridge and the sprue snip with central bar (*Mary Rose*)

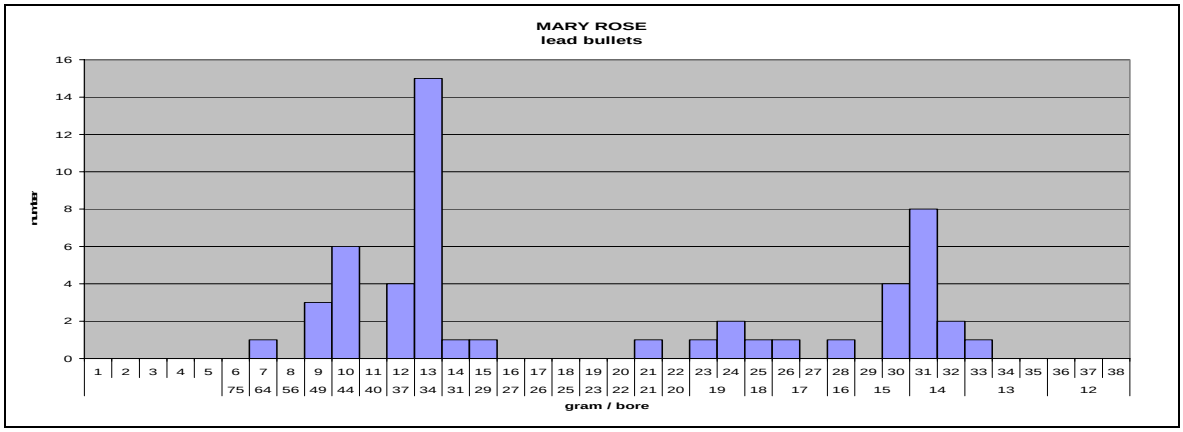


Figure 40: Calibre graph for lead ball from the *Mary Rose*, wrecked 1545

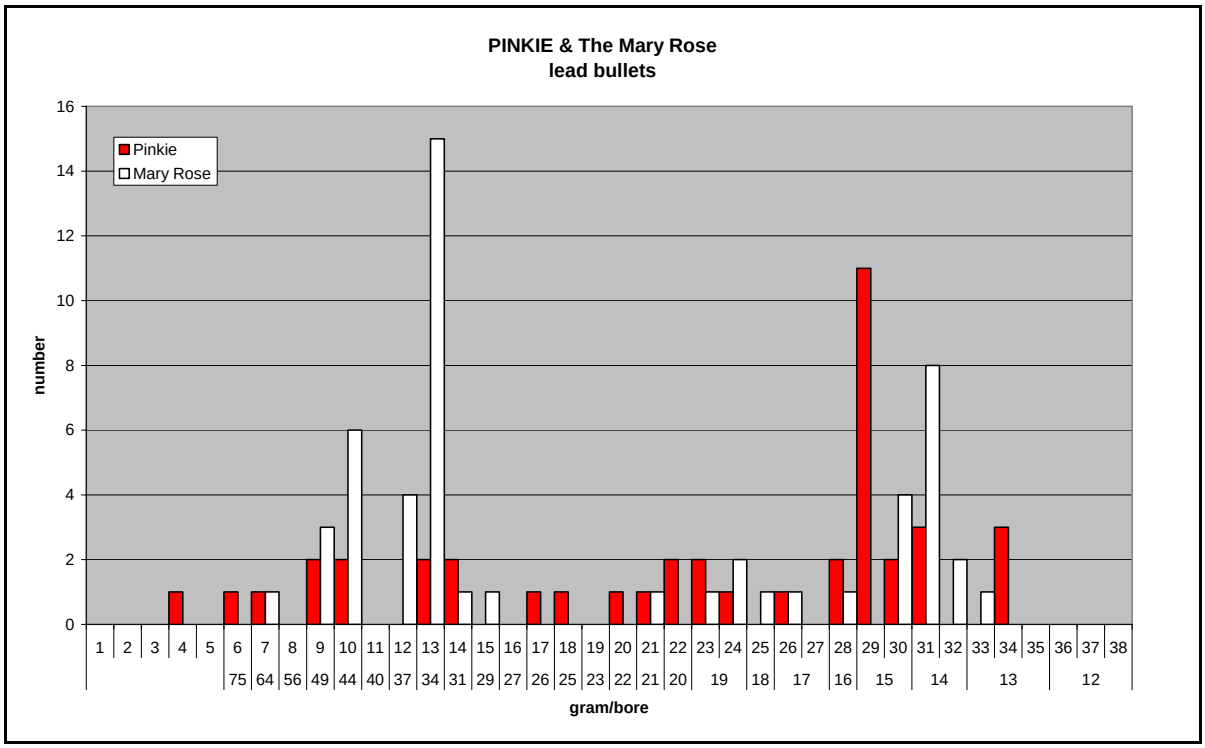


Figure 41: Comparison of calibre of assemblages of lead bullets from Pinkie and the *Mary Rose*

The calibre graph, most practically prepared in grams and cross-referenced to bore (bullets to the pound of lead), has been shown for the seventeenth century to be the most effective way in which to gain an overview of an assemblage of spherical lead bullets. Though there are many caveats regarding the nature of the sampling process involved in the collection of the assemblage, the exact position of the peaks and the gaps in the graphs may provide a reasonable, though not infallible guide to the period of a bullet assemblage.[17] For 16th-century battlefields the small number of bullets from the *Mary Rose* provides a more limited guide, and wider research on wrecks of the period is urgently needed to provide a comprehensive partial baseline from unfired magazine assemblages. If we take into account the calibre shift seen in larger calibre small arms bullets, as a result of melting during firing, then the calibre graph from recent fieldwork at Pinkie appears very different from later battlefield assemblages but is fairly compatible with the *Mary Rose* data (though with this said, the sample is currently too small to draw secure conclusions).[18] The fact that many fewer firearms were in use on the 16th-century battlefields than in battles of later periods in turn points up the high intensity of organised detecting that will be required on 16th-century sites to recover a sufficiently large assemblage of bullets.

Bullets for handcannon

Handcannon or 'coulovrines' and the bullets for use in them are documented for the 15th-century Burgundian arsenal. For handcannon the bullets are almost exclusively of lead throughout the 15th century. There is little specific information on calibre but one description indicated lead ball of 1134gram (2.5lb) which would be 57.5mm diameter, for use in 'culverins'.[19] The bore of a surviving handcannon of c.1440 in Basel is 29mm, which would give a ball of circa 150gram. One lead ball with a diameter of 40.67mm, recovered with the other bullets from Barnet (above), does lie within the potential calibre range of hand cannon. However, from the discussion roundshot (below: 00), that there is potential for confusion with artillery roundshot.

It is possible that the bullets recovered from Towton and from close to Barnet do not derive from those battles but rather represent background noise of later date. The Barnet calibre graph shows the metal detecting finds from immediately south-east of Monken Hadley are unlike any other of 16th or 17th-century date that have so far been examined. The slight focus on seventeen bore is however the bore identified by Cruso in 1632 as that of an arquebus. On present evidence it would appear that these bullets are of the wrong calibres for handcannon of the mid 15th century. The

[17] Foard, 2008a
[18] Foard, 2008b
[19] Smith and DeVries, 2005, 248-253

Towton graph looks very similar to background noise as seen at Bosworth and elsewhere.[20]

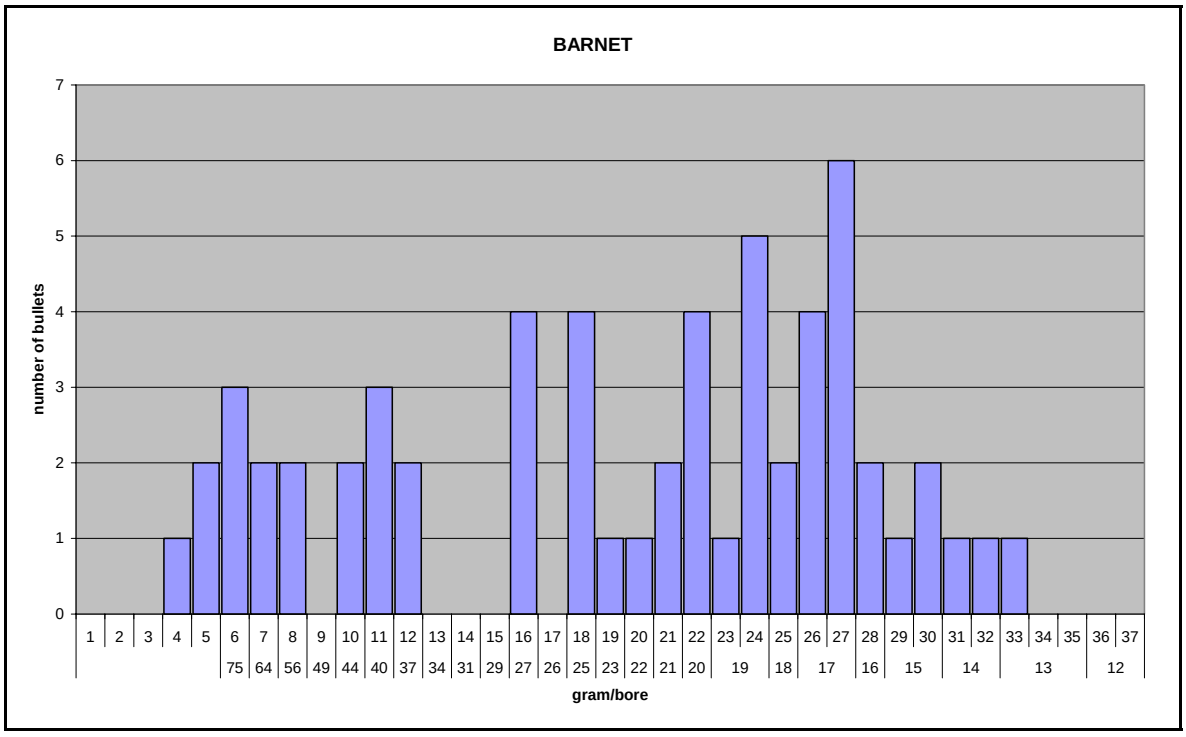


Figure 42: Calibre graph from Barnet, possibly representing background noise of later date

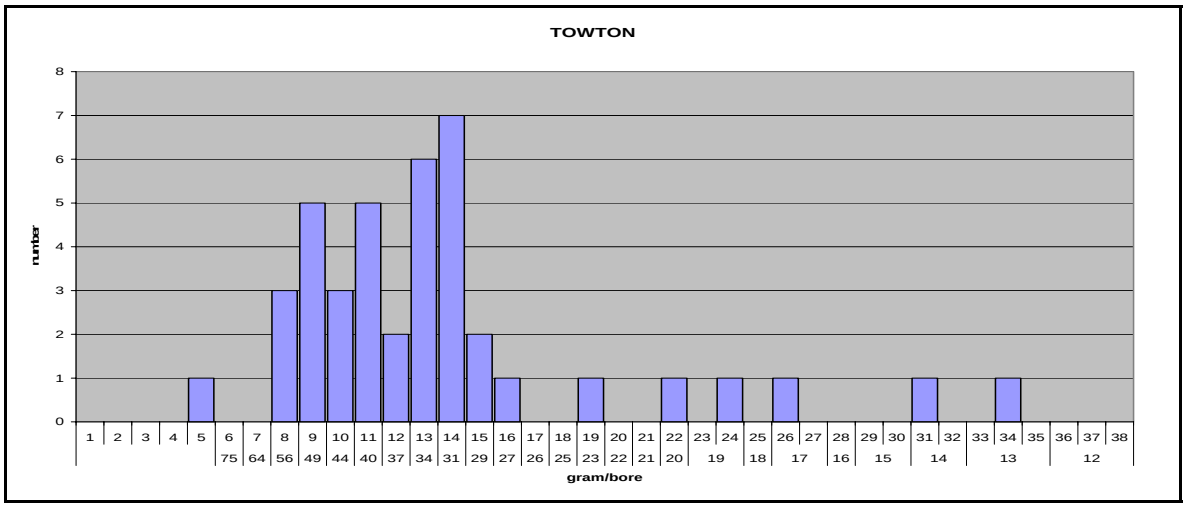


Figure 43: Calibre graph from survey of Towton battlefield, believed to represent background noise from later sporting activity

[20] Foard, 2008a

Background noise

Given the relatively limited use of hand held firearms on 15th- and 16th-century battlefields, at least until the middle of the 16th century, it will be essential to have a high intensity of metal detecting survey on these battlefields to recover sufficient quantities of bullets to be able to distinguish early munitions from the result of later sporting activities. If there is later military action on a site then separating the two assemblages will pose an even greater challenge. This is a concern, for example, at Pinkie, where there was also a Civil War cavalry action somewhere near Musselburgh, as well as the possibility of finds resulting from training at a nearby early 19th-century barracks.

If the general background noise from sporting activity is to be screened out, then it will be necessary for regional reference collections to be brought together from non battlefield sites, as is already for data from Midland England.

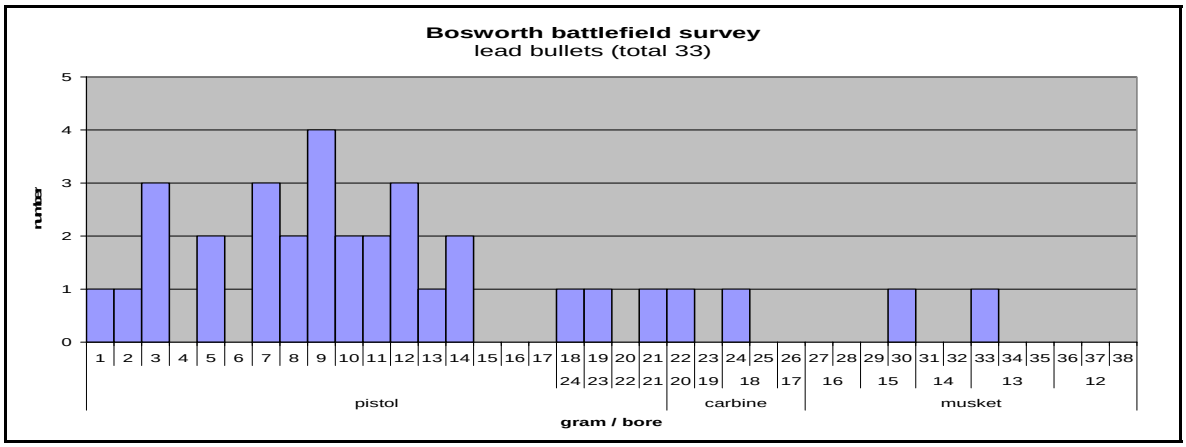


Figure 44: Calibre graph from survey of Bosworth battlefield, believed to represent background noise from later sporting activity

Roundshot

Most metal ammunition documented from the fifteenth century was of lead or composite lead/iron and was for use in smaller calibre weapons, both hand-held and artillery. These are reflected in purchases in the Burgundians records for 1476-77 for 'Making of 2,000 plommées, 6 f. and purchase of 600 livres of iron to make cubes to put in plommées', and in another from 1473-74: 'Item 200 lead plommées, some of which have iron inside, for the said serpentines, the said plommées weighing 505 livres.' Significantly, the Burgundian records suggest these were much more expensive to make than solid metal shot.[21] Whereas roundshot wholly of lead are not obviously distinctive from those of the 17th century, composite roundshot was in use

[21] Information from Kelly De Vries

from least the 1470s but seems not to have continued beyond the end of the 16th century.[22]

The *Mary Rose* contains a large number of roundshot for artillery. While the larger calibres are of iron or stone, the smaller calibres are almost all composite. There is just one intermediate sized roundshot of lead but this is a fired round and so represents incoming fire rather than being from the English ship's magazine.

Figure45: Distinctive 16th-century composite roundshot of 'iron dice cast about with lead' probably for use in an artillery piece called a Falconet, with a bore of 57mm, here showing evidence of firing (Flodden battlefield survey)

Figure46: Unfired composite roundshot of multiple small iron dice cast about with lead, where the dice are now lost through oxidisation leaving two conjoined and roughly square holes in the lead sphere (The *Mary Rose*)

At Pinkie two certain and one possible composite roundshot and one apparently wholly lead roundshot have been recovered. The two calibres of composite represented are close to the two main calibres represented on the Mary Rose. The smaller is 221g and the larger 530grams. From Flodden the composite roundshot are of 576g, c.49mm, and an incomplete damaged ball of 387g but

[22] Lists of munitions in the Tower during the 16th century are printed in Blackmore, 1976

apparently or nearly identical diameter. All the composite roundshot from Pinkie and Flodden have single large dice but on the *Mary Rose* there are also a small number of examples with at least two smaller dice. The larger of the two calibres are approximately that of an artillery piece called a falconet.

In the absence of experimental data one must use the manuals, though these only relate to effective range, not final range after bounce and roll. According to Bellone in 1587 the point blank range of a falconet was 381m (250 paces or 1250ft) and the extreme range 4572m (3000 paces, 15,000ft). However, the information provided by different manuals varies both in the weight of the munition and the range.

Two lead roundshot is also reported from Barnet, where it is known that a substantial artillery exchange took place before the battle. It is of 538.4g (1.187 lb) and 46.2mm in diameter. A second is 362.6g and 40.3mm. Although both are identified in the Portable Antiquities database as being from the 17th or 18th century, they lie well within the range of calibres of lead roundshot recorded for 15th-century Burgundian artillery. Confusingly, the PAS database places them well away from their actual place of discovery, one over a kilometre to the north east the 400m to the south east of the actual location of discovery..[23] There is no recorded military action in this area from the Civil War. Since such small roundshot of lead are not common finds and so it is highly likely that both derive from the battle of Barnet.

Hailshot

The other class of munition for artillery was hailshot. These were for use at close quarters and comprised either iron dice, pebbles or ordinary lead balls as used in small arms. They could be fired loose or in cases of wood, metal or canvas. Though well known from 17th-century battlefields (below), 15th- and 16th-century hailshot munitions are known only from documentary sources or from the *Mary Rose* and other wrecks. None have yet been identified in a battlefield context.[24]

[23] Information from Adrian Coulston, Hendon and District Archaeological Society, based on information provided by the finder.
[24] Starkey *et al*, 1998

Figure 47: Dice of iron to be used as hailshot, fired loose from a Murdered (The *Mary Rose*)

Research questions

For reasons already given, it is only now becoming possible to begin to frame research question for the study of munitions of the period. There are obvious questions, such as the reasons for the use of the more expensive and difficult to manufacture composite roundshot in preference for wholly lead roundshot. There are also wider questions that could be addressed by the study of the munitions from wrecks and battlefields, including the degree of standardisation of the calibre of bullets. This is important both for an understanding of the weaponry themselves but also has significant implications for the study of the development of industrial processes and particularly the progress in the reduction of production tolerances from the 15th to the 19th centuries, culminating in the dramatic changes seen in the industrial revolution.

Table: Bore and weight of roundshot for artillery and small arms from Eldred (1648 but relevant to the early 17th century and before)

	Bullets to the pound	*Bullet weight in pounds and ounces*	*Bullet weight in grams*
Caliver	**20**	**0.8oz**	**22.6**
Musket	**11**	**1.45oz**	**41.1**
Hargobus of Crock shot	**7.5**	**2.13oz**	**65.2**
Po(r)t Piece		**11.25, 0**	**5103**
Fowler		**6, 3**	**2806**
Base		**0, 6**	**170**
Robinet		**¾**	**340**
Falconet		**1 ¼**	**566**
Falcon		**2 ¼**	**1020**
Minion (3 prd)		**4**	**1814**

Saker (6 pdr)[25]		**5 ¼**	**2381**
Demi-Culverin ((12 pdr)		**9**	**4082**
Culverin		**15**	**6803**
Demi-Cannon		**27**	**12246**
Cannon		**47**	**21318**
Cannon Royal		**63**	**28576**

[25] Royalist ordnance papers refer to 6 pounders and 12 pounders. They have been listed here together with saker and demi-cannon, with which the bullet weights broadly coincide.

Sixteenth-century case studies

St Albans II

Date: 17th February 1461

County: Hertfordshire

Grid Reference: TL151078

Outcome: Lancastrian victory

Location: secure

Terrain: urban / heath

Armies: Yorkist; Lancastrian

Numbers: up to 40,000

St Albans II was assessed for the Register but quite reasonably considered to be too badly damaged to justify inclusion. However, in the light of the potential of the site to contribute to the understanding of the introduction of gunpowder weapons, a rapid desk based assessment of the likely survival of battle archaeology has been conducted here. [26]

While much of the action in the battle of St Albans II took place within the urban area itself, part of the action took place on Bernard's Heath on the north-eastern edge of the town, with the Yorkists then being driven back north eastwards towards Sandridge and Nomansland Common beyond.[27] The surviving nineteenth-century extent of Bernard's Heath at the eastern end of the town has been defined using the 1805-6 Ordnance Surveyor's Drawings and the extent of the urban area of St Albans has been plotted from Hare's 1634 map, all transcribed to the 1883 Ordnance Survey first edition six-inch map base. The extent of quarrying has been taken from the latter while the extent of undeveloped modern parkland is taken from Live Search vertical air photography.

[26] Burley *et al*, 2007
[27] Haigh, 1995, 46-54

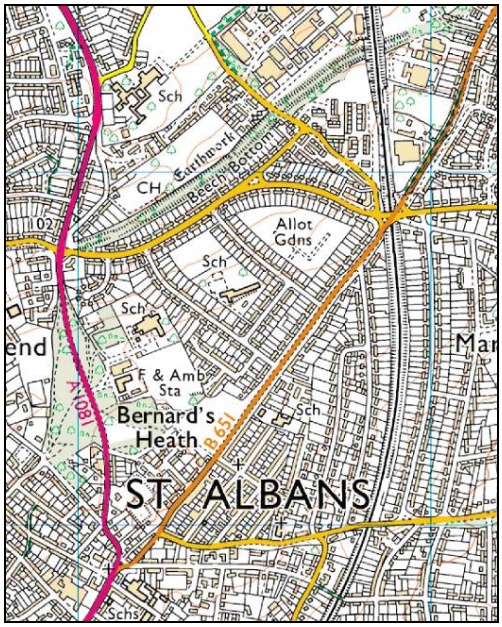


Figure 48: Current state of development of the former area of Bernard's Heath (Crown Copyright 2008)

The greater part of Bernard's Heath as it survived in the early nineteenth century is unaffected by development as parkland. If this area encompasses part of the action then there seems initially to be a possibility that it will contain significant battle archaeology including lead bullets. However, as so often when local historians are consulted or local histories and local archaeological studies are examined for a battle or its landscape context, it is discovered that the situation is far more complex. In this case detailed study has already been undertaken of the historic landscape of the St Albans area and particularly Bernard's Heath. This suggests that the heath was far more extensive prior to enclosure in the 1670s, spreading north eastward from the nineteenth-century area. Unfortunately it has also shown that quarrying activity apparently extended over most of not all of the surviving area of the former heath.[28] Hence apart from the improbable survival of bullets in the redeposited topsoil the only area of undisturbed ground where remains might be found is likely to be immediately to the north where the prehistoric earthwork known as the Beech Bottom survives. It has been suggested that it was where this was crossed by the railway cutting that the nineteenth century discovery of a mass grave, supposedly containing artefacts of the fifteenth century, was made.[29] Thus the research potential of this battlefield appears to have been wholly lost.

[28] Information from Peter Burley; Reynolds, n.d., Hunn, 1991
[29] Burley et al., 2007; information from Harvey Watson; Burely 2007

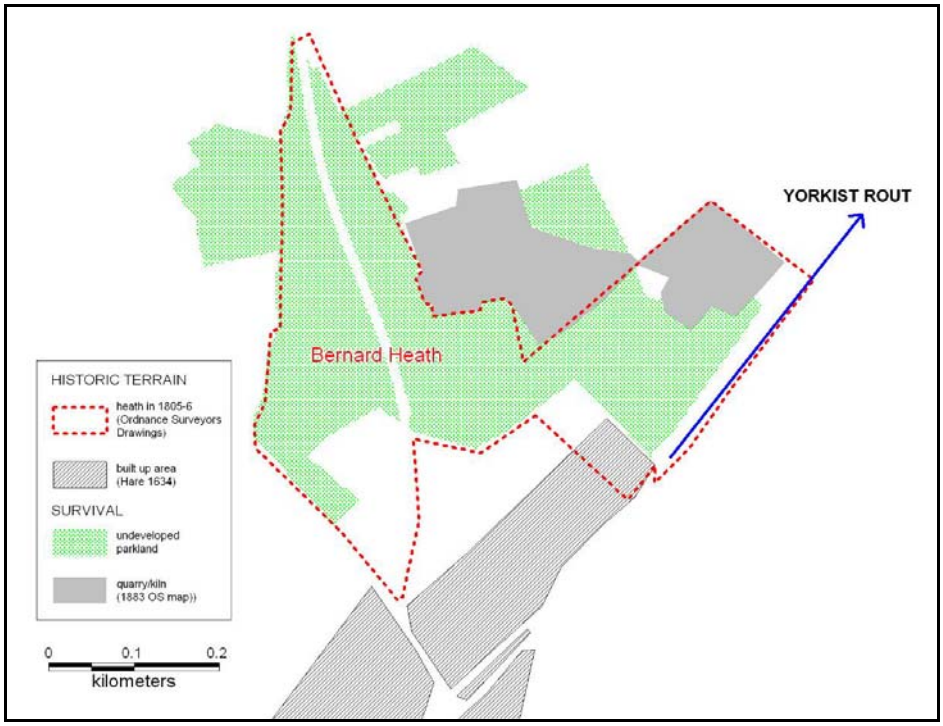


Figure 49: St Albans II: the general area of the final stage of the battle on the northern edge of the town. The modern built up area is shown as white

Dussindale

Date: 27th August 1549

County: Norfolk

Grid Reference: TG282090

Outcome: Government victory

Location: alternatives

Terrain: heath?

Armies: Government; Kett's rebels

Numbers: 5-10,000

Losses: several hundred?

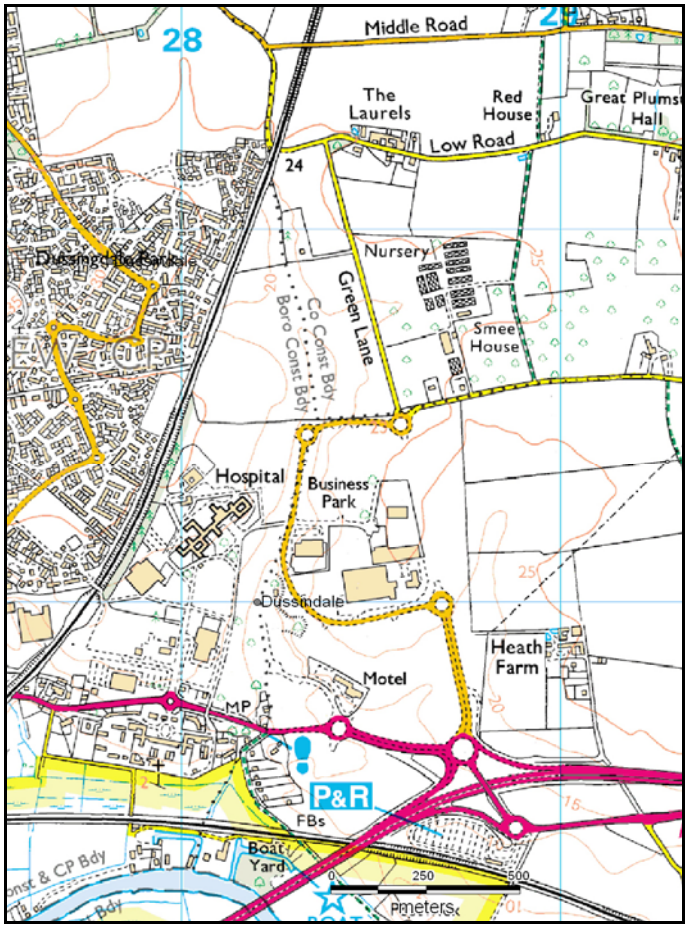


Figure 50: Putative site of the battle of Dussindale, centred on the north south valley along which runs the administrative boundary (Copyright Ordnance Survey)

Dussindale well typifies smaller scale battles and the problems that they pose. The battle is not well documented but a number of accounts do survive from the following decades, though none accurately locate the action. The generally accepted number of combatants is between 5 -10,000. The government forces under Warwick numbered about 3500-4500 men, largely professional including 1500 German 'lance knights' and Captain Drury's handgunners as well as retinues of several prominent local lords and remnants of Northampton's forces brought up from Cambridge, again containing a disproportionate number of foreign mercenaries. The rebels were armed with bills, bows and agricultural implements though archers are consistently mentioned and played a significant part. They may also have had as many as twenty captured guns commanded by 'Miles, the Master Gunner', which they had already used effectively against the city defences. The number killed at Dussindale was as high as 3500 by Neville's account, though more likely to be in the high hundreds.[30]

[30] Champion, 2001; information from Matthew Champion

The action saw the intensive use of both mercenary arquebusier as well as English archers, while there is good reason to believe that there may also have been a substantial artillery exchange though it is unclear whether this could have included use of case at close quarters. The soils of the putative site lie partly on sand and gravel and partly on glacial till, the former probably acidic and aggressive towards lead while the latter is likely to have produced more favourable conditions, depending on land use history.

The site was lost for centuries and was believed by some to have lain to the north of the city. It was within the parishes of Thorpe and Sprowston and 'a mile or above' from Mount Surrey. Terrain reconstruction by Carter resulted in the suggestion of a new location, to the east of the city along a shallow north/south valley, Dussindale, that rises up to a small ridge on the eastern side.[31] This dale is the first substantial feature travelling eastward across Mousehold heath from the city. To the north were two enclosures called Lumners. Further enclosures lay to the south, providing a narrow frontage of well under a kilometre and providing flank protection on both sides, with other enclosures to the east behind the putative rebel position on the eastern side of the dale.

This is arguably the most threatened site of its kind in England, lying on the edge of expanding Norwich, with part of the area already built over and much of the rest already evaluated in the late 1990s. The problems are compounded by the fact it is also one of the least recognised. Despite publication in the 1970s of terrain-based research that located the battlefield more accurately it has only recently been added to the SMR and the location given is not on the undeveloped but threatened location which the terrain research indicated, but under an existing housing estate. Of almost equal concern is the lack of recognition of the research potential of the site or of the methodology necessary for the evaluation and recording of such sites.

The site was evaluated in 1995 but without awareness that this may have been the battlefield.[32] Thus, despite metal detecting being included in the evaluation strategy, finds of lead were apparently discriminated out, the priority being the investigation of much earlier settlement activity. The failure of the evaluation to yield relevant evident is therefore not surprising as the main evidence from evaluation of the battlefield should be lead bullets. However, the site is said to have been subject to extensive metal detecting by a local detectorist over many years who reports no significant battle-related finds. Again however, this is not necessarily a valid conclusion as detectorists normally dismiss low densities of lead bullets as irrelevant

[31] Carter, 1984
[32] Norfolk Archaeological Unit, Report 121

background noise and so may not have reported or even collected such material. What is urgently required is a re-examination of the terrain evidence and the evidence for the placement of the battlefield here, together with systematic sampling of the site by metal detecting survey at 10m transects, the case then being reviewed.