Roman weaponry in the province of Britain from the second century to the fifth century AD.

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ROMAN WEAPONRY IN THE PROVINCE OF BRITAIN FROM THE SECOND CENTURY TO THE FIFTH CENTURY AD.

TWO VOLUMES

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VII. Axes.

"On both sides helmets and breastplates were split in pieces by blows from the battleaxe". (Ammianus Marcellinus XXXI, 13, 3).

Introduction.

Of all the main types of weapon used in the Ancient period the axe is perhaps the one least associated with the Roman army. Only a handful of literary references exist, many of them of doubtful value and there are a few representations of axes on Roman monuments. Most of the latter in fact show captured weapons. The archaeological evidence is scanty and difficult to interprete. Axes could be (and frequently were) used as tools and with axes of the Roman period it is not easy to decide where the dividing line lay (if one existed at all) between those axes which were weapons and those which were tools. Some light may be shed on these problems by examining other peoples noted for their use of battleaxes, most especially the Franks and the Vikings.

The Franks were famed for their use of a small throwing axe called the Francisca. This perhaps derived its name from the people who used it. This weapon is described by Procopius in his account of the Frankish invasion of Italy in 540AD (Gothic Wars VI, 25, 3-4):- "Each man carries a sword and shield and one axe. Now the iron head of this weapon was thick and exceedingly sharp on both sides while the wooden handle was very short. And they are accustomed always to throw these axes at one signal in the first charge and thus shatter the shields of the enemy and kill the man." In Britain a francisca was found at Wroxeter, dated to the late 5th or early 6th century (Selkirk 1971 p49;Wilson 1971 p261). This can be taken as evidence for the presence of Germanic (perhaps even Frankish) troops in Roman service, but this is far from being certain.

The Roman army of the 4th and 5th centuries included increasingly large numbers of "barbarian" troops. For example the army of the emperor Majorian in 458AD is said to have numbered in its ranks Suebians, Huns, Getans, Dacians, Alans, Rugians, Burgundians, Visigoths, Ostrogoths and Sarmatians (Sidonius Apollinaris, Panegyric to the emperor Majorian L475-9). The most likely way that the Romans came into contact with the battleaxe was through Germanic tribes, initially as enemies and later as contingents in their own army. The Franks are known to have fought for the Romans on occasion, as for example at the battle of Chalons in 451AD. It is not unlikely that the use of the axe may have spread to some other tribes as well. Unfortunately there is no direct proof that any of the axes found on Roman sites in Britain belonged to Germanic troops.

The axe is often seen as the principal weapon of the Vikings but in fact it was at first only used by them as a tool (J. Simpson 1967 p125). Three types of Viking axe have been identified. Firstly there was the hand-axe. This was simply a tool adapted for warfare, since it had a hammer head opposite the blade. One must allow the possibility that Roman battleaxes evolved from civilian axes as well. The "bearded" axe was distinguished by the square-cut projection on the lower side of the blade, whilst the "broad axe" (Hewitt 1855 plate VII no. s 3, 7) had an extremely wide, flaring blade-up to 12" (c30cm) across and was used two-handed. Axes of the Roman period are generally much smaller and were probably used one-handed. However double-headed axes are known from a late Roman pictorial source and these may have been used two-handed.

The intended method of use of an axe determined the size of its blade and the manner of hafting. Whilst "cutting" axes had broad blades and were usually tanged, "piercing" axes had narrower blades and were socketed (Cohen 1975 p17-18). To look at it another way, the construction of a throwing axe probably did not need to be robust, since it would probably only be used once in a battle, whereas an axe which was intended for use in hand-to-hand combat to chop through shields or armour would have to be securely hafted. We do not have any specific evidence as to how Roman axes were used, but as all the excavated specimens seem to be socketed it can be argued that they were intended primarily for close combat.

Literary Evidence.

There is only a very small amount of evidence for the use of axes as weapons by the Roman army and much of this is ambivalent. Axes were used as tools for digging, cutting down trees, etc. as can be seen on Trajan's column (scenes LVI, XCII, CXVII).*1 Doubtless such implements could be used in an emergency as weapons but this was not their primary function. This factor must account for the earlier literary references to axes being used by Roman troops.

Axes were employed by the soldiers of Mark Antony at Actium in 30BC (Cassius Dio L, 33) in a desperate attempt to prevent their ships being boarded. Legionaries used axes ("securibus") at the battle of Bedriacum between the forces of Otho and Vitellius (Tacitus, Histories II, 42) and at the battle of Cremona (Tac. Hist. III, 29). Chronologically speaking the next mention of axes occurs in Arrian's "Tactica", written in the reign of Hadrian (Pelham 1911 p232) , although others have interpreted the passage as referring to maces (Couissin 1926 p387-8). There is some sculptural and archaeological evidence for maces, none of it from Britain.*2 According to the SHA (vita Caracalla IV, 1;Geta VI, 3) Papinian the Praetorian Prefect was killed with an axe ("securi") in the presence of Caracalla. The emperor merely remarked that they should have used a sword instead! The story is repeated in an epitome of Cassius Dio (LXXVIII, 4, 1). Like much else in the SHA this may be a piece of fiction, but the reported remark of Caracalla is interesting if nothing else. Perhaps it implies that the axe was not a proper weapon for use by a Roman soldier.

The most positive evidence we have belongs to the 4th century AD. Ammianus Marcellinus (XIX, 6, 7) recounts that at the siege of Amida in 359AD a legion of Gauls, formerly a part of the army of Magnentius led a sally against the Persian camp. These troops were armed with axes ("securibus") and swords. The "Gauls" were surely recruited from the frontier area and may well have been largely Germans, hence it is not surprising to find them using axes. In a later passage (XXXI, 13, 3) Ammianus says that both Goths and Romans were using axes at the battle of Adrianople.

Pictorial Evidence.

The main source of information here are two illustrations in the Notitia Dignitatum (OR XI, 2;OC IX, 2) referring to the Magistri Officiorum. Amongst the weapons shown are axes, some with single blades, others double-headed. If these pictures are faithful to the originals then they are the best proof that we possess that Roman troops used axes. However since the pictures are copies made by the Carolingian Franks some caution is needed because of the afore-mentioned Frankish preference for axes. The Notitia illustrations may have been influenced by Frankish weaponry.

From Britain there is one auxiliary tombstone which probably shows an axe. This is the well-known archer tombstone from Housesteads (Webster 1985 plate XVI) which may be of 2nd century date. The stone is quite worn so the detail is hard to make out, but the weapon is obviously fairly short, with a small head. One edge of the blade appears to be curved, whilst the other is straight and the end is curved.*3 The axe, together with the dagger or short sword also shown was presumably issued in case the archer got into close combat - something a unit of this type would try to avoid if at all possible.

A mounted figure in a belted tunic, cloak and a round, flat-topped hat appears on a 4th century relief from Gamzigrad in Yugoslavia (Bishop and Coulston 1989 fig54. 2). The man carries a single-bladed axe. The head-gear of this figure (an officer?) can be paralelled by the porphyry statue of the Tetrarchs (Beckwith 1963 plates 3-4).

Axes (both double and single-bladed) appear amongst trophies on the base of the column of Arcadius in Constantinople - which was erected between 395 and 408AD (Freshfield 1922 plate XVII). An early imperial column now in Perigueux (Robinson 1975 p136) shows a double-headed axe and a pickaxe, again probably captured weapons. Finally a victory panel from the lost Arch of Diocletian in Rome shows an axe amongst the spoils of war (Brilliant 1974 fig VI. 51). It has a slim, basically rectangular blade with a straight end and may be compared with another single-bladed axe shown in the Notitia (OR. XI, 2). The arch dated to about 305AD. It is alleged (Couissin 1926 p494) that on the Arch of Constantine, troops of asiatic appearance are shown carrying axes. I have been unable to trace any such representations.

The Archaeological Evidence from Britain.

This is rather limited and extremely difficult to interpret . Several Roman sites in Britain, both military and civilian have produced finds of axes, but in no case can one definitely say that they are weapons as opposed to tools for digging, woodworking or other such tasks. Some examples are given below.

Brancaster.

A pair of axeheads were found in the Saxon Shore fort during the excavations of 1974-7 (Hinchliffe and Sparey-Green 1985 p215-7, fig 93 no.s 79-80). In form they are like the axes from Burnswark and the excavators noted their similarity to woodworking axes. One axe was 10.5cm long by 2.5cm across at the butt, the other measured 15 x 3.5cm. The shaft holes were circular or sub-rectangular. The excavators felt that the axes could only have been used in hand-to-hand combat, but did not state any reason for this. Date:Unstratified, but probably not earlier than the 3rd century AD.

Burnswark.

Two axeheads were found in the early excavations at the site (Christison et al 1898-9 p249, figs 6-7). These were single-bladed, the edges of the blade being curved, the lower edge rather more so, giving a "drooping" appearance. Blade Lengths:c18cm. Blade Widths at cutting edge:c7.6/10.7cm. Shaft hole diameters:3.8/c3.2cm. Date:Antonine or later?

Camelon.

Two axeheads have been found here (Christison et al 1900-1901 figs 44-5). One of these was probably the remains of a pickaxe. It had a straight-edged blade at one end, tapering gradually in width and the remains of a tine at the other end. The second axe (Ibid fig45) had a circular shafthole and a blade with concave edges and a curved end. Date:Context unknown therefore Flavian or Antonine.

Greta Bridge.

An iron axehead was found by some workmen during the excavations of 1974 (unpublished). This is single-bladed, with curved edges and a rounded end. Date:2nd/early 3rd century.

Richborough.

About a dozen axeheads of various forms have been found at this site, most of them unfortunately unstratified. These are dealt with here in order of discovery. The first excavations produced one axehead (Bushe-Fox 1926 plate XVI no. 35). The blade has a very marked downward curve on both edges, especilly the lower one and the end is straight. Four axes are illustrated in the next report (Bushe-Fox 1928 p51-2, plate XXIV no.s 70-73). The first of these is a simple hatchet, the head being an extension of the socket. This type is said to be unusual on Roman sites. No. 73 features a hammerhead at the end opposite the blade and must have been a tool, perhaps for woodworking. Nos. 71-2 were more or less identical except one had a square shafthole, whilst the other had a circular opening. The blades curve gently downwards and there are upward pointing projections either side of the shafthole. Half-a-dozen axes appear in the following report (Bushe-Fox 1949 plate LXI no. s 338-343). Most of these were clearly tools. Nos. 341 and 342 with their downward curving blades might have been weapons. They came from topsoil just to the north of (and inside) the west gate of the fort. Date:None of the finds are stratified and we cannot tell therefore whether the axes belong to the 1st century occupation or to the time of the Saxon Shore fort - perhaps begun in the reign of Probus. There is no firm evidence for a Germanic occupation here, although a burial to the north of the fort (Bushe-Fox 1949 p80, 155) could be that of a Germanic raider or of a soldier in a Germanic unit brought in by Theodosius in about 367AD. There is no practical way of determining if either of these theories is correct.

South Shields.

Axes are mentioned as having been found in the fort (Hodgson 1903 p25) but no further details are known of them. The only axe known to me from this site (Allason-Jones and Miket 1984 p288) is clearly not a weapon.

Continental Parallels.

An obvious parallel are the Germanic weapon burials found on the continent, dateable to the later Roman period. Here again it is often impossible to decide whether the occupant of the grave had been fighting for or against the Romans. The site of Furfooz in Belgium (Stillwell 1976 p339- 340) is an exception to this rule. There was a Roman fort here in the late 4th and 5th centuries and the occupants were Germanic troops. Some axes were found in graves in the cemetery and since swords and other kinds of weapons were found with them, it seems reasonable to interpret these as being battleaxes.

Conclusions.

To sum up, the evidence for Roman battleaxes is very unsatisfactory. In the light of the passages in Ammianus we cannot dismiss the evidence altogether but little can be said that is positive. Axes found on Roman military sites vary greatly in size and shape. Some are clearly tools, others are not unlike battleaxes used by the Franks, Vikings and others but we cannot prove that they were used in combat. The sculptural evidence at least shows that the Romans were familiar with the use of axes as weapons. It is tempting to see a connection with the francisca, but it cannot be proved archaeologically that the Romans acquired their battleaxes from the Franks. Some influence from this quarter may be suspected, but equally, Roman battleaxes may in origin have been tools like the dolabra. The paucity of the evidence available would suggest that whatever its origin, the battleaxe was never commonly used in the Roman army.

NOTES

*1. Josephus (Bell. Jud. III, 5) numbers the axe and the pick amongst the equipment of the legionary. The pickaxe or dolabra was obviously designed as a tool since on the head there was a narrow tine at one end.

*2 What might be round-headed maces are shown on a sarcophagus from Rome and a relief from Arles. Spiked mace heads have been found in Germany,Greece and Italy and one is shown on a wall painting from the villa Albani in Italy (Couissin 1926 p337-8, figs 144-7).

*3 It has been suggested that this implement is a "bill hook" (Coulston 1985 p236, 280) used for cutting arrow shafts. There does not seem to be any evidence for such a tool in the Roman period. I still feel that this object must be an axe albeit of a rather odd form.

VIII: Archery Equipment

"I deem [this] the most criminal artifice of man's genius, inasmuch as to enable death to reach human beings more quickly we have taught iron how to fly and have given wings to it." (Pliny. Natural History XXXIV, 39, 138-9).

Introduction.

Proficiency with the bow was not something traditionally associated with Roman or other Italian troops and for a long time Roman armies did not contain any archers at all. When in the later Republic the Romans found the need on occasions for such troops they had to turn to other nations who could provide skilled bowmen. This at first meant the Cretans who had long supplied the Greeks (like the Romans unfamiliar with the bow) with their archers (Caesar De Bell. Gall. II, 7; Xenophon. Anabasis III, 3, 16). When the Roman sphere of influence extended into the East however, they encountered peoples who used the composite bow (see pages 11-17) rather than the wooden "self bow". This much more powerful weapon was destined eventually to be of great importance in the Roman army, especially since many of Rome's future enemies used it - the Parthians, Sassanid Persians, Sarmatians and the Huns for instance. Thus eastern troops came to provide the bulk of the archers in the Roman army, initially in contingents supplied by client Kings (Josephus. Bell. Jud. III, 68, 168), but latterly as properly constituted auxiliary units, distinguished by the epithet "sagittariorum" in addition to their titles. Of 43 known archer units, 26 came from Syria (Davies 1977 p260). *1 Only one archer unit is attested in Britain. This was the Cohors I Hamiorum from Hemesh in Syria, based at Carvoran (R. I. B.1778) and Bar Hill (R. I. B.2167, 2172). The distribution of bone bow laths and arrowheads, both in Britain and on the continent does suggest that the use of the bow was not confined to units of sagittarii.

Literary Evidence.

Most Graeco-Roman references to archery are of limited value and they tell us very little about the actual equipment used. Vegetius and Ammianus (see pages 36-37) describe fire arrows. Pliny the Elder (Nat. Hist. XVI, 65, 160) notes that "the peoples of the East employ reeds in making war.... and to reeds they add points which deal wounds with their barbs that cannot be extracted..... almost half mankind in the whole world lives subject to the reed." Pliny may be referring to the very common triple-vaned arrowheads which originated in the east and were much used by the Romans (see page 22). The SHA (vita Maximini XXXIII, 2) recounts that the citizens of Aquileia used women's hair in place of normal bow strings when the town was besieged by Maximinus Thrax in 238AD. Otherwise we have no written information on the form of Roman bows.

There are several passages dealing with the training of troops in archery. In the SHA (vita Avidii Cassii VI, 3-4) it is stated that in Cassius's army "once a week there was a drill of all the soldier's in which they shot arrows....". It would be unwise to take on trust minor details like this from the SHA especially when relating to people of whom little or nothing could have been known when the work was written. Still, Vegetius also states that archery was practiced by the Roman army:- "A third or fourth of the youngest and fittest men should also be exercised at the post with bows and arrows made for that purpose only. The masters for this branch must be chosen with care and must apply themselves diligently to teach the men to hold the bow in a proper position, to bend it with strength, to keep the left hand steady, to draw the right with skill, to direct both the attention and the eye to the object and to take their aim with equal certainty, either on foot or on horseback. But this is not to be acquired without great application, not to be retained without daily exercise and practice." (Ep. rei Mil. I, 15). Vegetius does not it may be noted state that this training should be restricted to certain kinds of troops, so that theoretically at least, in the 4th century AD all units in the Roman army would have had some trained archers. Elsewhere (Ep. rei Mil. II, 23) Vegetius specifies a distance of 600 feet for practice shooting at bundles of twigs or straw. He clearly attached much importance to archery since he claims that the (alleged) abandonment of body armour by Roman troops in the reign of Gratian led to many defeats because of casualties inflicted by Gothic archers (Ep. rei Mil. I, 20).

Ammianus's battle scenes are full of references to clouds of arrows (XIX, 2, 15; XX, 6, 6) and in one place he calls archers "a formidable branch of the service." (XVI, 12, 7). The Notitia lists not only many units of archers, but also three factories involved in the production of archery equipment (OC. XI, 24, 28, 32). Concordia and Matisco were "sagittaria", whilst Ticinum was an "arcuaria". *2 To the effectiveness of archery we have the testimony of Celsus (De Medicina VII, 5, 1-5): "Nothing penetrates into the body so easily as an arrow, which also becomes very deeply embedded. This is caused by the fact that it is propelled with great force and is pointed."

Composite bows:Basic theory.

It will become apparent from the archaeological and pictorial evidence that the composite was the main kind of bow used by the Roman army. It is possible that the older style of weapon - the "self" bow, which was made entirely of wood - continued to be used as well, but there is no direct proof of this. The composite bow has been in use since the Neolithic period (Rausing 1967 p146). The principle behind it may be defined as follows:- "The bow differs from all the other early weapons in being able to store the energy supplied by human muscle, on the release, this pent up energy is suddenly transferred to the arrow, which can thus be projected at a much higher velocity than that at which it can be thrown by hand." (Ibid p13). Before looking in detail at the components of such bows, a number of technical terms need to be understood. The "stave" is the whole of bow, whilst the "limbs" are the wooden arms of the bow. The "grip" is the central portion where the bow is held. The "tips" are the ends of the limbs. The "ears" are the ends of a bow that have been stiffened. This is achieved by the use of "laths" - plates of bone or antler - which are sometimes also applied as a reinforcement to the grip. The "belly" is the side of the stave towards the archer. This was usually covered with horn. The "back" on the other hand, was the side of the stave away from the archer. This was generally covered with sinew. The "nock" was the cutout (usually semi-circular) on each ear lath, through which the string ran.

We have no contemporary information on the construction of composite bows, but there are technical treatises (Chinese and Islamic) of the 14th to 19th centuries (Coulston 1985 p248-259) which provide much information. One should not assume that Roman practices were identical in every respect, but it is unlikely that the basic principles have changed very much over the centuries. Whatever the details, the process of making a bow of this type was one requiring a great deal of expertise. A good composite bow might take a year to produce (Ibid p248). Without descending into all the minutiae of construction methods, some general points can be made.

The core of the bow was made of wood. This was essential since it provided a stable framework onto which the rest of the elements could be applied. It was however the least important part of the composite bow. The great power of this weapon lies in the natural elasticity of the other two main components, the horn and the sinew. When a composite is drawn, the sinew on the back is stretched, whilst the horn belly contracts. This results in more energy being stored than in a normal bow. When the string is released, the horn and sinew spring back to their former shapes, giving the bow shot more impetus (Ibid p245). Because of this and as less wood is used, a composite bow of a given power can be much smaller than its wooden equivalent (Rausing 1967 p19-20). The various parts of the bow were held together with glue, usually obtained from animal tendons (Coulston 1985 p250) and sometimes as with the Yrzi bow (ibid p255) there were sinew bindings. Since most of the components were made of perishable materials, we have little direct information about Roman bows.

It is claimed that the horn from western domestic/wild animals would have been unsuited for use on composite bows as it was too brittle (ibid p252). If this is true, perhaps the horn (maybe even whole bows) was imported into Britain from areas better acquainted with composite archery. However, given the example of the poor quality laths being made at Caerleon (see page 18), we might well ask if the Romans might not have compromised with other materials also, in the interests of quick mass production. In this sense the Chinese and Islamic manuals may be misleading, for they were written by craftsmen who produced only a few bows at a time for wealthy customers. The Romans were equipping very large numbers of troops with bows so their manufacturing methods may not have been so painstaking.

In normal circumstances the only parts of the bow likely to survive the passage of centuries are the laths. These were of bone or antler, applied in pairs on the ears and sometimes on the grip as well (Rausing 1967 p65; Coulston 1985 p251). Bone or antler are very hard to distinguish except by their cellular structure (Coulston 1985 p229). Bone was easier to obtain, but "antler is a significantly tougher material than bone, with a markedly better capacity to absorb shocks and sudden impact loads" (A. Macgregor 1985 p29). A disadvantage is that antler has to be softened by soaking before use (ibid p63). In shape, ear laths may be described as "sword-like" (Nash-Williams 1932 p50). One end is usually rounded and the other, when it survives, comes to a point. In the edge towards the archer a nock is cut. The outer surface of the laths is convex and highly polished. The pairs were glued together and the flat undersides were scored with a sharp implement to give the glue a better grip. These score marks are clearly visible on excavated laths.

The laths in this country have been stripped clean by the soil conditions, but a pair from Belmesa in Egypt (Coulston 1985 p234) gives us an idea of how they would have looked originally. The laths are 15.5cm long and 2.2cm wide. The rear edges were covered with sinew, of which only a few traces remain. Above the nock there was a sinew binding, covered in leather. Dark brown horn was glued on as a backing. The purpose of ear laths was to stiffen the ends of the bow and to act like levers, drawing back the limbs (Ibid p247). They may also have served to protect the more vulnerable parts of the weapon. (For grip laths see page 18).

One critical factor was the vulnerability of composite bows to the elements, particularly moisture and changes in temperature. These would affect the elasticity of the sinew and therefore the performance of the weapon (ibid p253). Varnishing and painting could combat this and may have been used in the Roman period (ibid p255). Bow cases would have been used to provide further protection. Given the cool, damp conditions prevalent in Britain, the preservation of a large number of bows in good working order must have presented something of a challenge. Potentially the composite bow was a weapon of great power and accuracy, but it required much skill to produce, use and maintain. *3

Composite Bows:Methods of firing.

There were essentially two ways of firing a composite bow. These two methods are referred to as the Mediterranean Release and the Mongolian Release (Coulston 1985 p275-8). In the first of these methods the bowstring was drawn back with two or more fingers and the hand was held vertically. The arrow was placed on the left side of the stave and on firing it would tend to fly slightly to the left. The left forearm was covered with a leather bracer to protect it from chafing by the string.

With the Mongolian Release the arrow was held onto the string between the index finger and the thumb, with the hand horizontal or pointing downwards. The arrow was placed on the right side of the stave and would travel a little to the right when fired. The string was drawn back by a bone thumb ring, which had a flange on the inside. This method of archery was used by eastern nomads such as the Huns and may have been adopted by the Romans in the 4th century. There is little evidence for this however. Even the bone ring from Dura-Europos (see page 16) may not be Roman (Coulston 1985 p278). It is likely that most Roman troops used the Mediterranean Release.

Composite Bows:Range.

Contemporary sources offer very little information on this all important point, so we have to turn to later archery manuals and modern experiments to arrive at a reasonable estimate. As with slings and artillery weapons, we have to distinguish between effective and maximum possible range. Battlefield conditions - rain, wind, sun dazzle etc would all tend to reduce the range and efficacy of bows. It should also be noted that foot bows were larger and therefore more powerful than horse bows.

Vegetius (Ep. rei Mil. II, 23) recommended practice at a range of 600 feet (182 metres). This is clearly nowhere near maximum range, but might represent a starting distance for recruits. Collingwood and Richmond (1969 p306) give the range of modern bows as being 250 yards (229 metres), with an effective range of c150 yards (137 metres). Rausing regards 280-290 yards as a "reasonable range at which to open fire" (Rausing 1967 p31). Distances of over 850 yards claimed for Turkish bows (Coulston 1985 p291) are not really relevant since they were not achieved in combat and light weight "flight" arrows were used.

The Archaeological Evidence for Bows.

There is sadly very little physical evidence for Roman bows, apart from the numerous bone and antler laths listed later (see pages 17-20). The laths at least serve to show that the Romans were using bows with a composite construction, for it would be useless to apply laths to a wooden bow. The find most relevant to the present study is a nearly complete bow from Yrzi on the Euphrates (Rausing 1967 p68; Coulston 1985 p239 fig 2). This can only be broadly dated to the period 1st century BC to 3rd century AD and might be Parthian or Sassanid Persian rather than Roman. It does at least illustrate how these weapons were made during the Roman period.

The wooden grip and one limb of the Yrzi bow have survived. These were made of oak, elm and another unidentified species. Parts of the horn belly and the sinew backing were present. The horn laths were just like those found in Roman contexts, with rounded ends, U-shaped nocks and scoring on the back. One pair was 22.5cm long and the other 19cm. Clearly one limb (probably the upper) was longer. This was a feature of Scythian, Sassanid Persian and Japanese bows (Coulston 1985 p247).

Thumb Rings.

Half of an ivory thumb ring was found in the tower of the Palmyrene gods at Dura-Europos (Rostovtzeff 1931 p73, plate IX; Coulston 1985 p275). This was decorated with incised circles. If Roman it would date to c250AD. A bone ring from Chesters (Clayton Collection no.473) lacks the characteristic flange and may just be a piece of jewellry.

Composite Bows:The Pictorial Evidence.

Sculptural and other depictions of bows from the Roman period have to be treated with a great deal of caution, for they are generally not attuned to the finer points of bow construction. The sources of information include Trajan's column, the column of Marcus Aurelius, the arch of Severus, the column of Arcadius, several auxiliary tombstones and a number of mosaics from Syria (Rausing 1967 p100-1; Coulston 1985 p234-8).

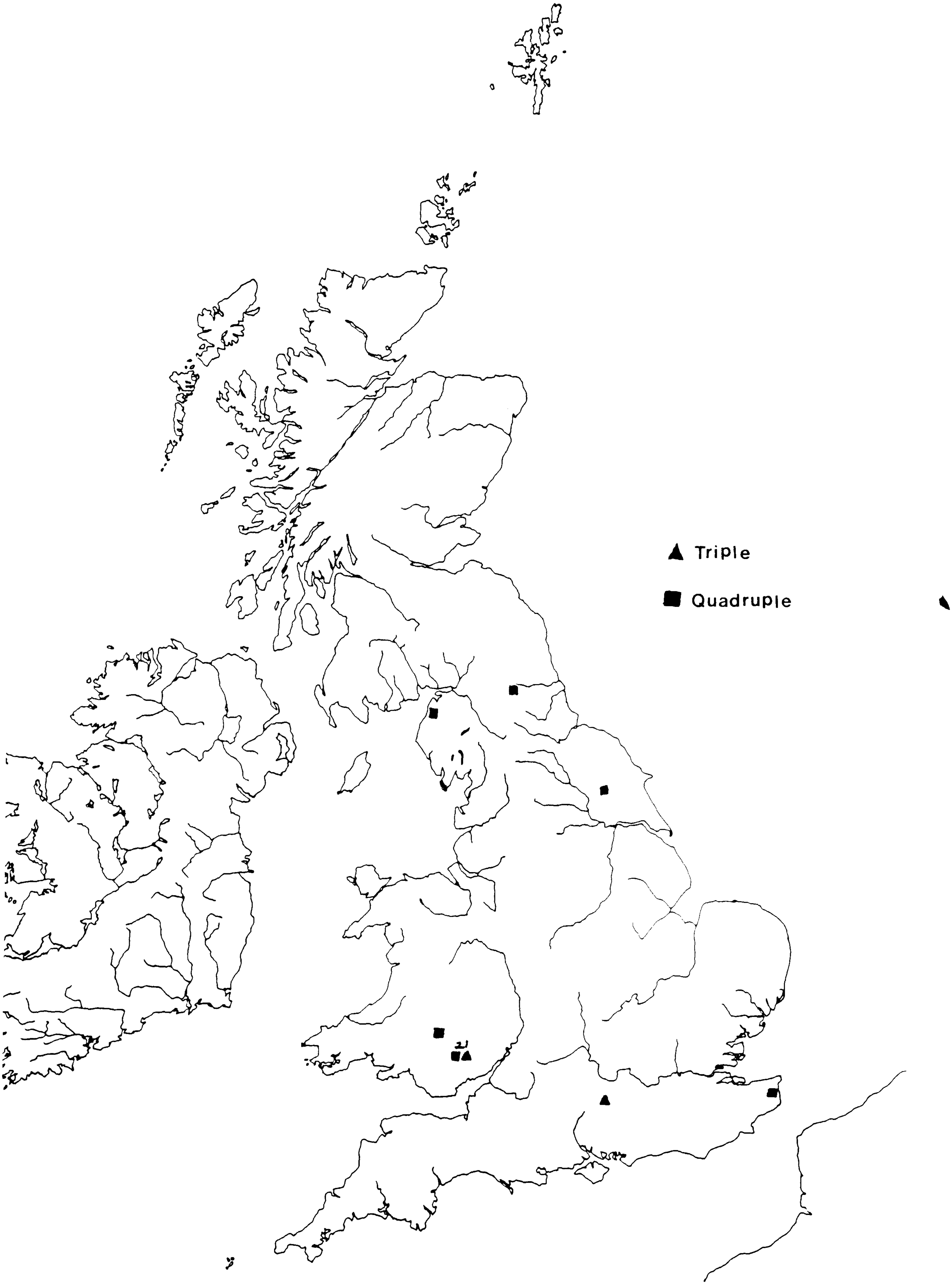
Most Roman bows are shown as being recurved, with a set back handle and prominent ears. This shape cannot indicate anything other than a composite weapon. Sometimes bows with an unbroken curve are shown (Trajan's column scenes LXX, CVIII). Depictions of bows are frequently innacurate. For instance bows are shown with ears curling forwards (the column of Marcus, scenes XXXIX, LXXVIII), for which there is no archaeological evidence. From Britain there is a single depiction of a Roman archer. This is a tombstone from Housesteads which is now in the Museum of Antiquities in Newcastle (Coulston 1985 p236; Webster 1985 pl. XVI). The figure on the stone is perhaps a member of Cohors I Hamiorum (known from Carvoran and Bar Hill), although this unit is not known to have been based at Housesteads. He is dressed in a knee length tunic and a conical (?) helmet, with a quiver for arrows on his back. This appears to be cylindrical in shape with a conical cover. As well as a short sword or dagger and a possible axe, the man has a bow in his left hand. This is recurved, with a set back handle and forward pointing ears. The bow is around 52cm long, of which the upper limb forms c22cm, the grip c13cm and the lower limb c17cm (pers. obs.). The actual length of this weapon has been estimated at about 1 metre (A. Macgregor 1985 p207, note 53). As ever we have to be aware of problems of scale, but this stone may give us a fair idea of what an archer and his equipment looked like. It is probably more accurate than the depictions on the monuments in Rome, where the sculptors could have seen few soldiers. It is surely no accident that the bow is shown with a longer upper limb - a feature of the bows of several other peoples (see page 16).

Bow laths from Britain. (Map 20)

Bar Hill. (plate 16 no.1)

Six laths were found here in 1905-6 (Macdonald and Park 1906 p122-3; Robertson et al 1975 p56, fig 18 no.s 8-10; Coulston 1985 p224). One was from the principia's well, another from a rubbish pit and the rest from the fort's ditches. All are of antler (Hunterian museum Acc. no. F.1936.117). The largest fragment is part of an ear lath, with a rounded end and a semi-circular nock. The tip is missing. The outer surfaces are polished. Near the rounded end the lath is pierced by a brass pin which has a domed head at either end. This seems to serve no structural purpose, but might have been used to hang up the bow (Coulston 1985 p225). L:26.8cm. Max W:2.1cm. Thickness:0.1-0.3cm. A second piece is the tip of an ear lath, with an iron rivet through it. L:8.5cm. Max W:1.5cm. The other three pieces do not seem to fit together, contrary to the impression created by the published illustration (Robertson

MAP 16: Triple/Quadruple Vaned, Tanged Arrowheads.



MAP 17: Triple/Quadruple Vaned, Socketed Arrowheads.

MAP 18: Flat-bladed, Tanged/Socketed Arrowheads

MAP 19: Fire Arrows/"Bodkin" Arrows.

MAP 20: Bow Laths.

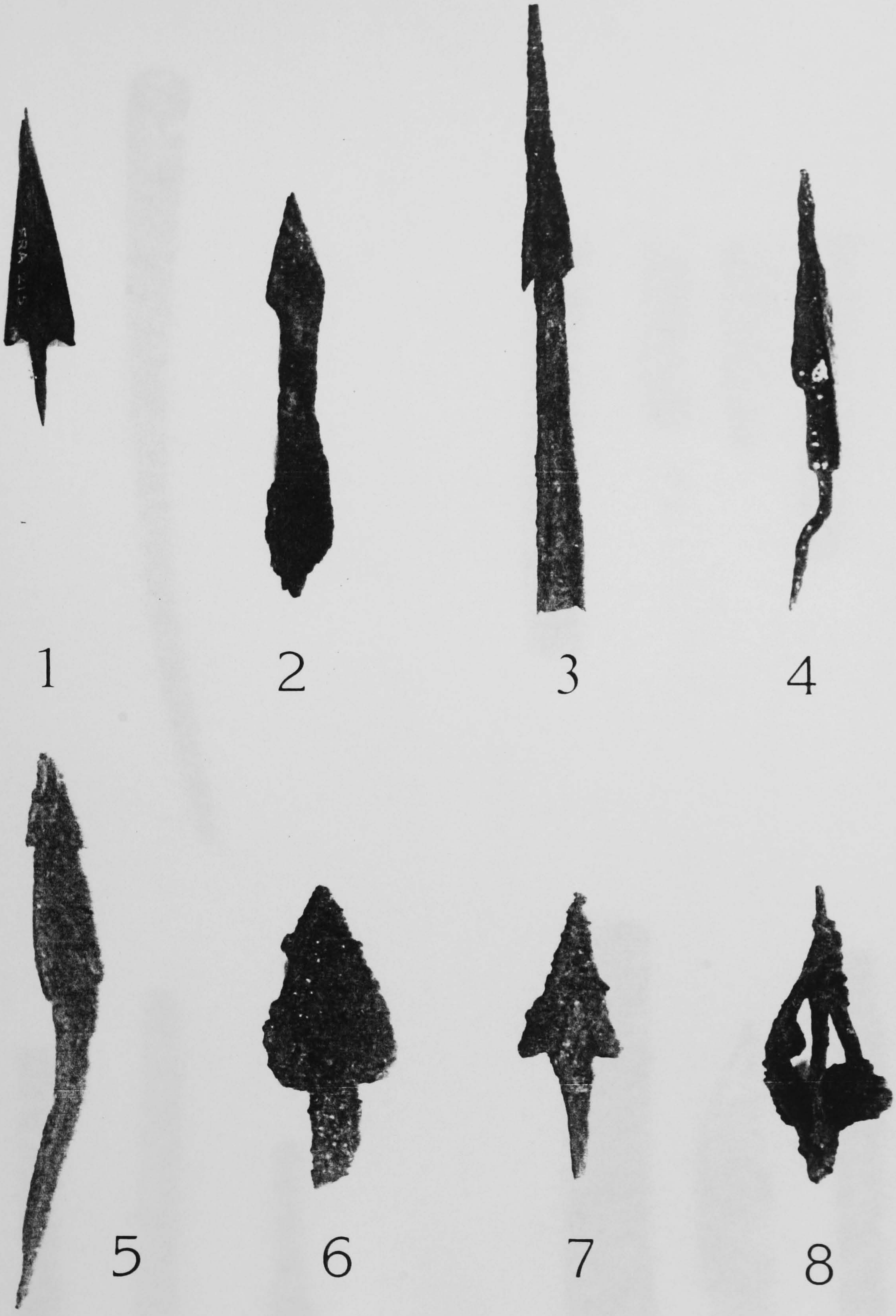


PLATE 15: Arrowheads (all at 1:1)
1. Newstead 2. Corbridge 75.4054 3. Caerleon
4. Richborough 1525 5. Bearsden 6. Housesteads
7. Housesteads 8. Bar Hill

Plate 16: Bow Laths (all at 1:2)
1. Bar Hill ear lath 2. Caerleon ear laths
3. Caerleon grip laths 4.Caerleon wasters

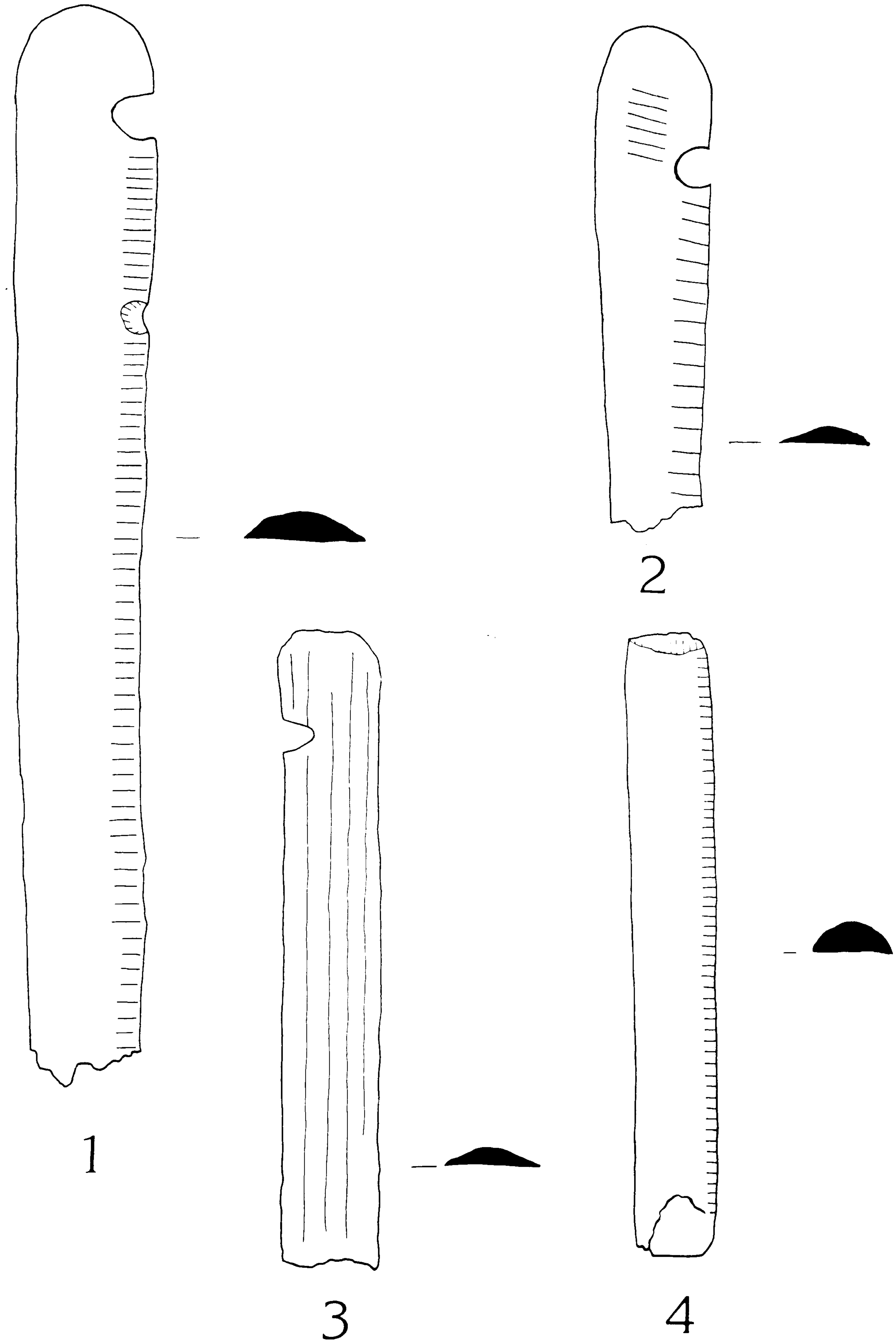


FIG 21: Bow Laths (all at 1:1)
1. Caerleon ear lath 2. Corbridge ear lath 75.1220
3. Corbridge ear lath 75.1221 4. Caerleon grip lath

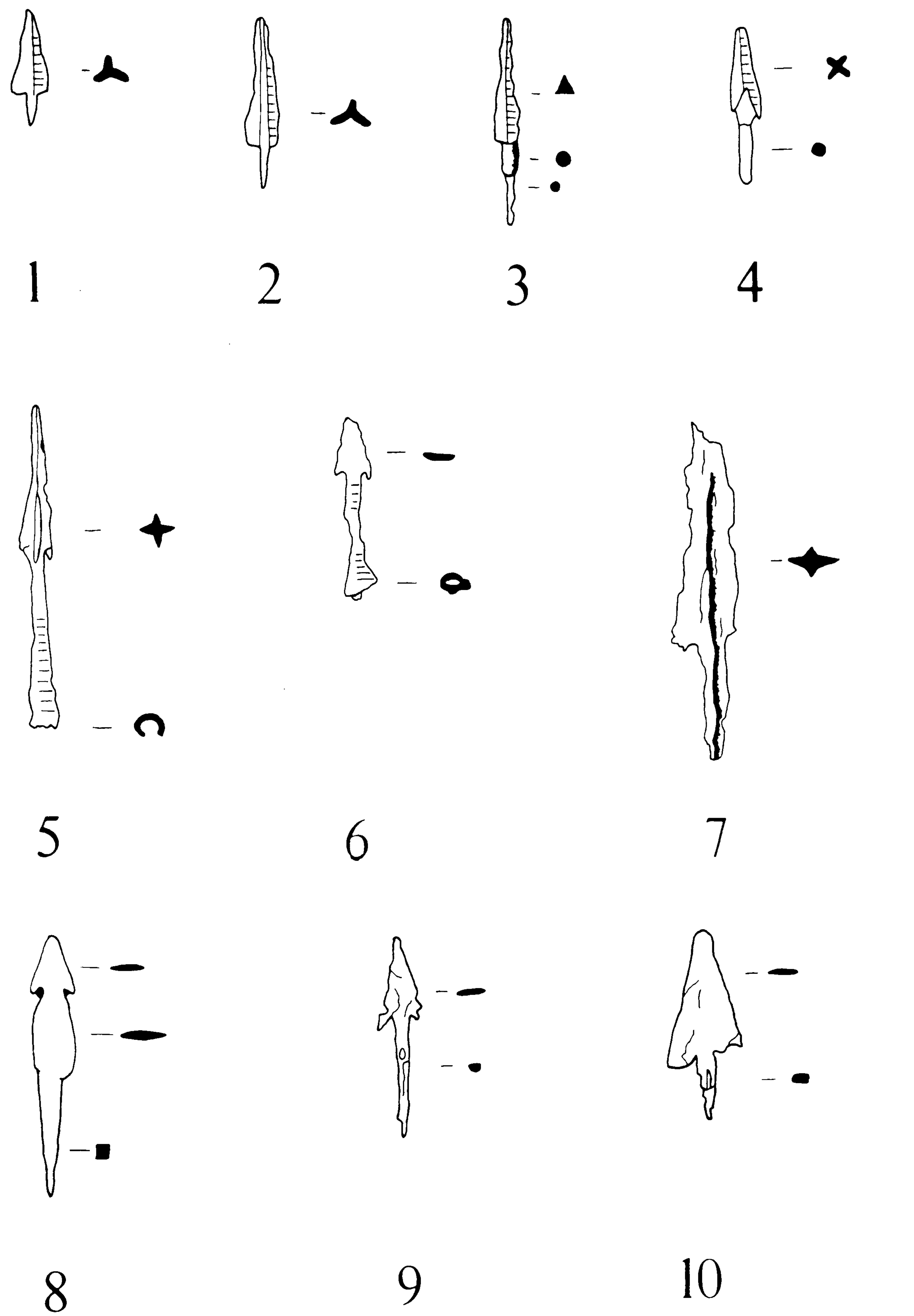


FIG 22 Arrowheads (all at (1:2)
1. Housesteads 2. MC.35 3. Richborough 1525
4. York 1499 5. Caerleon 6. Housesteads 3695
7. Richborough V 262 8. Bearsden 9. Richborough 264
10. Richborough IV 294

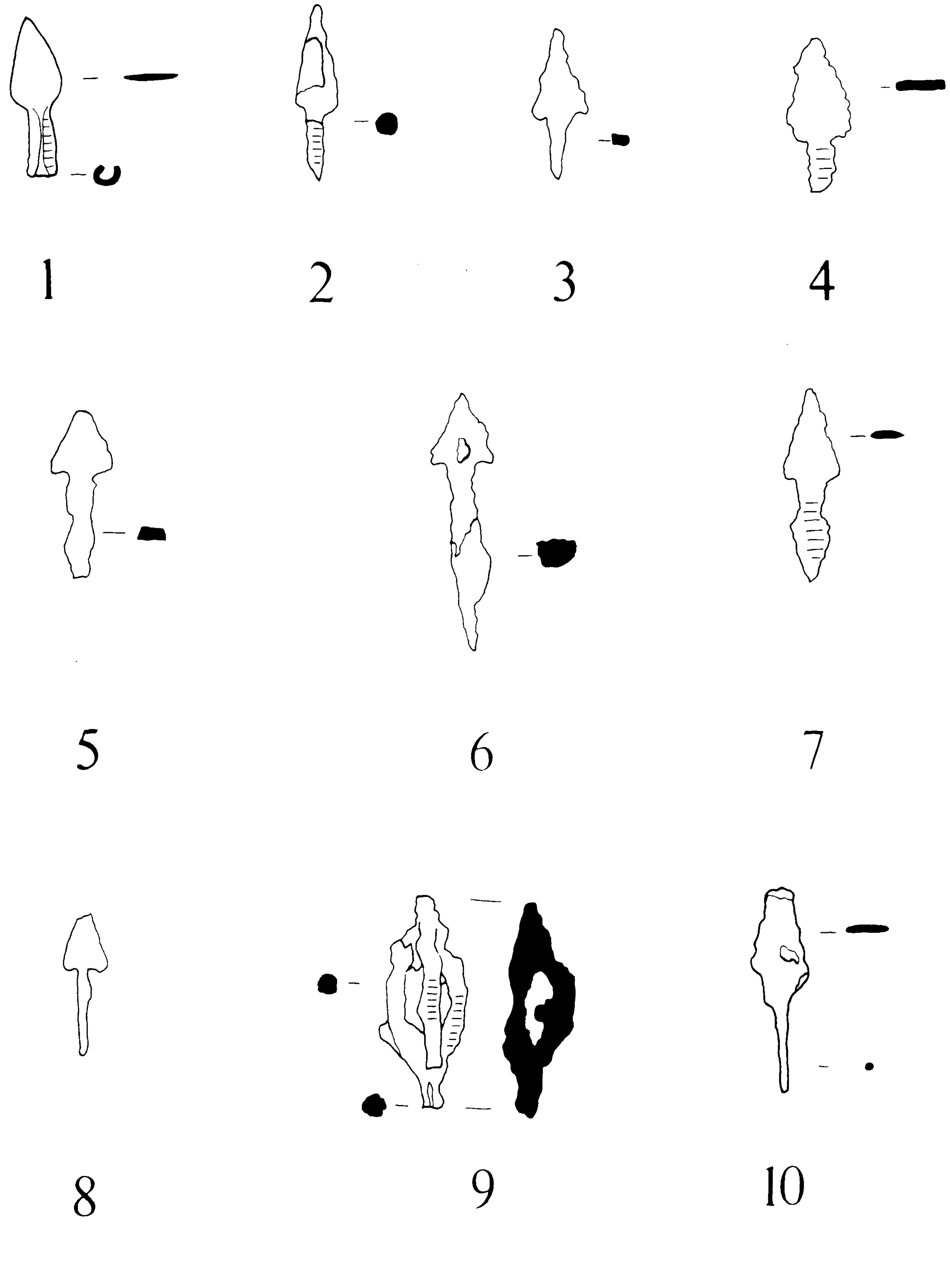
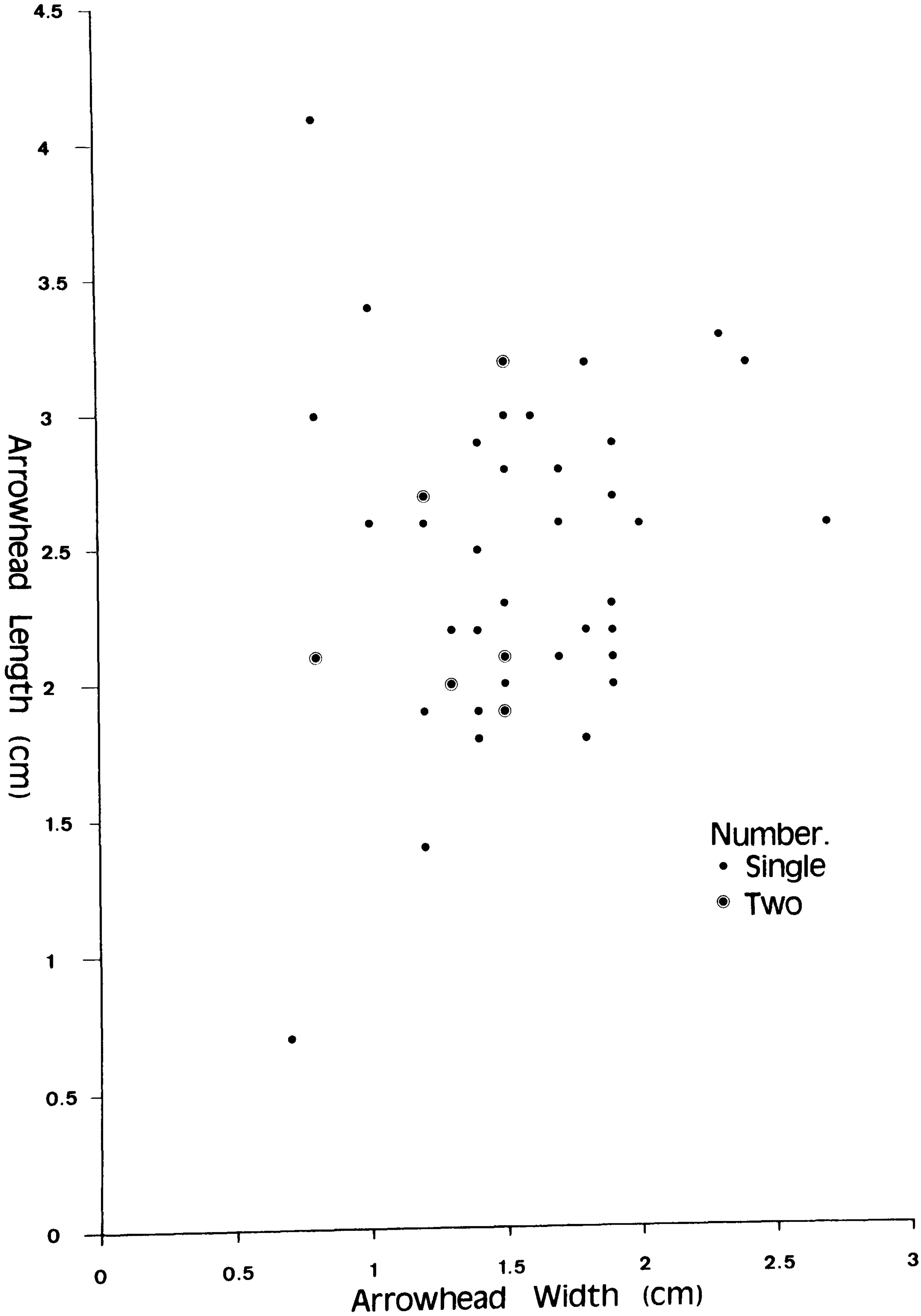


FIG 23: Arrowheads (all at 1:2)
1. Cowbridge 2-7. Housesteads 8. Vindolanda 3498
9. Wroxeter 10. Richborough IV 302?

FIG.24 Head Length: Head Width Ratio of
Housesteads Arrowheads.



et al loc. cit.). Of these, one is the end of an ear lath. L:6.2cm. Max W:0.9cm. The remaining two fragments seem to be grip laths (see page 18) with laterally sawn sections at one end. L:9.4/12.8cm. Max W:1.6/ 1.4cm. T:0.1-0.3. The sixth piece was not available for study. Date:Antonine. These finds are associated with either Cohors I Baetasiorum or Cohors I Hamiorum sagittariorum.

Caerleon. (plate 16 no.s 2-4; fig 21 no.s 1, 4).

Large numbers of ear laths, grip laths and waste material were found in the rampart back buildings in Prysg Field in 1927-9 (Nash-Williams 1932 p51-2, fig 42; Coulston 1985 p228-9). There are about 318 fragments in all, of which 33 are upper ear laths, 32 are lower ear laths, 9 grip laths and the other 244 middle fragments and wasters. The standard of workmanship is generally very poor, with badly cut edges and nocks. Many of the pieces of bone used were clearly unsuited for the task, being bent, cracked or with a poor grain structure. Some pieces were never finished - their nocks were not properly cut or there is no scoring on front or back. In one case two nocks were cut on the same lath but neither was completed. Those that were finished have the usual polished, convex upper surface and the flat undersides left rough. Most of the ear laths have rounded ends, but some are squared-off and there is even one that comes to a point. The best preserved lath is nearly complete (Nash-Williams 1932 fig 42 no.1). L:30cm. Max W:1.8cm. T:0.2-0.4cm. Another, broken example is 37 X 1.9cm. The grip laths are c10-15cm long, 1.3cm wide and 0.1-0.4cm thick. They are rectangular with virtually straight sides, sometimes with one end flaring out slightly. They have one end cut thinner, a feature referred to as "a laterally sawn section" (Coulston 1985 p224). All of the laths are made from ox rib bones. Amongst the waste material are several partially completed laths. Date:The finds came from rooms 42-44 in the rampart back buildings, in a layer of disturbed tesserae representing the destroyed floor. A late 3rd century date has been proposed (Coulston 1985 p229), although as noted elsewhere occupation in this area ceased about 200AD (pers. comm. P. J. Casey).

Chesters.

There are fragments of two ear laths in the site museum (Clayton Collection no.s 633, 634). L:9.4/13.1cm. Max W:1.6/1.9cm. Date:No context recorded. Hadrianic or later.

Colchester.

A small fragment of a bone lath (2.15cm long) was found in a destruction deposit at the Balkerne gate site (Crummy 1983 p137; Coulston 1985 p226). Date:c100/125-150AD.

Corbridge. (fig 21 no.s 2-3)

There are five bone and two antler pieces, making up five laths (Corbridge museum Acc. no.s 75.1219-23, 75.3630, 75.3634). L:4.7-16.8cm. Max W: 1.6-2.3cm. No.75.1220 came from workshop VII in 1946 and may therefore belong to the 3rd/4th century. Otherwise the finds are undated.

London.

There are three antler ear laths in the Museum of London (Acc. no.s 13942, 18268, 20077). The first of these was found at the Bank of England site in 1936. The lower end is missing. L:21cm. Max W:1.3cm. T:0.2cm. Date:late 1st-2nd century? The second find was found in the Walbrook in 1954 and is also incomplete. L:32.2cm. Max W:1.9cm. T:0.1cm. Date:1st or 2nd century? Both the above have rounded ends and semi-circular nocks. The last piece is from Bucklersbury House and lacks both ends. L:25.1cm. Max W:1.4cm. T:0.3cm. Date:pre c150 AD?

Silchester.

A bone lath was found in the guard room of the west gate (Boon 1974 p68, fig 8.7; Coulston 1985 p227). The lower end is missing. L:10.4cm. Dated to the 3rd century on analogy with the finds from Caerleon.

South Shields.

There are fragments of two bone ear laths from this site (Allason-Jones and Miket 1984 no.s 2.16, 2.18;

Coulston 1985 p225). L:5.1/8.5 cm. Max W:1.7/1.8cm. Several other finds illustrated are probably not laths. Date:Hadrianic or later?

Verulamium.

Two possible lath fragments have been found in insula XIV. L:2.4/3.6cm. Undated. (Coulston 1985 p298).

Continental Parallels (Stade 1933 110-114; Eckinger 1933 p289-90; Coulston 1985 p224-234).

Laths have been found at Velsen (undated), Oberaden (c10-8 BC), Mainz (3rd c), Zugmantel (Flavian-c260), Heddernheim (2nd c), Stockstadt (pre c210) Osterburken (pre c260), Selz (undated), Windisch (c45-100), Dangstetten (pre c9BC), Ribtissen (Claudian-Domitianic), Buch (pre c260), Carnuntum legionary fortress (1st or 2nd c?), Straubing (pre c260), Dura Europos (mid 3rd c) and Belmesa in Egypt (undated). Three laths have recently been found in the auxiliary fort at Carnuntum (Stiglitz 1986 taf III no.s 1-3). These probably belong to the period between Trajan and Marcus Aurelius. The bow laths from Intercisa probably date to the 4th or 5th centuries and could be Hunnic rather than Roman (Lengyel and Radan 1980 p400). Of all these sites, only Intercisa, Mainz and Straubing have produced any evidence for archer units.

Arrowheads.

Arrowheads can be either tanged or socketed and in the Roman period were made exclusively of iron. Tanged arrowheads were easier to produce, but a socket gave a more secure grip on the shaft. Speed of production rather than cost would have been more important as arrowheads could be made from any scrap of metal. The type of arrowhead used depended to some extent on the intended target. For hunting soft skinned game and against unarmoured men, wide heads are needed, but the opposite is true for armoured targets. The key factor for arrowheads is that they should penetrate deeply without bending or blunting (Rausing 1967 p164). Different types of arrowheads were used for practice shooting and in combat (Coulston 1985 p291). We cannot however determine the type of bow used by looking at the arrowheads:- "it is impossible to draw any conclusions from the shape of an arrowhead as to the bow used in conjunction with it. Many different types of arrows can have been used with any given type of bow, " and although much effort might be expended on producing superior arrowheads for a high quality bow, "a simple arrowhead is no guarantee that the bow used with it was not a powerful one" (Rausing 1967 p14-15).

Arrow shafts and flights.

There is little direct information on the other parts of arrows as used in this period. As noted already (see page 9), Pliny speaks of "almost half the world being subject to the reed". Ammianus Marcellinus (XXIII, 4, 14) recommends reed for the shafts of fire arrows. The tips of three cane or reed arrows were found in the base of tower 19 at Dura-Europos (Rostovtzeff 1936 p453) the ends reinforced with sinew whipping. These had three feathers glued on and parts of the shafts were painted with red, white and black circles, dots and lines. Perhaps the decoration served a practical purpose, allowing the archers to retrieve their own arrows. L:21/21.5/27cm. Diameter:1/0.95cm.

Of the arrowheads found at Masada (Coulston 1985 p267-8), some had wholely wooden shafts. Others had a tamarisk wood shoot (one was 17cm long) which glued onto the arrowhead and was then pushed into the reed shaft. This construction would help stop the reed splitting on impact.

The evidence from Britain is not surprisingly more limited. Some socketed heads from Caerleon and Corbridge have remains of wood inside them and several heads from the Housesteads hoard have wood fragments on their tangs. In neither case are the remains sufficient for the species to be identified.

Arrowheads from Britain.

Type 1:Trilobe Tanged. (Map 16)

This form of arrowhead is found more widely in Roman contexts than any other. The head has three ribs or vanes. These can end in barbs, or they simply run straight into the tang. There seems to be general agreement that this type is descended from cast bronze, socketed arrowheads with three vanes, which were used by the Scythians (Davies 1977 p260). The form spread eastwards from the southern Russian steppes to China and westwards to Achaemenid Persia, Parthia, Greece (by the 6th century BC) and, most crucially, Syria. Given the predominance of Syrians in Roman archer units, the Romans may well have acquired the trilobe tanged arrowhead from that area. Such arrowheads were also used by the Avars, the Huns and the Sarmatians.

Bar Hill.

Seven triple-ribbed arrowheads were found in the well of the principia at a depth of 43 feet (Macdonald and Park 1906 p115; Robertson et al 1975 p99; Hunterian museum Acc. no. F.1936.176). TL:3.2-4.3cm. Date:Antonine. Associated with either Cohors I Hamiorum or Cohors I Baetasiorum.

Bewcastle.

One arrowhead was found in the strongroom of the principia in 1937 (Richmond et al 1938 p208). Coins from this deposit dated to 268-273 AD, although the arrowhead could be earlier or later. Associated unit:Cohors I Aquitanorum or the Equites Dalmatae.

Brancaster.

Three very roughly formed arrowheads were found in the fort (Hinchliffe and Sparey-Green 1985 p217, fig 93 no.s 82-4). The tangs are circular-sectioned. Date:3rd or 4th century?

Burnswark.

Nine trilobe tanged arrowheads have been found here (Jobey 1978 p89-90, fig 13). Some were probably barbed. Six were found in the back -filling of the 1898 excavations at the west gate of the hillfort, two were found on top of the rampart and one from beneath the spill of the west transverse bank. Date:Antonine or later?

Caerleon.

A triple vaned arrowhead was found in the Prysg Field excavations (Nash-Williams 1932 fig 22 no.18). A find in Caerleon museum is presumably to be equated with it. Most of the tang is missing and the vanes extend into barbs. Date:Flavian-c200AD? Associated unit:Legion II Augusta?

Caernarvon.

One arrowhead of this type has been found here (Coulston 1985 p264). Date:Flavian-4th century.

Carlisle.

A triple-vaned arrowhead, lacking the point was found on the Blackfriars site (unpublished, find no.309). TL:4.8cm. It is described as being Medieval, but there is no difference between it and definitely Roman examples.

Clausentum.

One arrowhead has been found here (Waterman 1947 p161, fig 6.6). The vanes run straight into the tang. Date:from a 4th century context.

Corbridge.

Three examples were found in 1908 (Forster and Knowles 1909 p409, fig 32). The one illustrated had barbs. Ten more were found in 1910 (Forster and Knowles 1911 p190) and an unspecified number in 1911 (Forster and Knowles 1912 p207). No contexts are given for these finds and it is not now possible to identify them with certainty. There is one trilobe tanged arrowhead in the site museum (case 3, Acc. no.75.1367) amongst finds supposedly from fort 3 (c121-125AD) and fort 4 (c139-163AD). However in the finds index, no context is recorded for this find, so its date must remain an open question. Three further arrowheads are grouped with some small spearheads (Acc. no.75.194). TL:5.4/4.3/3.3 cm. The latter find lacks most of its tang.

Date:Flavian or later.

Ebchester.

One arrowhead was found in excavations in the area of the commandant's house in 1962-3 (Reed et al 1964 p185). Date:c80AD-4th century.

Housesteads. (fig 22 no.1)

One arrowhead of this kind was found in 1898 (Bosanquet 1904 p290-1, fig 48; Manning 1976 p22, fig 14 no.36; M. A. Acc. no.1903.1). The vanes extend into barbs and part of the tang is missing. TL:3.7cm. Date:Hadrianic or later. The context has not been recorded, but it was apparently not found with the hoard in the principia.

Milecastle 35 (Sewingshields). (fig 22 no.2)

The site has produced two examples of this type (Haigh and Savage 1984 p84, fig 13 no.54). The first is well-preserved and has vanes with rounded ends. TL:5cm. Max W:1cm. The other find is a very corroded fragment. TL:2.8cm. Date:2nd or 3rd century?

Milecastle 39 (Castle Nick).

One arrowhead was found in the recent excavations by Mr J. Crow (unpublished). Two of the ribs are damaged, the third has a rounded end. TL:4.7cm. Max W:1.3cm. Date:late 2nd/3rd century?

Newstead. (plate 15 no.1)

Seven triple-ribbed arrows have been found here (Curle 1911 p116, plate XXXVIII, no.s 1-7; Nat. mus. of Scot. Acc. no.s FRA 211-216, 216a). Some examples are incomplete. TL:3.2-5cm. HL (incl. barbs) :2.6-3.8cm. Max W:0.8-1.3cm. The best preserved example is 5cm long (HL:3.8cm) and 1.1cm wide. Where the vanes of these arrows survive intact they are barbed. The tangs are basically circular sectioned, although some have one flat side. Date:Flavian/Antonine. Curle's no.1 was found in the praetentura, no.s 2-6 were found in pit 1 and no.7 came from barrack block XVI. Pit 1 was in the northeast corner of the outer courtyard of the principia. It was a "late" pit (Curle 1911 p113, 116), that is it contained supposedly Antonine pottery. Associated unit:legion XX or the ala Vocontiorum.

Old Penrith.

One badly corroded example was found in unpublished excavations by Mr. P. Austen (AML no.7815069). TL:4.6cm. Max W:1.7cm. Date:perhaps 3rd century or later, but could be residual. Associated unit:Cohors II Gallorum Eq. ?

Piercebridge.

Two triple-vaned arrowheads have been found here (unpublished ironwork report). One has a square-sectioned tang. The illustrated example has one straight-ended vane. TL:c3.3cm. Date:late 3rd-late 4th/5thc? Associated unit:perhaps the Equites Catafractariorum (if Piercebridge=Morbio).

Richborough.

Two triple-vaned heads have been found here (Cunliffe 1968 plate LIII no.265, AML no.4611). One of these is 5.1cm long, with a head of 3cm. The vanes are badly damaged but appear to run straight into the tang. Date: Claudian to 4thc or later. A slight variation on this type is represented by two examples from Richborough, for which I have been unable to find any parallels. One of these has been published (Bushe-Fox 1949 plate LIX no.300; AML no.1525). The upper part of the head has the usual trilobe form, but the lower part is slimmer and circular-sectioned. The thin tang is also circular. TL:6.8/6.3cm. HL:4.6/4.8cm. (plate 15 no.4; fig 22 no.3). Date:Claudian-4th century or later.

Turret 25B (St. Oswald's).

One arrowhead was found here in 1959 (Woodfield 1965 p117 fig 1a J; Coulston 1985 p264). Date:probably 2nd century.

Watercrook.

Eight arrowheads were found in 1974 (Potter 1976 p32) and fourteen more in 1976-8 (Potter 1979 p222). In the latter group the tangs are either square or circular-sectioned. Some have barbs, whilst the vanes on others run straight into the tangs. Date:Of the second group, some were unstratified, whilst others came from phase 2 (late Hadrianic to early Antonine) or phase 3 (c155/165-220AD).

York.

An unspecified number have been found here (Coulston 1985 p264). Date:Flavian or later. Associated unit:legion IX Hispana or VI Victrix?

In addition, there are many examples which either belong to the 1st century or come from civilian contexts. There are finds from Dinorben (Davies 1977 p257f), Hod Hill (Manning 1985 p177), Margidunum (Webster 1958 p88 no.176), Wall and Wilderspool (Davies loc. cit.), Chichester, Gloucester, Godmanchester, Ham Hill, Kingsholm, London and Maumbury Rings (Coulston 1985 p264).

Continental Parallels.

Finds of these arrowheads on the continent have been very numerous, ranging in date from the 1st to the 4th century. There are finds from Haltern, Oberaden, Xanten, Krefell Gellep, Neuss, Wiesbaden, Hofheim, Mainz, Stockstadt, Osterburken, Dangstetten, Vindonissa, Biberlikopf, Weissenburg, Epfach, Pfunz, Eining, Straubing and watchtower 9/107 (Erdmann 1976 p7-8). Four have been found in recent excavations at Carnuntum auxiliary fort (Stiglitz 1986 taf III no.s 5-8). Several examples have been found at Masada (Knox et al 1983 p97ff). One of these was examined metallurgically and found to have been hammered out from a piece of bloom iron. It had not been quenched or tempered and would have been ineffective against metal armour. No arrowheads in Britain have been analysed in this way, so it would be unwise to draw any general conclusions from the Masada find. Armour-piercing arrows would in any case have been largely unnecessary in Britain.

Type 2:Quadruple vaned, tanged. (Map 16)

These are a minor variant of type 1 and far less common.

Corbridge.

Three quadruple-vaned arrowheads were found in workshop III of the west compound in 1938-9 (Richmond and Birley 1940 p112, plate XI). The heads were 1.25" (c3.2cm) long. Date:Severan?

Housesteads.

One such arrowhead was found here in 1898 (Bosanquet 1904 fig 48). This is probably to be equated with an object in the M. A. , Newcastle (Manning 1976 p22, fig 14 no.35; M. A. Acc. no.1956.151.66. A). The head is now square-sectioned due to corrosion. TL:5.3cm. Date:Hadrianic or later.

Type 3:Triple vaned, socketed. (Map 17)

Another rare variant of type 1.

Caerleon.

Twenty-one arrowheads were found in the NW rampart buildings in 1927-9 (Nash-Williams 1932 fig 19 no.s 2-6, 9, 21, 23-5). A few of these are socketed with three vanes. They are about 10cm long. Date:Flavian-c200AD?

Silchester.

One arrowhead of this kind was found in the lower filling of the outer earthwork ditch during the excavations of 1954-8 (Boon 1969 p50, fig 7). Date:The context produced samian of the Hadrianic and later 2nd century (ibid p48), but the arrowhead could be intrusive.

Type 4:Quadruple vaned, socketed. (Map 17)

A rather more common variant of type 1.

Beckfoot.

One possible example was found in a cremation burial to the south of the fort (Hogg 1939 p34-5; information from Mr. I. Caruana). The head definitely had four vanes, but they are much damaged so we cannot now tell if they ended in barbs. It is not absolutely certain that the head was socketed rather than tanged. TL:c5cm. HL:c3cm. Max Surviving W:1.9cm. Original W:c2.3cm? Date:Hadrianic or later?

Brecon Gaer.

A quadruple-ribbed, socketed arrow was found here (Wheeler 1926 p118, fig 60.1). Date:Flavian-c300AD.

Caerleon. (plate 15 no.3; fig 22 no.5)

Of the twenty-one arrowheads found in NW rampart buildings (see page 27), most had four vanes and sockets. The heads are pyramidal in shape, generally rather narrow and they meet the sockets with a saw tooth pattern (Nash-Williams 1932 fig 19). Where they survive intact the vanes end in short barbs. A couple of the sockets are split but they are mostly closed. Most of the finds are incomplete. Two essentially complete examples are 9.8 and 10.1cm long, with heads of about 5cm. The largest of these has a maximum width of around 1cm. Its socket diameters are 0.7/1.1cm. Date:many of the finds were unstratified, but others were dated c200-300AD. A date much beyond 200AD is unlikely.

Corbridge. (plate 15 no.2)

The 1912 excavations on site XLVII (Forster and Knowles 1913 p250) located several hearths and furnaces. Among them were some four-sided, socketed arrowheads. These were about 3" (c7.6cm) long, with heads 0.75" (c1.9cm) in length. Date:coins from the context belonged to the late 3rd/early 4th centuries. Five more such arrowheads were found in workshop III in the west compound in 1938-9 (Richmond and Birley 1940 p112, plate XI). These had heads 1" (2.5cm) long and sockets 2" (c5cm) long. Date:possibly Severan. A thorough search of the material in Corbridge museum revealed only one arrowhead of this type (Acc.

no.75.4054). The date of discovery and context of this find are not recorded. TL:6.4cm. HL:2cm. Max W:0.8cm. SD (Int) :0.4cm. SD (Ext) :0.7cm.

Richborough.

One quadruple vaned, socketed arrowhead has been found here (Bushe-Fox 1932 plate XI no.26). This could not be located amongst the finds in the AML. Date:Claudian-4thc or later.

York. (fig 22 no.4)

There is one arrowhead of this type from the General Accident Extension Site (York Archaeological Trust find no.1984.32 2071 II 1499). As with the finds from Caerleon, the head meets the socket with a saw-tooth pattern. TL:4.7cm. HL:2.8cm. Max W:0.8cm. SD (Ext) :0.4cm. Date:late 2nd/early 3rd century.

Type 5:Flat-bladed, socketed arrowheads. (Map 18)

Carlisle.

There is an arrowhead from here, possibly from the Tullie House excavations (Acc. no.1892/170). It has a flat, triangular head, badly damaged on one edge. The socket is closed. TL:9.3cm. HL:5.4cm. SD (Int) :0.7cm. SD (Ext) :0.9 cm. Undated.

Corbridge.

Nine flat-bladed, double-edged arrowheads with sockets were found in 1938-9 in workshop III of the west compound (Richmond and Birley 1940 p112, plate XI). The heads were 1.25" (c3.2cm) long and the sockets were c1.75" (c4.4cm), giving an overall length of about 7.6cm. These finds were not available for study. Date:Severan?

Cowbridge. (fig 23 no.1)

There is a flat-bladed arrowhead with a wraparound socket from this site (Gwent-Glamorgan Archaeological Trust find no.43/640 315/ 051). TL:4.8cm. HL:2.9cm. Max W:1.6cm. SD (Int) :0.6cm. SD (Ext) :0.8cm. Date:could be Medieval rather than Roman. If Roman then probably 1st or 2nd century.

Housesteads. (fig 22 no.6)

There is a small flat-bladed, socketed arrowhead in the museum at Corbridge (Acc. no.3695). The point is missing, but the head must originally have been triangular. It has short barbs. This find may have come from F. G. Simpson's excavations in 1909-10. TL:5.6cm. HL:1.7cm. Max W:1.2cm. SD (Ext) :0.6 cm. A further socketed arrowhead was found in 1960 (Wilkes et al 1961 p295 fig 3). This had a "leaf-shaped" blade. Date:Hadrianic or later.

Newstead.

One socketed arrowhead was found here (Curle 1936 p18). No further details are known. Date:Flavian/Antonine.

Ravenglass.

A small, "leaf-shaped" missile head of square section was found here in 1976-8 (Potter 1979 p89, fig 32 no.78). It is not certain whether this was socketed or tanged. Date:c200-350AD.

Watercrook.

A "leaf-shaped", socketed arrowhead was found in 1974 (Potter 1976 p32). This was undated. An arrowhead with a flat, possibly triangular head and a closed socket came from the 1976-8 excavations (Potter 1979 p223, fig 88 no.s 105). There is a rivethole in the socket. Date:c155/165-220AD.

Parallels.

This type also appears in civilian contexts, as shown by an example from Gadebridge Park villa (Neal 1984 p172, fig 73). This had a triangular blade. TL:8.4cm. It was found in a chalk quarry pit to the west of the villa. The pit contained 4th century pottery. An example from Hod Hill (Brailsford 1962 p6, plate VI. B106) with a "leaf-shaped" head, illustrates the use of this type in the 1st century. There are also three socketed arrowheads with "leaf-shaped" blades-one with a basal expansion-at Brigstock (Greenfields 1963 p247, fig 7 no.s 1-3). These might be religious offerings from passing soldiers or hunting weapons. TL:c7.6-8.9cm. Date:3rd/4th century.

Continental Parallels.

A few socketed arrowheads have been found elsewhere in the empire, but they are few when compared to the tanged (especially type 1) forms. There is an example from Lauriacum (Von Groller 1908 fig 47.10) which has a triangular head with short barbs. Date:3rd-5th century? A "leaf-shaped", socketed projectile point, possibly for an arrow, was found in a cremation burial at the late Roman villa at Voerendaal in Holland (Willems 1989 p148, fig 52). The head is of elliptical section and the socket is closed. TL:11.2cm. Date:1st quarter of the 4th century.

Type 6:Flat-bladed, tanged arrowheads. (Map 18)

This was the simplest form of arrowhead to produce, since they could be made from any scrap of metal. Many could be produced in a short space of time, a crucial point if there was a desperate need for a large number of missiles. Often they were made by re-using nails. Examples of this type are often very crudely made.

Bearsden. (plate 15 no.5; fig 22 no.8)

Forty-four tanged arrowheads were found in the middle west ditch of the fort during excavations in 1978 (Goodburn 1979 p276; Coulston 1985 p266, fig 47). These are now in the Hunterian museum. The heads are flat and triangular, with short barbs. These arrowheads are unusual in that between the point and the square-sectioned tang is a broader central section which has curved edges. This is of elliptical section. Most of the finds are incomplete. The dimensions of the best preserved example are as follows:- TL:9.2cm. HL:1.7cm Max W:1.2cm. These have been identified as hunting arrows (Coulston 1985 p266), since they seem to have been designed for use against soft-skinned targets. As already noted however, there can have been little need for armour-piercing arrows in a province where Rome's opponents wore very little armour. Date:Antonine.

Carrawburgh.

One arrowhead was found in the excavations of 1967-9 (Breeze 1972 p135, fig 15 no.147; Manning 1976 p23, fig 14 no.45). The head is triangular, as is the tang, which comes to a point at the lower end. It was found in the principia. TL:5.8cm. HL:2.4cm. Date:Hadrianic or later.

Housesteads. (plate 15 no.s 6-7; fig 23 no.s 2-7)

This site has produced many times the number of arrowheads so far found on all the other Roman sites in Britain. Unfortunately of the hoard of 800 or more flat-bladed and tanged arrowheads found in 1898, many have been lost and the remainder are badly corroded. The hoard was discovered in the right-hand room of the rear range of the 4th century principia:-"in the last foot of rubbish above the original floor. They were found in all parts of the room at various levels, but lay thickest about six inches from the floor over an area measuring about four feet north and south and three feet east and west, in the middle of the room, nearer to the east than to the west wall. Mixed with them were many nails and scraps of iron" (Bosanquet 1904 p225, figs 16, 47). The arrowheads were found scattered about, but the excavator was of the opinion that they had once been arranged in bundles. Given the nails, scrap metal and also an anvil found here, it would not be too rash to conjecture that arrowheads were being made and stored in the principia.

Those arrowheads which have come down to us are scattered amongst several museums. The Newcastle ironwork catalogue mentions 41 arrowheads from Housesteads (Manning 1976 p23, fig 14 no.s 37-45). There are now approximately 61 examples in two boxes marked 813 and 814-where the additional twenty specimens came from is not known. There are another 90 arrowheads in the store at Corbridge museum (Acc. no.4343) and a further 27 on display in Chesters museum. Oddly, there are none at all at Housesteads itself. There are also some arrowheads in the Hunterian museum

(Acc. no.1901.1), which because of the date of accession and their general appearance are probably from Housesteads. They are labelled as coming from Hadrian's Wall and number about a dozen.

We can thus account for about 190 arrowheads-just under 25% of the original total. The others cannot be traced and it must be assumed that they were given away, lost or thrown away after the excavation, or else are lying in some storeroom, corroded beyond recognition.

The 60 examples at Newcastle can now be considered in detail. They are representative of the group as a whole. Many have pieces of heavily corroded wood adhering to the tang. Where identifiable the section of the tang is square. The shape of the head varies considerably. Some have a rounded, "leaf-shaped" appearance, whilst others are triangular with slight barbs. Plotting head length against maximum head width (see fig.24) fails to show any clear divisions that might represent distinct types. Forty-eight specimens were measured for this purpose, the rest being too corroded for accurate measurements to be taken. The biggest example is 8.1cm long. Head lengths vary from 0.7 to 4.1 cm and widths from 0.8 to 2.7cm. Most examples have heads between 1.8 and 3.5cm long and 1 to 2cm wide. The arrowheads from Corbridge are identical in form and range from c3 to 5.5cm long. They are associated with a dozen or so large, roundheaded nails. In the Hunterian museum there are five recognisable specimens and a further fourteen fragments, representing about a dozen arrowheads. The longest example is 3.5cm long. The finds at Chesters were not available for detailed study, but they look just like the other examples. Overall these arrowheads have a very crude appearance, with no real attempt at standardisation and no attempt to produce "types". They are what you would expect of arrowheads produced from any available pieces of metal and perhaps in the face of some emergency.

Newstead.

A triangular bladed arrowhead from the site (Curle

1936 p18) may have been of this type. No details are known. Date:Flavian/Antonine.

Richborough. (fig 22 no.10)

Two flat-bladed and tanged arrowheads are illustrated in the 4th report on the excavations (Bushe-Fox 1949 p153, plate LIX no.s 294, 302). No.294 has a broad, triangular head with barbs. The point is rounded and the tang is square in section. TL:5.7cm. HL:4.1cm. Max W:2.2cm. No context is recorded. No.302 is barbed. The point is missing and the tang is circular-sectioned. It was found near the SW angle tower of the Saxon Shore fort and so may date to the late 3rd or 4th century. TL:6.5cm. HL (Surv.) :3.7cm. Max W:1.6cm. Both finds are in the AML, London.

Vindolanda. (fig 23 no.8)

A flat-bladed, "leaf-shaped" arrowhead was found on the berm of the Antonine ditch during recent excavations (find no.3498). This lacks the point. The tang is square-sectioned. TL:4.4cm. HL:1.8cm. Max W:1.3cm. Date: 140-180AD. Two arrowheads were found in the 1980 excavations in the stone fort (Bidwell 1985 p136, fig 49 no.s 30-31). The first of these has a triangular head of elliptical section, with incipient barbs. The tang is square-sectioned. It is very like the arrowheads from Housesteads. TL:5.6cm. Date:c275/300-370AD. The other find consists of the head only. This is triangular with well-developed barbs. TL:2.7cm. Date: unstratified.

Type 7:Tanged, "Bodkin" arrowheads. (Map 19)

This class of object is said to be square or triangular in section and about 4cm long (Coulston 1985 p265). Coulston lists examples from Corbridge, Kirkby Thore, Milecastle 48, Newstead and Richborough. These objects have already been considered in the section on pilum points (see pages 185-191). Some may in fact be arrowheads, but the dividing point is not clear, since they are of identical form. Many are much larger than the size quoted by Coulston.

Corbridge.

Twenty three square-sectioned and tanged objects were found in workshop III in 1938-9 (Richmond and Birley 1940 p112, plate XI). These were identified as pilum points. Ten of these were about 1.5" (c4.3cm) long, excluding the tangs. Date:Severan?

Kirkby Thore.

There do not seem to be any missile heads from this site of the appropriate size. The three pyramidal square-sectioned points known to me (see page 189) are 7-8cm long. Date:Flavian-4th century.

Milecastle 48 (Poltross Burn).

The pyramidal, square-sectioned projectile from this site (see page 189) is 7.4cm long. Date:Hadrianic or later.

Newstead.

Again, there do not seem to be any 4cm long points from this site. Two pyramidal heads (see page 189) are 8.3 and 9.4cm long. Date:Flavian or Antonine.

Richborough. (plate 10 no.4)

Five square-sectioned, tanged heads (see page 190) range from 4.5 to 7.2cm long. Date:Claudian to 4th century or later.

The evidence for this group is rather sketchy. Some of the finds could be pilum points, although they are rather small. Many are not complete however. There are three small, pyramidal, tanged points from Hofheim (Ritterling 1913 p160, taf XVII no.s 26-8) which are very similar. These might be arrowheads, but could conceivably be parts of tools.

Type 8:Socketed "Bodkin" arrowheads. (Map 19)

These arrowheads are described as having a long, slim head of square or rhomboidal section. They are about 5cm long (Coulston 1985 p265). The evidence for the existance of this type in Britain is unimpressive.

Richborough.

There is supposedly one example from this site (Bushe-Fox 1949 plate LIX no.301). Unfortunately this find could not be located amongst the Richborough material in the AML. The illustration is very poor, but this might be a ballista bolt. Date:Claudian-4th century or later.

Type 9:Fire Arrows. (Map 19)

To a Greek or Roman writer the forms of such mundane items as arrowheads was of little interest and they would probably have been amused or puzzled by our obsession with categorising these objects. Fire arrows are an exception for they had an unusual form and therefore attracted the attention of some Ancient authors. These arrowheads are referred to as "malleoli" by several writers. Ammianus Marcellinus (XXIII, 4, 14) gives a description of Roman incendiary projectiles:- "But the fire darts, a kind of missile, are made in this form:the shaft is of reed and between this and the point[spiculum]is a covering of bands of iron like a woman's distaff for making linen threads. It is skilfully hollowed out on the lower side with many openings and in the cavity fire and some inflammable matter is placed. And if it is shot slowly from a somewhat loose bow (for it is extinguished by too swift a flight) and has stuck anywhere, it burns persistently and water poured upon it raises the fire to still greater heat, and there is no way of extinguishing it except by sprinkling it with dust." Elsewhere (XXI, 9, 6) Ammianus likens Julian's advance to the flight of a blazing arrow. Julian himself (IInd oration on The Heroic Deeds of the Emperor Constantius line 63) refers to fire darts used by the Persians at the siege of Nisibis. Vegetius (Ep. rei MIl. IV, 18) mentions malleoli in a section devoted to the tactics of defenders in sieges:- "But if they have not the courage to come out, they shoot weapons called malleoli and phalaricae from large ballistae, that penetrate the hides and other coverings and fire the insides of the tower. The malleoli are a kind of burning arrow that set fire wherever they fix." Vegetius goes on to explain that the phalarica "is a sort of spear with a strong iron point:within a hollow on the staff is wrapt a combustible composition of tow, sulphur, rosin and bitumen, soaked in incendiary oil..." Presumably the malleoli used similar materials.

There are some earlier references to incendiary missiles which do not include the term malleoli. Cassius Dio (L, 34) claims that javelins with torches attached, as well as jars filled with pitch and fired from catapults were used at the battle of Actium. Incendiary missiles of an unspecified kind were employed when Corbulo attacked an Armenian fortress (Tacitus, Annals XIII, 39). Finally, to return to Ammianus, he notes the use at the siege of Bezabde in 360AD of "blazing wicker baskets smeared with pitch and bitumen", fired from scorpions (XX, 7, 10).

One further possible piece of evidence for fire arrows comes from an illustration in the Notitia Dignitatum (OC. XI, 2). This is the insignia of the Magister Officiorum for the western empire. Amongst the armour and weapons it shows an object with a straight central shaft to which are joined two curving bars, one either side, forming a basket-like arrangement. There is a slightly different, but perhaps related object to the left of this. The illustration is reminiscent of the malleoli described by Ammianus and as we shall see, also closely resembles a class of find known from several Roman sites.

Finds from Britain.

Bar Hill. (plate 15 no.8)

Five alleged fire arrows were found at the bottom of the fort's well, together with seven triple ribbed, tanged arrows (Macdonald and Park 1906 p116, fig 42; A. Robertson et al 1975 p99, fig 32; Hunterian museum Acc. no. F.1936.177). Three examples were examined by the present author. These range in size from 4 to 5.5cm, although the smallest is incomplete. Max W:1.8-2.2cm. *4 The curved bars appear to be circular-sectioned, whilst the point and the tang tend towards squareness. The excavators (Macdonald and Park loc. cit.), with some astuteness proposed that these objects were fire arrows, although at the time they had no parallels to draw on. Date:Antonine.

Chester.

There is an unpublished object from the Abbey Green excavations of 1975 which has been identified as a fire arrow (find no.267 972). This is rectangular in section, with a tang at one end and the other broken off. The main section consists of two bars, joined at the ends but diverging in the middle. The space between these has been filled with corrosion. L:11.5cm. Max W: 1.8cm. Max W of bars:0.6cm. Size of central opening:c5 X 0.8cm. Diameter of bars:0.7cm. Date:unknown, therefore Flavian or later.

Wroxeter. (fig 23 no.9)

An object just like those from Bar Hill was found in excavations in the forum in 1923-7 (Atkinson 1942 p225, plate 55B.1). The context of this find is rather puzzling. It might be residual from the first century military occupation or be evidence of some later army activity. Three curving bars come together at either end to form tangs. Both these and the bars are circular-sectioned (AML no.840756). L:6.6cm. Max W:c2.5cm. Diameter of tang:0.7 cm. Diameter of bars:c0.6cm. This was identified by the excavator as a spinning implement, possibly a distaff.

Continental Parallels.

A socketed variant, with a pointed head and three bars has been found at Dura-Europos (Brok 1978 p57ff; James 1983 p142-3). Date:c250AD? Another socketed example (unpublished) was found at the legionary fortress of Poetovio in Pannonia. This was unstratified (pers. comm. J. C. Coulston). An example has also been seen in a junk shop in Trier, along with other Roman detritus, perhaps dredged from the Moselle (pers. comm. P. J. Casey).

Although few in number, these finds do match the description in Ammianus and also the illustration in the Notitia. The object shown in the latter must surely be a piece of military equipment, for it is depicted alongside clear representations of other weapons and armour. The identification of the excavated objects as fire arrows is I think, quite reasonable. Their presence on fort sites in Britain is a little odd, for there can have been little need in this province for weapons which were essentially designed to burn the siege engines of attacking forces. Except in the east, Rome did not face opponents capable of sophisticated siege tactics. Still, perhaps stocks of incendiary missiles were kept at some forts against the unlikely eventuality that they would be besieged. Perhaps also, blazing arrows might be used as a short-range signalling device at night.

Type Uncertain.

Croy Hill.

One "barbed and tanged" arrowhead (Hanson 1979 p20) was found in an area of drainage ditches within the vicus. This might have been pre-Roman. No further details are known.

Conclusions.

Beyond the fact that composite bows were being used, we can say very little about the bows used by the Roman army in Britain. The spread of both the arrowheads and the bow laths indicates that most (perhaps all) types of unit, whether legionary or auxiliary, received some training in archery. There are far too many finds for them all to have been the property of the one unit of archers known to have been based in Britain. How often the weapons were actually used we cannot of course determine. It may be that only a proportion of each unit had any training in this skill and if they were mainly used for mural defence then they would seldom have been needed. At any rate, the presence of bow parts and arrowheads at sites like Caerleon further undermines the view of the imperial legions as a monolithic block of heavy infantry, unsuited to anything other than close-order fighting.

Of the various arrowhead types, the trilobe tanged form has been most widely found, although due to the distorting effect of the Housesteads hoard, the flat-bladed tanged type is most numerous. Trilobe tanged heads were quite complex to make and they must have been judged very effective to have been worth producing so frequently. The triple-vaned, socketed variant was perhaps a 3rd century introduction and this may be true of the quadruple-vaned, socketed form as well. The trilobe tanged type appears to persist right through from the 1st to the 4th century. Overall, tanged arrowheads far outnumber the socketed examples, showing that greater ease of production was more imortant than security of attachment to the arrow shaft.

With the exception of the laths from Caerleon, we do not know what types of bone were used for laths and it would be interesting to see what the preferences were. One suspects that local sources would have been used if at all possible.

NOTES

*1 Other easterners were recruited e.g. the Ala Parthorum et Araborum, based at Mainz in the 1st century (Coulston 1985 p230). An eques of Cohors III Batavorum milliaria equitata demonstrated his prowess with the bow before the emperor Hadrian in 118AD. Swimming the Danube in full equipment, he fired an arrow in the air and hit it with a second before the first hit the ground. Thus archery was practiced by some non-eastern units (Davies 1989 p85-6).

*2 It seems improbable that there were separate factories for bows and arrows. Perhaps "sagittaria" and "arcuaria" were different ways of describing a factory which produced all kinds of archery equipment. An alternative suggestion (pers. comm. P. J. Casey) is that the "sagittaria" made conventional bows and arrows, whilst the "arcuaria" made crossbows-arcuballistae.

*3 Later archery manuals recommend silk or sinew bowstrings for cold or humid climates respectively. Hide strings were good in all conditions and vegetable fibres might also be employed (Coulston 1985 p255).

*4 The size of the whole group has been published as 5.2-6cm (A. Robertson et al 1975 p99).

IX. Slings and Slingshots.

"Soldiers not withstanding their defensive armour, are often more annoyed by round stones from the sling than by all the arrows of the enemy. Stones kill without mangling the body and the contusion is mortal without loss of blood." (Vegetius, Epitoma rei Militaris I, 16).

a. History.

It is clear from a study of the literary sources that the sling was not a native Roman weapon. The army of the Republic relied almost exclusively on its disciplined legionaries, equipped with pilum, gladius and scutum. On open, flat terrain, assuming that it was competently led, such a force would generally be victorious. However, during the course of the 3rd and 2nd centuries BC, as Rome's influence began to expand across the Mediterranean area, she came into contact with some formidable military adversaries notably Pyrrhus, the Carthaginians and the Macedonians. The need for lightly equipped missile troops must have quickly become apparent. Such troops would be particularly useful in rough terrain where legionaries would be hampered in their movements and for skirmishing before the main forces came into contact. Initially these light troops were provided for Rome by client or allied states, or recruited as mercenaries. We can see an early example of the former in a passage in Polybius (III, 75) in which King Hiero of Syracuse sent a force of slingers to serve with the Romans during the 2nd Punic war.*1

Slightly different from these voluntary contributions of troops were the levies sent by client kingdoms. These we may suspect were not entirely voluntary. Such a force were the archers and slingers amongst the army of Vespasian in Judaea (Josephus Bell. Jud. III, 68, 168; Cassius Dio LV, 4, 2). These men evidently came from the various client states on Rome's eastern frontier.

The slingers par excellence of the Ancient world were undoubtably the Balearic islanders. The prodigious abilities of these people are mentioned by many Greek and Roman writers. Vegetius (Ep. rei Mil. I, 16) for example states that:- "The inhabitants of the Balearic islands are said to have been the inventors of the sling*2 and to have managed them with surprising dexterity owing to the manner of bringing up their children. The children were not allowed to have their food by their mothers till they had first struck it with their sling...." Very much the same story is told by Diodorus Siculus (V, 18), Strabo (III, 5, 1) and Florus (I, 43). Even as late as the fifth century AD we have a mention of Balearic slingers hurling balls of lead (Sidonius Apollinaris XXIII, lines 345-7). However as has been suggested recently, the continual linkage in the literature of the Balearics with slinging may be an example of "racial stereotyping" and is not therefore safe evidence for the use of Balearic slingers in the later Roman army. In the late Republic at least we have clear examples of the employment of Baleares in Roman service.*3 For example, Julius Caesar in his campaign against the the Belgae in 57BC used some "Funditores Baleares" (De Bell. Gall. II, 7). Likewise during his campaign in Africa, Caesar's army must have included some slingers, for his smithies were producing "glandis"   (De Bell. Afr.20).

It is not exactly clear what the status was of units like the Cretan and Numidian archers and Balearic slingers which were to be found in the army of Caesar (De Bell. Gall. II, 7). Were they for instance mercenaries hired for the duration of the campaign? Or were they conscripts, or even a regular part of the army? We have unfortunately no way of answering such questions definitively since all we have to interpret are a few rather vague references in the classical texts. We could even conclude (though this is very improbable) that the composition of Caesar's army was not typical for the period as a whole.

What then happened to the units of Balearic slingers following the establishment of the Principate by Augustus? Possibly they became for the first time a regular part of the army as a result of the far-reaching reforms made by

Augustus. This is however purely speculative. The Balearics virtually disappear in the literature of the early empire. The exceptions to this are references in two poems (Virgil, Georgics I, 309; Florus I, 43). These brief mentions could be simply literary motifs and do not prove the continuing use of Balearic slingers in the Roman army. That slingers of some sort continued to be used is proved by a number of other texts. One unit of "funditores libritoresque" was employed by Germanicus in one of his campaigns across the Rhine (TAC. Ann. II, 20, 2) ; whilst Corbulo's army in Armenia included some "libritores et funditores" (TAC. Ann. XIII, 39).*4 There is a complete lack of any epigraphic evidence for slingers in the Roman army, although as we shall see later there is ample archaeological evidence (in the form of slingshots).

The small amount of evidence that we have for slingers in the Roman army during the 2nd to 5th centuries AD suggests that the sling had ceased to to be the preserve of specialists. Vegetius (I, 16) felt that it was worthwhile to teach all recruits to throw stones, by hand as well as with the sling. His reasons for this are specifically stated:- "It is universally known that the Ancients employed slingers in all their engagements. There is the greater reason for instructing all troops without exception in this exercise, as the sling cannot be reckoned any encumbrance and often is of the greatest service especially when they are obliged to engage in stony places, to defend a mountain or an eminence or to repulse an enemy at the attack of a fort or city." Of course, what Vegetius felt to be useful and what happened in reality may have been quite different. Nevertheless, the widespread distribution of clay, stone and lead slingshots in Britain does imply that all types of troops were trained in the use of the sling. This is also the impression given by a well-known inscription from the fortress of Lambaesis in North Africa (CIL VIII 18042a=ILS 2487), which records Hadrian's speech to the army of the province in 128AD.

In the section dealing with the exploits of the cavalry of Cohors VI Commagenorum Equitata it is mentioned that they "hurled stones from slings." Whether this took place whilst they were on horseback or not is not stated. In a similar vein, Arrian (Tactica 43, 1) speaks of cavalry firing stones from slings. It can also be seen that there was more than one kind of slinger and several types of sling as well. Mention has already been made of the "libritores" and "funditores" employed by Corbulo, who can be regarded as two separate groups. Vegetius (II, 15) refers to slingers using either the common sling ("funda") or the "fustibalos".*5 The latter was apparently a sling fixed to a staff, capable of a greater range than an ordinary sling (c.f. Couissin 1926 p488).

With regard to the physical structure of the sling, we have to rely for information on the classical sources and ethnographic parallels as the actual weapons themselves do not survive in the archaeological record. Virgil, writing in the reign of Augustus makes reference (Georgics I, 309) to "the hempen thongs of a Balearic sling". Elsewhere he talks of slings made of smooth leather thongs (Aeneid XI, 579). Strabo in his "Geography" (III, 5, 1) comments that the Baleares have "three slings worn round the head... of black tufted rush I say, or of hair or of sinews:the sling with the long straps for the long shots, the one with short straps for the shots at short range and the medium sling for for the medium range." Perhaps here then we have the explanation of the difference between the "funditores"and "libritores"and between the common sling and the "fustibalos" i.e. it was a question of range. Structurally slings were of two types - either a single thong widened at the centre to hold the shot or a pair of thongs joined by a cup. It is rather doubtful whether the latter design was in use during the period under discussion (Griffiths 1989 p256-7).

We know very little about the appearance of slingers. It is assumed in modern reconstructions that they were lightly equipped, clad in a simple tunic and carrying a small shield and a sword in addition to the sling. The slingshots were carried either in the fold of a cloak or in a pouch hung around the neck. The only contemporary depiction we have of Roman slingers comes from Trajan's column in Rome (scene LXVI). Here they are seen operating on the flank of the army. As well as tunics they wear cloaks, fastened round the neck and then draped across the left arm. The slingshots are held in a fold of this cloak. The slings appear to be of the single thong type. The representation seems convincing but must be accepted with caution (as with so many other details on the column) due to the lack of supporting evidence. Nor can we really tell whether these slingers belonged to a regular auxiliary unit, a numerus or, to a force specially recruited for the Dacian campaign.

There are several further mentions of slingers in later Roman literature, including a reference to the use of lead shot during the campaign between Septimius Severus and Clodius Albinus in 197AD. This comes however from a highly unreliable source (SHA vita Severus XI, 2). Ammianus Marcellinus speaks of stones thrown both by hand and with the sling (XIV, 2, 16; XX, 6, 6; XX, 11, 12; XX, 11, 17; XXIV, 2, 14), but the references to archers and artillery are far more numerous. In the Notitia Dignitatum we find only one unit of funditores and that is in the east under the command of the Magister Militum per Orientem (N. D. OR. VII, 16). This does not of course preclude the possibility that other units had slingers but lacked the title of "funditores". Finally there are two late Roman poems which allude to slingers. Claudian in his panegyric on the third consulship of Honorius (396AD) lists the activities of the young emperor, amongst which was the firing of "acorn missiles with a barbaric sling" (line 50). The word "barbaric" is of interest here since it seems to imply a condescending attitude to the weapon. Sidonius Apollinaris (Carmen XXIII 1345-7) talks of "the balls of lead hurled by the Balearic slings [which] had never cut through the clear sky so fast." Although they are interesting, one can hardly claim that these poetic references are firm evidence for the use of the sling by the later Roman army. However the

Strategikon of the Byzantine emperor Maurice, written about 600AD does mention the sling on several occasions (XII, B:3, 4, 18, 20) - being used by heavy infantry as well as the light troops - so the weapon may have continued to be used throughout the Roman period.

b. Accuracy, Range and Effectiveness.

Many Ancient writers comment on the amazing proficiency of the Balearic islanders with the sling (Diodorus Siculus V, 18; Strabo III, 5, 1; Florus*6 I, 43; Vegetius I, 16). All four writers repeat essentially the same story, to the effect that from childhood the Baleares were trained in the art of slinging, the children not being able to eat their food until they had first hit it with a slingshot. Diodorus also says that the Baleares "hurl much larger stones than do any other slingers and with such force that the missile seems to have been shot, as it were from a catapult, consequently in their assaults upon walled cities, they strike the defenders on the battlements and disable them and in pitched battles they crush both shields and helmets and every kind of protective armour." There are other, rather exaggerated accounts of the performance of slings. Silius Italicus in his epic poem on the 2nd Punic war talks of slings "that had struck down many a bird high in the air" (Punica 1522-3). Studies of modern slingers have shown that the sling is capable of surprising accuracy, although a fair amount of practice is obviously required. New Guinea slingers could strike sticks at a distance of fifty paces - 125 feet (Griffiths 1989 p61) and Livy (XXXVIII, 29, 7-8) speaks of target practice involving shooting through rings. The efficiency of the sling became a byword in the literature of many nations and is perhaps best summed up by the passage in the Bible referring to slingers who were so skilled they could hit a hair with a stone (Judges XX, 16).

The range of the sling is a matter of some controversy. Some commentators seem to have accepted too readily the claims of the Ancient writers. It is most important to distinguish between ranges achieved on the field of battle on the one hand and during practice on the other. Adverse weather conditions, wind, dust, heat, unfavourable ground, fatigue, the type of sling and the weight of missile would all affect the performance of the slinger.*7 For example the distance achieved would obviously be greater if the slingers were firing downhill with a wind behind them. Therefore, Xenophon's statement (Anabasis III, 4, 15) that Rhodian slingers could outrange Persian archers (with composite bows?) is not a basis for assessing the relative merits of the two weapons. Comparisons of this sort are meaningless unless we can learn exactly what were the battlefield conditions in that situation. Vegetius (II, 23) recommended that recruits should begin to practise by firing stones from the fustibalos (staff sling) at bundles of twigs or straw 600 feet (218 metres) away.

So much then for the statements of the classical writers on the range of the sling. Archaeology and ethnography provide rather more information. This has recently been summarised in a useful article (Griffiths 1989 p261-3). At Burnswark, the Roman training complex in southern Scotland, the position of lead sling shot seems to show that they were being fired uphill for c150 metres. Using stone pebbles natives from New Guinea could reach distances of up to 180 metres on the flat, whilst an experiment with (allegedly) inexperienced Turkish youths achieved ranges of 230-240 metres - also with stones. These are impressive distances for hand-hurled weapons, but they do not come anywhere near proving that the sling had a comparable range to the composite bow. The Ancient texts are simply too imprecise and/or unreliable to support such a view. Statements that the sling had a range of 350-400 metres (Korfmann 1973 p37; Connolly 1981 p49) remain unproven.*8

The effectiveness of slings as weapons can be gauged firstly by their length of use and secondly by the descriptions in the classical sources. Onasander (The General XIX, 3) details the effects of slings in combat:-

"The sling is the most deadly weapon that is used by the light armed troops, because the lead sling is the same colour as the air and is invisible in its course, so that it falls unexpectedly on the unprotected bodies of the enemy and not only is the impact itself violent but also the missile heated by the friction of this rush through the air, penetrates the flesh very deeply so that it even becomes invisible and the swelling closes over it."

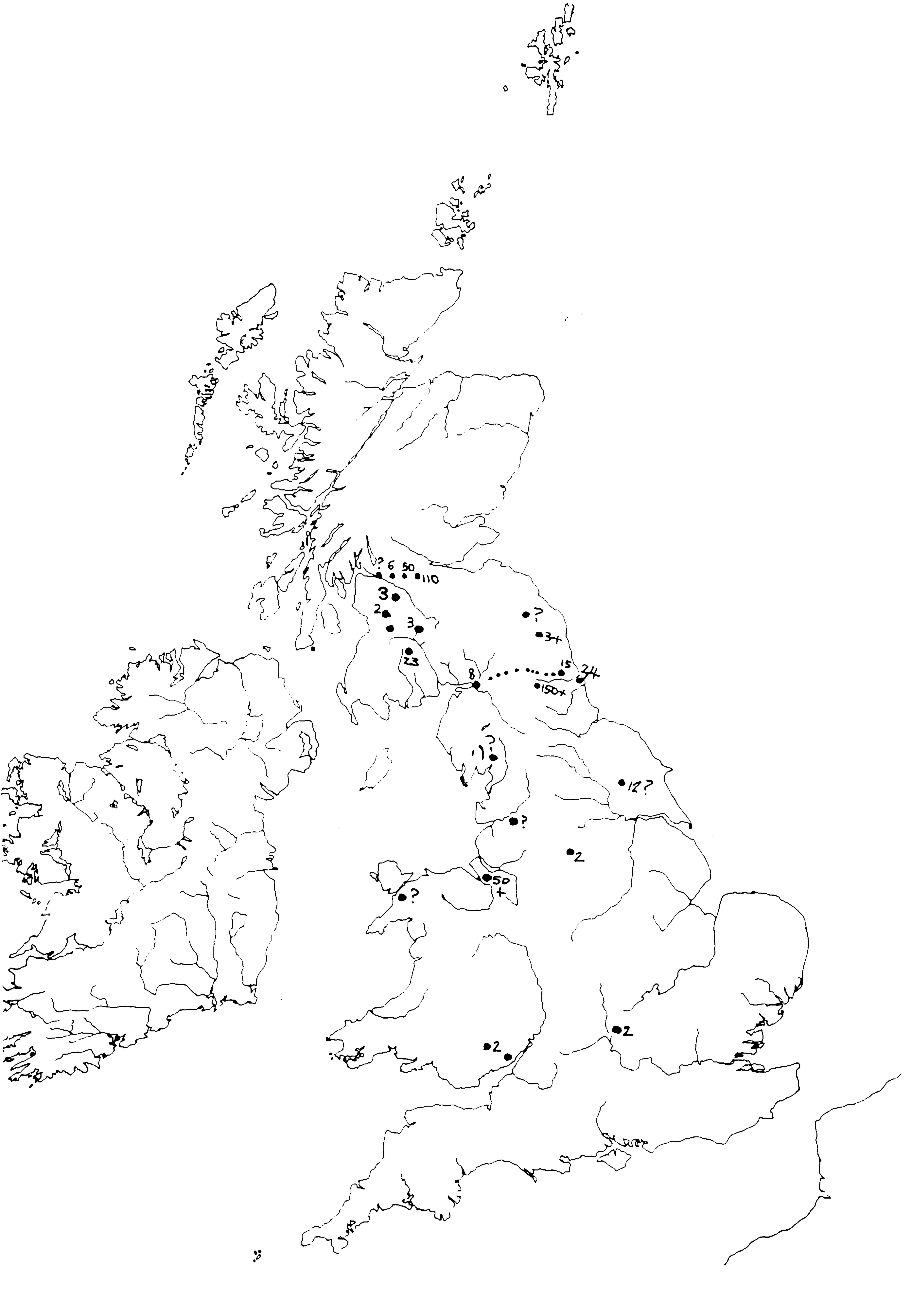
Celsus in his "De Medicina" describes the particular problems associated with wounds caused by sling bullets. These fixed within the skin un-broken and could lodge in a bone or in a joint between bones (VII, 5, 4).[*9] Like Onasander, Celsus thought that the sling was a very lethal weapon indeed, so much so in fact that he felt that "it is better to be wounded by a sharp weapon than by a blunt one." (V, 26, 5). There is ample evidence therefore for the power of the sling, although we may suspect a little exaggeration in some cases. We must now turn to the archaeological evidence for the use of the sling in Britain from the 2nd century AD onwards.

Finds of Roman slingshots in Britain.

<u>a. Stone slingshots. (Map 22)</u>

It seems reasonable to assume that stones were the commonest form of slingshot in use with the Roman army as they were in other periods. This is logical because of the ready availability of pebbles or stones as missiles on virtually any battlefield. The archaeological evidence is however rather ambivalent and hard to interprete. To begin with, we must be very careful before accepting rounded stones found on Roman sites as slingshots unless there were other definite artefacts in association with them. Isolated stones are just that and one cannot prove that they were used for anything. Furthermore there is a problem in distinguishing where the dividing line lies between slingshots and the so-called "ballista balls" i.e. missiles from stone throwing artillery. The latter will be discussed in the next chapter. Another complication is provided by the fact that on occasion Roman troops would throw stones

MAP 21: Ballista Bolts.



MAP 22: Stone Slingshots/Ballista Balls.

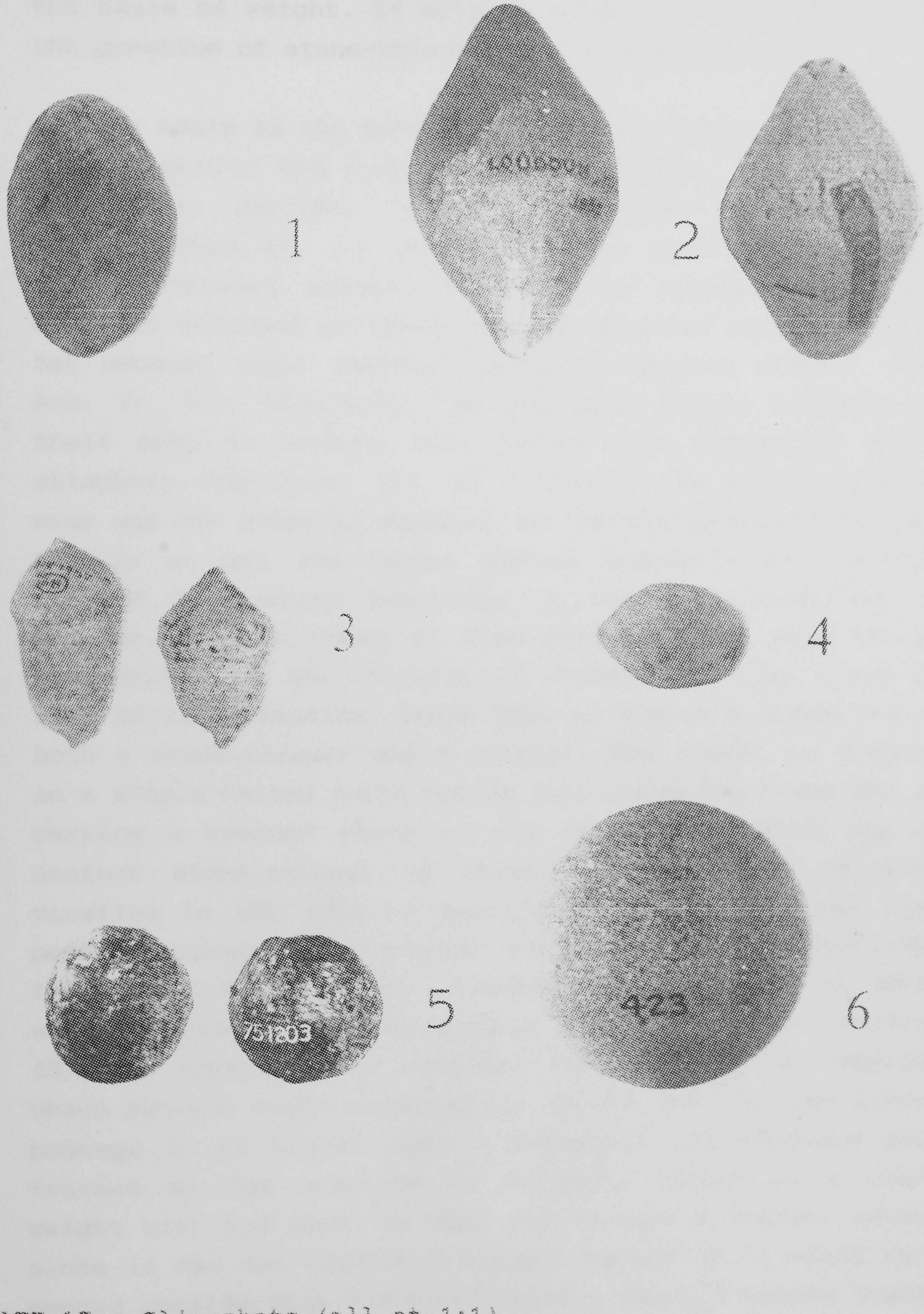


PLATE 17: Slingshots (all at 1:1)
1. Ardoch (Clay) 2. Loudon Hill (Clay) 3. Birrens (Lead)
4. Burnswark (Lead) 5. Corbridge (Lead) 6. Chesters (Stone)

by hand. These missiles may also be represented on sites in Britain. One would expect them to be inter-mediate in weight between the slingshots and the ballista balls, but again the dividing line (if any) is very hard to detect on the basis of weight. It will be covenient to discuss here the practice of stone-throwing in the Roman army.*10

As early as the battle of Asculum (279BC), between the Roman Republic and King Pyrrhus of Epirus, the forces of the former included "hurlers of stones" (Dionysius of Halicarnassus XX, 1). Early imperial writers show Roman troops throwing stones, generally in emergencies. Roman soldiers besieged in their camp by Thracian rebels in 26AD had amongst their weapons "piles of massive stones" (TAC Ann. IV, 51). Similarly, the Vitellian forces besieged in their camp at Cremona also hurled down stones on their attackers (TAC Hist. III, 27). Clearly the early imperial army was not properly equipped for defending fortifications and so we get the rather absurd spectacle of superbly trained legionaries resorting to the most primitive of weapons. However there is also evidence that some troops specialised in the throwing of stones and they could be used in field battles. Scene LXVI on Trajan's column shows both a stone-thrower and a slinger. The former is dressed in a simple belted tunic ending just above the knees and he carries a rounded stone in his right hand. What may be another stone-thrower is shown in scene LXX, carrying missiles in the fold of his cloak. This figure has also been interpreted as a slinger without his sling (Griffiths 1989 fig6). Other types of troops could be trained to throw stones - Arrian mentions cavalry in this context (Tactica 43, 1). There are in addition two passages in Vegetius which mention stone throwers (I, 16; II, 23). In the latter passage it is stated that:- "Formerely all soldiers were trained to the practice of throwing stones of a pound weight with the hand, as this was thought a readier method since it did not require a sling." Certainly it would have needed considerable practice before a recruit became truely proficient with a sling, but a trained slinger would have greater accuracy and better range than a stone thrower.*11

It does not seem likely for this reason alone that most Roman troops would ever have thrown stones in battle, except in the most desperate of situations. The figures shown on Trajan's column may well have been a body of irregulars who through long practice had become relatively skilled at their business.

We now move on to the stone missiles from British sites which have been (or could be) identified as slingshots, always keeping in sight other possibilities.

Alchester.

Two stone missiles were found in the outer ditch on the east side of the town during the 1928 excavations (Iliffe 1932 p47). In the finds list (ibid p66) no.24 is called a "smooth, heavy rounded stone, probably for slinging. Diameter:3" (7.6cm)." No.25 was similar but less well-rounded. But elsewhere (ibid p47) these finds are described as "two heavy, roughly rounded ballista balls", so clearly the excavator was uncertain as to the true identity of these objects. Unfortunately no weights are quoted. Iliffe considered that the ditch was filled in by c130-140AD, which would date the "slingshots" to the 1st or 2nd century if he was correct.

Bothwellhaugh.

There are three slingshots from this site in Glasgow's Hunterian museum (Accession no.s 1939.324, 1940.2, 1940.61). The first two of these were examined by the present author. The first is oval, measuring 3.2 x 2.6cm and weighs 40 grams.*12 The other is rather more rounded, 4 x 4.5cm across and weighing 100 grams. The final Bothwellhaugh slingshot is recorded as being 5.2 x 5cm, but its weight is not known as it could not be found. Date:Antonine?

Caerleon.

At least two supposed slingstones have been found here, both of them round (Nash-Willliams 1929 p259, fig18 no.s 16-17). Number 16 was found in an early second century deposit, the other was a surface find. No dimensions or weights are given. There are a number of "natural pebbles" on display at the site museum, some of which may have been used as slingstones, but this is of course impossible to prove.

Caernarvon.

In his excavation report Wheeler noted (Wheeler 1923 p139) that several stone shot had been found in the fort. He did not give any further details on these and I have been unable to trace any such finds. Undated.

Caerwent.

There are five round stones/pebbles from the town in Newport museum which may be slingshots. Not available for detailed study.

Carlisle.

Seven stone shot have been found here, all so far unpublished.*13 Of these, one is definitely Flavian. Another shot, which is oval and made of sandstone came from a context containing Trajanic samian. It is 3.5cm in diameter and weighs c45grams. The remaining five stones were found together with a single clay slingshot. Three are of sandstone and the other two are cobble. None of the samian from this context need be later than 100AD, so these finds could belong to the first century. In size they vary from c2.4 to 3cm and from about 10 to 15 grams.

Chesters. (plate 17 no.6)

About ten stone missiles can be seen on display in the museum at Chesters, although they did not necessarily come from this site. Half-a-dozen of these are identified as being slingshots and the rest are said to be ballista balls.*14 The identifications are somewhat arbitrary. Only one of this group really seems large enough to have warranted the use of a stone-throwing machine, the rest are more likely to have been thrown by hand or with a sling. These nine stones range in diameter from c1.8 to 4.5cm and weigh between 28.35 and 198.45 grams. Some are of sandstone, others are pebbles. The smallest is so irregular that it might not be an artefact at all. There is no information regarding the context in which these stones were found, so all that can be said is that they probably date to the Hadrianic period or later. No other objects are known to have been associated with them. Budge (1907 p367) refers to ten slingstones from Aesica (Greatchesters) and other places (Clayton collection no.s 418-427). These he says were one and a half to four inches (3.8-10cm) in diameter. If these are to be identified with the finds now in the museum then Budges's measurements are rather innacurate.

High Rochester.

In 1855 a quantity of "flat stones, round, one and a half to two inches in diameter" (3.8-5cm) were found just inside the west wall of the fort (Bruce 1857 p73). These may have been slingshot. Undated.

Housesteads.

In the report on the excavations of 1898, mention is made of "small balls probably used in games" (Bosanquet 1904 p285). These were of stone so they could have been slingshots. Nothing further is recorded of them and it has not proved possible to trace their whereabouts. Date:Hadrianic or later?

Milecastle 39 (Castle Nick).

There is one possible slingstone from this site, found in the recent excavations by Mr. J. Crow. This is a circular pebble, 2.7cm in diameter. Date:Late 2nd or early 3rd century?

Old Kilpatrick. (plate 18 no.4)

"Hundreds" of small stones one and a half to two and a half inches (3.8-6.35cm) in diameter were found during the 1923 excavations in the fort (Miller 1928 p25). They are reported as being found in post pits on the north side of the Principia's courtyard, as well as in the courtyard itself. Miller suggested that the area to the north of the yard may have functioned as the fort's Armamentarium. The missiles were then discarded because a new garrison arrived which did not need them. Judging from their size, these could have been slingshots. Only ten pebbles from the 1923 season are to be found in the Hunterian museum (Accession no.s F.1928.5/1-10). These run from 2.5 to c7.5cm in diameter and a couple have one flat surface. The weights range from 22 to 340 grams. Date:Antonine.

Peel Gap Tower.

An unknown number of stone slingshots were found during the recent excavations at this site (information from Mr. J. Crow).

South Shields.

A total of sixteen slingshots can be seen in the site museum. None of these are numbered, which makes it difficult to match them up with the published finds catalogue (Allason-Jones and Miket 1984 p352-3). The largest shot is oval with one flat side and about 4.5cm across. It weighs c170 grams (this may be no.12.54 in the catalogue). The smallest of the group is an irregularly shaped quartz pebble (Cat. no.12.49?) 1.7cm in diameter and weighing less than one ounce (<28.35 grams). There are also stones of magnesian limestone, Cheviot lava and sandstone. It is not known exactly where these objects were found, nor do they appear to have been associated with any other finds. Date:Hadrianic or later.

Turret 35a (Sewingshields).

A small quartz pebble, identified as a slingstone was found in an occupation layer inside the turret (Allason-Jones in Coulston 1988 p209). Diameter:29mm. Its weight is not known. Date:Hadrianic or later.

Wallsend. (fig 28 no.s 2-3)

Fifteen stone projectiles are on display in Wallsend Heritage Centre.*15 They are roughly rounded, usually with one or more flat sides. All of them are of sandstone, probably local. Many have red staining on the surface, presumably from contact with ironwork. Several have letters cut into them, an X in one case, XX in another and V in a third. Possibly these stones were marked to aid identification during target practice. The letters are not very conspicuous now, but would have been more so when freshly cut and perhaps even (though this is purely speculation) picked out with different colour paints. No provenances are available for these finds as yet, although a date in the 2nd or 3rd century is most likely since the subsequent industrial activity at Wallsend will have removed most of the later Roman levels.*16 The diameters of the missiles vary from c6.2 to c8.3cm. They weigh 255-625 grams, the average being 432 grams. In general these objects resemble a cricket ball in size and shape and they do fit very well in the hand. Could these stones in fact have been intended for throwing by hand? Certainly they are much larger and heavier than many of the other supposed slingshots discusssed in this section.

Watercrook.

Some slingshots are mentioned as having been found at this site (Burkett 1973 p74), although unfortunately it is not stated what material they were made of. No details are given as to their size or weight.

Whitemoss (near Bishopton). (plate 18 no.5)

There is one oval stone from the fort in the Hunterian museum (Accession no. F.1957.61). This measures 5.5 x 4.5cm and weighs 140 grams. Date: Antonine?

York.

A dozen stone shot were found in 1971 in interval tower NE.6 of the legionary fortress (Wilson 1972 p309). No further details are known.

Continental Parallels.

There is even less physical evidence from elsewhere in the Roman empire for the use of stone shot. This must be due to the difficulty of recognising such finds and possibly also a lack of publication. A hoard of about three hundred stone slingshots were found in the fortress of legio III Augusta at Lambaesis in North Africa (Curle 1911 p56). These came from a room adjoining the courtyard of the principia, which may have been used as a weapons store. These finds are described as being "late Roman" (Greep 1987 p197, note 81). The following table summarises the data on stone shot from this country.

Table 7 : Stone slingshots from Britain.

SITE	QUANTITY	DIAMETERS	WEIGHTS
Alchester	2	7.6cm	?
Bar Hill *a	110	3.8-14cm	200-2400g
Bothwellhaugh	3	3.2-5.2cm	40-100g
Carlisle	3	2.4-3.5cm	10/15-45g
Chesters	10	1.8-4.5cm	c28-198g
Old Kilpatrick	10	2.5-7.7cm	22-340g
South Shields	16	1.7-4.5cm	c28-170g
Turret 35a	1	2.9cm	?
Wallsend	15	6.2-8.3cm	255-652g
Whitemoss	1	5.5cm	140g

*a. These finds are discussed in the next chapter. Most of the stones are fairly irregular. Maximum diameters are given wherever possible.

<u>b. Clay Slingshots. (Map 23; fig 25)</u>

There does not appear to be any literary evidence for the use of fired clay sling bullets by the Roman army. The nearest we can come is a passage in Caesar's Gallic War (V, 43). Here the Nervii "sling red-hot bullets of softened clay" into a Roman camp.*17 We may speculate therefore that the Romans derived the idea of clay shot from the Gauls. There is plentiful archaeological evidence from Britain for the use of clay slingshot during the Roman period. They were also known in pre-Roman Britain as shown by examples from both prehistoric and Iron Age contexts (Greep 1983 fig8, p193). Pre-Roman shot are "biconical", that is to say oval in section and pointed at both ends. This type was very common in the Roman period, although round examples are also known. Many of the Roman finds are from civilian contexts, which suggests that clay slingshots were used in hunting as well as in battle. Only finds which are likely to be related to the army will be discussed in detail here. There is evidence from Caerhun and elsewhere that clay shot were produced in forts (fired in hearths) in large numbers. As with the stone shot there is some problem with identification. A number of finds which have previously been thought of as slingshot have now been rejected. Clay shot were evidently in use from the beginning of the Roman period in this country as examples dating to the 1st century have been found at Ham Hill, Brough-on-Humber and Gloucester - as well as in civilian contexts at Greensforge and (probably) Oare (see Greep 1984 p199-200 for details). Examples which may date to the 2nd century or later are listed here.

Abergavenny.

Thirteen biconical clay shot were excavated from a pit here in 1970 (Wilson 1971 p246). They may date to the Flavian-Trajanic period. No other details are known.

Alchester.

One undated example of the biconical type has been found here (Bulleid and St. Gray 1953 p272).

Ardoch. (plate 17 no.1; fig 25 group 1)

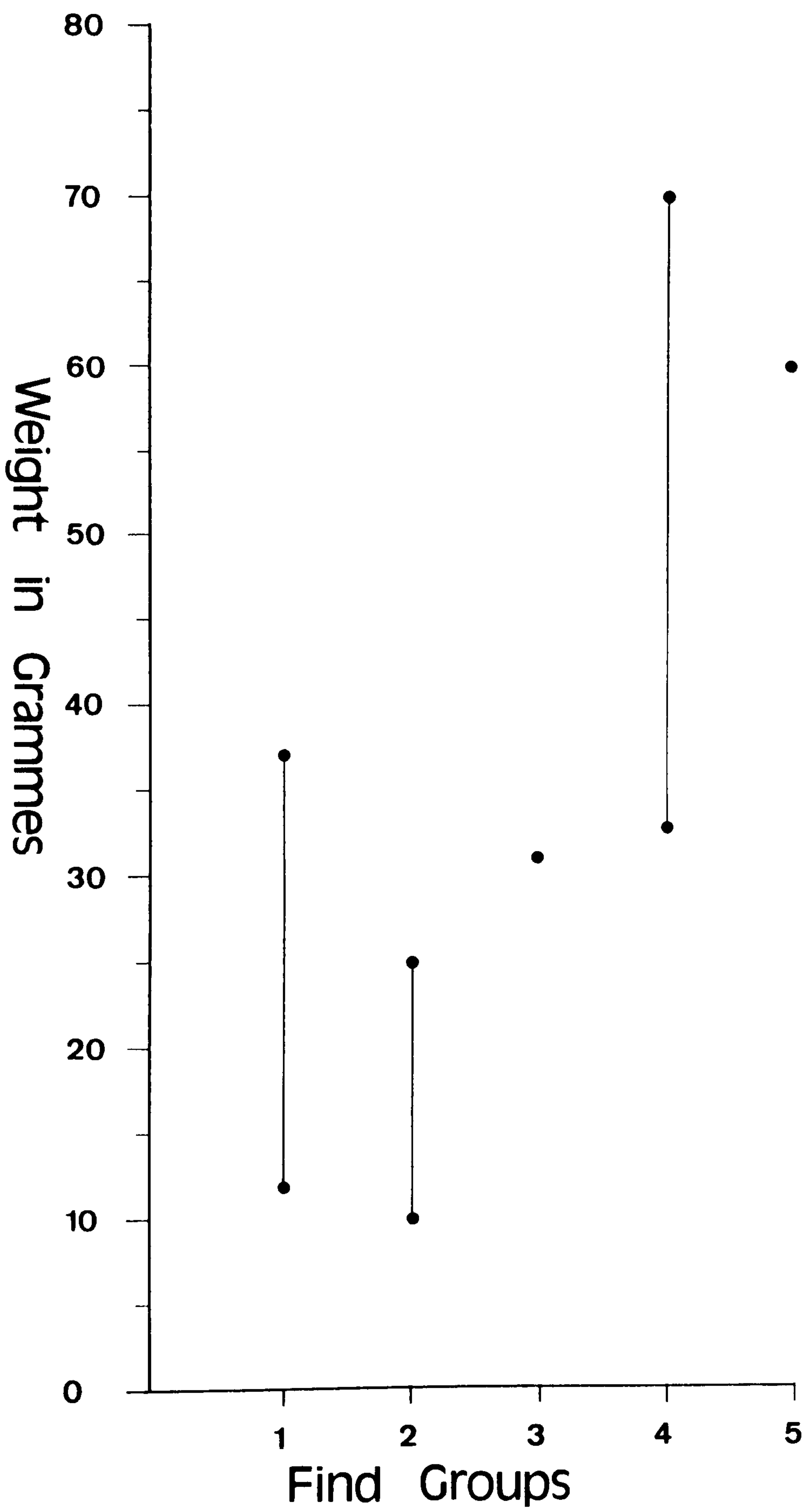
About seventy-five biconical shot of hard, orange-brown clay were found here during the excavations of 1896-7. These were one and a quarter to one and three quarters inches (3.2-4.4cm) long, three quarters to one and a quarter inches (1.9-3.2cm) in diameter and weighed about three quarters to one and a quarter ounces (21.3-c35.4 grams).*18 They were mostly found in the "Praetorium" i.e. the H. Q. building or Principia, but others were scattered about elsewhere (Christison et al 1897-8, p458-9, fig9; National Museum of Scotland Acc. no. FQ 295). Unfortunately it is not recorded whther these finds came from a Flavian or an Antonine context.

Balmuildy.

The round clay "marble" from this site, identified by the excavator as a slingshot (Miller 1922 plate LI, 2) is

MAP 23: Clay Slingshots.

FIG.25 Weights of Clay Slingshots (in grammes).



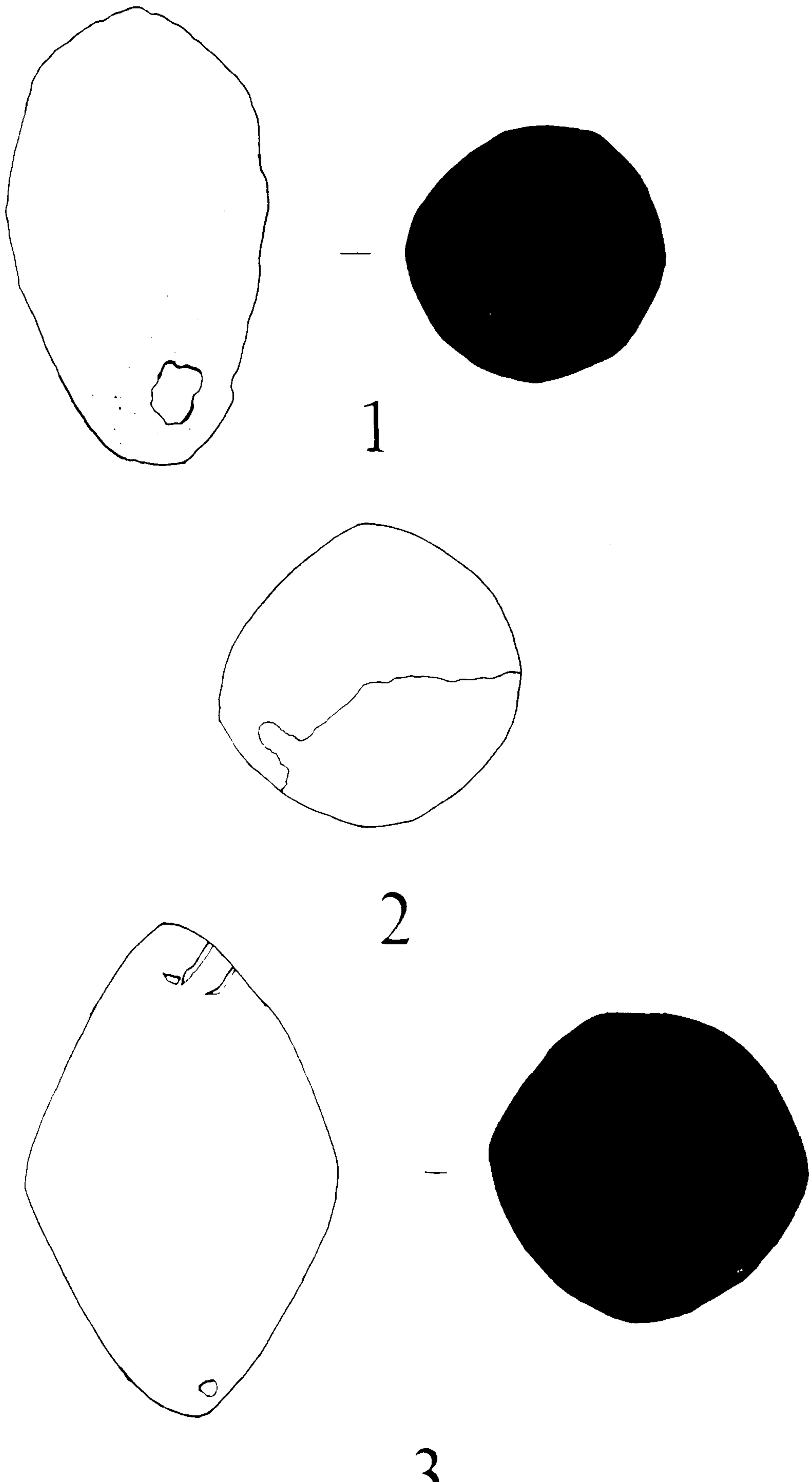


FIG 26: Clay Slingshots (all at 1:1)
1. Caerleon 2-3. Loudon Hill

now thought to be modern.*19

Bar Hill.

Six fired clay balls were found in rubbish pit 6 in the fort in 1906. These were red in colour, 0.75" (1.8cm) in diameter and are described in the excavation report as "children's playthings" (Macdonald and Park 1906 p78) and more recently as "marbles" (Robertson et al 1975 p124). They do seem rather small for slingshots and may even be modern.

Bothwellhaugh.

There is an unpublished fragment of a biconical shot from the site (Hunterian museum Acc. no.1976.574). The surface is of hard orange-buff clay, with a greyish core. It measures 5 x 3cm. Date:Antonine.

Caerhun.

During the 1926-9 excavations 30 to 40 baked clay shot were found in an ash deposit near to a circular hearth by the intervallum road. All of the shot are oval and pointed at both ends (Reynolds 1930 p78, fig4). The context indicates that they were made on site. Not available for detailed study. Date:Flavian-Antonine?

Caerleon. (fig 26 no.1)

One biconical clay shot is recorded as having been found in the fabrica (Nash-Williams 1929 p259, fig18.15; Greep 1987 p199). The context was dated to c70-110AD. There is one find in the Reserve Collection at Caerleon museum (Accession C26 A13 T2). This is pale orange in colour with some dark patches where it has been overfired. It is 5.4cm long and 3.1cm in diameter. I was not able to weigh this object. It is recorded simply as coming from Prysg field.

Carlisle. (fig 25 group 2)

Three clay shot have been discovered here, all of them currently unpublished. Two of these are Flavian, the third was found with the group of five stone shot already mentioned. It is pale pink in colour and oval in shape, with a pitted surface. Length: c3cm. Weight: 10-15 grams. Date:probably not later than 100AD. The other two are c3.6 and 4.8cm in diameter and weigh 20-25 grams.

Chester. (fig 25 group 3)

One biconical clay shot was found in Deanery field between 1921 and 1934 (Greep 1987 p199; Grosvenor museum Acc. no.43. R.1963). Length:4cm. Diameter:2.5cm. Weight:31.5grams. Undated, so Flavian or later.

Loudon Hill. (plate 17 no.2; fig 25 groups 4-5; fig 26 no.s 2-3)

At least 41 clay sling shot were found in the fort between 1942 and 1952 and are now in the Hunterian museum. Of these, 36 are biconical, 4 are round and there is one fragment of uncertain type. All are made of a hard, orange-red clay. Many are cracked and a number have been repaired with what seems to be cement or mortar. It is not clear when and by whom this was done. The largest of the biconical shot is 6.5 x 3.9cm, the smallest 4 x 3.2cm. Weights for these shot range from 33 to 70 grams. The round shot are all roughly the same size, about 3.5 cm in diameter and weighing c60 grams.

Milecastle 48 (Poltross Burn).

A "clay sling bolt" was found here in 1910 at the period Ia level (Gibson et al 1911 p434). The shape, dimensions and weight of this find are not given and its current location is unknown. Date:Probably 2ndc AD.

Neath.

There is one biconical shot from this site, dated to the Flavian-Trajanic period (Greep 1987 p199). No further details are known.

Old Kilpatrick.

Two round clay "marbles" were found at the fort in 1923 (Miller 1928 plate XXV 8-9). These are probably modern.

Papcastle.

The excavation report for 1912 mentions "a clay pellet, spherical and about half an inch in diameter", found in the area of the east gate of the fort (Collingwood 1913 p131-141). This seems rather on the small side to be a slinghot. Undated.

Strageath.

A group of clay shot were found in a workshop or stores building in an Antonine I context during the 1983 season. Others were found in the same structure in the following year (Frere 1984 p274; Greep 1987 p200). These shot were of the biconical type.

Watercrook. Two clay shot have been found at this fort (Potter 1979 fig 87, 84;

1987 p200). One was unstratified, but is presumed to be Roman, the other (possibly round?) came from the fill of the fort ditch and dates to the later Roman period.

Additionally there are a few other shot from civilian contexts (Greep 1987 p199-200). These include one example from the Romano-British village of Catsgore, Somerset (late Roman), one 3rd/4th century shot from Old Winteringham, Humberside and undated finds from Cold Kitchen Hill, Winterton and Woodeaton. Apart from the hoard of 6000 late Roman clay shot found at Lambaesis (Curle 1911 p56; Greep 1987 p197, note 81) very few such finds have been made on the continent. There are examples from Pforring in Raetia and Zugmantel in Germania Superior (Maier 1979 p166-8). The statistical evidence for clay slingshot is shown in the table below.

Table 8 : Clay slingshot from Britain.

SITE	QUANTITY	DIAMETERS	WEIGHTS
Ardoch	75	1.9-3.2cm	12.61-36.75g
Caerleon	1	3.1cm	?
Carlisle	3	3-4.8cm	10-25g
Chester	1	2.5cm	31.5g
Loudon Hill	41+	3.2-3.9cm	c33-70g

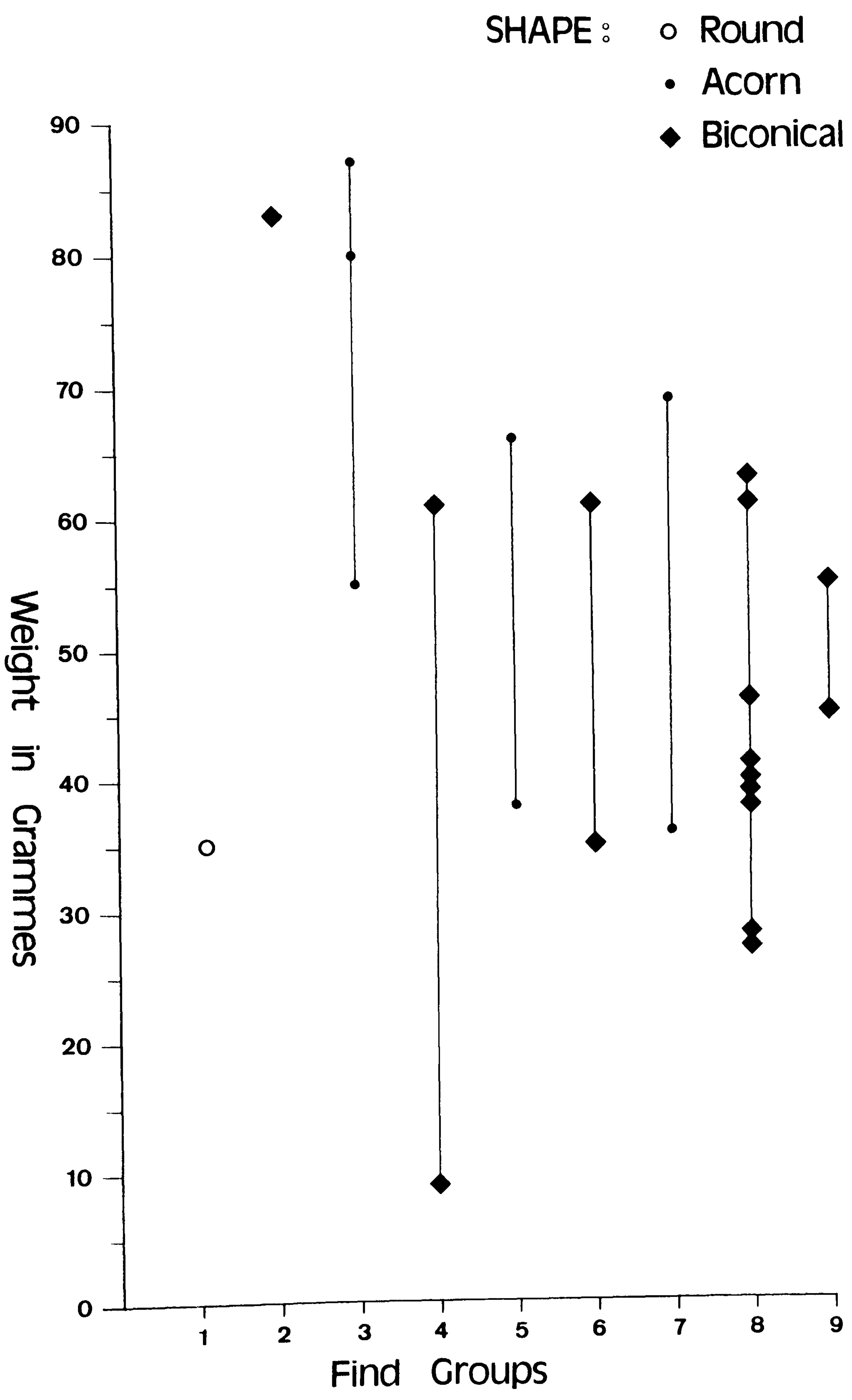
C. Lead Slingshots. (Map 24, fig 27)

The use of lead slingshots or "glandes" seems to go back as far as the 5th century BC and to have originated in Greece (Greep 1987 p189; Griffiths 1989 p258). Amongst the Greeks it was the Rhodians who were most skilled with the sling and we are told by Xenophon that because they used lead bullets as opposed to stones, they could achieve twice the range of the Persian slingers (Anabasis III, 3, 16). There are very few references in Roman literature to the use of lead shot. The earliest appears to be in the time of Caesar (Bellum Africum 20). This passage describes Caesar's army preparing for battle and included in the list of activities is the casting of lead shot. However the earliest definitely Roman lead slingshot come from Spain and date to the time of the 2nd Punic war. They belonged to Legio XIII (Keppie 1984 p69, note 10). Lead shot were also in use by both sides during the siege of Perusia in 40BC (Appian; Roman History V, 4, 36) and the literary reference is amply confirmed by finds of glandes from the site. So we have evidence for the use of lead shot by the Roman army as early as the 3rd century BC, presumably resulting from contact with the Greeks.

Most Roman writers of the imperial period only refer to slingers in a general way and so are of no value in deciding how long the use of lead shot persisted in the Roman army. Vegetius writing in the later 4th or early 5th century says (Ep. rei Mil. I, 16; II, 23) that recruits should be trained to sling stones and he nowhere mentions lead bullets. The anonymus author of the Augustan Histories gives an account of the battle of Tinurtium in 197 AD at which "it was even believed that he [Septimius Severus] had been slain with a ball of lead" (SHA vita Severus XI, 2). The dangers of using the SHA as a source of evidence cannot be denied, but it is tempting to accept the authenticity of this comment, as the army of Clodius Albinus which faced Severus in Gaul would surely have included British troops. It is in Britain that we find the latest archaeological evidence for the use of lead slingshots.

MAP 24: Lead Slingshots.

FIG.27 Weights of Lead Slingshots (in grammes).



Lastly there are two late Roman poems which contain references to lead shot. Claudian (Panegyric on the third consulship of Honorius line 50-396AD) has the young Emperor hurling "acorn missiles" (glandes) from a sling and Sidonius Apollinaris (c431-486AD) talks of "balls of lead" fired from Balearic slings (Carmen XXIII, lines 345-7). We may suspect however some degree of poetic licence from these sources.

Until recently archaeological evidence from the continent pointed to lead sling shot having gone out of use by the middle of the 1st century AD (Greep 1987 p191). There is now some proof that they were used beyond this date, outside Britain, so that province may not have been quite the special case that was previously thought. There are two inscribed shot of Legio II Italica, which cannot date earlier than c165AD (Griffiths 1989 p271). Most lead sling shot can be placed into two distinct groups - the biconical and the acorn. Round lead objects found on some British sites may also be slingshots, though this is far from certain. The biconical type (oval in section and pointed at both ends) is easily the commonest. This type was also the form ued by the Greeks. Clay moulds for the production of these shot have been found at Olynthos (Griffiths 1989 fig 1). No such moulds have so far been found in Britain, but mould lines are visible on a number of excavated slingshots. The acorn type (in Latin "glans"=acorn) are much rarer and seem in the main to be confined to the 2nd century AD, although a couple may date to the Flavian period.

Inscriptions are notable by their absence on slingshots from this country. The practice of inscribing lead shot is attested by one literary source (Bello Hispaniensis 18) and there are many inscribed shot from mainland Europe. These are always of the biconical type. Eighty examples have been found at Perugia in Italy (Keppie 1984 p123-5, fig 36). These are inscribed with legionary numbers, names of commanders and derisive comments about opposing leaders. Since we now have the Legio II Italica shot dating to 165AD or later, the lack of inscribed shot from Britain cannot be due to their having gone out of use by the time of the conquest. Some other explanation must be sought.

Type 1 (Biconical).

Ambleside.

A total of 16 shot were found in the 1913-14 excavtions (Haverfield and Collingwood 1914 p437; Collingwood 1915 p60; Greep 1987 p198). The nine found in 1913, mostly near the east gate are decribed as being "of the usual shape" i.e. biconical. A mould line was visible on one specimen, whilst others showed signs of having been hammered.*20 This may have been carried out after casting to remove the mould lines and other irregularities. The Ambleside shot were on average 1-1.25 inches long (2.5-3cm). No indications are given as to the weights of the shot. The missiles found in 1914 are not described other than that one was hammered to a point at both ends. A further slingshot was found in the vicus in 1963 (Burkett 1965 p91, fig 5.8). An unspecified number of shot were found in about 1870 (Haverfield and Collingwood 1914 p437). There are 17 lead slingshots on display in the Arnitt Library at Ambleside. Of these 6 are said to be round, 7 biconical and the rest acorn-shaped.*21 Date:Flavian or later.

Birdoswald. (fig 27 group 2)

One lead shot was found here in about 1898 during trenching to the east of the fort (Haverfield 1899 p200; Cormack 1959-60 p190, plate IX). It can now be found in Tullie House museum (Acc. no.81-1975.1). It is rather longer than most examples and has a pitted, chalky white surface. Length: c3.7cm ; Weight: 1280 grains (c83 grams). Date: Unstratified, therefore Hadrianic or later.

Burnswark. (plate 17 no.4; fig 27 groups 4, 6, 8)

Approximately 133 lead shot have been found here since 1898.*22 The significance and date of the structures at Burnswark have been the subject of much debate ever since the original excvations. Some preliminary discussion of the site is therefore necessary before the finds from it can be considered. The central feature at Burnswark is a native hillfort. This is flanked on the north and south sides by two rectangular bank and ditch enclosures which are of Roman date. These contain platforms facing the hillfort which can be interpreted as being for artillery and/or slingers. The first excavators at the site (Christison et al 1898-9 p215) took the view that Burnswark was the scene of a siege by the Roman army under Agricola of a native stronghold. In fact it now seems likely that the site was some kind of training ground. Significantly, none of the lead shot came from beneath the collapsed ramparts of the hillfort and so it has been suggested that it had long been abandoned when the Roman camps were built (Jobey 1977-8 p86-9, fig 13; Breeze and Dobson 1984 p107). Others factors lead to the same conclusion, including stone paving in one of the camps - hardly appropriate if it was only occupied for the duration of a short siege.*23

An orthodoxy had grown up until recently that the practice siege works date to the middle of the second century AD (Jobey 1977-8 p57; Wilson 1980 p73). One of the camps in fact has a fortlet in one corner dated to the Antonine period. However recent archaeological evidence suggests that the camps may date to the later 2nd or even the 3rd century (Breeze and Dobson 1984 p107). With such contradictory viewpoints and little concrete evidence the dating of the lead shot and other weaponry from the site must remain an open question.*24

Of the 67 shot found in 1898 all but half-a-dozen are of the biconical type, some being rather irregular. The standard of preservation is generally poor and the white powder (lead carbonate) coating the surface obscures any marks of casting or hammering. The largest is about 3 x 2cm. In weight they range from 14.81 to 65.1 grams, excluding a small fragment of only 9.39 grams. The exact findspots are not generally recorded, but we know that about six shot were found in the south camp and another twenty or so dented examples came from near the hillfort's gateways (Christison et al 1898-9 p213). Further quantities of lead bullets have been found subsequently, but most of these were surface finds and no definite dating evidence has emerged. Two shot were found in 1957, 75 yards from a corner of the south camp. These weighed 35.4 and 61 grams (Cormack 1957-8, p185). Another ten shot were discovered during field walking in 1960 (Cormack 1959-60 p189, plate IX), all but two being biconical. The weights of the biconical shot illustrated by Cormack vary from c28-63.5 grams.*25 These were found in several places:- in the south gate of the hillfort, between its inner and outer ramparts and midway between the south camp and the hillfort.

Most recently, George Jobey's excavations produced 54 lead shot (Jobey 1977-8 p86-9, fig 13). He does not give any information regarding the relative quantities of biconical and acorn shot, but he does note that there was no correlation between the type of shot and its weight.*26 They ranged in weight from 50 to 71 grams. No casting marks were visible. Once again, no precise dating evidence was forthcoming, many of the shot were in fact found amongst the back-fill of the 1898 excavations. Others were found on the ramparts of the hillfort or in the south camp.

Carlisle. (fig 27 group 9)

There is one unpublished biconical shot from the Annetwell street excavations (site find 94). Length:c2.5cm. Weight:45-50 grams. Date:Probably 2nd c.

Corbridge. (plate 17 no.5)

Nine lead shot were found in 1909-10 on sites XIS, XIV and XVIN. Eight of these were biconical (Greep 1987 p199). The report on the 1909 season (Forster and Knowles 1910 p268) mentions the disovery of several lead shot. One was examined and found to contain a small quantity of silver. The suggestion was made that the lead had been largely de-silvered prior to the manufacture of the shot. At present two lead shot are on display in Corbridge museum (Acc. no.s 1203, 1208). Both are in the case devoted to 1st century finds, but in fact, examination of the site index shows that neither find has a definite provenance. They could easily be later therefore. Diameters:2.8cm. The shot found in 1909-10 weighed between 71 and 142 grams (Forster and Knowles 1911 p191).

Hardknott.

A lead object, biconical in shape and measuring one and three quarter inches (c4.4cm) long and seven-eigths of an inch (c2.3cm) in diameter was found in the fort in about 1892 (Dymond and Calverley 1893 p437). This is said to have been found in the "western building" i.e. the principia. Described in the excavation report as a weight, it is accessioned at Tullie House museum as a slingshot. However it cannot currently be located. No weight is quoted for this object.

Vindolanda.

Fourteen lead shot have been found at this site (Greep 1987 p199) and they provide the latest evidence (thus far) for the use of this type of missile in Britain. Twelve of the shot were found on vicus site XXX, an area which in its later history may have contained a marriage quarters block (R. Birley 1977 p44-6, 72). This might explain the appearance of lead sling shot in what would otherwise be a civilian context. Presumably these finds can be connected with the latest garrison at Vindolanda - the Cohors IV Gallorum (Ibid p87). Of the shot found on site XXX, two were unstratified but the others were dated to the mid 4th century.*27 Of the remaining two shot, one was found between flagstones at the south end of the vicus (R. Birley 1970 p141, fig 3.3). No measurements or weights are available for these finds.

<u>Type 2 (Acorn).</u>

Birrens. (plate 17 no.3; fig 27 group 3)

Three acorn-shaped lead shot have been found here (Robertson 1975 fig 44 no.s 4-6; Greep 1987 p198; Hunterian museum Acc. no.s BIR 68, 71, 101). They come from the upper burnt layer and hence belong to the first Antonine phase.

Lengths:3.5, 3.5 and 3cm. Maximum diameters:1.9, 2.2 and 1.8cm. Weights:80, 87 and 55 grams. These finds can be associated with either Cohors I Nervana Germanorum or Cohors II Tungrorum, both milliary equitate units.

Burnswark.*28 (fig 27 groups 5, 7)

About half-a-dozen of the 67 shot found in 1898 are acorn-shaped (pers. obs.). They vary from c39 to c65 grams in weight and the biggest measures approximately 3 x 2cm. Two of the shot found in 1960 appear to be of this type, although the illustration (Cormack 1959-60 plate IX) is not of the best quality. They weigh c69.5 and 36.4 grams respectively. At least five of the shot found by Jobey were acorn-shaped (Jobey 1977-8 fig 13). No details are known of them.

Carlisle. (fig 27 group 9)

One acorn shot was found in the Annetwell street excavations (unpublished). This is c3.3cm long and weighs about 55 grams. Date:Probably 2nd century.

Corbridge.

One acorn shot was found in 1909/10 (Forster and Knowles 1911 p191; Greep 1987 p199). No details are given and its current location is unknown. Date: Flavian or later.

There is also one acorn shot from the fort at Caernarvon, found "in the lowest (first century) level of the Commandant's house" (Wheeler 1923 fig 61, 12 ; Greep 1987 p199). This find, if accurately dated points to an early origin for the acorn type. Finally, there is an undated example from Charterhouse-on-Mendip in Somerset (Bulleid and St. Gray 1917 p563).

<u>Type 3 (Round).</u>

Bar Hill. (fig 27 group 1)

One round lump of lead with a pitted surface was discovered in 1906 in a gutter on the east side of the Principia (Macdonald and Park 1906 p120; Robertson et al

1975 fig 40.1; Hunterian museum Acc. no. F.1936.229). It is 1.8cm in diameter and weighs 35 grams. Date:Antonine.

Cramond.

Two round shot were found here in excavations between 1954 and 1966 (Greep 1987 p199). Diameters:1.8 and 3cm. Weights:unknown. The objects were found in disturbed levels near a building which may have been a workshop. Date: Antonine or later. The fort was garrisoned by legionary vexillations.

Housesteads.

There is one find from here that may fit into this category (Jobey 1977-8 p89; Breeze 1982 p145; Greep 1987 p199). It is not clear when or exactly where the object was found and I have been unable to locate it. Information from records kept at Corbridge museum reveal it to be "an irregular pitted sphere", about 4.5cm in diameter.

The table below summarises the available information on the size and weight of lead shot.

Table 9 : Lead slingshots from Britain.

Site.	Quantity.	Diameters.	Weights.
Ambleside	17	2.5-3cm (average)	?
Bar Hill	1	1.8cm	35g
Birdoswald	1	3.7cm	c83.44g
Birrens	3	1.8-2.2cm	55-87g
Burnswark (1898)	66	2cm (largest)	14.81-65g
Burnswark (1957)	2	?	c35.4-61g
Burnswark (1960)	10	?	c28-69.5g
Burnswark(Jobey)	54	?	50-71g
Carlisle	2	c2.5/3.3cm	45-50/55g
Cramond	2	1.8/3cm	?
Corbridge	?	?	71-142g
Housesteads	1	c4.5cm	?

[Note : On figure 27, showing the weights of lead slingshot, group 9 should be a mixed biconical/acorn group].

Conclusions.

Lead shot.

1. There appears to be no real correlation between the shape of the shot and their weight. On the basis of the admittedly rather small amount of data available it seems that there is a tendancy however for the acorn shot to be heavier. Disregarding incomplete examples, the shot vary from as little as 25 grams up to 142 grams. Even shot from the same site can difer considerably in their weight, as is admirably demonstrated by the shot from Burnswark.*29

2. The use of lead slingshot does seem to have been confined to the army, which was clearly not the case with shot made of clay or stone. Most have come from indisputably military contexts. One exception are the 60+ shot found at Windridge Farm, St. Albans, but there may have been a fort there (Greep 1987 p184). It is not certain whether the Charterhouse slingshots came from the fort or the mines (Greep 1987 note 2), but it makes little real difference as the mines were under military control anyway. The Vindolanda shot although found in the vicus do not present any real problem. They were probably being produced for (or even by) the garrison of the fort. To the best of my knowledge no lead sling bullets have been found on any town or villa sites.

3. The distribution of lead shot overlaps hardly at all with those of clay or stone. The exceptions to this are: a. Bar Hill, which has produced one possible lead shot and what may be stone slingshots; b. Caernarvon, where one lead shot and an unknown number of stone shot have been found; and c. Carlisle, where we have slingshots of all three materials. The lead shot were not actually found in the same context as any of the others however.

4. The identification of the third (round) group of sling shots must be regarded with some suspicion. The objects from Bar Hill, Cramond and Housesteads were not associated with examples of either of the two recognised types. They might just as easily be stray scraps of lead

such as have been found on some sites e.g. Hardknott (Ferguson et al 1893 p430-8).

5. The distribution of lead shot may be tied to local sources of lead. The shot from Charterhouse for example must have come from the Mendip lead mines. Nearly all the lead shot from Britain come from on or just north of Hadrian's wall.

6. Most lead shot from Britain can be dated to the period from the Flavians to the Antonines. There are possibly later finds at Housesteads and more certainly at Vindolanda. Lead shot seem to have been used to a later date in this country than on the continent (although the Legio II Italica shot do act as a partial corrective to this picture). This may be due to the readily available supplies of lead or because of the native tradition in slinging or some other as yet unexplained factor.

Clay shot.

These were very widely used because the raw material for them was so readily obtainable and they were cheap and easy to produce. There is a concentration of clay shot in Wales and along its borders:- Abergavenny, Caerhun, Caerleon, Chester, Gloucester and Neath. There is another group from Scotland, mostly of Antonine date:- Ardoch, Bothwellhaugh, Loudon Hill, Strageath and possibly Bar Hill. It is interesting to note the almost total lack of clay slingshots from the area of Hadrian's wall, apart from one at Poltross Burn milecastle and a recent find from Carlisle. There is very little overlap with the distribution of lead shot. Of the clay shot from military sites in Britain, the majority are of 1st or 2nd century date. A few unstratified examples could be later e.g. the find from Chester. Clay slingshot were also widely used by civilians for hunting and some examples do date to the 3rd or 4th centuries.

Stone shot.

The difficulty of identifying these finds has already been noted. Slingshots, ballista balls, hand-thrown stones and simple lumps of stone are very hard to distinguish. There do not appear to be any standard weights so it is impossible to be precise about identifications in most cases. With regard to the slingshots there does appear to be some conflict between the archaeological evidence and the historical sources. The latter speak of stones "as big as one's fist (Xenophon, Anabasis III, 3, 16) or weighing over 400 grams (Diodorus Siculus XIX, 109), whilst the term "libritores" used in another source (Tac. Annals XIII, 39) may imply missiles of about 300 grams (see note 4). What then are we to make of the "slingshot" like those from Chesters, including one of only 28 grams or one from Carlisle which is only about 15 grams? Either the Roman army in Britain was using extremely small slingshot or else these are not really artefacts at all. The distribution of stone shot is most concentrated in the area of Hadrian's wall, with a few in Scotland and Wales. There is some overlap with sites that have produced clay shot (Alchester, Bothwellhaugh, Caerleon, Carlisle) and lead shot (Caernarvon, Carlisle).

NOTES

*1 The Republican legions did of course have their own integral light infantry - the velites - who were armed with javelins. However in this period specialist troops like archers and slingers seem generally to have been non-Romans.

*2 This was not in fact the case. The sling had a very long history both in hunting and as a weapon in battle. In Biblical times for example it had been used by the Assyrians, as seen on reliefs depicting the army of Sennacherib (Cohen 1975 p43).

*3 There is some archaeological evidence which shows that even in the period of the Republic, citizen troops were using slings. There are for example the lead shot from Spain and from Perugia inscribed with legionary numbers (Keppie 1984 p69, note 10; p122-5, fig 36).

*4 The distinction between these two groups is not known. It may be conjectured that it had something to do with the type of sling or the size of the missiles. "Funditores" is the usual term used by classical writers to describe slingers. In modern Spanish "funda" means a cover - or a pouch perhaps, such as slingers used to carry their bullets?The word "libro" can mean to brandish or throw. However the Roman pound was called a libra, equating to about 327.5 grams. Perhaps then, the libritores threw stones of a pound weight, either by hand or with a sling.

*5 In another passage (IV, 22), Vegetius comments that "it is superfluous to describe the fustibali, arcubalistae and slings as they are so commonly used and well-known at present."

*6 Florus, perhaps writing in the reign of Hadrian also says that the Baleares had three slings each (I, 43). Diodorus Siculus (V, 18) mentions three slings but states that one was worn around the head, another around the stomach and the third was carried in the hands.

*7 Not to mention the differing stength/skill of each slinger. We must also distinguish maximum possible range from effective range, the latter being a fairer reflection of a weapon's capabilities.

*8 Griffiths also talks of slingers from Ibiza hitting metre square targets at a range of 200 metres.

*9 Celsus states in another passage (VII, 5.5) that the effectiveness of weapons could be improved by dipping them in poison. There are no accounts of this actually having been done with slingshots.

*10 Diodorus Siculus says (XIX, 109) that the Balearic slingers used stones weighing one mina (=c436 grams). These would be quite large stones, about 6.3cm in diameter, not much smaller than a tennis ball (Connolly 1981 p49) and very much bigger than most of the Roman slingshot found in this country. However it is only fair to add that Diodorus does say (V, 18) that the Balearic slingers used much larger stones than others. Xenophon talks of the Persian slingers using "stones as big as one's fist" (Anabasis III, 3, 16).

*11 And as Vegetius says, "the sling cannot be reckoned any encumbrance" (I, 16). i.e. it was hardly very heavy to carry.

*12 My thanks to Dr. Lawrence Keppie for arranging the weighing of many finds.

*13 My thanks to Ian Caruana and Tim Potter of the Carlisle Excavation Unit for access to these finds.

*14 Most of the stones are unnumbered but they include three marked 423, 425 and 430.

*15 From the excavations by Charles Daniels. My thanks to Iain Watson of Wallsend Heritage Centre for allowing me access to these finds prior to their publication.

*16 A suggestion by Iain Watson.

*17 It is interesting to note in this context that the conquest period shot from Ham Hill, Dorset had been coated with bitumen prior to firing, presumably so that they could be used to set light to structures within the hillfort (Hensleigh Walter 1923 p150).

*18 My thanks to Trevor Cowie of the National Museum of Antiquities, Edinburgh for weighing 68 of the Ardoch shot (as well as the lead shot from Burnswark). The clay shot range from 12.61 to 36.75 grams.

*19 Comment by Dr. Keppie of the Hunterian museum.

*20 Lead can easily be hammered (Aitchison 1960 p185) so perhaps some slingshots were produced in this way without resort to moulds. This would account for the great variations in size and weight.

*21 Information kindly supplied by John Gavin and W. J. Wesbitt of the Arnitt Library.

*22 Sixty-six lead shot were weighed, all from the 1898 excavations. They range from 14.81 to 65.1 grams, excluding a fragment of only 9.39 grams.

*23 Nor does it seem likely that the Roman army ever needed to resort to a prolonged siege in order to take British hillforts.

*24 A coin of Domitian was found on the rampart of the hillfort during Jobey's excavations (Jobey 1977-8 p87). However, this could easily still have been in use during the second century so it does not prove that the camps date to the Flavian period.

*25 The weights were originally all given in grains.

*26 Which is equally true of the earlier finds from Burnswark and those from other sites (see table 9).

*27 However the chronology of the vicus has recently been drastically altered (see appendix 1).

*28 The Burnswark shot are distributed amongst several museums. All of those found in 1898 are in Edinburgh, four are at Tullie House museum in Carlisle (Acc. no.7-1960), including one of the acorn type and there is one acorn-shaped shot on display in Newcastle museum.

*29 The first century shot from Windridge Farm, St. Albans (Greep 1987 p183ff) varied from 2.2-2.9cm long and weighed between 28 and 78 grams. They had been made in moulds and casting flashes were visible in some cases. Most are biconical but some are rather irregular, perhaps as a result of miscasting.

X. Artillery Weapons.

"The force of the bolt-firers and stone-throwers was such that a single projectile ran through a row of men and the momentum of the stone hurled by 'the engine' carried away battlements and knocked off corners of towers...... One of the men standing near Josephus on the rampart got into the line of fire and had his head knocked off by a stone, his skull being flung like a pebble from a sling more than 600 yards; and when a pregnant woman was struck in the belly... the unborn child was carried away a hundred yards, so tremendous was the power of that stone-thrower." (Josephus, De Bello Judaico III, 243-7).*1

Classical Sources and the development of Ancient artillery.

Perhaps more than any other type of Roman weapon, the arrow-firing and stone-throwing artillery machines of the period have been the subject of much debate. This has included considerable discussion on the actual construction of Ancient artillery pieces. More recently, the argument has concentrated on the tactical deployment of artillery in the Roman army and the vexed question as to whether or not such machines were used by auxiliary troops (Baatz 1966 p194; Marsden 1969 p184, 191; Wilson 1980 p32; Cambell 1984 p75-84; 1986 p117-132) and Donaldson 1989 p217-8).

The archaeological evidence from Britain is largely confined to the missiles fired by the artillery - the so-called "ballista bolts" and "ballista balls". There are also some alleged crossbow fittings of somewhat doubtful relevance since they are not firmly dated. In order to place these finds in their proper context it is necessary to understand the workings of Roman artillery, as well as its historical background. We must turn first of all to the literary sources and also to the scarce finds of artillery fittings from outside this country. Modern scholars have devoted much energy to interpreting the texts; explaining how the archaeological finds can be related to the machines described by Ancient writers and even building replicas. Such then is the material upon which any study of Roman artillery must be based.

Terminology.

At the most basic level, Ancient artillery may be divided into two classes - those machines which fired arrows or bolts and those which hurled large stones. During the Republican and early Imperial periods bolt-firers were termed "catapulta" or "scorpions" (Vitruvius De Arch. X, 10, 1-5; Tacitus Annals XV, 9). The stone throwers are invariably referred to as "ballistae" or some variant thereof (Josephus Bell. Jud. III, 166-7; Tacitus Ann. XV, 9; Vitruvius De Arch. X, 10, 1-5). Subsequently however a change in nomenclature occurred. This can be seen in the works of two late fourth century authors, although it probably took place much earlier. Ammianus Marcellinus calls bolt-firing artillery "ballistae" (XIX, 2, 6; XXIII, 4, 2-3), whilst stone-throwers are described as onagri because the impact of the stones they hurl is likened to the stones kicked backwards by wild asses when pursued by hunters (XXIII, 4, 7). In the same passage Ammianus calls the stone-thrower a "scorpion" because the throwing arm of the machine resembled the raised sting of that creature.

Vegetius also speaks of the onager (Ep. rei Mil. II, 25; IV, 9; IV, 22). He mentions several different kinds of arrow-firer, including the "carroballista" (II, 25), which was mounted on a cart, the "manuballista" which fired small, slender darts (II, 15; IV, 22) and was formerly called a scorpion and finally there was the "arcuballista" (II, 15; IV, 22) which has been interpreted by some as an early form of crossbow (Marsden 1969 p191; Coulston 1985 p260-1). Occasionally also, use is made of the term "tormenta" (Vegetius IV, 9; Ammianus XVIII, 8, 13; XVIII, 9, 1; XIX, 7, 4). This was applied to all types of artillery in which the torsion principle (see below) was utilised.

The Historical Background.

The precise origins of Ancient artillery, its early development and the exact date of its invention need not concern us here. All of these subjects have been fully dealt with elsewhere (Marsden 1969). However Roman Imperial artillery cannot be treated entirely in isolation and so it is necessary to look briefly at the evolution of Greek and Hellenistic artillery.

The earliest artillery piece was simply a development of the composite bow. This was the Gastraphetes or belly bow, developed in Syracuse about 400BC.*2 The principal components were the bow, a grooved slider with a trigger mechanism and the stock, which had ratchets attached to help pull back the slider. When the slider was pushed forward the bow string was caught by a hook. The slider was then pulled back by resting the bow against a hard surface, such as the ground, leaning on it and utilising brute strength to draw back the slider (and the bowstring with it). The weapon was then fired by pulling the trigger, which raised the hook and released the string. Although more powerful than the composite bow, the Gastraphetes was fairly heavy and had a slow rate of fire. Over the course of the 4th and 3rd centuries BC ever larger and more complex artillery machines appeared, all based on the power of a bow (Marsden 1969 p13-16; Warry 1980 p18). This non-torsion artillery was not used by the Roman army, until its reappearance in the 4th century AD in the form of the Arcuballista.

Two inventions during the Hellenistic period were of crucial importance for the future development of torsion artillery. These were the base (with a universal joint) - which allowed bigger engines to be produced and made it easy to change the direction of fire - and the winch. The latter was indispensable for the powerful torsion artillery pieces soon to be developed, for it was not really feasible with these to pull back the slider by hand.

Torsion artillery.*3

Inevitably the point was reached where composite bows had achieved their maximum practical size. Therefore Ancient artillery makers had to look for an alternative source of power. Either by accident or through experiments they discovered that the animal sinew used in bows was an eminently suitable material. Hellenistic (and most Roman) torsion machines consisted of a rectangular wooden frame mounted on a stand. Circular holes were cut through this frame near to either end. Iron levers ran through these and around them was wrapped as tightly as possible a great quantity of sinew rope. This had to be at exactly the right tension or the accuracy of fire would suffer.*4 Once a sufficient amount of sinew had been inserted the bundles were tightened up with the levers. These were set into circular metal washers with a series of round holes around their edges and these in turn rested on square counterplates which also had holes drilled into them. There were four such assemblages on each artillery piece, two on the top and two on the bottom (Baatz 1978 figs 2-5). When the sinew had been tightened, retaining pins could be put into the holes through the washers and counter plates. Such an arrangement can be seen on the ballista from Hatra, dated to the 3rd century AD (Ibid p3-4).

The ends of a wooden rod were pushed into the two sinew bundles and the bowstring was fastened to the projecting ends of the rod. Between the two vertical sinew coils was the wooden case of the machine, incorporating a grooved sliding section for the missile. This projected out of the front of the machine. The case had a trigger and claw mechanism for engaging the bowstring. The slider was wound back by a windlass, aided by a ratchet and pawl system. Stone-throwing machines tended to be more solidly built because of the greater stresses exerted on the frame by firing them and the centre of the string was in the form of a pouch to hold the stone ball. The method of firing had not changed greatly since the days of the Gastraphetes. Firstly the slider was pushed forward until the trigger engaged the bowstring and then it was wound back using the windlass. This had the effect of pulling back the ends of the wooden rod and of stretching the sinew - a naturally elastic material. The arrow was positioned in the groove of the slider so that its flights touched the string. When the trigger was released the sinew snapped back into its former shape, the string leaped forward and the arrow was hurled forward at a considerable velocity. Ammianus (XXIII, 4, 3) comments that "the arrow, driven by the power within flies from the ballista out of sight, sometimes emitting sparks because of excessive heat." This is very likely exaggeration, but these machines were certainly capable of inflicting terrible wounds, not to mention their psychological effects.

This simplified description of torsion artillery leaves out of account a number of important design modifications which occurred (Marsden 1969 p42ff). One of these was the fitting of curved arms to arrow-shooters. This was designed to put more tension in the spring bundles and so increase the range of the machines. Possibly in the second half of the 1st century BC stone-throwers (and perhaps also bolt-firers) were fitted with oval rather than round washers, so that more sinew could be used in the bundles without increasing the size of the machine. With these improvements torsion artillery achieved the form it was to retain until the introduction c100AD of the metal-framed mobile bolt-shooter known as the Carroballista.

Roman artillery pieces were essentially the same as their Greek counterparts, especially since during the Republican period the Romans often obtained their artillery from Greek/Hellenistic cities or employed specialists from these places to build their machines. Before moving on to look at the various artillery machines used by the Roman army one final technical detail has to be considered. Artillery pieces were not produced in a random fashion but rather to precise formulae in which the size of the machine was directly related to the length of arrow or weight of stone that it was meant to fire. Probably from the reign of Ptolemy II of Egypt (285-246BC) two exact mathematical formulae were employed (Marsden 1969 p25, 49). For arrow-firing machines the diameter of the openings in the frame was calculated by dividing the length of the missile by nine. All measurements were in dactyls. Stone throwers as already noted had a more complicated structure and so the formula for building them was accordingly more involved. The diameter of the holes was equal to 1.1 multiplied by the cube root of 100 Mina - the latter being the weight of the shot.*5 Having decided on an appropriate diameter for the holes in the frame, all the other measurements were in proportion to this dimension. This theory can be seen in use in the manual of Philon of Byzantium, dated to c200BC (Marsden 1969 p25). Vitruvius devoted the tenth book of his work De Architectura (written in the reign of Augustus) to the construction of artillery. He gives measurements for the components of both bolt-firers and stone-throwers (X, 10-11) and as with Philon, it is the length of the arrow/the weight of the stone which is the crucial factor. Vitruvius's figures are however rather smaller, perhaps because the Roman machines were more powerful than their predecessors.*6

Of course the formulae are easily reversible, so that given the length/weight of the missile we can reconstruct the size of the machine that fired it. However, we should expect some leeway in the size of missile used. This is particularly true for stone-throwers - it is not realistic to expect that artillerymen would have spent much time looking for stones of precisely the right weight in accordance with the formula. This point is well illustrated by the stone shot found at Carthage and Pergamum (Marsden 1969 p80-2).

Table 10: Stone missiles from Carthage and Pergamum.

a. CARTHAGE.

QUANTITY	WEIGHT	SUGGESTED CALIBRE
Unspecified c3500	35-40.5KG 5-7.5KG	90 MINA (39.3KG) 15 or 13/16 MINA

b. PERGAMUM.

QUANTITY	WEIGHT	SUGGESTED CALIBRE
57 353 188 118	38.7-40KG 20-26KG 16.2-20.1KG 12.35-13.5KG	90 MINA 60 MINA 40 MINA 30 MINA

Vitruvius's discussion of artillery machines shows that the Hellenistic calibration formulae were still being used, albeit perhaps in a modified form, at the start of the Imperial period. It remains to be seen how well the supposed "ballista balls" from Britain will fit in with theoretical calibres of machine.*7

Classical descriptions of Roman artillery.

1. The Ballista/Carroballista.

During most of the period under discussion "ballista" was the standard term for bolt-shooting artillery machines. These were of the wooden-framed type already described and they tended to be used mainly in sieges.*8 Around the start of the 2nd century if not earlier a more powerful metal-framed bolt-firer mounted on a small cart had been developed. This machine, which is described in Heron's treatise entitled 'Cheiroballistra' (Marsden 1969 p2, 188), is shown in several scenes on Trajan's column (XL, LXVI). The metal frame helped protect the spring bundles from the elements and the use of carts facilitated the deployment of artillery in the field.*9 In the Notitia there are a number of units of 'ballistarii' (ND. OR. VII, 48, 57; VIII, 46, 47; IX, 47; OC. VII, 97). These were all comitatensian or pseudo-comitatensian legions i.e. field army units and they presumably employed light artillery pieces such as carroballistae. However the Praefectus Militum Ballistariorum at Bodobrica (ND. OC XLI, 23) perhaps commanded a static unit with heavier machines (Marsden 1969 p197).

Vegetius (II, 25) noted the dual function of artillery machines:- "They are used not only to defend the entrenchments of camps, but are also placed in the field in the rear of the heavy infantry." However most of the literary references to ballistae are in the context of sieges.

Construction.

Sinew rope was the best material for use in sinew bundles, but Vegetius (IV, 9) comments that "the hairs of the manes of and tails of horses are also fit for this use and we are taught by the experience of our ancestors [during the siege of Rome by the Gauls in 390BC] that women's hair will serve equally for this purpose in cases of necessity." Ammianus in his description of bolt-firers (XXIII, 4, 2-3), simply mentions "a great number of twisted cords" which supplied the motive power. Vitruvius (XI, 2) lists women's hair and animal sinew as suitable material for torsion bundles, without expressing any preference.

Calibres of machine.

There is evidence from the literary sources that the Romans used several different sizes of bolt-firing ballistae. For instance, Ammianus in his account of the siege of Amida (359AD) talks of "five of the lighter ballistae" being used to eject some Persian archers from a tower (XIX, 5, 6). At the siege of Jerusalem the Xth legion is said by Josephus (Bell. Jud. V, 269) to have had the most powerful bolt-firers and stone-throwers, thus showing that the other units present had different machines. The calibres used would obviously have depended on availability and on the task for which the machines were to be used. One of the commonest types of bolt-firer was the three span machine, which fired bolts about 27" (c68.5cm) long (Warry 1980 p178).

Range.

This depended primarily on the size and power of the machine, but also on the skill of the operator, the angle of fire, the condition of the sinew bundles and the weather conditions - particularly the speed and direction of the wind. Sources from the imperial period are generally unhelpful with regard to information on the range of artillery, being more concerned with graphic (and probably exaggerated) accounts of the effects of the missiles. Tacitus simply states that in 62AD, the artillery of Corbulo outranged the Parthians, who were armed with bows (Annals XV, 9). Procopius says that the ballistae of the Byzantine general Belisarius - essentially the same as Roman machines - could hurl bolts over a distance of "not less than two bow shots" (Gothic Wars V, xxi, 14-19).*10 Greek sources do add a little more information. From a passage in Diodorus (XX, 83, , 3) it has been deduced that the three span bolt-firer had the greatest range of any artillery piece. Agesistratus the famed Greek artilleryman of the early 1st century BC is credited with quite incredible ranges for his machines:- three and a half stades (700 yards) with a three span catapult and four stades (800 yards) with a stone-thrower converted to fire bolts. These results were of course achieved under experimental conditions and it is unlikely that they could have been duplicated on the field of battle.*11 It has been suggested that 700 yards was an absolute maximum range and that effective fire could only be brought to bear at about 400 yards (Marsden 1969 p88-9, 205).

<u>Accuracy and Effectiveness.</u>

A number of Greek and Roman sources pay tribute to the fearful effectiveness of bolt-shooters and this testimony is to some extent confirmed by the archaeological evidence from Britain. Ammianus (XIX, 5, 6) for example talks of ballista bolts piercing two men at once. Procopius tells the story of a Goth who was pierced right through with a bolt, which then pinned him to a tree and sank into it for more than half its length (Gothic Wars V, 23, 10-11). The forts of Corbridge (Forster and Knowles 1911 p193, fig40) and Vindolanda (R. Birley 1977 fig 58) have both produced finds of ox skulls perforated with small square holes. This is clearly the result of target practice and the damage is most likely to have been done by ballista bolts. Only these would have had the necessary force to punch right through the bone without leaving cracks (as happened here), whereas arrowheads or javelins would probably have shattered the skulls. Admittedly this point is arguable and it would be useful to experiment with replica arrowheads, boltheads and pilum points against a variety of targets to see what effects they have. Quantities of supposed ballista bolts have been found at both Corbridge and Vindolanda, although none, unfortunately, associated with the ox skulls. The alleged ballista bolt embedded in the skeleton from Maiden Castle (Wheeler 1943 plate LVIIIa) may well be nothing of the kind. Examination of the illustration suggests that this missile is "leaf-shaped" with a wraparound socket. This form of missile is more likely to have been an arrowhead or a small javelin head. In fact Wheeler himself identifies this object as an arrowhead in the caption to the picture, so it would seem that subsequent writers have been responsible for the growth of a myth. The Maiden Castle skulls on the other hand (Ibid plate LIII) have small square holes punched through them, which might conceivably have been produced by ballista bolts. A number of pyramidal boltheads were found nearby.

2. The Manuballista.

This weapon is only mentioned by Vegetius (Ep. rei Mil. II, 15; IV, 22). It is said to have been carried by a group of soldiers called the tragularii,*12 and it fired arrows. According to Vegetius the tragularii were positioned near to the rear of the battle line - presumably on high ground so they could fire over their own men. In the second reference to them, Vegetius relates that "the manuballistae because they kill with small and slender darts were formerly called scorpions." The term "manuballistae" implies that these were small machines, capable of being loaded and fired by one man.

4. The Ballista Quadrirotis.

This machine is described and illustrated in the De Rebus Bellicis (VII). It was mounted on a four-wheeled cart pulled by two horses, which were protected by cataphract armour. It must be presumed that this ballista was powered by torsion, but the illustrations do not show any sinew bundles (Hassall 1979 p84). The illustrations are copies many times removed from the originals so it would not be at all surprising if their accuracy has suffered over the centuries. The machine had a grooved slider for the missile and this was drawn back by a length of rope attached to two windlasses at the back. Aiming was done by looking through an arched strut - a feature of other ballistae too (Baatz 1978 fig9). The angle of fire could be altered by means of a pair of screws and the author claims that the machine could easily be fired in any direction. This may have been achieved by the use of a central pivot (Hassall 1979 p84).

5. The Ballista Fulminalis.

This large static ballista, designed for defending fortifications was another of the "inventions" of the author of the De Rebus Bellicis (XVIII). Most of the usual features are present, including the slider (pulled back by two windlasses using a pulley block system), the arched strut and the screws for raising or lowering the machine. The bowstring attached to the slider was a "rope of elastic fibre" - perhaps sinew (Hassall 1979 p82). Again there is no mention of any torsion bundles, although the machine could not have been at all effective without them. Nor does there seem to have been any provision for turning the machine. The Anonymus claims that his invention could fire across the Danube - a statement which even if it were true is of no value since the width of the river varies greatly. Although technically it is possible to build machines of this type which would work, that is still a long way from proving that they were ever used by the Romans. Coincidently some remains of catapults have been found in two Danubian forts, but their size is more comensurate with the manuballista than with the Ballista Fulminalis (Baatz 1978 p9ff).

6. The Arcuballista.

As with the manuballista, this weapon is only spoken of by Vegetius (II, 15; IV, 21; IV, 22). Unfortunately there is no description of the weapon; we are only told that it fired arrows and was used by the tragularii. Its name implies that it had a bow and it seems very probable that the arcuballista was an early form of crossbow. Weapons of this sort appear on two 3rd century reliefs from Gaul (Esperandieu 1908 no.s 1679, 1683). The first of these is a tombstone from Salignac-sur-Loire and shows a crossbow (?) hanging up. The bow is recurved - indicating a composite construction - and there is a grooved stock. The other relief, from the village of Espaly shows a man carrying a weapon with a recurved bow. He also has a quiver attached to his belt. The stone has been damaged however so it would be unwise to place much reliance on it. We have no definite evidence for military crossbows, but the references in Vegetius and the Gallic reliefs cannot be ignored. Some of the boltheads from British sites may have come from crossbows.*13

Byzantine technical treatises beginning with the 'Srategikon' of the emperor Maurice (c600AD) refer to a weapon called the Solenarion (Haldon 1969 p155-7). It is hard to see this as being anything other than a crossbow and it could well have been a descendant of the arcuballistae. Technically there should have been no difficulty for the Romans to have produced a crossbow. All the necessary components - the bow, trigger mechanism and stock - were known and all that was needed was to scale these down. A composite bow would have given it a reasonable amount of power. The steel crossbows of the medieval period were slower in their rate of fire than ordinary bows, but they were accurate and good at penetrating armour. The Greek gastraphetes had in effect been a crossbow, but was not very portable. All the evidence from the period both literary and pictorial points to the Romans having developed a true crossbow by the 3rd/4th century AD.*14

Stone-throwing Artillery.

In the early empire stone-throwers were termed ballistae but by the 4th century (and probably earlier) a different type of machine known as the onager or scorpion was in use. The older type of stone-thrower had much in common with the torsion-powered bolt-shooters already discussed. They came in various sizes - Tacitus for example notes "a ballista of enormous size at the battle of Cremona in 69AD (Histories III, 23).

The onager or 'wild ass' is mentioned several times by Ammianus (XIX, 7, 6; XXIII, 4, 4-7; XXXI, 15, 12), Vegetius (Ep. rei Mil. II, 25; IV, 22) and Procopius (Gothic War V, 21, 19). Much simpler in design than the earlier machines, its method of firing resembled that of a mortar. The onager consisted of a rectangular wooden frame drilled through from both sides for the insertion of a cross-beam. This was entwined with sinew ropes and the necessary tension was maintained by a washer and lever system at either end of the cross-beam. Inserted into the centre of the sinew rope bundle was a slim wooden arm, which rose "obliquely like the pole of a chariot and is twined about with cords in such a way that it can be raised higher or depressed" (Ammianus XXIII, 4, 5). The upper end of this arm had a sling attached to it - of iron or hemp according to Ammianus (XXIII, 4, 5) and into this was placed the stone missile. The arm was winched back using a rachet and pawl system and held in place by a metal bar. To fire the machine this bar was knocked out with a hammer and the arm sprang forward until it contacted a raised cushion of horse hair filled with chaff. This brought the arm's motion to an abrupt halt and caused the stone to be flung out of the sling at great speed. After each shot the arm could be wound back and the onager was reloaded.

Calibres of machine.

Both the technical treatises (Vitruvius De Arch. X, 11) and the archaeological evidence show that the Romans were using several different "calibres" of stone-thrower. The size of a stone-throwing machine was tailored to fit the weight of the shot which it fired. They tended to be bigger than boltshooters, no doubt mainly because their construction needed to be sturdier to withstand the strain put on the components by firing heavy missiles. Roman sources say very little about the size of stone-throwers, the exception being Josephus (Bell. Jud. V, 269-270) who talks of machines which fired stones weighing one talent - about 26KG. Elsewhere (III, 166-7), he mentions stones of twice that weight. Vitruvius (De Arch. X, 11, 3) gives the size of sinew bundle necessary to hurl stones of between 4 and 360 Roman pounds (1.3-118KG). Perhaps however these were only theoretical weights and they need not relate to the calibres of machine actually used by the Romans.

Range and Effectiveness.

Due to the nature of the missiles that they propelled, stone-throwing artillery pieces were inherently rather less accurate than their bolt-firing counterparts. They were heavier and less mobile, difficult to aim precisely and they needed a large target (such as a city wall or a mass of enemy troops) to be of much use. The latter factor must have somewhat limited the use of stone-throwers in Britain, where Rome's opponents generally fought in a dispersed formation and lacked defensive structures except earthworks. Literary references show that stone-throwers were usually employed in siege warfare, both by the attackers and by the defence. Stone-throwers were occasionally used in the field, as at the battle of Cremona (Tacitus Hist. III, 23) and Vegetius (Ep rei Mil. II, 25) speaks of onagri being transported on carts ready-armed and being used to defend camps. Whilst stone-throwers were at their most effective against walls and large troop concentrations, they could also have a psychological effect against foes who were not used to artillery. When the Goths briefly besieged Adrianople after the battle nearby (in 378AD), they are said to have been greatly perturbed by a tremendous stone from an onager which crashed to the ground - even though it did no physical damage (Ammianus Marcellinus XXXI, 15, 12). One can envisage that a few stone-throwing machines might have been deployed in British forts for the purpose of deterring the natives from attacking rather than because of any real tactical usefulness.

Data on the range of stone-throwing machines is rather scarce. At the siege of Jerusalem, the engines of the Xth legion battered the city walls from a distance of two stades (400 yards). General Schramm in his experiments with replica artillery pieces (Marsden 1969 p86) achieved a range of about 300 metres (c275 yards) with his stone-thrower. Payne-Galloway on the other hand shot an eight pound (3.6KG) ball for a distance of c500 yards from an onager. This was rather a small missile however.

The Archaeological evidence from Britain.

In general the evidence for artillery is rather indirect since no actual machines have yet been found. Instead we have to look at three main categories of information:- alleged artillery missiles, supposed artillery platforms at several Roman sites and inscriptions which seem to indicate the presence of artillery at a military establishment. The single exception to this statement is a washer from a ballista found at Bath (Cunliffe 1985 p45, 182; 1988 p8-9, fig4.6, plate V). This was found in 1979 in the reservoir of the baths. It is of bronze, round in shape with six circular holes evenly spaced around the edge and with a flange. Two worn rectangular notches on the upper edge of the washer would have held the iron lever for tightening the screw bundle. Outer diameter: 8cm. Inner diameter at base:4cm. Height:3cm. Diameter of holes:0.4cm. Notches:1cm wide by 0.5cm deep. The washer is of modest proportions and would have been from a small machine, perhaps even a crossbow. The context of the find can be explained by it being given as an offering after the washer had worn out. Date:Although similar in form to a 1st century washer from Cremona, this find could easily be much later as it is unlikely that artillery components changed significantly in the imperial period. [It has come to my attention that another ballista washer has recently been found at the fort of Elginhaugh near Edinburgh. This is doubly suprising since not only is this an auxiliary fort, but also a cavalry unit was stationed here - the last kind of troops that one would expect to be equipped with artillery. Date:Flavian. Information from Dr. M. C. Bishop].

Stone "Ballista Balls." (Map 22)

Alchester.

Two possible ballista balls were found in the outer ditch on the east side of the town in 1928 (Iliffe 1932 p47). One was only three inches (7.6cm) in diameter and the alternative theory that these were slingstones (Ibid p66) seems more appropriate.

Bainbridge.

Three stone balls have been found here and can now be seen on display in the Yorkshire Museum. The first is roughly rounded, creamy coloured with some red staining on the surface and with one flattened side. Diameter:c7cm. Weight:c400grams. Another, marked "638" in white ink has two opposing flat surfaces. Diameter:c8cm. Weight:nearly 500grams. The remaining stone is egg-shaped and is marked 362 259 II 1. It measures c8 x 7cm and weighs around 600grams.

Balmuildy.

A number of stone shot were found behind the fort's north rampart in 1912-14 (Miller 1922 p97-8; plate LV.13). Three are illustrated in the report. Six stone missiles from the site are in the Hunterian museum (Acc. no. F.1922.41). These are between c8.25 and 12.7cm in diameter and weigh 620 to 930 grams. Date:Antonine.

Bar Hill.

A total of 110 stone balls were found in various parts of the fort during excavations early this century (Macdonald and Park 1906 p21, 32, 89; A. Robertson et al 1975 p46). They form part of the collection at the Hunterian Museum (Acc. no. F.1936.68). Some of these were of Andernach lava, the same material as some quern stones also found here. They are very roughly formed, several with red (iron?) staining on the surface. Diameters:3.8-14cm. Weights:200-2400grams. Two of average size are 510 and 720grams respectively.*15 Date: Antonine.

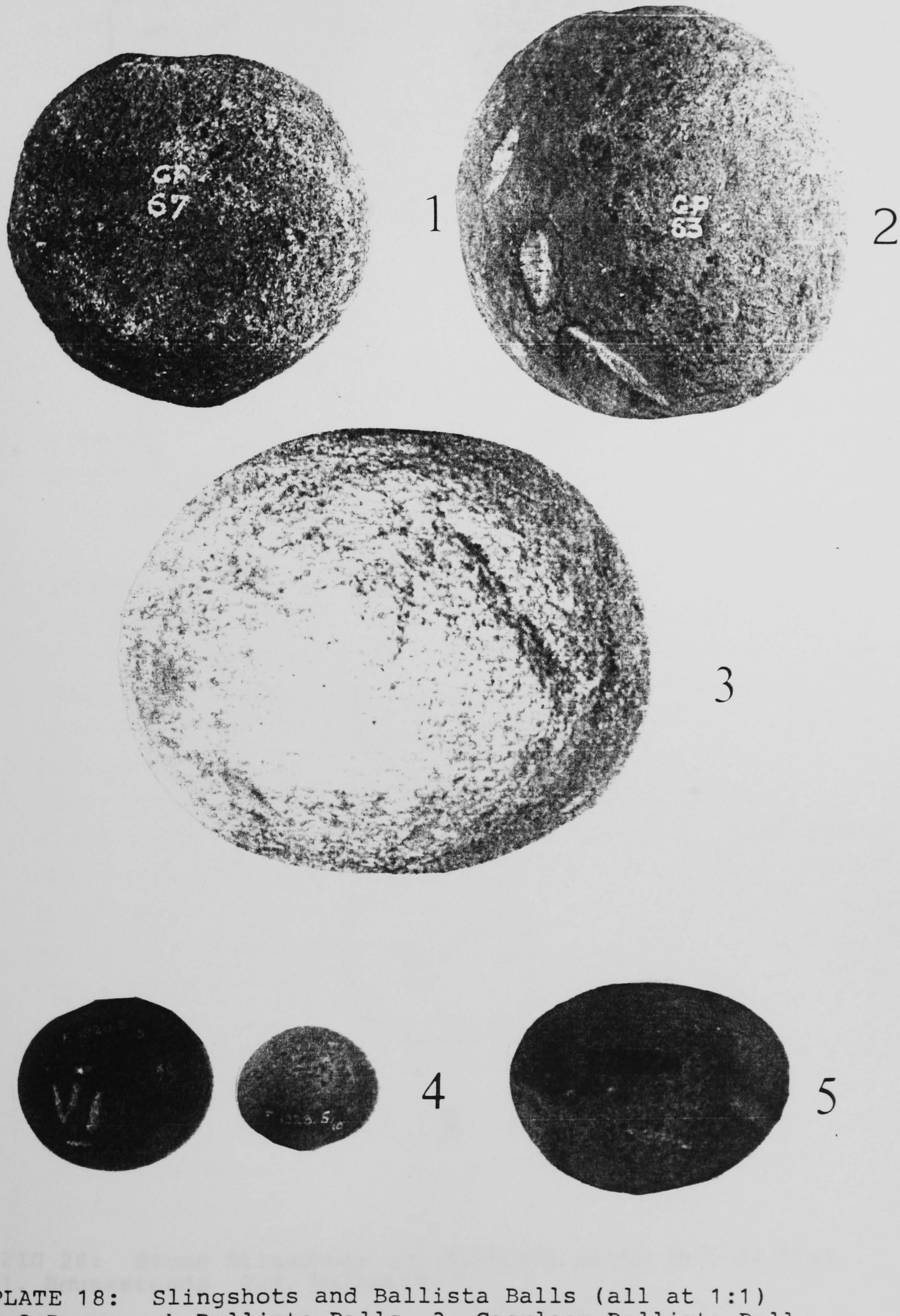


PLATE 18: Slingshots and Ballista Balls (all at 1:1)
1-2 Burnswark Ballista Balls 3. Caerleon Ballista Ball
4. Old Kilpatrick Sling Shots 5. Whitemoss Slingshot

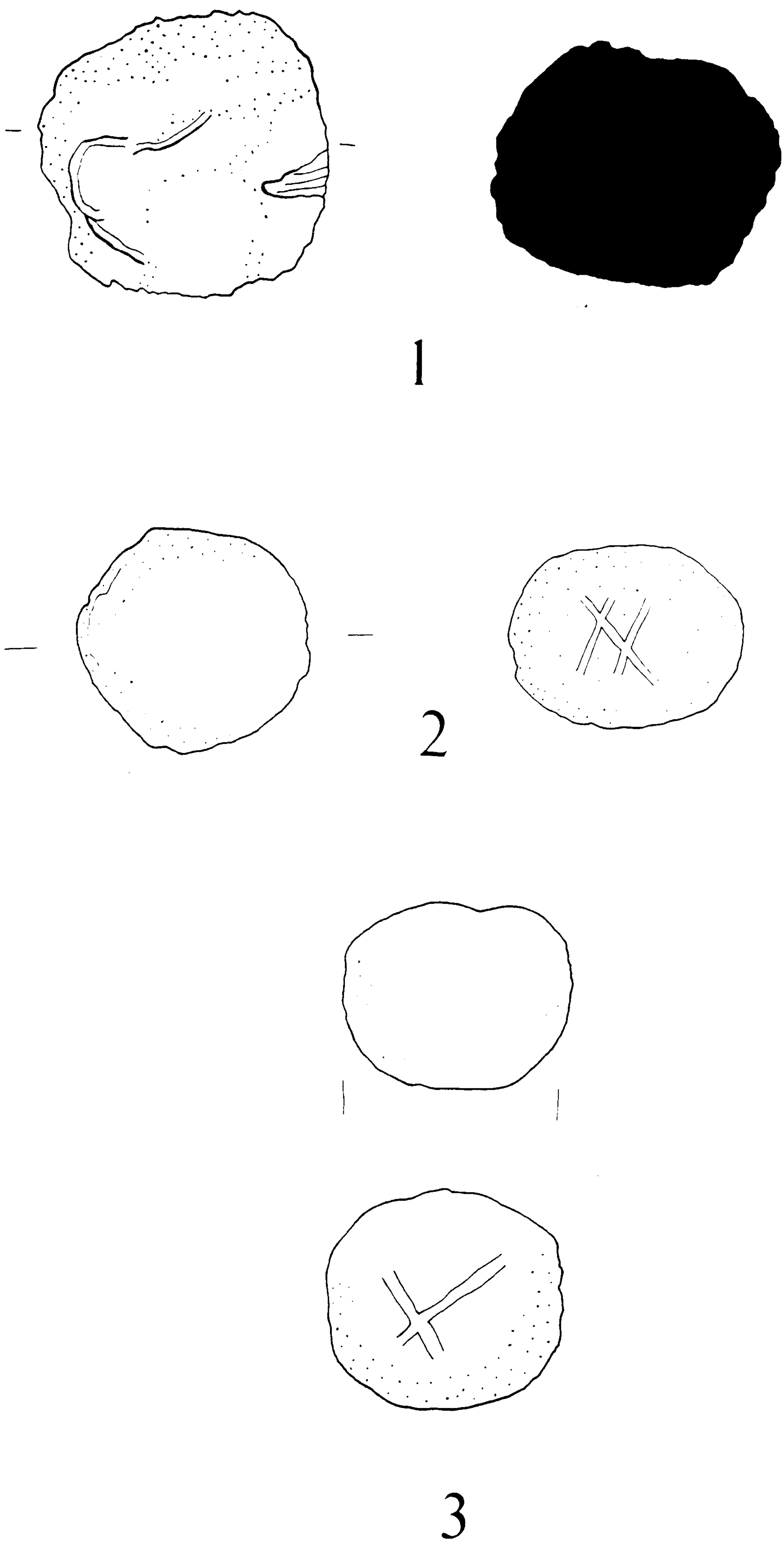


FIG 28: Stone Slingshots and Ballista Balls (all at 1:2)
1. Housesteads 2-3. Wallsend

Benwell.

One (sandstone?) ball from the site is on display in the Museum of Antiquities, Newcastle (Acc. no. M. A.1956.53. A). This does not appear to have been published and the circumstances of the discovery are unknown. Diameter: c9cm. Weight:1150grams. Date:Hadrianic or later.

Brough-on-Noe.

A stone ball was found lying on the intervallum road of the period III fort - which possibly dates to the late 3rd to mid 4th centuries (G. D. B. Jones 1967 p5). The size and weight are unknown.

A further find came from period IIB debris (possibly Severan) in the inner ditch. This was 17 inches (43.2cm) in diameter, but the weight is not known (Jones and Wild 1969 p106, plate IIB).

Burnswark. (plate 18 no.s 1-2)

Eleven complete balls and nine fragments, all made from the local red sandstone were found here in 1898 (J. Anderson 1898-9 p245-6). Some of these have one flattish side (Edinburgh Museum of Antiquities Acc. no.s GP59-68). The smallest is only about 5.2cm in diameter and weighs just 166grams - more suitable for a slingshot than an artillery missile. The largest of the group is 8.5cm across and weighs a little over 1KG. Jobey (1977-8 p90) divided these finds into four weight classes:- 1.1KG, 0.7KG, 340g and 170g. He felt that the smallest of these were not fired by artillery, but we have the usual problem of where exactly we draw the line between different categories of missile.

Another three shot were found in Jobey's excavations (Jobey 1977-8 p90, fig13). Two of them weighed about 500grams and the other was nearer to 600grams. One came from the ditch of the south camp and a second from the gateway of the hillfort. No dimensions are given for these finds.

Caerleon. (plate 18 no.3)

Two ballista balls were found during excavations at the School Field site in 1928 (Caerleon museum Acc. no.s C28 S. F. /C28 S. F.35-118). Both appear to be of sandstone. The first is well-rounded with a large letter M cut into one side. Diameter:c10cm. Weight:c1.5KG. The other stone is more irregular with one flattish side. Diameter:c9cm. Weight:c1KG. Unpublished and undated.

Carlisle.

There is an unpublished stone ball from excavations in 1973, which was found in a pit containing late Antonine samian. Diameter:c7.5cm. Weight:c485grams.

Chester.

The legionary fortress has produced a large number of stone missiles over the last 75 years, from many parts of the site. The exact number is difficult to quantify because many of the references in excavation reports are rather vague, some finds have since been lost and many others are not marked and so cannot be identified with published finds. Fifty-three stone balls were examined by the present author. Some of these are clearly too irregular to be considered as artillery shot. Thirty-five have some sort of provenance.

a. Three stone balls were found in Hunter street in 1909 (Newstead 1928a p77), but have since been lost. They were made of local red sandstone and weighed two or three pounds (c907-1361grams).

b. One ballista ball was found in Eastgate street in 1914. This is in the Old Collection at the Grosvenor museum, marked in black ink "from Roman stratum". Diameter:c9.5cm. Weight:c964grams.

c. There is one irregular (and incomplete) stone marked as coming from Foregate street, 1914. This is probably natural.

d. A "hoard" of ballista balls was found in Deanery Field in 1922-23. These were from a late context, associated with a Constantinopolis coin. A few of these are said to have been angular or cubelike and were therefore quite probably natural. none of these finds can now be located (Newstead 1924 p78-9, plate IV no.1).

e. Five red sandstone balls were found in Deanery Field in 1924-6. These came from barrack block B, in association with "late" pottery. Most of them had one flat side and they ranged from 2-5.5 pounds (c907-2495g). None of these can be located (Newstead 1928 p22, plate X).

f. "Several" red sandstone balls were found in Deanery Field in 1928 (Droop and Newstead 1931 p136), weighing between 11 ounces and 4 pounds, 4 ounces (c312-1928grams). One small ball in the Old Collection may be part of this group. It has one flat side and is marked "2:1928", probably meaning Deanery Field, barrack block 2. Diameter:c8cm. Weight:496 grams.

g. In 1935, three red sandstone shot were found in Deanery Field in the "upper Roman stratum" (Droop and Newstead 1936 p37, plate VII no.3, plate XX no.1). These weighed 1 pound 11 ounces (765grams), 2 pounds 10 ounces (1191grams) and 4 pounds 6 ounces (1984.5grams).

There are in fact four balls in the Old Collection which are said to have come from the 1935 excavations. The biggest of these is marked as being from an Antonine layer in barrack block I. It is 12.5cm in diameter and weighs 2225.5grams. The next ball is incomplete, made from red sandstone. Diameter:11cm. Weight:1204.8grams. This is presumably to be equated with the second ball mentioned by Newstead, which he said came from an Antonine layer. The third stone came from an Antonine layer in Block I. Diameter:c8.5cm. Weight: 765grams. This matches the weight of the smallest ball mentioned by Newstead, although this find is NOT of red sandstone. The fourth ball, from the same layer and area was presumably overlooked by the excavator. Diameter:8cm. Weight:496g. It is instructive to note here the discrepancies between the actual weights of the finds and the figures given by Newstead. This is a problem often encountered with material from the older excavation reports.

h. One sandstone ball was found by Newstead in Foregate street in 1938. This is in the Old Collection. Diameter:c9.5cm. Weight:878.85grams.

i. A very large red sandstone ball was found in Newgate street in 1938. Diameter:c16.5cm. Weight:5216grams.

j. Six round stones were discovered during excavations in Princess street in 1939 (Newstead and Droop 1939 p42). One of these weighed 2 pounds 4 ounces (c1021grams). None of these can now be located.

k. A total of eight sandstone ballista balls were found in the excavations (unpublished) in Crook street in 1963-4. Three are incomplete, the remainder range in size from 6-8.5cm to 11.5-12cm and in weight from 450 to 1876grams. They are undated.*16

l. One red sandstone ball was found in Trinity street, Hamilton House oil bunker in 1968. Diameter:c11.8cm. Weight:992grams.

m. Two ballista balls were found in Goss street in 1973. Both came from post-Roman levels. One was 7.7-9.6cm in diameter and weighed c710 grams. this was damaged in storage and is now fragmentary. The other is a very roughly shaped sphere, 9.2-10.5cm across and weighing 1178grams.

n. Eight balls, all of red sandstone were found in Crook street in 1973-4. The context was a Saxon pit, so we cannot assume that these are Roman finds. Three of them are incomplete and a fourth (Acc. no. F226 800) is so irregular that it cannot seriously be considered as an artillery projectile. The others vary in diameter from c9-11cm and weigh between 1052 and 1356grams. Several have one or more flat sides.

o. Four stone balls were recovered during excavations on Abbey Green in 1975-8. One is very irregular, possibly industrial raw material, but certainly not a ballista ball, whilst another is only a fragment. The other two have one flat side, a charateristic of many ballista balls. The first (VI 381 1193) came from a context containing 3rd century pottery. Diameter:c9-9.5cm. Weight:854 grams. The other is undated, 7.2-8cm across and weighing 555grams.

p. Two red sandstone balls were found in the Hunter street school excavations of 1981 (unpublished). The first came from an early-late 3rd century barracks, whilst the other came from a context in which most of the material was 2nd or 3rd century. Diameters:7.3-7.7/7.7-8.1cm. Weights:c530/560g. The first of these is rather angular, with several flat surfaces.

q. Finally there is one stone ball marked simply "E-W 1983". This was an unstratified find. Diameter:10-12cm. Weight:1453grams.

In addition to the above there are a number of other stone balls whose context and date of discovery are unknown. Some of these are so irregular in shape that they can scarcely be ballista balls. The more convincing examples are included on table 12. It is worth recalling that some of the published finds are unaccounted for and they may be among these unprovenanced finds.

Chesters (?).

Most of the ten stone missiles in Chesters museum are so small and light that it seems best to classify them as slingshots. Only the largest of the group need be considered here. This is pale yellow in colour, probably of sandstone and is about 8cm in diameter. It weighs 1134grams. This and the other stones could be from Greatchesters or indeed some other site (see page 52) but they might be unrecorded finds from Chesters itself.

Corbridge.

Four large sandstone balls (Acc. no.75.2306, finds no.s CN66/BY66) were apparently found on site XI in 1966. Nothing further has been recorded about these finds so it seems pointless to give weights and measurents. There are additional stone missiles in the store at Corbridge, perhaps 100 or 150 specimens.*17 These have no accession numbers or provenances, but may have been found in pre-war excavations. None of these finds can be closely dated; they can only be said to be Flavian or later.

Croy Hill.

About 50 yellow sandsone balls were found at the fort in a series of excavations early this century (Macdonald 1920-21 p230; 1924-5 p288; 1931-2 p248, 251, 267; 1936-7 p69). Macdonald's statements as to the precise numbers of shot involved are rather contradictory. As far as can be made out, 14 were found in 1920, about 24 in 1931 and 12 in 1935. The findspots of the first group are not recorded. One of those found in 1931 came from the south side of the fort-perhaps from the gate guardhouse-together with pottery and burnt material (Macdonald 1931-2 p248). Another one or two finds from the same season were found on an area of cobble flooring, perhaps part of the NW angle tower (Ibid p 251). Seven of the stones found in 1935 were from the easternmost room in the rear range of the principia (Madonald 1936-7 p40). This may have been the fort's weapon store, but no other pieces of weaponry were found there so this remains unproven. Very little is said about the sizes of the Croy Hill shot. The group found in 1920 were between 7.6 and 10.5cm in diameter (the measurements are given in inches in the report). No weights are quoted. Date:Antonine?

Durisdeer.

One stone ball has been found at the fortlet (Hunterian museum Acc. no. F.1938.42). It is oval and grey in colour with a smooth surface. It measures c7.5 x 8cm and weighs c540grams. Date:Antonine?

Earsdon.

A granite ball, possibly an artillery missile was found in a North Sea Gas pipeline between Holywell and Earsdon (South Northumberland). Diameter:5.4cm. Weight:240grams. Undated. (Peel 1973 p5; Wilson 1974 p409).

Greatchesters.

A large heap of rounded stones was found in the NW angle of the fort during the excavations of 1894-5 (Gibson 1903b p36). No dimensions or weights are recorded and the current whereabouts of these finds are not known. The excavator inferred from the presence of these stones that the NW tower had a ballista platform on it. There was however no structural evidence to back up this theory. Date:Hadrianic or later.

Haltonchesters.

A single stone ball was found in the east ditch during the 1936 excavations (Simpson and Richmond 1937 p167-8). The weight of this find is given as around 50KG, but like the published weights of the stone shot from High Rochester and Risingham (see below) this is an estimate only and perhaps not a very accurate one at that.

High Rochester.

"A number of stone shot were found in and around the fort in 1855 (Bruce 1857 p73). One of these, found outside the west wall is said to have measured 4 feet 6 inches in circumference (1.37m). Two other stone balls, said to weigh one hundredweight or c50KG (Richmond 1936 p181) are on the roof of the School house at High Rochester. However more recently an attempt was made to calculate more accurately the weight of these latter two stones (Owen unpub. p32-33). Owen first of all measured the stones and found that their average circumferences were 1.485 metres and 1.525 metres. Some small chips of the same sandstone were then used to calculate the relative density of the stone. Armed with these two pieces of information it was then possible to determine the weights of the missiles. The results of this process are very surprising indeed, for Owen shows conclusively that the two stones weigh about 134.5 and 146KG (5-5.5 talents or about 411-445 Roman pounds), much greater than the figure suggested by Richmond. Using the same method Owen calculated that the stone found in 1855 (4' 6"in circumference) weighed about 106KG.

These stones are much larger than most of the others found in Britain and their use as artillery projectiles may be questioned. Owen (Ibid p34-5) felt that they were too heavy to be fired from machines and were instead dropped by hand onto the heads of attackers. This is in line with the view that many of the stones from forts/watchtowers on the German limes may have been used in this way (Baatz 1966 p203). Owen noted the general lack of any stones lying around the interior of the fort at High Rochester and argued (Ibid p34) that there ought to be more if there were really any artillery machines there. This is not necessarily true as much stonework may have been removed from the site since the fort was abandoned some 1600 years ago. Owen did find one stone (Ibid plate 8) which may have been a ballista ball. This was about 30cm in diameter and weighed 26KG i.e about 1 talent.

Housesteads. (fig 28 no.1)

Three stone balls are preserved in the Fulling Mill museum at Durham. One is marked "Housesteads" in black ink and a note in the museum's records states that the ball was found in 1961. The report on the excavations of that year (Wilkes et al 1961 p279-300) does not mention any such find however. Stone shot from Housesteads are mentioned as a parallel for the finds from Burnswark (Anderson 1898-9 p245) but nothing further is known of these. The "Housesteads" ball is roughly rounded with one flat side and some orange/black staining on the surface. Diameter:c7.5cm. Weight:c608grams. The remaining two balls at Fulling Mill are unprovenanced, although perhaps they are also from Housesteads. The first is c8.3cm in diameter and weighs c1033grams. It is marked GP57, a letter code which coincidently was used for the shot found at Burnswark in 1898. However, this ball is not of red sandstone - as are all those from Burnswark - and is unlikely therefore to come from that site. The last stone is labelled 56/CY. It is about 8.5cm in diameter and weighs c1020grams.

Lower Machen.

One possible ballista ball was found during the building of a by-pass (JRS Vol. XXIX-1939-p199). The site (in Gwent), may have been a mining settlement under military control. Pottery ranged from not later than 75AD to the end of the 2nd century.

Loudon Hill.

There are two possible ballista balls from this fort (Hunterian museum Acc. no.s 1948.2; 1948.3). These are identifified as being of a granitic igneous rock, one possibly of dolerite. Diameters:7.8/7cm. Weights:500/415 grams. Date:Flavian-Antonine.

Milton.

Three supposed ballista balls have been found in the fortlet; one in 1938, the others in 1949. They are all in the Hunterian museum collection. The earlier find (Acc. no. F.1938.8) measures 6.5 x 8.2cm and weighs 490grams. The other two finds were not available for study. One (F.1949.46) is said to be 1.75" (4.4cm) in diameter and to weigh 180grams. The other find (accession number not known) has a diameter of 1.25" (3.2cm). Date:Flavian or Antonine.

Ribchester.

Some ballista balls are said to have been found at the site (Wilson 1980 p73, note 17), but no details are known of them.

Risingham.

There are three stone shot from the fort on display in the Museum of Antiquities, Newcastle. These are said to weigh a hundredweight or c50KG (Richmond 1935 p186, 194, plate XV, fig 2a-c). One was found on the berm outside the west wall, another on gravel behind the west rampart and the third behind the Severan west rampart with pieces of 3rd century pottery. Owen has calculated (Owen unpub. p33) that the three stones from Risingham actually weigh c40/44/126.5KG.

South Shields.

Eight stone balls, possibly artillery ammunition (Allason-Jones and Miket 1984 p353) can be seen in the site museum. The smallest measures about 8cm across and weighs in at c907grams. The largest of the group has a diameter of 12cm and weighs 2381grams. Several of these stones have one flat side. Date:Unknown, therefore Hadrianic or later (?).

Turret 8a.

A ballista ball is said to have been found here (Brewis 1932 p200) but no details are known of it. Date:Hadrianic or later.

Turret 17a.

There is a whinstone ballista ball from this site in Newcastle museum (M. A. Acc. no.1934.28), but this is not mentioned in the 1931 excavation report (Allason-Jones 1988 p198). At only 5.3cm in diameter it seems rather small for an artillery projectile. It weighs 266grams. Date:Hadrianic or later.

Turret 18a.

A "small ballista ball" was found here in 1931 (E. Birley et al 1931 p259). It was about 7.9cm in diameter. The excavators considered that it came from a small 4th century catapult. Date:Hadrianic or later.

Continental Parallels.

Stone balls have been found in several of the watchtowers on the limes in Germany (Baatz 1966 p201, note 45). The largest has a diameter of 28cm and weighs 25-30KG. Examples with diameters of about 20cm and weighing roughly 10KG are quite frequent. Baatz also notes (Ibid p203) that eight stone balls have been found in the Numerus fort at

Altenstadt, in the NW angle tower. These were between c10KG and 24.4KG in weight. Some auxiliary forts in Germany have produced such finds - for example at Niederberg in Upper Germany, some "tuff-stone ballista balls" were found (A. Johnson 1983 p108). The stone shot from Pergamum and Carthage (Marsden 1969 p81-3) are appreciably bigger than most of the examples from Britain and also far more numerous. Both groups include shot of over 40KG. Such large numbers of finds cannot easily be dismissed and it is probable that they served some defensive purpose. However the evidence is somewhat ambivalent. Stone-throwing machines could not have been accommodated in the German watchtowers and even supposing that they could have been, they could not have defended the ground immediately around the base of the structure (Baatz 1966 p202). Nor can a case really be made for artillery in Numerus forts merely on the basis of the finds from Altenstadt. Such posts were very small and relatively unimportant it does not seem feasible that they could all have been given artillery pieces. The Altenstadt stones may have been used for other purposes or may not have been artefacts at all. However there does seem to be rather stronger evidence for the presence of artillery in some auxiliary forts and this will be considered in more detail in the conclusion to this chapter.

The Archaeological Evidence for Bolt-firing Artillery in Britain.

The presence or absence of bolt-firing machines in British forts rests largely on the numerous finds of iron missile heads. These have been found in auxiliary forts as well as legionary fortresses and the interpretation of these objects is far from straightforward. Since we know that the legions were regularly equipped with artillery (Josephus, Bell. Jud. V, 269-70; Vegetius Ep. rei Mil. II, 25) it seems improbable that the British legions were not similarly equipped. The finds from auxiliary sites are more controversial.

Briefly we must also note some finds of supposed crossbow fittings from Britain. There is an antler trigger catch or "nut" from Buston Crannog in Ayrshire, but this is not necessarily Roman (A. Macgregor 1975-6 p319). A chalk cut grave from Burbage, Wiltshire contained some finds which were interpreted as crossbow fittings (Goddard 1896 p87-90; A. Macgregor 1975-6 p319). These consisted of a bone nut with a trigger notch cut across it, some bone strips (perhaps decorative fittings from the crossbow stock) and lastly some iron fragments of even more doubtful relevance. There is absolutely no evidence to date these finds to the Roman period - they could be much later. Goddard also mentions two or three bone catches from London (Ibid p87) but these cannot now be located. There is a crossbow nut from the legionary fortress of Carnuntum in Upper Pannonia, but even this find is not definitely Roman (Von Groller 1909 p64, fig22). The identification of all of these finds rests on their resemblance to Medieval crossbow nuts - which were usually of antler. (see plate 19 no.5).

We must now turn to the large quantities of iron missile heads from Britain which have been or could be identified as ballista bolts.*18 Some of these are more convincing than others. The main problem lies in distinguishing boltheads from arrowheads and even small javelin heads. This problem is compounded by the almost total lack of any complete bolts from other parts of the Empire. Undoubted examples of ballista bolts have been found at Dura Europos in Syria (Rostovtzeff 1931 p72, plate XI; 1936 p455, plate XXIV no.s 2-3). Several wooden shafts (of ash) were found and since these do not have string notches they are clearly not arrow shafts. One of these shafts was 37.5cm long and 1.4-3.3cm in diameter. The most distinctive feature of these shafts are the three slots in each, about 5cm long. Into these were placed thin triangular vanes of maple wood, obviously designed to stabilise the missile during flight. It is the presence of these vanes which marks out the Dura finds as being ballista bolts. Procopius (Gothic War V, xxi, 14-19) states that the missiles fired by the ballistae of Belisarius were "about one half the length of the missiles that they shoot from bows, but about four times as wide. However it does not have feathers of the usual sort attached to it, but by inserting thin pieces of wood in place of feathers, they give it in all respects the form of an arrow, making the point which they put on very large and in keeping with its thickness." Given the gap of three centuries between the siege of Dura and the events recounted by Procopius, it is remarkable to find the same form of construction still in use.

Seventeen iron points were found with the complete shaft (Rosovtzeff 1936 p455, plate XXIV.3). These had pyramidal four-sided heads and split sockets, there being (to judge from the illustration) a slight angle where the head met the socket. The points had an average length of 12cm and an average socket diameter of 1.6cm (Ibid note 52). They weighed 50.6-62.5 grams and were fastened to the wooden shaft by means of a bronze rivet through the socket.

There were undoubtably other patterns of bolthead in use by the Roman army, but the finds from Dura do at least give clues as to what to look for when studying the material from Britain. In a study of finds from Germany (Baatz 1966 p203-7), iron missile points were categorised according to their size, weight and centre of gravity. A group 6-13cm long and weighing 25-75grams were identified as boltheads (Ibid p205). As Baatz noted, certain features are critical when trying to identify ballista bolts. Since they had to be fired over considerable distances, a streamlined shape would be useful to cut down wind resistance. For this purpose a pyramidal shape would be ideal. Deep penetration would be aided by having most of the bolt's weight in its point, with a centre of gravity near to the tip. Penetration was the most important function of such missiles and there are many references in classical texts to people being pierced through by boltheads (Bellum Africum 29, 3; Ammianus XIX, 5, 6; Procopius. Wars V, 23, 10-11). Javelin heads on the other hand tended to be broader in the blade and the weight lay more in the wooden shaft. These weapons were only thrown for short distances and relied more on causing large wounds than on penetrating deeply. For this reason the small "leaf-shaped" missile heads sometimes identified as boltheads (Baatz 1966 p205, no.s 3-4; Stead and Rigby fig 65 no.s 471-7) do not appear appropriate for such a task. In theory these are reasonable criteria for distinguishing boltheads from other missiles and they may be applied to the finds from Britain. Unfortunately most of them are far too corroded to make weighing them at all useful.

Type 1.

This is the category of projectile points most commonly identified as ballista bolts. They have tapering, pyramidal points which are square in section. The socket can either be closed or split up one side. In some cases the junction or "neck" between the head and the socket is quite distinct, but in others there is only a slight angle or no clear junction at all. This degree of variability is only to be expected given the wide geographical spread of the material, the differences in date and most crucially the rather random method of production.

Bainbridge.

One bolthead from this fort is in the Yorkshire museum (marked B50 168). There is no clear junction between the square-sectioned, tapering head and the closed socket. The latter is filled with corroded wood. TL:c9.5 cm. Head Length:c7.5cm. Socket Diameter (External) :1.1cm. Date:Unknown, therefore Flavian to late 4th century.

Bowness-on-Solway.

There is an iron object from this site which has been identified as a bolthead (Potter 1979 p337, fig 136 no.10). It certainly has a square-sectioned head (the end of which is blunt), but it appears to be tanged rather than socketed. This makes the identification as a bolthead rather doubtful - it may instead have been an arrowhead. Date:Unstratified, therefore Hadrianic or later.

Brancaster.

Excavations in the vicus to the west of the Shore fort produced more than a dozen projectile heads of various kinds (Hinchliffe and Sparey-Green 1985 fig32 no.s 37-50). The classification of these is quite a difficult task. No.s 37-8 are most probably boltheads. They are short and chunky with pyramidal points and split sockets. The head turns in slightly where it meets the socket. No.39 is similar but has a 'wraparound' socket - that is one where the edges have been folded over but do not quite join. Unfortunately, no measurements are given for any of the finds from Brancaster. The weapons may have been produced in the vicus or alternatively they may have been fired from the fort into the vicus during target practice, when the settlement had gone out of use. Date:late 2nd/early 3rd century or later.

Brecon Gaer.

There are two boltheads from this site in the National Museum of Wales (unnumbered). Both have square-sectioned heads and split sockets. Lengths:8.7/9.9cm. These finds are believed to be of 1st century date.

Brough-under-Stainmore.

There are two boltheads from "Brough, Westmoreland" in the British Museum (Acc. no.s 1902.8-16.32; 1902.8-16.33). The heads are pyramidal and slightly rounded in section, but as they are rather worn they may once have been square. In both cases the socket is damaged but they were probably closed. Lengths:8.8/8cm. HL:4.5/4.1cm. Max W:1.2cm. SD (Int) :0.7/1cm. SD (Ext) :1cm. Date: Flavian-4th century or later.

Caerleon.

Three boltheads of this type were found in the Prysg Field excavations (Nash-Williams 1932 p26, fig19 no.s 1, 7, 8). The first of these has no clear junction between the head and the socket. The latter may have been split anyway but is now badly damaged. TL:9.5cm. HL:c5.5cm. Max W:1.3cm. The other two bolts are similar and both have split sockets. No.8 still has a piece of the wooden shaft inside its socket. TL:10.8/9.7cm. HL:5.5cm. SD (Int) :1.2cm. SD (Ext) : 1.6/1.8cm. Date:Nash-Williams dated no.s 1 and 7 to c200-300AD, whilst no.8 was unstratified. However the latest pottery from this area of the site dates to the Antonine period and occupation ceased in the Severan period.*19

Caister-on-Sea.

Seven square-headed bolts have recently been found here. The four complete specimens are between 9.2 and 9.8cm long, with socket diameters (presumably external) of 0.8-1cm. Date:3rd or 4th century?*20

Chester.

Two ballista bolts with square-sectioned heads have been found here. One came from the Goss street excavations of 1970 (unpublished). The socket of this find is split and there is a clear junction with the head. No measurements are available for this find. The other bolthead is from the Abbey Green site, excavated in 1975. There is a clear junction with the closed, circular socket. TL:7.6cm. HL:3.6cm. Max W:1cm. Max Socket diameter:1cm. This bolthead is thought to come from a Cheiroballista whose missiles were 38cm long and 1.3cm in diameter (information from display panel in the Grosvenor museum). Neither of the finds are dated.

Corbridge.

Four bolts with square-sectioned heads and long, tapering points can be seen in the site museum. These are in a case devoted to finds from forts III (c121-5AD) and IV (c139-163AD). Overall lengths are:- 6.2/8.1/9.8/9.4cm. (Acc. no.s 75.1358-75.1361). A lengthy search of the site records failed to find any positive dating evidence for these objects. They could therefore just as easily belong to the 1st century. Socket diameters were not determinable for these finds, except for 75.1360 which has an internal diameter of 0.6cm and an external diameter of 0.8cm. There is also an unstratified bolthead which has a very slim

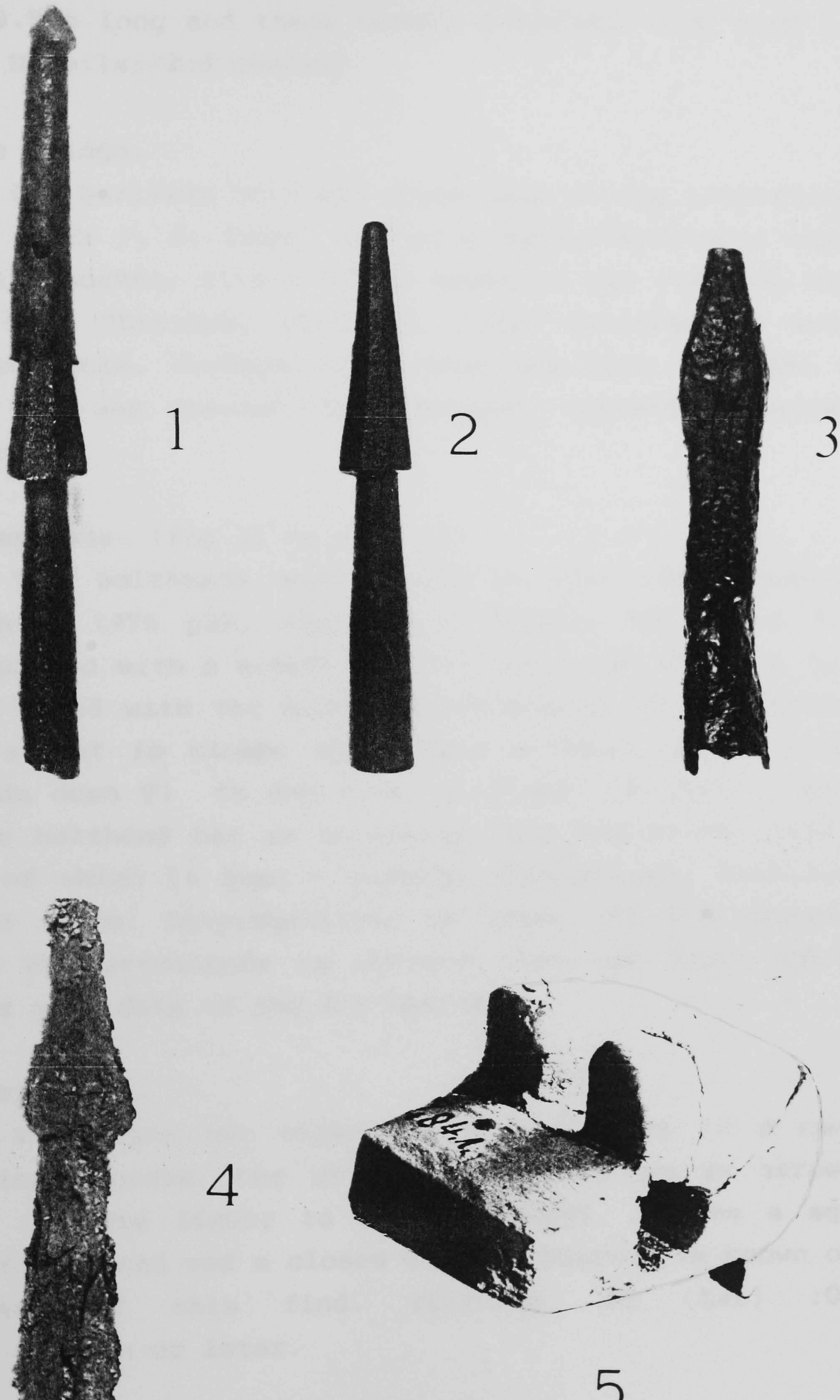


PLATE 19: Ballista Bolts and Crossbow Fitting
1. Vindolanda (at 1:1) 2. Vindolanda (at 1:1)
3. MC.35 (at 1:1) 4. Old Penrith (at 1:1)
5. Burbage Crossbow Trigger (at 2:1)

four-sided head (Acc. no.75.1185). TL:14.6cm. Finally there are three boltheads of this type from the Corbridge Hoard (Bishop and Allason-Jones 1988 fig19 no.s 48-50). These are all 9.5cm long and their socket diameters vary from 1.6 to 2cm. Date:1st/2nd century.

Greta Bridge.

One ballista bolt was found here during excavations in 1974 by Mr P. J. Casey. It has a square-sectioned head and a split socket, with a slight angle at the junction between the two. TL:c10cm. HL:5.2cm. Other measurements are not determinable. Perhaps fired from the fort into the vicus when it was disused. Date:Unknown, therefore Flavian-4th century.

Housesteads. (fig 31 no.s 9, 11)

Two boltheads were found in the 1898 excavations (Manning 1976 p22, fig13 no.s 30-31). The first is now associated with a number of iron nails and it seems to have been found with the hoard of arrowheads in the Principia. The socket is closed apart from a small cutout (like an upside down V) in one side. TL:8.6cm. SD (Ext) :1cm. The other bolthead has an unusually long and narrow head, the end of which is bent - perhaps through use. TL:9.3cm. SD (Ext) :c1cm. Date:Hadrianic or later. If the association with the arrowheads is correct then the first of these finds will date to the 4th century.

Kirkby Thore.

There are two objects from this site in a case in Chesters museum, one of them described as an arrowhead. This is more likely to be a bolthead. It has a square-sectioned head and a closed socket. Nothing is known of the context of this find. TL:7.2cm. SD (Ext) :0.9cm. Date:Flavian or later.

Milecastle 35 (Sewingshields). (plate 19 no.3; fig 31 no.10)

One bolthead is known from this site, dated to the 2nd or 3rd century AD (Haigh and Savage 1984 fig14 no.47). The tip is blunt and the socket is split. There is no clear border between head and socket. TL:7.2cm. SD (Ext) : 1.2cm. Weight:c22.5grams (probably much reduced by corrosion).

Old Penrith. (plate 19 no.4)

The weapons from this site were mainly found in contexts dating to the 3rd century or later[*21], although much of the material could be residual. Included amongst the finds are six boltheads with square-sectioned points. These are of a very standardised form, except that three have elongated points. Four examples have split sockets and in one case there is a rivet still in place. The dimensions of the three longer boltheads are as follows:- TL:11/12.2/ 11.2cm. HL:5.4/?/5.5cm. SD (Ext) :1.2/?/1.6cm. The remaining boltheads are shorter and broader. TL:9/8.5/8cm. HL:5/3.8/? SD (Ext) :1/1.4/? All six boltheads have a very distinct junction between the point and the socket. We might deduce that these finds represent two different calibres of missile designed for different machines. Unfortunately all of the boltheads are very corroded so this point could not really be clarified by weighing them.

Pevensey.

There are two objects from the Saxon Shore fort which although not found in Roman contexts, may be considered as boltheads because of their form.[*22] One (find no. IR48) came from an area inside the east gate in the makeup of a road surface which was probably Medieval. There is no clear junction between the head and the socket - the latter is split up one side. TL:6.6cm. HL:c2.7 cm. Max W:1.3cm. SD (Ext) :c1cm. The other bolthead (find no. I-P36/380) came from a black earth layer containing Saxon and Medieval pottery. The slim head has no distinct junction with the closed socket. TL:6.6cm. HL:? Max W:1cm. Date:Probably late 3rd century or later.

Richborough. (fig 31 no.5)

There are five possible boltheads of this type from the fort, none of which seem to have been included in the published lists and illustrations. One labelled "1994" has a split socket, which is incomplete. The tip is and there is no clear junction with the socket. TL:6.8cm. SD (Ext) :1.3cm. There are two similar finds both unlabelled and both incomplete. They are 6.2 and 7.1cm long. A further find labelled "1856" shows a clear junction between the head and socket - the latter is split and filled with corroded material. TL:5.3cm. HL:3cm. (fig 31 no.5). There is another unlabelled find, perhaps a bolthead, in which the square upper part tapers into the (broken) circular socket. TL:12.6cm. Even more enigmatic are several very thick, diamond-sectioned iron points (Cunliffe 1968 plate III no.266), which are tanged. These may perhaps have been boltheads or even pilum points. Date:unknown, therefore Claudian to 4th century or later.*23

Silchester.

There are four probable boltheads from this site and three belong to this type. TL:13.4/9.5cm. HL:c6/4.8cm. SD (Int) :1.3/1.6cm. SD (Ext) :1.7/2cm. The measurements for the third member of the group are not available. It has a blunted tip and looks rather like the bolthead illustrated by Boon (1974 fig 8.6).

Verulamium.

A bolthead comparable to one of those from Housesteads (Manning 1976 fig13 no.31) was found here in a 4th century context (Wheeler and Wheeler 1935 p219, plate LXIVA; 7).

Vindolanda.

The 1980 excavations in the stone fort produced two square-sectioned boltheads (Bidwell 1985 p138, fig49 no.s 32-33), both with a clear junction between the head and the socket. In one case the socket is split, the other is closed. TL:8.8cm/8.7cm. Date:One bolthead was not stratified, but the other was found with mid 3rd century material.

Watercrook.

Four examples of this type were found in the excavations of 1974-76 (Potter 1979 p223, fig88 no.s 102-

103). In all cases there is a clear junction between the head and the socket. Some of the latter are split. The finds came from various contexts - the fort defences, the east vicus, the ditches and from a phase 2 (late Hadrianic/early Antonine) layer in the eastern angle of the fort.

There are in addition two unprovenanced objects in the Fulling Mill museum, Durham which although labelled as being pilum points are in fact almost certainly boltheads. These are square in section, with nails in their sockets. This type of bolthead was in common use in the 1st century AD, as is seen by finds from London (Parnell 1985 p65, no.29), Longthorpe (Frere and St. Joseph 1974 fig41 no.9), Colchester and Cirencester (Webster 1958 figs3 no.38, fig 4 no.75) and Hod Hill (Manning 1985 plates 82-84). There are also many continental parallels, including of course those from Dura-Europos, but also from Haltern (Ritterling 1913 taf XVII no.s 23-5, 29-53) and Moos Burgstall in Raetia (Schonberger 1982 Abb.30.197) to name but a few. As with the finds from Britain, some have a noticeable "neck" where the head meets the socket, whilst others do not. There does not seem to be any pattern to this feature. Boltheads with a distinct neck tend to have a neater and more finished appearance, but it was evidently not an essential feature and perhaps it was not felt to be worth the extra effort to produce in many cases. Functionally it cannot have made any difference for as long as the bolthead was straight and balanced it would fly satisfactorily.

Type 2.

This category includes all boltheads with an hexagonal-sectioned head. There is always a clear junction with the socket. This is a slight more elaborate version of type 1.

Bainbridge.

There is a very corroded bolthead from the fort in the Yorkshire museum. The writing on this is a little indistinct - it may read B62 205. The split socket is filled with corroded wood. TL:8.3cm. HL:3.6cm. SD (Ext) :c1.5cm. Date:Flavian-4th century.

Holt.

There is an unnumbered bolthead from this site in the collection of the National Museum of Wales. The head is very worn, but clearly it was facetted and probably six-sided. TL:8.2cm. HL:4.7cm. SD (Ext) :1cm. Date:Unknown.

Vindolanda. (fig 31 no.2)

A very finely preserved bolthead was found in the workshop of one of the pre-Hadrianic forts in 1987 (find no.3754). The socket is split up one side and there is a rivethole near the lower end in the side opposite the split. Faintly inscribed on one side of the socket is a mark consisting of four upright strokes. This number may have some significance, but it will be discussed later (see page 112) in relation to a clearer example. TL:8.8cm. HL:4.3cm. SD (Ext) :1.2cm. Weight:33grams. Date:105-120AD. (fig 31 no.2).

In passing we must also note a bronze object on display in the museum at Chesters (Clayton Collection no.1087). This was once identified as a borer (Budge 1907 p377 no.834), but now as a staff butt. It closely resembles the type 2 boltheads, having an hexagonal-sectioned head and a closed socket - with a ridge between the two. There is a blocked rivethole in one side of the socket. Bronze would certainly be a very unusual material for a weapon head in the Roman period, although it might be a practice missile. It is more likely though that this object was a staff butt or a tool head of some kind. TL:8.2cm. HL:4.1cm. SD (Ext) :1.3cm. Date:Hadrianic or later.

<u>Type 3.</u>

These bolts have fluted, octagonal-sectioned heads and a clear junction with the socket. Closely related to type 2.

Carlisle.

Two such boltheads were found in the excavations in Castle street (unpublished). Both have split sockets and in one case a rivethole is visible. TL:7.9/7.2cm. HL:3.8/2.5. SD (Ext) :1.1/1cm. One bolt is dated c85-120AD and the other to c120-140AD.

Catterick.

There is a well-preserved bolthead of this type in the Yorkshire Museum (Acc. no.1980 54.4731). The socket is closed. TL:10.7cm. HL:4.9cm. SD (Ext) :1.2cm. Date:Precise context unknown, therefore Flavian-4th century.

Corbridge.

An octagonal-sectioned bolthead was found in the Commandt's house (Site Inventory no.75.3600). TL:11.5cm. HL:5.3cm. SD (Ext) :1.3cm. Date: There is unfortunately no information whatever as to the context of this find. The parallels from Carlisle and Vindolanda suggest that the find from Corbridge dates to between the Flavian period and the mid second century. This would fit in well with what we know of the site's history, for the fort at Corbridge was given up c163AD and military occupation was not resumed until the early 3rd century.

Vindolanda. (plate 19 no.s 1-2; fig 31 no.s 1, 4)

Five type 3 boltheads were found here in 1986-7, all in a superb state of preservation (Site Find no.s 3632, 3702, 3725, 3741 and 3742). The last of these has a conical-headed bolt superimposed on it and therefore cannot be properly measured. The remaining four are virtually identical in form. They vary in length from 8.4-9cm, with heads 3.8-4.1cm long. In each case the external socket diameter is 1cm (and all of the sockets are split). Finally there is a notable standardisation of weight-30, 31, 35 and 37 grams. Clearly some trouble was taken to produce boltheads of fairly uniform size and weight - presumably because they were all to be used with a particular calibre of ballista? Two of the bolts have blunted tips and may well have been fired. Number 3742 has the mark XX cut into the side of the socket, like the IIII (or III) already noted (see page 111) in connection with another bolthead from this site. These marks must have served some official purpose. Perhaps they were batchmarks put on during production as a means of quality control, or else for identification purposes during target practice - maybe with the letters picked out with paint? It is quite likely that other boltheads had such marks but generally finds are too poorly preserved for such details to be noticeable. (plate 19 no.2; fig 31 no.1).

Even more intriguing is the possibility that these marks are to identify the units that were using them. Thus XX could signify Legio XX Valeria Victrix and the III or IIII would refer to the Batavian cohort known to have been based here (see Appendix 1 for a list of the garrisons). This is I admit highly speculative but if units could mark their pottery in such a way (Southern 1989 p109) then why should not weapons be so marked if they were going to be re-used? Dates:All of the finds came from the fabrica, except 3702 which was found in the praetorium.3702 dates to 100-105AD.3632, 3741 and 3742 date to 105-120 AD.3725 belongs to the period 120-140AD.

York. (fig 31 no.3)

There is one bolthead from the General Accident Extension site (York Archaeological Trust no.1983.32 1399 I 1130). There is a slight ridge at the junction of the head and the socket. The latter is split and there is a rivethole in one side. TL:8.2cm. HL:4.3cm. SD (Ext) :1.1cm. Date:Late 2nd/Early 3rd century.

Type 4.

Boltheads with a distinctive conical head. There is a clear junction with the socket, which is sometimes split. These objects have in the past been identified as butts/ferrules, either for spears (Frere and St. Joseph 1974 p78) or for artillery missiles (Collingwood 1930 fig66a). Recently it has been suggested that they may have been fitted to a different kind of spear than the usual ferrules, perhaps on cavalry spears (Allason-Jones and

Bishop 1988 p105). However this theory does not seem to me to be very convincing. Why go to the trouble of making an alternative type of ferrule when the existing form was perfectly adequate? Fortunately there is now some evidence that these conical-headed objects are in fact boltheads.

Bewcastle.

There is one find in the report on the 1937 excavations (Richmond et al 1938 fig13) which looks as though it might have had a conical head, although its appearance could admittedly be due to corrosion and I have not had the opportunity of examining this object at first-hand. It is included in a group of ferrules and other finds which came from the shrine in the principia. It was thought that this building had been burned down by barbarian raiders in the period c273-297 (Ibid p209), but this view has recently been challenged.*24

Caerleon.

One conical-headed bolt was found in the Prysg Field excavations (Nash-Williams 1932 p27, fig19 no.26). The head comes to a point and the socket is incomplete. The excavator identified this object as the butt from a ballista bolt. TL:5.3cm. HL:0.9cm. Dated to 200-300AD by Nash-Williams, but in fact like other finds from this area probably not later than c200AD.

Carlisle.

Two conical-headed bolts were found in excavations in Castle street (unpublished). TL:5.7/5.6cm. HL:0.7/?cm Diameter of head:0.9/0.8cm. SD (Ext) :1/0.9cm. Dates:c120-140/c100-120AD. Three more boltheads were found in the Annetwell street excavations. TL:5.9/4.4/4.9cm. HL:0.5/0.6/0.6cm. SD (Ext) :0.9 /0.8/1cm. Dates:Two belong to the late 1st century, the other to c105AD.

Housesteads. (fig 31 no.7)

One iron object of this type was found here in 1898 (Manning 1976 p21, fig13 no.28). TL:4.7cm. SD (Ext) :0.8cm. Manning identified it as a ferrule. A similar shaped object made of bronze was found in the 1960 season (Wilkes et al 1961 p294, fig3 no.4). This was thought to be the butt end of a javelin. Date:Hadrianic or later.

London.

One conical-headed bolt from the Bank of England site can be found in the Museum of London (Acc. no.1935.187). Identified as a ferrule, it has a split socket with a rivethole in it. TL:8cm. HL:0.7cm. SD (Ext) :1.4cm. Date:Late 1st/2nd century?

Milecastle 39 (Castle Nick).

There are two examples from the recent excavations (find no.s 1134a, 457). One of these has carbonised wood in the socket - the remains of the shaft. TL:5.3/2.8cm. Date:Late 2nd or 3rd century?

Old Penrith.

Two conical-headed iron objects have been found here (unpublished site report, finds no.s 643, 644). No.643 is of the usual form and is identified as a ferrule. TL:9cm. Diameter of head:1.8cm. The other object is oddly shaped. For some way below the conical head (which is almost hidden by corrosion) the shaft is solid - and circular sectioned. Just above the point where it becomes a socket there is a protrusion on either side of the shaft. The excavator speculates in the report that this object was either a complex form of ferrule or a practice bolthead. If the latter identification is correct then the protrusions on the shaft may have been intended to prevent penetration beyond a certain point. Date:Although much of the weaponry from this site was found in contexts of the 3rd century or later, it is quite likely that some of the finds are residual. A date in the 1st or 2nd century seems most probable - by analogy with other finds.

Vindolanda. (plate 19 no.1; fig 31 no.s 4, 6)

This site has produced the best evidence for arguing that this class of objects were boltheads. One example found in 1987 (find no.3741) had been pushed over the tip of an octagonal-sectioned bolthead. This must have occurred because the tip of the latter had been blunted. This find seems to show that these objects could be used as artillery projectiles, even if this may not have been their intended function. TL (both bolts) :11.9cm. TL (Conical bolt) : 5.5cm. HL (Conical bolt) :0.9cm. SD (Conical bolt) :c0.9cm. Weight:43grams. This find came from the fabrica. Date:105-120AD. (plate 19 no.1; fig 31 no.4).

A separate conical bolt was found in the fabrica in 1986 (find no.3447). The lower part of its split socket is missing. No rivetholes are visible in the remaining portion. TL:8.3cm. HL:c1cm. SD (Ext) :1.1cm. Weight: 26 grams. Date:120-140AD. (fig 31 no.6).

At least one other example has been found in the past in pre-Hadrianic deposits (R. Birley 1977 plate 26). A further six conical bolts were found in 1989, in the fabrica, the praetorium and the ditch of the early forts.*25 In several cases the socket is split and some have parts of the wooden shaft surviving. One example (find no.4311) is unique in having a square-sectioned tang rather than a socket. TL:5.5-10.4cm. HL:0.6-0.8cm. SD (Ext) :0.9-1cm. Tang thickness (no.4311) :0.3-0.7cm. These finds are variously dated. All lie in the period between c85/90AD and 120-140AD.

York.

There is a single bolthead from this site (York Archaeological Trust no.1984.32 2202 II 2339). TL:6.4cm. HL:0.7cm. SD (Ext) :0.8cm. Date:Late 2nd/early 3rd century. This site lies within the area of the later colonia, but its precise nature is unknown. There was a smithy in the vincinity so this might have been the site of the legionary fabrica.*26

As well as the above-mentioned examples, these conical-headed objects have turned up in 1st century contexts on several sites. There is for example a Claudian-Neronian specimen from Longthorpe (Frere and St. Joseph

1974 fig 41.15) and five Flavian finds from Newstead (Curle 1911 plate XXXVIII no.s 12-13, 15-17).

Continental Parallels.

Numerous parallels are available for the British finds, all so far from 1st or 2nd century contexts. For instance there are about ten from Hofheim (Ritterling 1913 taf XVII no.s 57-66), two from Moos-Burgstall in Raetia (Schonberger 1982 p258, Abb.5 no.s 258-9) and at least seven from the auxiliary fort at Carnuntum (lecture given by Sonja Jilek at the 6th Roman Military Equipment Conference, Bonn, November 1988). The latter date to the period from the reign of Trajan up to the time of the Marcomannic wars.

The four types discussed so far account for the majority of the finds from Britain which are at all likely to be ballista boltheads. The remainder are really only minor variations.

Type 5.

Bolts with round or square-sectioned heads and grooved sockets. These are only rarely found and there is no real proof that they are artillery boltheads, but the size and general proportions are appropriate for such a function.

Housesteads.

One such object was found here in the 1898 excavations (Manning 1976 fig14 no.34). The head is circular in section, with an angular appearance. The socket - which is incomplete - has a pair of grooves running around it at the junction with the head. TL:7cm. Date:Hadrianic or later.

London.

One unstratified bolthead was found at the Angel Court site in 1974 (Blurton 1977 p61, plate 17 no.447). This was circular in section, with a single groove running around the socket. No measurements are quoted, but the find was clearly incomplete in any case.

Wallsend. (fig 31 no.8)

A find in the Museum of Antiquities, Newcastle belongs with this group (Manning 1976 p22, fig14 no.33; Acc. no.1956.176. A). The head is square-sectioned and the junction with the socket is marked by a pair of grooves set very close together. The socket is split and a rivet still remains in it. TL:7.5cm. HL:c3cm. SD (Ext) :0.9cm. Date:Hadrianic or later.

Type 6.

Bolts with a square-sectioned head and the junction with the socket marked by a ridge.

Chesters.

This is the only example known to me (Clayton Collection no.3128) and it may simply be a minor variation of type 1. The socket is incomplete. TL:8.7cm. HL:5.5cm. SD (Ext) :1cm. Date:Hadrianic or later.

Type 7.

Bolts with a diamond-sectioned head.

Richborough.

One unlabelled object in the Richborough collection may be discussed here. The head of this object is irregular in shape and it tapers into the socket - the upper part of which is also diamond-sectioned. TL:9.6cm. HL:c3.5cm. SD (Ext) :0.9cm. This is perhaps to be equated with a rather slim bolthead found in the fill of one of the stone fort's ditches (Bushe-Fox 1949 plate LVIII no.288). This find would date to the late 3rd century at earliest.

Vindolanda.

One possible bolhead of this type was found in the excavations of 1980 (Bidwell 1984 fig49 no.34). There is no clear junction between the head and the socket. The latter is closed and has a rivethole in it. TL:8.2cm. Date:c370AD.

Type 8.

Bolts with circular-sectioned heads and a clear junction with the socket.

Cowbridge.

The site is a bath-building of military type. It has produced one bolthead (Gwent-Glamorgan Archaeological Trust 41/085 091 2705). The head is rather corroded but was probably circular-sectioned. The socket is split and filled with corroded wood. TL:7.6cm. HL:3.2cm. SD (Ext) :1.1cm. Date:Possibly early 2nd century.

Vindolanda.

There is one bolthead from the praetorium (find no.4347), which appears to have a round head. The tip has been flattened by impact, whilst the socket is split for most of its length and still has part of the wooden shaft inside it. TL:8.6cm. HL:4.2cm. SD (Ext) :1cm. Date:100-105AD.

In addition there is an unprovenanced bolthead in Tullie House museum (Acc. no.27-1926.102) which has a circular-sectioned head. TL:6.9cm. HL:2.7cm.

<u>Boltheads of uncertain type.</u>

Doncaster.

A supposed bolthead is illustrated in a short report on this site (Buckland and Magilton 1972 p275). This is socketed, with a pyramidal point. Date:Unknown, therefore Flavian-4th century.

Kirkbride.

Five possible boltheads were found in a group of four furnaces during excavations in 1971 (Bellhouse and Richardson 1975 p85). No details are known of them. Date:Flavian or later.

London.

A socketed missile head, perhaps fired from a ballista was found near the Tower of London, lodged in the right tibia of an ox (Parnell 1985 p65). The head was triangular-sectioned, with some wood still in the socket. Date:Found with material contemporary with the construction of the second river wall. Numismatic evidence dates this to the last decade of the 4th century (Ibid p30).

Portchester.

One possible bolthead has been found here (Cunliffe 1975 fig124 no.170, p233). This had an angular head (of unknown section) with a split socket. Date:late 3rd century or later.

"Leaf-Shaped" Boltheads.

Finally it is necessary to take a brief look at a group of missile heads which have occasionally been identified as boltheads. These are short, with "leaf-shaped" heads and stubby sockets of the "wraparound" type i.e. with the sides folded over but not welded together. This looks a rather insecure method of hafting. The blade shape does not fulfil the criteria needed for ballista bolts (Baatz 1966 p205-6).

A number of these points were found in a 3rd century well at the Roman settlement of Baldock (Stead and Rigby 1986 figs 64-5, no.s 471- 7, p149). These could be a batch of weapons made at the settlement and destined for shipment to a military post. The finds resemble small javelin heads or arrowheads more than they do artillery bolts, so they may even be civilian hunting weapons and nothing to do with the army at all.

Similar projectiles have been found at Maiden Castle in Dorset and were interpreted as arrowheads (Wheeler 1943 fig93 no.s 9-12). Such an interpretation fits in well with the basic shape of these missiles. In order to be effective an artillery bolt has to be pretty well perfectly symmetrical. Most of the finds we have are very poorly preserved, but the boltheads from Vindolanda demonstrate a desire on the part of the maker for standardisation of shape and weight. It is very difficult to produce perfect leaf-shaped points and any irregularity would have a drastic effect on accuracy if such missiles were fired at high speed from an artillery machine (pers. comm. Dr. M. C. Bishop).

Artillery Platforms.

The identification of structures for the support of artillery pieces in several Roman forts and camps in Britain is a matter which has led to considerable debate. That this debate arose was largely due to the energetic excavations carried out by Sir Ian Richmond at many military sites and the sometimes rather optimistic interpretations that he placed on his discoveries (e.g. Richmond 1930 p170-198). That artillery platforms existed cannot be doubted since we have pictorial and literary evidence for them. On Trajan's column ballistae are shown firing from the walls of camps or on log platforms (scenes 165-6, 169). Such platforms could not have been very stable, but any recoil from small bolt-shooters like these was probably not very great. These platforms may have been provided simply to give the machines greater elevation (Cambell 1984 p77). Ammianus Marcellinus speaks of the violent recoil of the onager after it had been fired (XXIII, 4, 5) and he recommends the use of heaps of turf or a pile of sundried bricks if the machine was being used on top of a stone wall. If this was not done then the shock waves could damage the wall. Ammianus does not say whether other types of artillery required such platforms and they do not appear to be mentioned by any other author of the classical period.

In Britain artillery platforms were identified by Sir Ian Richmond at Cawthorn, Chew Green, Haltonchesters, High Rochester and Hod Hill. In no case except at High Rochester was there any epigraphic evidence for the presence of artillery platforms. Haltonchesters and High Rochester have also produced finds of supposed ballista balls. It has also been claimed that the towers of the fort at Burgh castle held artillery (Morris and Hawkes 1948 p68; S. Johnson 1976 p39). Several of these sites lie outside the timescale of this work, but it is necessary to consider here all of the evidence for artillery platforms, even though much of it is highly dubious.

Burgh Castle.

The projecting towers of the Saxon Shore fort - which are pear-shaped and flat-topped may have supported artillery machines. The evidence for this consists solely of a circular hole in the top of each bastion, measuring about 0.6m across (Morris and Hawkes 1948 plate IIIC). The towers are solid and certainly capable of supporting artillery pieces, but we cannot be sure that the holes had anything to do with revolving ballistae/onagri - they may have served some structural purpose, such as supporting a roof. It has also been pointed out (S. Johnson 1976 p39) that the corner towers do not project far enough to allow fire down the line of the walls, something which would allow enemies to gather unmolested at the foot of the walls. No artillery missiles have been found at the site.

Cawthorn Camps.

In 1924 a mound in the SE corner of camp A was investigated and found to consist of "alternate layers of turf and very stony upcast" (Richmond 1932 p33). On top of this was a hollow which Richmond saw as being a "gun-pit" and on the west side were some postholes, allegedly for an ascensus (Ibid p34). This and a further six (unexcavated) mounds in camp B (Ibid p57, fig 11) Richmond unhesitatingly identified as ballistaria and from this deduced that the troops who built the camps must have been legionaries, since at this time (between c80 and 120AD) auxiliaries did not have artillery. The mounds in camp B were semicircular and about eight feet in diameter, whilst that in camp A was c9 metres from front to back and over 10 metres wide. Richmond admitted (Ibid p58) that most of the mounds were not well placed for defensive purposes, but argued that this was because the camps were only built for practice and would never have needed serious defence.

Chew Green.

In the so-called "labour camp" at this site, "the back of the rampart[was]strengthened on the north-west side with rounded platforms occurring at 60 feet west of the north gate and at a point midway between there and the north-west angle" (Richmond and Keeney 1932 p139). These structures were not actually excavated, but it was argued that as the rampart was not very high - about 3'3" - the mounds could hardly be ascensus, but "are more likely to be ballistaria as at Cawthorn" (Richmond and Keeney loc. cit.). As at Cawthorn, the mounds are not very noticeable on the ground.

Greatchesters.

A large heap of rounded stones found at the base of the NW angle tower was used to postulate the presence of a ballista platform (Gibson 1903b p36). There does not seem to have been any structural evidence to back up this theory.

Haltonchesters.

There was a "heavy pitching of stones and clay extending for 30 feet behind the[north]rampart, up to the intervallum road, [which was] altogether too large to have been a tower and is best explained as a ballistarium" (Simpson and Richmond 1932 p167). This feature was not fully excavated and its identification rested mainly on a comparison with the finds at High Rochester and Risingham.

High Rochester.

An area of stones set in clay, found behind the fort's rampart was interpreted by Richmond as the foundations of an artillery platform (Richmond 1936 p170-198; Cambell 1984 p77, 83; Donaldson 1989 p217-8). This measured a little over 7.5 metres from front to back but it was not fully excavated, so the overall size is not known. It was not visible as a mound on the surface. Ballistaria are attested at this site on two inscriptions (R. I. B.1280, 1281). The first of these dates to 220AD and the other to the reign of Severus Alexander (222-235AD). Both record the restoration of a structure from ground level by Cohors I Vardullorum. The abbreviation "Ball" on R. I. B.1280 and "Ballis" on 1281 can hardly be expanded to anything other than ballistarium. However the purpose, location and design of this feature eludes us. We cannot assume that the ballistarium has anything to do with the feature excavated by Richmond. It has even been suggested (Donaldson 1989 p218) that the ballistaria at High Rochester - the two inscriptions may not refer to the same structure - were not platforms at all, but rather sheds for the storing of artillery. Only onagri are known to have needed platforms and there is no safe evidence that such machines were in use at this fort. The stone shot from the site (see page 97) need to be treated with some scepticism. We have epigraphic evidence for the presence of artillery at High Rochester, but it is not really certain what kind of machines were involved and where they were placed.

Hod Hill.

A mound behind the rampart, near to the south gate was identified as an artillery platform. It was about 6.5 metres square and made of chalk rubble. This would hardly have been an appropriate material for resisting the recoil of an artillery machine and although Richmond initially identified this structure as a ballistarium, he later argued that it was a ramp up to the walkway, where the ballista was actually stationed (Richmond 1968 p73). Another mound, north of the east gate was not excavated.

To summarise, virtually all of the evidence for artillery platforms is based on the initial identification of these structures at Cawthorn and the evidence from there can hardly be said to be conclusive. Many of the so-called artillery platforms have not been fully excavated and since it is only the foundations that survive we can only guess at the function and original form of these structures. Wishful thinking and an (understandable) tendancy to argue by analogy have created much spurious evidence for artillery platforms. Only at High Rochester can we be reasonably sure that there were buildings or structures connected with artillery. However we do not know their precise nature, just as we cannot really tell whether the machines were stone-throwers or bolt-firers.

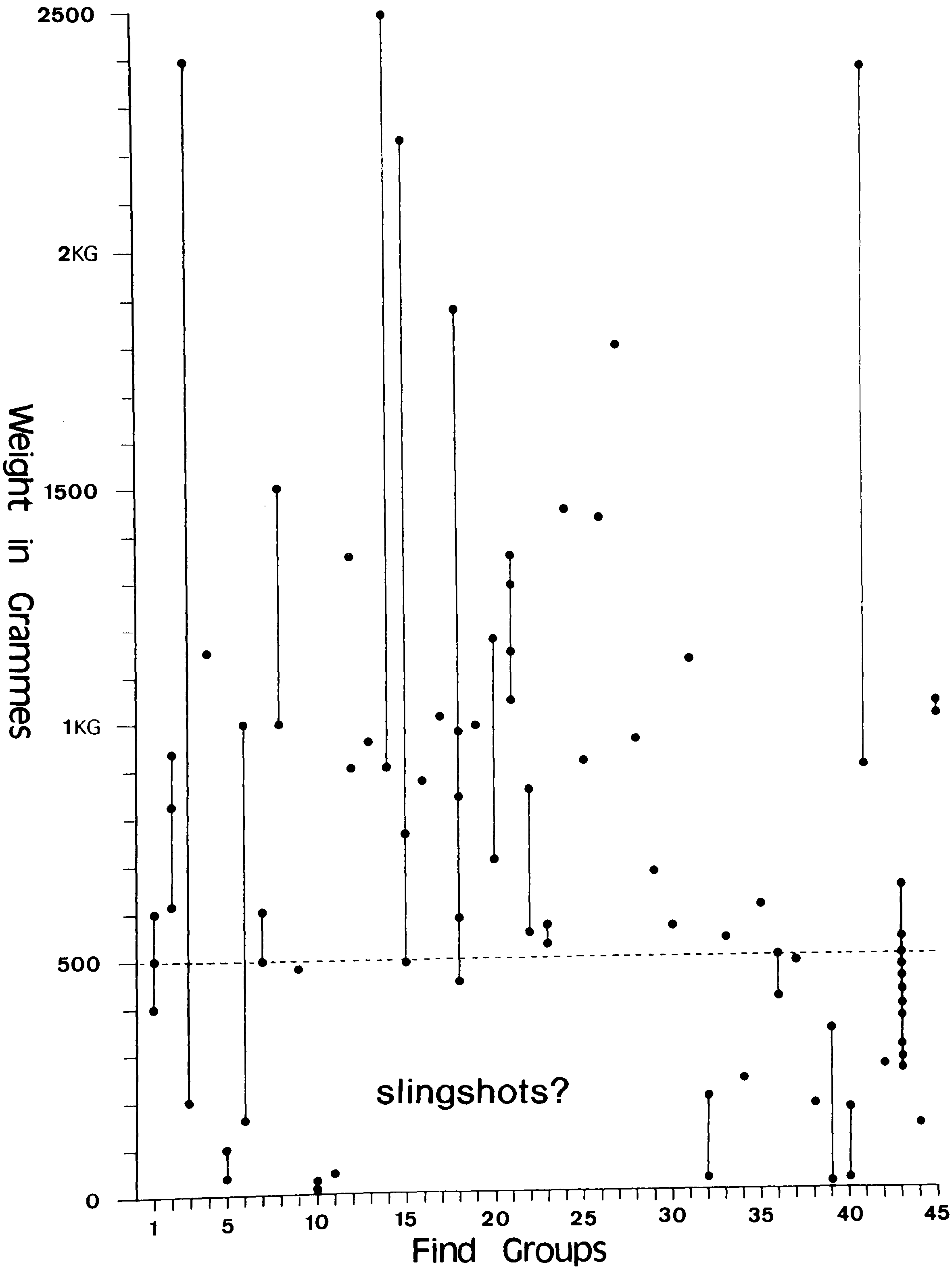
Conclusions.

Ballista Balls.

We must start here with the reasonable premise that if stone-throwing artillery was being used in Britain in the Roman period then one or more distinct types of machine would have been used, built to fairly precise specifications. Each calibre of machine would have fired a missile of a specific weight, but in practice there must have been some leeway in this, up to the tolerance limits of the machine concerned. Problems occur when interpreting the data because some slingshots were also made of stone and hand thrown stones are also known to have been used by the Roman army on occasion. Even if we can distinguish these three groups then we must also allow for the presence of naturally rounded stones which are not artefacts at all. We should be wary of labelling stones as "ballista balls" unless:- a. They were found in definitely Roman military contexts; b. They are of a fairly regular shape. c. Substantial quantities of rounded stones are found together. very few of the finds from Britain can fulfil these preconditions.

Preservation might not seem to be a major problem with such objects but weathering and accidental damage can reduce the size and therefore the weight of stone balls. Obviously incomplete finds have to be ignored when we come to statistical considerations. I have also had to make some subjective judgements on which finds might be natural - usually those stones which are very irregular. Before beginning it is as well to have a refresher of the relevant weight standards. Sixty Attic mina were equal to one talent and one mina is 436.6grams. A Roman pound (libra) equals 327.5grams (Marsden 1969 pxix). Table 11 below gives all available weights for stone missiles from Britain, including those finds which have been identified as slingshots. Figure 29 shows the weights of numbered finds (or groups of finds) in grams relative to one another. A few finds of over 2.5KG have been omitted from the latter and very large groups are shown by their minimum and maximum weights only. The diameters are given in

FIG.29 Weights of Missiles from Britain (in grammes).
N.B. Objects over 2.5kg have been omitted.



centimetres.

Table 11: Roman Stone Missiles from Britain.

SITE	DATE	NO.	DIAM.	GRAMS	MINA	LIBRA
1. Bainbridge	?	3	7-8	400-600	0.9-1.4	1.2-1.8
2. Balmuildy	1922	3	8.2-10	620-930	1.4-2.1	1.9-2.8
3. Bar Hill	1905	110	3.8-14	200-2400	0.4-5.5	0.6-7.3
4. Benwell	?	1	9	1150	2.6	3.5
5. B'wellhaugh	1939-40	2	2.6x3.2	40	0.09	0.1
6. Burnswark	1898	11	5.2-8.5	166-1000	0.4-2.3	0.5-3
7. Burnswark	?	3	?	500-600	1.1-1.4	1.5-1.8
8. Caerleon	1928	2	9-10	1000/1500	2.3/3.4	3/4.6
9. Carlisle	1973	1	7.5	485	1.1	1.5
10. Carlisle	1977	5	2.4-3	10-15?	0.02-0.03	0.03-0.04
11. Carlisle	1977	1	3.5	45?	0.1	0.14
12. Chester	1909	3	?	907-1361	2-3.1	2.8-4.2
13. Chester	1914	1	9.5	c964	2.2	2.9
14. Chester	1924-6	5	?	c907-2495	2-5.7	2.8-7.6
15. Chester	1935	3	8-12.5	496-2225.5	1.1-5	1.5-6.8
16. Chester	1938	1	9.5	878.8	2	2.7
-- Chester	1938	1	16.5	5216	12	16
17. Chester	1939	1	?	1020.6	2.3	3.1
18. Chester	1963-4	5	6-12	450-1876	1-4.3	1.4-5.7
19. Chester	1968	1	12.5	992	2.3	3
20. Chester	1973	2	7.7	710	1.6	2.2
			10.5	1178	2.7	3.6
21. Chester	1973-4	4	9-11	1052-1356	2.4-3.1	3.2-4.1
22. Chester	1975-8	2	7.2	555	1.3	1.7
			9.5	854	1.9	2.6
23. Chester	1981	2	7.3	530	1.2	1.6
			8.1	560	1.3	1.7
24. Chester	1983	1	12	1453	3.3	4.4
25. Chester	?	1	9	921	2	2.8
26. Chester	?	1	11.5	c1430	3.3	4.4
27. Chester	?	1	12.5	1899	4.3	5.8
28. Chester	?	1	10	964	2.2	2.9
29. Chester	?	1	8.7	680	1.5	2.1
30. Chester	?	1	9	567	1.3	1.7
31. Chesters	?	1	8	1134	2.6	3.5
32. Chesters	?	9	1.8-4.5	28-198	0.06-0.45	0.08-0.6
33. Durisdeer	1938	1	8	540	1.2	1.65
34. Earsdon	1973	1	5.4	240	0.5	0.7
-- Halton -chesters	1936	1	?	50KG?	114.5	153
-- High Rochester	1855	1	?	c105KG?	c240	c320
-- High Rochester	1935	2	?	c134.5KG?	308	410
				c145.7KG?	334	445
-- High Rochester	1987	1	30	c26KG?	60	80

SITE	DATE	NO.	DIAM.	GRAMS	MINA	LIBRA
35. Housesteads	?	1	7.5	c608	1.4	1.85
36. Loudon Hill	1948	2	7	415	0.95	1.3
			7.8	500	1.1	1.5
37. Milton	1938	1	6.5x8.2	490	1.1	1.5
38. Milton	1949	1	4.4	180	0.4	0.5
39. Old Kil-patrick	1928	10	2.5-7.5	22-340	0.05-0.8	0.08-0.5
-- Risingham	1935	3	?	40-126.5KG	91-290	122-386
40. S. Shields	?	10	1.7-4.5	28-170	0.06-0.4	0.08-0.5
41. S. Shields	?	8	8-12	907-2381	2-5.4	2.8-7.3
42. Turret 17A	1931	1	5.3	266	0.6	0.8
43. Wallsend	?	15	6.2-8.3	255-652	0.6-1.5	0.8-2
44. Whitemoss	1957	1	4.5x5.5	140	0.3	0.4
45. Unknown Prov.	?	2	8.3	1020.5	2.3	3.1
			8.5	1033	2.4	3.15

NOTE: The numbers in the left hand column refer to the numbers used on fig 29. Incomplete and doubtful specimens have been omitted from this list, as have finds for which no weights are available. Included here are objects identified as sling shots and ballista balls.

Not surprisingly perhaps there is a fairly continuous spread, although there is a noticeable thinning out towards the upper end of the scale. The arbitrary identifications of "slingshots" and "ballista balls" are seen to be unhelpful - thus the "slingshots" from Bar Hill run from 200-2400 grams and the "ballista balls" from Burnswark from 166 to 1000 grams. In trying to isolate the slingshots one might use as a rough guide the statement of Diodorus Siculus (XIX, 109) that Balearic slingers used stones weighing one mina (436.6g). Perhaps we should identify groups of stones of this weight or less as being sling shots? Where there is some overlap, but the majority of the group fall above or below the line then we might be justified in assigning the whole group a particular function. One ought to allow some leeway with the slingshot category - up to c500 grams seems reasonable. This would take in finds from Bainbridge, Bothwellhaugh, Burnswark, Carlisle, Chester, Chesters, Earsdon, Loudon Hill, Milton, Old Kilpatrick, Wallsend and Whitemoss, many of them previously identified as ballista balls. This is only a tentative suggestion but it is at least as valid as more subjective approaches.

Comparatively few finds fall outside the range 500-1500 grams, that is to say 1-3.4 mina. All of these stones are minute when compared with the size of missiles - 60 mina - mentioned by Josephus (De Bell. Jud. V, 269-270). Vitruvius's list of weights for artillery (De Arch. X, 11, 3) only starts at 4 Roman pounds (about 3 mina) and goes up to around 270 mina. One thing one can certainly say about the stone missiles from Britain is that apart from a very few examples they are very small indeed. Even leaving aside those which are too minute to be anything other than slingshots, many of the others could be comfortably thrown with one hand. It would seem that if they existed at all, stone-throwing machines in Britain were of modest dimensions - or perhaps several shot were fired together in a cluster? A similar picture is obtained by looking at the finds from a single site, namely Chester (table 12, fig 30). Weights were obtained for 40 shot from this site. There are published references to some additional finds, but these could not be positively identified. They may be among those finds listed here whose exact provenances are unknown.

Table 12: "Ballista balls" from Chester.

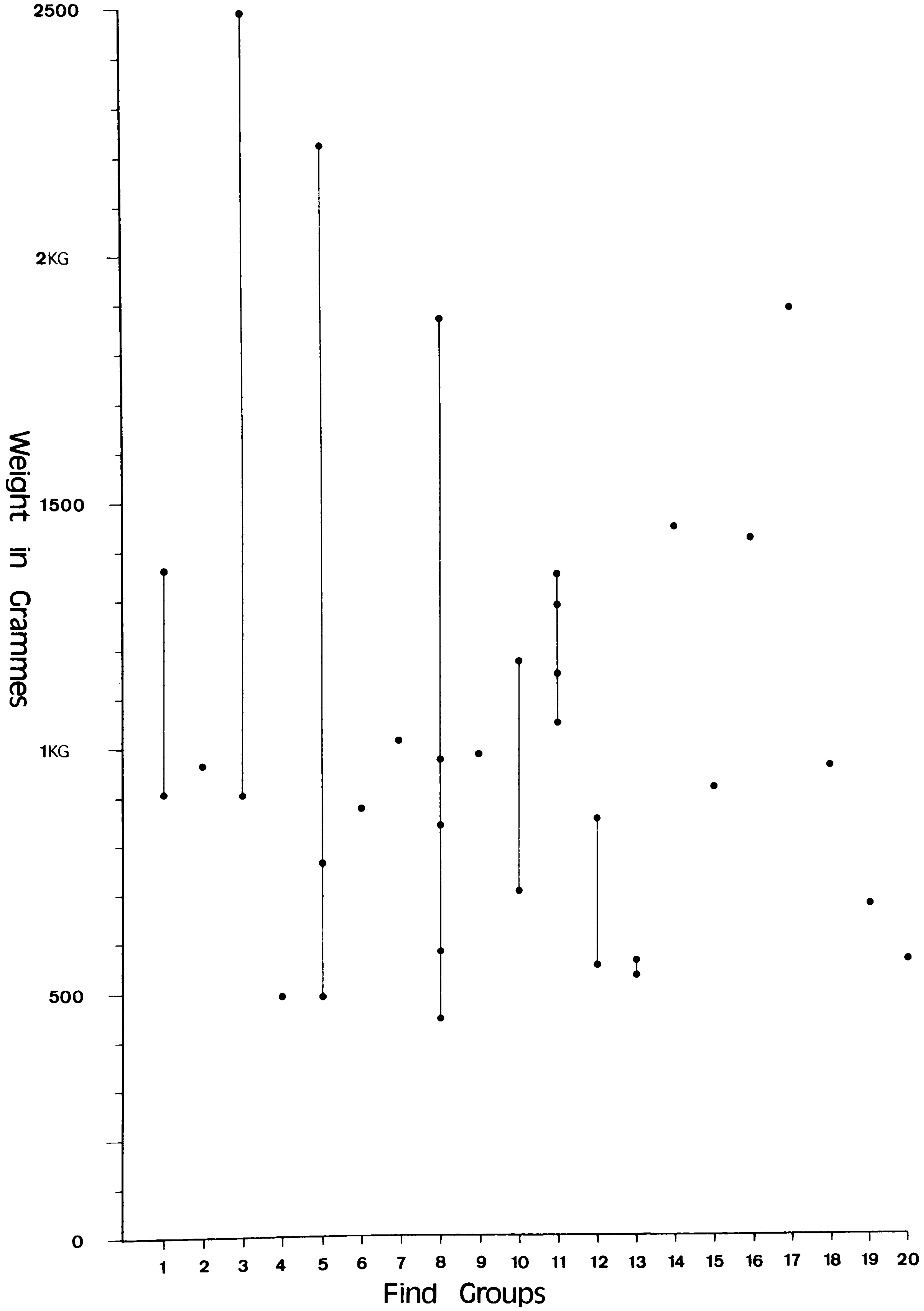
SITE	DATE	NO.	DIAM.	GRAMS	MINA	LIBRA
1. Hunter St.	1909	3	?	c907-1361	2-3.1	2.8-4.2
2. Eastgate St	1914	1	c9.5	c964	2.2	2.9
3. Deanery Fld	1924-6	5	?	c907-2495	2-5.7	2.8-7.6
4. D'nery Fld?	1928	1	c8	496	1.1	1.5
5. Deanery Fld	1935	3	8-12.5	c496-2225	1.1-5	1.5-6.8
6. Foregate St	1938	1	c9.5	879	2	2.7
7. Princess St	1939	1	?	1020.6	2.3	3.1
8. Crook St.	1963-4	5	c6-12	450-1876	1-4.3	1.4-5.7
9. Hamilton Hs	1968	1	12.5	992	2.3	3
10. Goss Street	1973	2	7.7-10.5	710-1178	1.6-2.7	2.2-3.6
11. Crook St.	1973-4	4	9-11	1052-1356	2.4-3.1	3.2-4.1
12. Abbey Green	1975-8	2	7.2-9.5	555-854	1.3-1.9	1.7-2.6
13. Hunter St. School	1981	2	7.3-8.1	530-560	1.2-1.3	1.6-1.7
14. "CHE/EW"	1983	1	12	1453	3.3	4.4
15. ?	?	1	9	921	2	2.8
16. ?	?	1	11.5	c1430	3.3	4.4
17. ?	?	1	12.5	1899	4.3	5.8
18. ?	?	1	10	964	2.2	2.9
19. ?	?	1	8.7	680	1.5	2.1
20. ?	?	1	9	567	1.3	1.7

NOTE: All fragmentary and doubtful specimens have been omitted. There is also one stone ball from Newgate Street (1938) which weighs 5216 grams and one from an unknown excavation which is 2693 grams.

As with the wider sample the majority of finds from Chester fall in the range 500-1500 grams, with a little spread beyond this. The concentration is at its thickest between c800 and 1200 grams (c2-3 mina) but little can read into this. Even within a small group there is often a broad band of weights - there seems to be little evidence for use of a calibration formula here.

Very few of the stone shot from Britain exceed five mina (6.6 Roman pounds). There is one of c12 mina from Chester and one of about one talent from High Rochester. There is then a very large gap before we come to a stone ball from Haltonchesters said to weigh 50KG (a little under two talents). This weight has not been checked however. Beyond this there is a small group of immense shot from

FIG.30 Weights of Ballista Balls from Chester (in grammes).



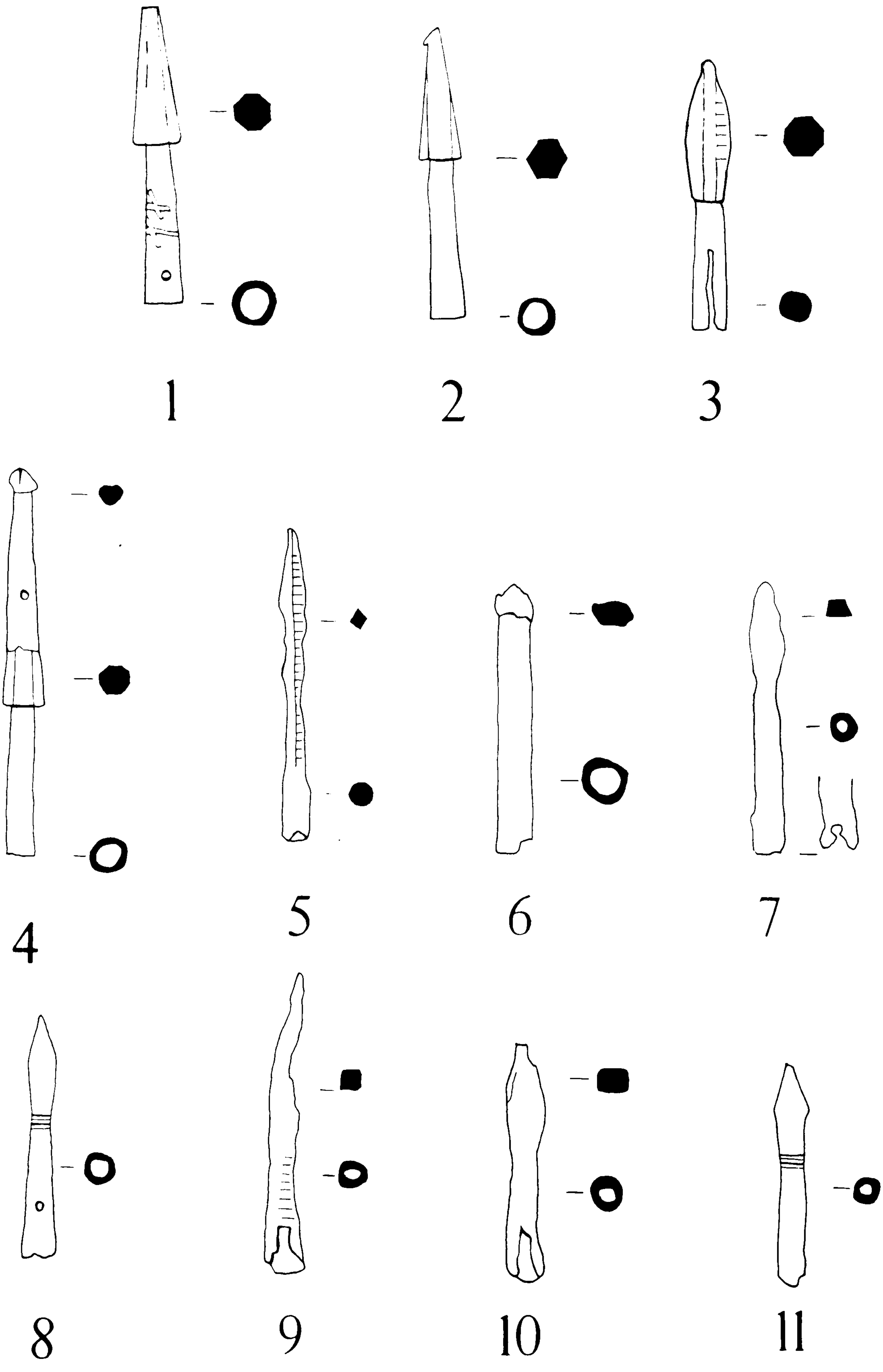


FIG 31: Ballista Bolts (all at 1:2)
1. Vindolanda 3742 2. Vindolanda 3754 3. York
4. Vindolanda 3741 5. Richborough 1856 6. Vindolanda 3447
7. Housesteads 8. Wallsend 9. Housesteads
10. MC.35 11: Housesteads

High Rochester and Risingham, perhaps weighing from 90-335 mina. These are so large that it is difficult to envisage an artillery machine capable of firing them, nor is it easy to see a need for such weapons in Britain, where Rome's enemies were light, mobile barbarians, lacking proper fortifications or siege equipment against which stone-throwers could profitably be employed. This is not to say that large stone-throwers, even onagri may have been used in Britain, for it does not necessarily follow that because something was not military good sense it was therefore not done. It is possible that some of the stone missiles from Britain may indeed be ballista balls - especially those from c500-2500 grams, but we lack positive proof. This remains perhaps the most enigmatic and intractable class of finds found on Roman military sites.

2. Ballista Bolts.

Several categories of iron points may be identified as catapult boltheads with greater or lesser certainty. Of these types 1-3 seem to me to be the most convincing. With the other types alternative identifications as other types of missile head, spearbutts or even tool heads cannot be ruled out. As with the stone balls there is a lack of associations with artillery platforms or parts of the machines themselves. More finds of the latter are urgently needed in this country before a full study of the artillery in the province can be attempted. The finds from Old Penrith and Vindolanda suggest that both the weight and the length of boltheads were standardised - at least for a single unit. This would have the obvious advantage of assuring reasonably consistent performance for the artillery. We may hope in future for more well-preserved finds, perhaps even with the wooden shafts intact, from waterlogged deposits.

3. The Provision of Artillery.

The distribution of the stone shot and more importantly the iron boltheads is very persuasive for the argument that auxiliary troops were sometimes provided with artillery. The finds at Vindolanda, well-preserved and well-stratified point to this taking place early in the 2nd century. As we have already seen there is little evidence for legionaries at this site, once we abandon preconceptions about "legionary" equipment. In such a situation it is impossible to be dogmatic but one should at least admit the possibility of some auxiliaries being equipped with artillery before the 3rd century. There is a literary passage which seems to support such a view. This comes in Arrian's "Tactica" which dates to the Hadrianic period. Talking about cavalry in training (43.1) he remarks that "they practice various methods of throwing either light darts or even missiles (these being fired not from a bow but from a machine)." This comment is more than a little suprising, but it seems illogical to try and interpret this passage as referring to anything other than artillery. It remains to examine the arguments against auxiliaries using artillery and to assess their validity.

When it is conceded at all that auxiliaries might have used artillery, it is generally argued that this did not take place before the 3rd century AD (Baatz 1966 p194; Cambell 1985 p81). Not only does this seem to contradict the archaeological evidence, but on a theoretical basis also the arguments put foward seem to me flawed and unconvincing. Luttwak stated (Luttwak 1976 p45) that to have armed auxiliaries with artillery would have intefered with the principle of "escalation dominance", i.e. that the legions should be seen to be superior to other elements of the army. This is a 20th century viewpoint and there is no evidence that the Romans thought of the army in this way. In the course of the Principate the role of auxiliaries extended ever wider. Not only did they garrison forts and police frontiers, but they were also an important element on the battlefield. On one occasion it is specifically stated (Tacitus, The Agricola 35) that to use auxiliaries to win a battle was to save the lives of citizen troops. It is not known how widely this rather cynical attitude was held, but given that the legions were often stationed in bases many miles to the rear of the frontiers, the auxiliaries were more likely to see action on a regular basis. At least in the non-specialist units this must have led to a blurring in the differences between legionary and auxiliary equipment - a theory which would account for the finds of "legionary" arms and armour on auxiliary sites.

A frequent explanation for the discovery of artillery projectiles on auxiliary sites is that the machines were being manned by legionary detachments. This is of course possible but we do not have any proof that this was the case. Anyway, there is a danger of a circular argument here:- Auxiliaries did not have artillery, therefore the machines must have been operated by specialists, hence any new finds can be conveniently explained away and therefore ...... auxiliaries did not have artillery. This line of reasoning seems to me to be rather blinkered. Just how many auxiliary sites have to produce finds of artillery missiles before the old argument becomes untenable?

The assertion that auxiliaries could not use artillery seems to rest largely on the supposed complex nature of the machines and the inability of non-specialists to build, maintain and operate them. But it is clear, for example from one of the Vindolanda writing tablets (Bowman and Thomas 1983 p77-8) that auxiliary units had skilled workers in their ranks, just like the legions. This tablet, dating to c100AD, records that on a single day 343 men of a unit were engaged in work in the fabrica. This included 12 shoemakers, 18 builders at the bath-house and plasterers. It is not at all unlikely that some men would have been engaged in the repair/production of weapons and as we have seen (see pages 255,111) weapons - including ballista bolts - have been found in the fabrica in recent excavations.

It is true that thus far we have no epigraphic evidence for auxiliary artillery makers, but chance plays a large part in the discovery of many Roman inscriptions and written records. If 20th century archaeologists can build adequate replicas of Roman artillery, armed only with some technical treatises, a few inadequate illustrations and a handful of very poorly preserved finds, then it is hard to credit that experienced auxiliary soldiers could not have done so, perhaps initially with some aid from legionary technicians. We are not dealing with barbarians here but with trained troops in the forefront of Roman military strategy. They may have needed artillery on occasions and one cannot state categorically that they did not have it. The finds from many sites in Britain discussed in this chapter seem to indicate that auxiliaries sometimes did use artillery and that this occurred before the 3rd century AD. [The recent discovery of a ballista washer at Elginhaugh lends further support to this argument].

4. Tactical Use.

Allowing that at least some of the stone balls and iron projectile heads from Britain come from artillery, we must look at the likely ways in which artillery was employed in the province. In the conquest period it was no doubt very useful when deployed against native British hillforts - as shown by the finds from Maiden Castle. Thereafter it is difficult to see a very real need for artillery in the province. This is especially true in the 1st-3rd centuries AD, when Roman troops did not (on the whole) tend to fight from behind fortifications. In the field, light bolt-shooters might usefully be employed, but Rome's opponents in Britain were essentially light-armed and mobile infantry, fighting in fairly dispersed order - hardly the ideal target for artillery. Also there were comparatively few pitched battles, with skirmishes and small scale raids probably predominating. The usefulness of artillery in the field in Britain must have been fairly limited. As for stone - throwers, it is difficult to see them having any value, for there were no fortifications to smash and no substantial bodies of formed enemy troops to molest.

What then of the supposed value of artillery in defending forts or towns against enemy attack? As noted above this does not really apply for much of the period under discussion, as Roman troops would generally try to fight in the open unless heavily outnumbered. Still, there do seem to be some artillery projectiles from 2nd/3rd century forts. In extreme circumstances the garrison of a fort might have to defend the walls and artillery might then have a limited tactical value, particularly for picking off individuals, especially leaders. However there are severe problems involved here. Bolt-shooting artillery would not be able to depress sufficiently to cover the base of the walls, thus leaving a blind spot in which the enemy could gather. It might be supposed that a fort would have an artillery piece in every tower, which would then allow interlocking fields of fire along the walls - assuming that the towers projected far enough. Such a lavish provision of artillery seems unreasonable in most cases given the difficulty barbarians traditionally had in taking fortifications. It is more likely that forts would have sufficient artillery to defend the gates - the most vulnerable part of any wall circuit. Even then not all forts are likely to have had artillery and its provision may have depended on the site's importance or supposed vulnerability to attack. It may be noted parenthically that stone-throwing artillery would have been even less useful. It was capable of firing only in a high arc and therefore could not cover ground close to walls. Also it was not very accurate. Moreover in Britain there would presumably have been no enemy siege equipment to smash. One other problem is the question of how and where the artillery was stored. If it remained on the ramparts or in towers then it would have to be protected or the torsion bundles would be exposed to the elements with disastrous consequences for the effectiveness of the weapons. Also to be at all useful the artillery pieces would have to be left in working order for it would not be very practical in the event of a sudden attack to have to go round "winding up" all the sinew bundles. As with composite bows (see page 14) the sinew in an artillery machine would be adversely affected by being permanently in tension. All of these problems it may be noted apply equally to suggestions that artillery was mounted in the turrets/milecastles of Hadrian's Wall. There is in any case no evidence that the wall was used as a fighting platform.

It is supposedly in the later 3rd/4th centuries that artillery came into its own. The provision of projecting towers on many fort and town walls, combined with a more defensively minded attitude lead naturally to the assumption that artillery was commonly being used to defend fortifications. In fact mounting artillery in towers so that they could fire out of windows does not make paricularly good sense as the field of fire would be very restricted. Archers/crossbowmen could achieve just as good effects and would not need the care and maintenance required by artillery. There is no good evidence that the provision of projecting towers was directly connected with the use of artillery. Some towers may have housed artillery but not necessarily all of them.

To sum up, after the conquest period, it would appear that artillery would have had very little role to play in Britain. Finds from military sites do suggest that it continued to be used. Perhaps its value was largely psychological - deterring barbarian attacks by its shock value and long range. Of course in looking for a tactical role for artillery we do tend to assume that the Roman military command would have appreciated all of the problems outlined above. Perhaps artillery was used in situations where it was of no real value. Throughout history commanders have not infrequently clung to outmoded tactics and equipment and it would be wrong to presume that things were any different in the Roman period.*27

NOTES

*1 So runs Josephus's colourful and probably rather exaggerated account of the power of Roman torsion artillery. The distance quoted for the flying head - three stades - may be an error. Three plethra (c100 yards) might have been intended (Marsden 1969 p96).

*2 Diodorus Siculus (XIV, 41.4; 42.1) credits the invention of non-torsion artillery to artisans working for Dionysius I of Syracuse in 399BC. It is likely that these machines were gastraphetae (Marsden 1969 p49).

*3 There is some very circumstantial evidence that torsion artillery was invented by Phillip II of Macedon between 353 and 341BC (Marsden 1969 p58).

*4 Torsion artillery was also very sensitive to weather conditions and humidity, as these would affect the tension of the sinews (Lindsay 1974 p308).

*5 One dactyl is equivalent to 19.3mm and one mina to 436.6 grams. There were 60 mina to a talent.

*6 Marsden has suggested (Ibid p204) that Vitruvius's measurements should have been in unciae rather than in digits. If this were so then there would be very little difference between these figures and the Greek formulae. Baatz (1978 p16, note 57) rejects this suggestion.

*7 Vegetius (Ep. rei Mil. IV, 22) clearly knew that ballistae were not made in a random fashion:- "The ballista is bent with cords of sinew:the longer its arms, that is, the larger the engine itself is, the further it throws the darts; if constructed with proper proportions and served by skilful men acquainted with its powers it penetrates whatever it strikes." This passage implies the continuing use of calibration formulae, although not necessarily the ones originally used by the Greeks.

*8 Both offensively (Josephus De Bell. Jud. III, 166-7) and defensively (Ammianus Marcellinus XIX 5, 6; 7, 7; Procopius V, xxi, 14-19), the latter particularly during the later empire.

*9 This had occurred occasionally in the 1st century as at the battle of Cremona (Tac. Hist. III, 23) and during Germanicus's campaigns of 14-16AD (Tac. Ann. I, 56).

*10 Vegetius recommended practice with the bow at a range of 600 feet (183 metres). Battlefield range would have been somewhat greater - c250 yards has been suggested (Collingwood and Richmond 1969 p306). So in theory

Belisarius's artillery could achieve a range of c500 yards.

*11 This comment applies equally to modern replicas of Ancient artillery machines, such as those made by Payne-Galloway, Schramm and Marsden. The latter's three-span catapult fired bolts over 300 yards (Marsden 1969 p86, note 3). Such tests can only give an approximate idea of the capabilities of such machines because the literary/archaeological evidence as to the constructional details is incomplete.

*12 The tragula was "a spear fitted with a throwing strap, used as a hunting and military weapon." (O. L. D. p1958). A tragularius was "a soldier who placed and levelled the tragulae to be discharged from an engine." (O. L. D. loc. cit.). Other references to the tragula (Livy XXIV, 42, 2; Caesar Bell. Gall. V, 48; Silius Italicus Punica III, 318) show that it was in origin a hand-thrown weapon, so either it underwent some changes or Vegetius is mistaken in his terminology.

*13 Eleven iron points from a 4th century villa at Voerendaal, Holland were at first identified as crossbow boltheads (Willems 1989 p150-2). They were tanged and square in section, weighing between 32 and 57 grams. No actual remains of a crossbow were found and it is not altogether clear if the burial was of a soldier or a civilian. However the finds have recently been re-interpreted as rake prongs (Willems 1990 p22). Although their presence in a grave is rather odd, the explanation is at least as convincing as the former one and casts doubt on the identification of other tanged objects as artillery projectiles.

*14 The range of a 15th century steel crossbow has been estimated at about 500 yards - twice the range of a longbow and with greater penetrative power (Vale 1981 p113). Roman crossbows could not have been so powerful, but were probably still quite effective. The disadvantage of such weapons was their slow rate of fire.

*15 Information on the weights was supplied by Dr. Lawrence Keppie of the Hunterian museum.

*16 The measurements are taken from the unpublished site report. These and some subsequent figures give both the minimum and maximum diameter for each shot.

*17 Information from Miss Georgina Plowright, Curator of the Hadrian's Wall Museums. The figure is an approximate one.

*18 It may be preumed that all boltheads were forged with hammer and anvil, there being no evidence for casting in any case.

*19 Information from Mr P. J. Casey.

*20 Information from Miss M. Darling. Some finds may be residual.

*21 Access to the finds and the unpublished report was provided by the excavator Mr P. Austen.

*22 Assistance with the material from Pevensey was generously provided by Mr. Malcolm Lyne.

*23 However the early military occupation at Richborough seems to have been fairly brief, so it is likely that the bulk of the finds date to the 3rd and 4th centuries.

*24 The fort is now considered to have been occupied from c90AD to at least the mid 4th century, with a gap from c120 to c163AD. (see appendix 1).

*25 My thanks to Mr R. Birley for access to these finds prior to publication.

*26 I owe this suggestion to Mr. A. D. Hooley of the York Archaeological Trust.

*27 Some obvious examples are the existence of cavalry in the Polish army up to 1939 and the use of biplane aircraft like the Gladiator and the Swordfish by the British airforce in World War II.

General Conclusions.

Much has already been said in the closing sections of chapters III-X with regard to the evolution of individual weapon types, their dating, tactical usage etc. Some common threads can be seen running right through the whole body of the material and these are discussed here.

Firstly there is the practicality, even crudity of much of the Roman equipment of this period. In contrast to the situation in the 1st century decorative fittings if present, are generally kept to a minimum. The simplicity of most weapon forms is striking. Thus for instance the bulk of spearheads can be categorised as "leaf-shaped", usually lacking barbs or mid-ribs. Spearbutts are almost invariably of one extremely basic form. Slingshots lack the inscriptions which were present in an earlier period. Swords are largely uniform by the end of the 2nd century and the common form is one of infinite simplicity, lacking any of the finesse of the earlier gladius. Even decorative fittings like chapes are as a rule roughly made. The highly decorated, largely ornamental pugio disappears at the start of our period. This is an army, whose equipment, by and large is functional above all else. The pattern-welded swords are an exception to this, but their use was probably not very widespread.

The distinction between legionaries and auxiliaries, fairly clear-cut in the 1st century, blurs very rapidly thereafter. The gladius has virtually disappeared by the end of the 2nd century. Finds of pila are scarce and even in the 2nd century this weapon may have been declining in importance. Supposed "legionary" equipment - pila and artillery weapons - can be found on a number of auxiliary sites. Legionary equipment seems to have undergone its own transformation. There appears to be evidence for the use of ordinary spears by some legionaries, even in the period when the pilum was still in existence. Missile weapons like the sling and the bow also seem to have had a place in the legionary arsenal. By the early 3rd century it is likely that the equipment of the legions and that of many auxiliary units was quite similar. This implies that in terms of their tactical roles also, the two categories of troops had moved closer together.

On the other hand it can be seen that many types of weapons remained essentially unchanged throughout the period - trilobe tanged arrowheads, slingshots, pelta chapes, "leaf-shaped spears" etc. This makes the dating of weapons by their form alone a very dangerous practice. There was clearly a great deal of conservatism in the Roman army. Equipment changed but rarely and when it did change there were probably practical reasons for this.

The limits of the technology of the day meant that true standardisation as we would understand it was not possible. There is no evidence for any high level control over the precise forms of weapons. Certain "types" of equipment were prevalent in certain periods. In the 1st and 2nd centuries legions were mostly equipped with pila and gladii because their tactical role dictated the style of their equipment. However this did not mean that all such weapons were made to precisely the same length, width etc. Likewise spear shapes had a great deal more flexibility than modern typologies might suggest. Typologies are only really meaningful for objects which had a fairly consistent form e.g most scabbard fittings. The ethnically diverse nature of the army and the frequent re-deployment of troops must have been responsible for much of the variations in military equipment. New troops arriving in a province would bring in their own preferences and these might in time spread to other units. Our dating evidence is seldom good enough to track this kind of process closely. We may surmise that the dolphin form of scabbard runner arrived in Britain in the Hadrianic period, perhaps brought over by Legio VI Victrix, but this is only conjecture. The twin problems of poor dating evidence and lack of precision in our knowledge of garrison movements mean we cannot unfortunately trace units by their equipment.

If we exclude decorative fittings, it is only a matter of commonsense that the changes in weaponry that we can observe in this period came about for practical reasons, rather than as a result of "fashion". Generally speaking, changes in weaponry are linked to changes in tactics or as a result of encountering new opponents. There is also a clear relationship between improvements in offensive killing power and changes in defensive protection. This remains a fundamental truth whether we are dealing with Ancient arms and armour or the development of tanks and anti-tank guns in our own century. The problem is that our evidence is too imprecise for the Roman period to show how and when exactly these changes came about. The case of the weighted pila (see page 181) has already been cited. Likewise the upturn in the numbers of barbed spears in the 3rd/4th centuries may well have come about because Rome was fighting (and recruiting?) peoples using such weapons. Sadly, we know too little about Roman battle tactics and even less about that of their opponents, so we cannot in most cases follow the process of action and reaction which must have occurred.

Without a doubt there was a very fundamental change in the equipment of the Roman army in the 2nd/3rd centuries, which led to a force much less rigidly divided into categories as the army of the 1st century had been. Nowhere than in the field of weaponry is the adaptive nature of the Roman army better illustrated. The picture that emerges from the archaeological material is one of a flexible, well-armed force, with a great diversity of equipment.

Throughout this work I have tried to put forward possible solutions to many of the problems surrounding Roman weaponry. Much more will I am sure be done in the future, for this is a very challenging and stimulating area for research. New archaeological material is emerging all the time, much of it very well preserved. It may also be hoped that more epigraphic evidence will come to light, to improve our knowledge of the garrisons of Roman forts in Britain. In the future therefore, with more reliable data we might be able to identify units by their equipment. The typologies proposed may need some refinement as our database grows, but it is hoped that the schemes used here are basically sound. Another area which clearly needs much more work is the range and performance of Roman weapons. In the absence of much meaningful information from the Ancient texts, our best angle of approach is to build and test replicas, using only techniques and tools which are likely to have been available to Roman armourers. This has been done for artillery machines on several occasions and most recently for lead-weighted darts, but a comprehensive study would be of great value. In particular, the effectiveness of bows and slings might be examined. Finally, detailed studies of the weaponry from other provinces could be undertaken, with the ultimate aim of providing an overview across the whole empire of the diversity of Roman arms.

Appendix 1 : Chronologies and known Garrisons of Sites.

Abergavenny (Gwent).

Most of the finds from here belong to the period c75-150 AD, but there is some Claudian pottery, hinting at an early base (Nash-Williams 1969 p45-6).

Alchester (Oxfordshire).

The Roman occupation began in the Claudian period, perhaps with a fort. The town was created c80AD and deserted after the 5th century. (Iliffe 1932 p35-67; Stillwell 1976 p34).

Aldborough (Yorkshire).

The Roman town of Isurium was situated here. There may have been a Flavian fort in the area. Recent finds of military equipment, including 3rd century optio badges suggest that there may have been a military presence here in the late Roman period (Stillwell 1976 p417; A. Johnson map 4; information from Dr. M. C. Bishop).

Ambleside (Westmoreland).

The initial fort probably dates to the late Flavian period. The site was perhaps reoccupied c160AD and abandoned after c367AD, since the fort is not listed in the Notitia. Garrison:unknown. Area:under 2 acres. (Collingwood 1915 p3-62; 1916 p57-90; 1921 p1-42; M. J. Jones 1975 p126-7; Breeze and Dobson 1984 p126).

Ardoch (Tayside).

The Flavian fort perhaps held a legionary cohort and Cohors I Hispanorum. The latter unit is known to have been here in the Antonine phase. Area:6.2 acres (Antonine I). (Christison et al 1897-8 p400; Collingwood 1936; Maxfield 1980 p60; Hanson and Maxwell 1983; Breeze and Dobson 1984 p122).

Atworth (Wiltshire).

A villa site, perhaps first occupied in the early 3rd century and possibly continuing to be used down to the late 4th or early 5th century. (Mellor and Goodchild 1942 p89).

Bainbridge (North Yorks.).

The initial fort was Agricolan, succeeded by a late Flavian/Trajanic base, probably held by a quingenary cohort. The site was unoccupied from c120 to the mid 150's when a new fort was built, probably with the same type of garrison as before. There was occupation down to the late 4th century or beyond, the Notitia giving the garrison as being Cohors VI Nerviorum (OC. XL, 56), assuming that Virosido is to be equated with Bainbridge. Area:c2.5 acres. (Hartley 1959-62 p116-119; M. J. Jones 1975 p128; Breeze and Dobson 1984 p126, 133, 207).

Baldock (North Herts.).

The site consists of a Romano-British settlement with associated temples and cemeteries. The site had pre-Roman origins, the Roman phase beginning after c50AD and probably extending into the 4th century (Stead and Rigby 1986).

Balmuildy (Strathclyde).

This Antonine wall fort was built between 139 and 142AD and is about 4.3 acres in area. The first garrison may have been part of a milliary cohort, whilst in the second phase the fort may have housed a cohors quingenaria or a detachment of a quingenary equitate cohort. (Hanson and Maxwell 1983 p87, 112, 154, 157; Breeze and Dobson 1984).

Bar Hill (Strathclyde).

The Antonine wall fort was preceded by a Flavian fortlet. The first Antonine fort was 3.2 acres in area and was garrisoned by Cohors I Hamiorum. In the second phase it was 3.6 acres and held the Cohors I Baetasiorum. (Robertson et al 1975; Hanson and Maxwell 1983 p154-5; Breeze and Dobson 1984 p97).

Bath (Avon).

The Roman town and bathing/religious complex was founded around 75AD and reached its peak in the 4th century. (Stillwell 1976 p78-9; Cunliffe 1985, 1988).

Bearsden (Strathclyde).

This fortlet on the Antonine wall was too small (2.77 acres) to hold a complete unit and it is suggested that it was garrisoned by cavalry from Cohors IV Gallorum Equitata from nearby Castlehill. It was only occupied in the first Antonine phase. (Goodburn 1976 p302-3; 1977 p365; 1978 p413; Breeze and Dobson 1984 p21-5).

Beckfoot (Cumbria).

A fort on the Cumberland coast, built in the 120's AD and occupied into the 4th century. Area:2.5 acres. Cohors II Pannoniorum may have been the 2nd century garrison - it was a quingenary part-mounted unit - whilst in the 3rd century it may haver been a 500 man infantry cohort. The fort is not mentioned in the Notitia. (Collingwood 1936 p76-84; Potter 1979 p46; Breeze and Dobson 1984 p256).

Benwell (Tyne and Wear).

A Hadrian's wall fort, 5.6 acres in extent. The Hadrianic garrison may have been a quingenary Ala. Under Marcus Aurelius the Cohors I Vangionum milliaria equitata was based here and in the 3rd/4th centuries the Ala I Asturum was in residence. The latter unit is listed in the Notitia. (Birley 1961 p259; Breeze and Dobson 1984).

Bewcastle (Cumbria).

An outpost of Hadrian's wall, 6 acres in area, built between 124-130AD. The chronology proposed by Richmond has been greatly modified by recent excavations, it now being suggested that the fort was not occupied from c140 to c163 and was given up by Constantine around 312/314AD. The Hadrianic garrison was Cohors I Dacorum and in the later 2nd century it was Cohors I Nervana Germanorum milliaria equitata. A cohors milliaria was here in the 3rd century. The Venatores Bannienses may also have been based here at some point. (Richmond et al 1938; Welsby 1982 p10, 32, 34, 92, 103; Breeze and Dobson 1984 p140, 226, 247; information from Mr. Paul Austen).

Binchester (County Durham).

The first fort may have been built c80AD. The later base was perhaps occupied from the reign of Hadrian down to the time of Valentinian I with a break in the Antonine period. The Ala Hispanorum Vettonum was in garrison by the Severan period. If Binchester was the Morbio of the Notitia, then the Equites cataphractarii were based here in the late 4th century. (Dobson and Jarrett 1958 p117, 124; Jarrett 1969 p17; Breeze and Dobson 1984 p215).

Birdoswald (Cumbria).

A Hadrian's wall fort, 5.33 acres in size. It was occupied down to the late 4th century as shown by an entry in the Notitia and there may have been post-Roman activity here. The initial garrison was the Cohors I Tungrorum milliaria peditata, the garrison in the Antonine phase not being known. Cohors I Aelia Dacorum milliaria peditata was here by 205/7AD and according to the Notitia was still here in the late 4th century. The Cohors I Thracum, the Venatores Bannienses and a Frisian numerus have all been suggested as garrisons for this fort, but the evidence is inconclusive. (Welsby 1982 p32, 34; Breeze and Dobson 1984 p48, 140, 245).

Birrens (Dumfries and Galloway).

Probably built before 128AD as an outpost of Hadrian's wall. Rebuilt after destruction (possibly accidental) in 158AD, the fort was held down to the mid 180's. The Cohors I Nervana Germanorum milliaria equitata may have been the initial garrison, but by 158 the unit based here was Cohors II Tungrorum milliaria equitata. Legion VI Victrix is also attested here but it may simply have been engaged in building work. The fort increased in size from 3.3 acres to 4.07 acres in the Antonine phase. There was also a Flavian fort here. (Christison et al 1895-6 p161; M. J. Jones 1975 p129-130; Robertson 1963 p27-8; 1975 p19, 74-8; Breeze and Dobson 1984 p137, 142, 146, 248).

Bothwellhaugh (Strathclyde).

The fort was about 3.5 acres in area and was perhaps garrisoned by a cohors quingenaria equitata. It dates to the Antonine period. (Wilson 1968 p178; Hartley 1972 p11; Keppie 1979 p5-6).

Bowness-on-Solway (Cumbria).

This Hadrian's wall fort was about 7 acres in extent. The pottery sequence runs down to the late 4th century and a coin of Gratian dating to 367-375AD has been found here. The fort is not mentioned in the Notitia however. The Hadrianic garrison may have been a cohors milliaria equitata. It is also likely that such a unit was stationed here in the mid 3rd century, as two inscriptions of 251-3AD (R. I. B.2057-8) mention a Tribunus Cohortis. (Potter 1979 p42-6, 348; Breeze and Dobson 1984 p48, 140, 246).

Brancaster (Norfolk).

There may have beena fort here in the later 2nd century, contemporary with the civil settlement. The Saxon Shore fort was built in the 2nd quarter of the 3rd century. The Equites Dalmatae Branodunenses are listed as the garrison in the Notitia, but stamped tiles of Cohors I Aquitanorum have also been found here. This unit may have been an earlier garrison. Coins indicate occupation through the 4th century and perhaps into the 5th. (Welsby 1982 p12, 51; Hinchliffe and Sparey-Green 1985 p1-2, 176, 180-1).

Brecon Gaer (Powys).

The initial fort was built c75-80AD and covered 7.8 acres. The stone fort was perhaps built c140AD or later. Occupation may not have outlasted the 2nd century, but there was a brief revival of activity c290-300AD. The Ala I Hispanorum Vettonum was here in the late first or early second century and legio II Augusta was responsible for building the stone fort. By c150 the garrison may have been a quingenary cohort. (Simpson 1963 p17, 36-7; Jarrett 1966-68 p430-1; Casey 1971 p96).

Brigstock (Northants.).

A religious centre of the 3rd and 4th centuries AD. The circular shrine was built around 260AD or not long after. The latest coin from this structure is of Valentinian II (c380AD). The polygonal shrine produced coins of Magnentius and Valentinian/Valens. Second century coins may have been brought in later as offerings or may indicate some previous activity here. (Greenfields 1963 p238-9).

Brough-on-Humber (Yorkshire).

The nature of this site is confused. A stores base was built here c70AD and succeeded by a c4.5 acre fort - perhaps given up by Agricola. The town may have been the capital of the Parisii. There may have been a naval base here in the 4th century. A Numerus Supervenientium Petueriensium, perhaps based at either Malton or Papcastle is listed in the Notitia and it must have derived its name from a stay at Brough (Petuaria). It is suggested that the unit was composed of naval scouts. (Wacher 1960 p59-64; M. J. Jones 1975 p132; Hassall 1976 p111-2; Welsby 1982 p20, 43).

Brough-on-Noe (Derbyshire).

The Flavian timber fort may have been held into the Trajanic period. The second phase of occupation extended from c154-158AD. The final period ran from the late 3rd century to at least the middle of the 4th century - the latest coin dates to 350-353AD. The only unit known from here is the Cohors I Aquitanorum, which may have been the garrison in 155-8AD. A cavalry garrison has also been proposed on the basis of an alleged "stable". (Jones et al 1966 p99-101; Jones 1967 p155; Jones and Wild 1968 p92-3; 1969 p106; E. Birley 1978 p59).

Brough-under-Stainmore (Westmoreland).

The fort is about 2 acres in area and was founded in the Flavian period. It was destroyed c197AD and rebuilt under Severus. Many units are mentioned on lead seals from the site, but most of these were probably based elsewhere.

Cohors VII Thracum, which is more frequently attested, may have been the garrison in the 3rd century. If Brough is the "Verteris" of the Notitia then the garrison in the late 4th century was the Numerus Directorum. (E. Birley 1959 p31-56; Hartley 1972 p42; M. J. Jones 1975 p132, 215; Hassall 1976 p111).

Burgh Castle (Norfolk).

The Saxon Shore fort was perhaps built in the decade 276-285AD. It is 5acres in area and was garrisoned (at least in the late 4th century) by the Equites Stablesiani. The coin sequence runs down to the time of Honorius. (Morris and Hawkes 1948 p66-9; S. Johnson 1976 p96-8, 101).

Burnswark (Dumfries and Galloway).

The practice siege works to this site were initially dated to the Flavian period, but subsequently to the 150's AD. Most recently a date in the later 2nd or even in the 3rd century has been proposed. Although a date in the 2nd century seems quite likely, the evidence is very sparse. (Christison 1898-9 p215; Davies 1972 p104; Breeze and Dobson 1984 p107).

Cadder (Strathclyde).

There may have been a Flavian fort here prior to the building of the 3.3 acre Antonine wall fort. The latter may have been held by a cohors quingenaria and was perhaps given up c180AD. (Hartley 1972 p12; Hanson and Maxwell 1983 p154-5; Breeze and Dobson 1984 p95, 97).

Caerhun (Gwynedd).

The first fort was erected in the Flavian period and rebuilt in stone in the Antonine period. There was subsequently a gap in occupation, but the large number of late 3rd century coins and late pottery suggests that the site was re-used. The fort is 4.86 acres in area. The garrison may have been a cohors quingenaria equitata. (Baillie-Reynolds 1929 p95, 98-9; Jarrett 1969 p56-9; M. J. Jones 1975 p134).

Caerleon (Gwent).

The legionary fortress was built in 74-5AD, with an area of just over 50 acres. Rebuilding in stone may have begun as early as the late 1st century, in which case the Trajanic gate inscription marks the completion rather than the start of this phase. The site was not fully occupied after the mid 3rd century; the last epigraphic evidence for the garrison - legion II Augusta - dates to 268-270AD. There may have been some military occupation in the 4th century but this is uncertain. (Jarrett 1964 p52-62; 1969 p32; Welsby 1982 p47-8; information from Mr. D. Zienkiewicz, Caerleon museum).

Caernarvon (Gwynedd).

The initial fort was built about 77-8AD and the site was occupied until nearly the end of the 4th century. The old view that the fort was unoccupied from c140-210 and c290-350 has been abandoned. The fort is 5.6 acres in extent and could have been designed for either a cohors milliaria or an ala quingenaria. A 1st century altar mentioning a bucinator and another of the mid 2nd century referring to an optio imply that the garrison was at least partly infantry. The Cohors I Sunicorum from the Rhine-Meuse area is mentioned on a Severan inscription (R. I. B.430). The Seguntienses must have acquired their name from a stay at the fort, but in the Notitia they are stationed in Illyricum (ND. OC. V, 213; VII, 9). (Simpson 1962 p111-123; Jarrett 1969 p59-62; Casey 1974 p55, 61; Davis and Casey 1976 p30; Welsby 1982 p96, 126; James 1984 p167).

Caerwent (Gwent).

This town, the civitas capital of the Silures, was founded after 74AD. There may have been an earlier fort. Late 4th century coins are uncommon, although there are some of Arcadius and Honorius (393-423AD). There is also no late 5th century pottery. (Stanford 1980 p161-2, 171-2).

Caister-on-Sea (Suffolk).

It is conjectured that there may have been a fort here, probably in the early 3rd century. The rarity of later coins suggests that occupation had ceased by the end of the 4th century, perhaps in the 380's. Extensive evidence of butchery points to the existence of a supply base here in the mid-late 4th century. (Letter from Miss M. Darling, 21.11.89).

Camelon (Central).

A Flavian fort is inferred by coins and pottery, but no structures have been found as yet. The Antonine fort was 8 acres in area and was perhaps given up in the mid 160's. Going by the number of barrack blocks known it has been suggested that the garrison was a cohors milliaria or part of such a unit. (Hartley 1972 p12, 40-2; Breeze et al 1976 p73-5; Maxfield 1979 p28-32).

Canterbury (Kent).

The Roman town was begun soon after 43AD. A wall built in c270 enclosed 52 hectares. There was a Germanic settlement here in the early 5th century. (Stillwell 1976 p289-90).

Cappuck (Borders).

An auxiliary fortlet. The evidence for a Flavian phase is very slender. The occupation was probably solely in the Antonine period and the site may have been given up c165AD. Two inscriptions from Jedburgh (R. I. B.2117-8) mention the Raeti Gaesati and the Cohors I Vardullorum milliaria equitata. These stones may have come from Cappuck. Both units are attested at Risingham in the reign of Caracalla and it is possible that detachments from them were based at Cappuck. (Stevenson and Miller 1912 p478; Breeze and Dobson 1984 p115, 252, 258).

Carlisle (Cumbria).

The first fort may have been built under Cerialis or Frontinus but there is no confirmation of this as yet. A turf and timber fort was erected in c79AD. Military occupation may have been run down or ceased altogether in the reign of Trajan. The town of Luguvallium was created in the 1st half of the 2nd century. Stone barracks were later built in the Annetwell street area, probably in the early 3rd century. These went out of use at the turn of the 3rd and 4th centuries. Stamped tiles of legions II Augusta and XX Valeria Victrix were found in association with these barracks. A stone slab set up by a prefect of the Ala Augusta (R. I. B.946) has also been found at Carlisle. (Gosling 1976 p171-172; McCarthy and Dacre 1983 p124-130; McCarthy 1984 p65-74; Hassall and Tomlin 1989 p331-2).

Carrawburgh (Northumberland).

The Hadrian's Wall fort had an area of 3.9 acres. The latest coin from the fort is of Valens, but some later than 383AD have been found in the nearby Coventina's well. The first garrison may have been a cohors quingenaria equitata and in the 3rd/4th centuries it was the Cohors I Batavorum Q. Eq. Several other units are attested here, but these may have been engaged in building work, or setting up dedications to Coventina, rather than actually being in garrison. (E. Birley 1961 p175-8, 259; Welsby 1982 p37; Breeze and Dobson 1984 p48, 69, 78, 140, 144, 230).

Carvoran (Northumberland).

Hadrian's wall fort with an area of 3.6 acres. The fort may have existed in the Flavian period as part of the Stanegate system. The Hadrianic garrison was the Cohors I Hamiorum and in the 3rd/4th centuries it was the Cohors II Delmatarum Equitata. The change in garrison may have occurred about 180-184AD. The mention in the Notitia implies occupation down to the end of the 4th century. (Breeze and Dobson 1984 p20-1, 48, 52, 71, 140, 245).

Carzield (Lothian).

The fort was only occupied in the Antonine period and possibly only in the first phase (c140-155AD). The garrison may have been a quingenary Ala. (E. Birley and Richmond 1942 p3, 163; Hartley 1972 p22, 41).

Catterick (Yorkshire).

The earliest fort was perhaps built by Agricola. It was given up c120AD, but was probably re-occupied by c160AD. There was major rebuilding in the vicus in about 370AD. Finds of military equipment from this period point to the existence of a garrison, possibly of Germanic laeti. (Hildyard 1957 p224-265; Wacher 1971 p165-177; James 1984 p167).

Chester (Cheshire).

The legionary base was begun not later than 79AD and initially housed legio II Adiutrix. This unit was replaced by XX Valeria Victrix in c88AD. This unit is last recorded on the coinage of Carausius and it is not clear whether the fortress was occupied in the 4th century. It has been suggested that it was abandoned c368-373AD or that it was given up by Stilicho. (Jarrett 1968 p77-91; Welsby 1982 p44, 126; Webster 1985 p57, note 3).

Chesters (Northumberland).

The Hadrian's wall fort is 5. 75 acres in area. The first garrison was the Ala Augusta, whilst the 3rd century garrison was the Ala II Asturum. This unit is also mentioned in the Notitia as being at Chesters. In the 2nd century the Cohors II Delmatarum may have been based here and a legionary detachment might have been here in the 140's. (E. Birley 1961 p172-5; Austen and Breeze 1979 p115; Breeze and Dobson 1984 p48, 140, 243; A. Johnson 1983 p295).

Cirencester (Gloucestershire).

The site was occupied by a series of auxiliary forts between c45 and c70-80AD. The vicus of these forts grew into the civitas capital Corinium Dobunnorum, which survived into the 5th century. Inscriptions of soldiers of the Ala Indiana and the Ala Thracum (R. I. B.108-9) are known from here, dating to the 1st century. (Stillwell 1976 p240).

Clausentum (Hampshire).

This small town was founded soon after 43AD and continued to be occupied into the 5th century. There may have been a fort here before the town was built. The walls may have been built c330AD. A garrison may have been moved here from Portchester by Theodosius. (Stillwell 1976 p227).

Colchester (Essex).

The base of the XXth legion from c43-8AD, succeeded by a colony. As well as the legion, the Ala I Thracum and possibly Cohors I Vangionum (R. I. B.201, 205) are attested here. (Webster 1985 p42).

Corbridge (Northumberland).

The chronology of this site is extremely complicated and has often been revised. The scheme adopted by Gillam is now largely accepted. Fort IA was Flavian and held the Ala Petriana (then 500 strong). Fort IB (also Flavian) may have had a legionary garrison, but this interpretation was largely based on the discovery of two pieces of lorica segmentata and must be treated with scepticism. This fort may have been burnt down c105AD. Fort II, built c106 and abandoned c122AD may have been garrisoned by a cohors milliaria equitata. Fort III was occupied from c121-125AD, the suggested garrison being two infantry cohorts. The site was largely unoccupied from c125-140AD. Fort IVA (c139/140-155/8) may have contained either an ala quingenaria or a cohors milliaria equitata. Fort IVB was occupied from c155/8-c163AD and held the Cohors I Vardullorum. After this there ceased to be a fort at Corbridge, although the town continued and developed. In the 3rd century, perhaps in the Severan period a military compound consisting of workshops, offices and barracks was created. This lasted into the 4th century. The town may have been given up in the 5th century. A legionary garrison in phase II or III has recently been postulated on the basis of the pieces of lorica segmentata in the Corbridge Hoard. (E. Birley and Richmond 1938 p260-5; Gillam 1979 p47-54; Allason-Jones and Bishop 1988 p109-110).

Cowbridge (S. Glamorgan).

A military style bath-house near Cardiff, perhaps part of the lost settlement of Bovium mentioned in the Antonine Itinerary. The bath-house has produced stamped tiles of legio II Augusta. The main range was built around 100AD and the structure seems to have been demolished by the end of the 2nd century. (Thomas and Brooksby 1972 p26; Parkhouse 1981 p46-8).

Cramond (Lothian).

The fort appears to have been built about 140AD and there was a second phase of occupation in the reign of Septimius Severus. There are coins of Diocletian and Constantine from the site but these do not necessarily prove continuing occupation. The fort is 4.8 acres in area. Cohors I Tungrorum milliaria and Cohors V Gallorum are both attested here. A few early coins might imply a Flavian occupation, but there are no traces of any Flavian structures. (Macdonald 1918 p213ff; Hartley 1972 p8, 36; Rae 1974 p163ff; Breeze and Dobson 1984 p251, 254).

Croy Hill (Central).

The site of an Antonine wall fort. Traces of an earlier ditched enclosure and annexe have been claimed as evidence for a Flavian fort. There is an altar and some building slabs set up by legio VI Victrix (R. I. B.2160-3). A stone showing three soldiers with pila and scuta might be evidence for a legionary garrison, but by the Antonine period the distinctions between legionary and auxiliary troops were probably no longer hard and fast. With an area of only 1.5 acres this fort was clearly not large enough to have held a whole unit (Macdonald 1932; Coulston 1988 p1-29).

Doncaster (Yorkshire).

The first fort was built c71AD and covered at least 6 acres. This was occupied up to the reign of Hadrian. A new stone fort was built in the 150's or 160's, which was 5.85 acres in area. The evidence for 3rd century occupation is slight, perhaps indicating a period of abandonment. Nothing is known of the earlier garrisons, but in the Notitia, the garrison of Danum is listed as being the Equites Crispiani. (M. J. Jones 1975 p148; Buckland 1978 p247; Welsby 1982 p45).

Dover (Kent).

There were two successive bases of the Classis Britannica at this site, the first dating to c80-120AD and the second to c130-140. The latter was given up by the mid 3rd century. The Saxon Shore fort was perhaps built between 276 and 285AD. The Notitia garrison of this fort are the Milites Tungrecanorum, from Tongres (or nearby), in Germania Secunda. This unit might have been brought to Britain by Count Theodosius in c369AD. (S. Johnson 1976 p68-9, 109; Philp 1981 p91-100; Welsby 1982 p52).

Durisdeer (Dumfries and Galloway).

The pottery from this fortlet in sw Scotland is entirely Antonine. The area is just over one seventh of an acre and half of this is taken up by a single barrack block. Nothing is known of the garrison of the site. (Stillwell 1976 p287).

Ebchester (Durham).

All sources are agreed that a fort was built here in c80AD, but beyond this the chronology of the site is disputed. Occupation perhaps continued up until c140, when there was a break until c163AD. It has been suggested on the basis of the coin evidence that the garrison was removed in about 312AD, but sherds of Crambeck and Huntcliff ware may indicate that the site was still in use in the later 4th century. The Cohors IIII BR ANTONINIA (na) is referred to on an altar, which must date to the reign of either Caracalla or Elagabalus and a (co) H (ors) I BR - perhaps Bracaraugustanorum - is also attested on a stamped tile. This unit was probably based here sometime in the period 80-197AD. (Jarrett 1960 p193ff; Taylor 1960 p215; Welsby 1982 p92).

Exeter (Devon).

The legionary fortress was occupied from c55/60-75AD. The baths continued in use after military occupation had ceased. There were a series of alterations to the forum/basilica of the town between the Antonine period and the late 4th century. The basilica was demolished before the mid 5th century. The fortress was garrisoned by legio II Augusta. There is no epigraphic evidence for a later garrison. (Bidwell 1979; Webster 1985 p57, note 4).

Gadebridge Park (Hertfordshire).

A Roman villa. The earliest pottery dates to c75AD and the earliest coins to c64AD. The villa largely went out of use around 353AD, but one building was still used down to c388-402AD. (Neal 1974 p88, 98-9).

Gellygaer (Mid Glamorgan).

The earliest fort here was built c74/8AD and given up in c98AD. The stone fort (3. 7acres) was perhaps built in the reign of Trajan and given up c196AD. There was rebuilding in the late 3rd-mid 4th century. The final date of abandonment is unknown. The available barrack accomodation suggests that the garrison was a cohors quingenaria peditata. (Ward 1903 p90-2; Simpson 1963 p49-65; Nash-Williams 1969 p88-90).

Gestingthorpe (Essex).

The votive objects from this site suggest that it was some kind of religious centre. Occupation ran from the Belgic period down to the 4th century, declining post 350AD. (Draper 1985 p2).

Gloucester (Gloucestershire).

The fortress of legio XX was founded c49AD*. The colony of Glevum was ostensibly founded in the reign of Nerva, but mat actually have been created by Domitian. (Webster 1985 p42, 57, note 3). * In the suburb of Kingsholm. A later fortress was on the site of the Colonia.

Godmanchester (Cambridgeshire).

There was a fort here in the mid 1st century. The town grew out of the vicus. A late 2nd century ditch and palisade has been claimed as evidence for a Severan fort. The town was still occupied in the 4th century. (Stillwell 1976 p358).

Great Chesterford (Essex).

There was a fort here in the first few years of Roman occupation. The cremation burials outside the town perhaps date to the 2nd century AD. They lie within the Saxon cemetery. (Information from Professor Vera Evison in a letter dated 14.8.89).

Greatchesters (Northumberland).

The wall fort is 3.36 acres in area. The fort was one of the last to be completed (in 128AD or later) and seems to have been occupied at least down to the end of the 4th century. The initial garrison was perhaps Cohors VI Nerviorum. There may have been a legionary vexillation here (R. I. B.1725) but this is open to doubt. A Cohors Raetorum was here in the 160's (R. I. B.1737). The attested garrison in the 3rd century is the Cohors II Asturum q. eq. and the Raeti Gaesati. The latter are recorded on an inscription of 225AD. In the Notitia the Cohors I Asturum is mentioned, this perhaps being an error for II Asturum. (Breeze and Dobson 1984 p53, 68, 130, 140, 244; Poulter 1988 p41).

Greta Bridge (N. Yorks.).

Occupation began in the late Flavian period. Excavations in the vicus in 1973 produced coins of the mid to late 3rd century, including one of Allectus. The fort was still held in the late 4th century, when it was called Maglona. The Notitia garrison is the Numerus Solensium. The mansio in the vicus survived through the Antonine period into the later 2ndc (Wilson 1974 p413-4; Bennett 1984 p38).

Haltonchesters (Northumberland).

A Hadrian's wall fort, 4.3 acres in area. It was destroyed in the 180's, but rebuilt. The fort was run down in the period c270-370, but was then restored. The Hadrianic garrison is thought to have been a cohors quingenaria equitata. The Ala I Pannoniorum Sabiniana was based here in the 3rd and 4th centuries. (A. Johnson 1983 p295; Breeze and Dobson 1984 p48, 68, 128, 140, 213, 243).

Haltwhistle Burn (Northumberland).

A fortlet to the south of Hadrian's wall, less than one acre in size and holding a small detachment. Occupation began c105 or even 100AD and did not continue beyond the start of Hadrian's wall in 122AD. (Simpson 1974 p324; Breeze and Dobson 1984 p20-3).

Hardknott (Cumberland).

The chronology of the site is disputed. The fort was perhaps built in the reign of Trajan or that of Hadrian and occupied for 60-70 years. There may have been rebuilding c163AD. Fragments of an inscription found at the fort in 1964 have been reconstructed as referring to Cohors IIII Delmatarum, a 500 strong part-mounted unit. The fort is 2.5 to 3 acres in area. (Wright 1965 p169-175, fig 1; Hartley 1972 p41; M. J. Jones 1975 p154-5; Stillwell 1976 p561).

High Rochester (Northumberland).

The original fort here was built in the 80's AD. The later base was constructed in the 140's and probably held throughout the 3rd century. Various dates have been put forward for the abandonment of this fort, either in c312AD or c343AD. The fort covers 4 acres. The garrison under Antoninus Pius was Cohors I Lingonum equitata and under Marcus a cohors DA. . . . . (either Dacorum or Dalmatarum). Cohors I Vardullorum milliaria equitata is recorded on an inscription of 213AD and the Numerus Exploratorum Bremeniensium (scouts) on another of 238-241AD. If these units were in garrison simultaneously then parts of them may have been outposted. (Richmond 1936 p170-198; Casey and Savage 1980 p75-87; Wilson 1980 p69; Breeze and Dobson 1984 p84, 133, 140, 203, 220, 248, 253).

Holt (Clywyd).

A tile-producing complex for legio XX Valeria Victrix at Chester, manned by personnel from the legion. It was perhaps founded c75AD and there is some evidence that it was still in use in the 3rd/4th centuries. The date of abandonment is unknown. (Grimes 1930 p47-52; Liversidge 1968 p199).

Housesteads (Northumberland).

The fort is 5 acres in area and was built as part of the Hadrian's wall complex. Occupation continued into the later 4th century at least. The Hadrianic garrison may have been a cohors milliaria peditata. There is a suggestion that a legionary vexillation was based here at some point (R. I. B.1582-3). The archer tombstone, now in the Museum of Antiquities at Newcastle need not necessarily imply that such a unit was ever in garrison at Housesteads. In the 3rd century the garrison comprised the Cohors I Tungrorum milliaria, the Cuneus Frisiorum Ver. (attested in the reign of Severus Alexander) and possibly the Numerus Hnaudifridi - the inscription recording the latter unit is undated. The Cuneus and the Numerus were most likely recruited from Free Germany. Whether all three units were in garrison at once would depend on their strength and the possibility of some men being outposted. In the Notitia only the Tungrian cohort is mentioned. (E. Birley 1961 p259; Welsby 1982 p40, 157; Breeze and Dobson 1984 p48, 76, 78, 140, 227, 244).

Huntsham (Herefordshire).

An enclosure with several buildings has been discovered here. Amongst them was a corn-drying kiln of the late 3rd century (Taylor and Wilson 1961 p171, note 81).

Ilkley (W. Yorks).

The earliest fort was held from the Flavian period until perhaps the reign of Hadrian. Re-occupation occurred in the 160's and seems to have lasted into the 4th century. The latest coins are of Valentinian or Valens (364-378AD). The Cohors II Lingonum equitata was based here in the reign of Marcus. (M. J. Jones 1975 p156; Welsby 1982 p45; Breeze and Dobson 1984 p126, 133, 207, 255).

Inveresk (Midlothian).

The Flavian fort was succeeded by a new one in the Antonine period, garrisoned by an ala quingenaria. Occupation continued into the late 2nd century - with one short break. (Stillwell 1976 p412-3; Breeze and Dobson 1984 p97; Maxwell 1984 p32).

Kenchester (Herefordshire).

The 1912-13 excavations produced an estimate for the size of the town of 22 acres. Flavian samian and coins found at the time may indicate the date of its foundation. The coin sequence extends down to the period 383-395AD. There may have been some prior military occupation here, but nothing definite is known. The discovery of barbed spearheads of the "gaesum" type here points to the presence of a military unit, possibly of a Germanic character in the later period. (Jack 1916 p20, 34-54; Kent 1952 p11; Stillwell 1976 p545).

Kinneil (Lothian).

A small fortlet on the Antonine wall. Its garrison is not known. (Breeze and Dobson 1984 p97).

Kirkbride (Cumberland).

There was a fort here from c80-120AD, which may have covered as much as 30 acres, implying a multi-unit garrison. Some pieces of BB2 pottery and a single Antoninianus of Tetricus, provide a little evidence for a later occupation. Nothing is known of the garrison. (E. Birley and Bellhouse 1963 p126-139; M. J. Jones 1975 p158).

Kirkby Thore (Westmoreland).

The first fort was built here in c80AD and was replaced by another at an uncertain date. It has been suggested that the garrison was an ala, but there does not seem to be any hard fact to back up this theory. An altar seen here in 1664 (R. I. B. 764) had on it the abbreviation N. M. S. S. - allegedly short for Numerus Syrorum Sagittariorum. Finds of pilum points may indicate the presence of legionaries at some stage but this need not necessarily be so. Kirkby might have been the "Braboniaco" of the Notitia, garrisoned by the Numerus Defensorum. (E. Birley 1963 p122; M. J. Jones 1975 p158).

Lancaster (Lancashire).

A fort was built here in about 79AD. It received stone defences in the Trajanic period (R. I. B.604) and was occupied down to the late 4th century. Part of the later defences (called the "Wery Wall") have been found at the NE angle. Coins and pottery of c300AD were found in West Vicarage Field in 1972. The Ala Augusta was based here in the 1st or 2nd century and the Ala Sebosiana was here in the 3rd. A Numerus Barcariorum mentioned on a stone found downstream at Halton, was perhaps based at Lancaster in the 4th century. (Richmond 1945 p15; G. D. B. Jones 1970 p240; Wilson 1973 p282-3; Garlick 1977 p8-11, 36).

Llandough (Glamorgan).

Emergency excavations took place at this previously unrecorded villa site in 1979. The presence of a bone scabbard runner here implies a military presence or the production of military equipment by civilians. (Owen John 1979 p31).

London.

a. General:Besides being the administrative capital of the province and probably a colony there was a military presence here. A fort of c12 acres built to house the governor's bodyguard was incorporated into the city walls when they were constructed in about 100AD. Large numbers of military personnel would have passed through London and it is therefore not surprising that many pieces of military equipment have been found here. Many soldiers would been attached to the governor's staff. It is not likely that the Roman city was ever wholely abandoned.

b. Individual sites:-

Angel Court.

Rubbish material was perhaps accumulating in this area from the late 3rd century onwards. The latest coin from the site dates to 364AD or later. The pottery is mainly L3rd/4th century. (Blurton 1974 p14-100).

Bank of England.

Most material from this site tends to be of late 1st/ 2nd century date and there are very large numbers of

Flavian coins. (letter from Miss Christine Jones, Museum of London, dated 16.8.89; pers. comm Mr. P. J. Casey).

Bucklersbury House.

Excavations took place in 1955, the material coming from the bed of the silted up Walbrook stream. Most of the finds should date to before c150AD. (letter from Christine Jones, 16.8.89).

London Wall (No.44).

The pottery was spot-dated to 120-160AD (letter from Christine Jones, 16.8.89).

Mansion House.

The site lies close to the former course of the Walbrook stream and therefore finds from the site may date to before the mid 2nd century. (Manning 1985 p152).

St. Magnus New Fresh Wharf, Lower Thames St.

The spearhead from the site was found in a level dated by pottery to c225-240AD. (Letter from Christine Jones, 16.8.89).

St. Thomas Street (Southwark).

The scabbard runner from this site came from a pit dated to 170-190AD.

Tower of London (Inmost Ward).

The site of some Flavian period reclamation. Coins indicate that the riverside wall was built in the last decade of the 4th century. (Parnell 1985 p1-79).

Upper Thames Street.

The context contained pottery of late 1st to mid 3rd century date. There were timber lined pits, some perhaps for refuse, with 2nd century pottery in them. One pit may have been used in the production of fish sauce or in pickling. (Bird et al 1979 p291, 303-5; letter from Christine Jones, 16.8.89).

Loudon Hill (Ayrshire).

A fort was built here in the Flavian period (perhaps by Agricola) and there was also an Antonine base here. There were perhaps some gaps in occupation. The fort area is about three acres, with a similarly sized annexe. (M. J. Jones 1975 p163).

Lydney Park (Gloucestershire).

Initially a mining community, perhaps under military control - in the 2nd/3rd centuries? In the 4th century it was the site of a shrine to the god Nodens and there were associated buildings, including a bath-house and an inn. There was a decline in usage in the later 4th century. The latest coins are of Arcadius. (R. E. M. and T. V. Wheeler 1932 p1, 62, 91; Stillwell 1976 p537-8).

Lyne (Borders).

The pottery evidence at this fort indicates an Antonine occupation. Nothing is known of the garrison. (Steer 1959 p39-40; Hartley 1972 p9).

Malton (Yorkshire).

The earliest base dates to c71AD and it was at least 20 acres in extent, perhaps holding part of legio IX Hispana. The Agricolan fort was around 8.4acres in extent. The stone fort was built in the reign of Trajan and was held down to the late 4th century or later. The coin sequence extends down to Theodosius or Arcadius and the fort ditches may have been redug in the later 4th century. The site had a reduced garrison from c108-182AD and may have been empty from c280-300. No garrison is known for this site, unless we accept that Malton was the "Derventio" of the Notitia. Derventio was held by the Numerus Supervenientium Petueriensium. This unit could have moved to Malton in c367AD or under Magnus Maximus. (Mitchelson 1964 p209-261; M. J. Jones 1975 p164-5; Hassall 1976 p111-112; Welsby 1982 p20, 45).

Manchester (Lancashire).

First occupied in the Flavian period, the stone fort was perhaps built in the reign of Trajan. It had an area of about 5 acres. A later reconstrucion perhaps took place in the later 3rd or early 4th century. Most of the coins date to the 2nd and 3rd centuries and the fort is not mentioned in the Notitia. Finds from the site include an altar (R. I. B.576) set up by the commander of a VEXIL (atio) RAETOR (um) (et) NORICOR (um) - perhaps parts of legions II and III Italica sent to Britain to help in rebuilding work in c197AD. There are also centurial stones of Cohors I Frisiavonum (late 1st/early 2nd century?) and a tile stamped C III BR. The latter could indicate a cohort of Bracaraugustani or of Breuci. The former unit, composed of Spaniards, was in Britain in the 1st half of the 2nd century AD. (Collingwood and Wright 1965 p192; G. D. B. Jones 1974 p11, 18-20; 26, 92). The start of the final phase has also been dated to c200AD (Frere 1986 p385).

Maryport (Cumbria).

There is very little evidence for a 1st century phase here. The existing fort is of Hadrianic date and covers 5.8 acres. Coins of Theodosius I have been found, pointing to a late 4th century occupation. The Hadrianic garrison was the Cohors I Hispanorum Equitata, initially 500 strong, but later a milliary unit - by 130AD. Under Pius the Cohors I Delmatarum Equitata may have been stationed here and the Cohors I Baetasiorum was here in the reign of Marcus. The 3rd century garrison was perhaps a Cohors milliaria - R. I. B.812. (Jarrett 1959 p63-7; M. J. Jones 1975 p166; Potter 1979 p46; Breeze and Dobson 1984 p42, 48, 140, 230, 247).

Milecastles (general).

The Milecastles may have been garrisoned by small detachments from units in the neighbouring forts. This seems reasonable but is unproven. There is no epigraphic evidence for an alternative suggestion (E. Birley 1932 p213) that they were occupied by Numeri. The milecastles were part of the original plan of construction, begun around 122AD.

Milecastle 9 (Chapel House).

The site has produced 4th century coins, the latest being of Valentinian I (364-375AD). (E. Birley 1961 p260; Welsby 1982 p87).

Milecastle 35 (Sewingshields).

The coins from this site run from Vespasian to Valentinian I/Valens, but with gaps from Antoninus (138-161) to Tetricus (275) and from Constantine I (330-5) to Valentinian/Valens (364-375). The military finds are of 2nd/3rd century character. Later 3rd and 4th century activity at the site, involving metal-working may have involved civilians. (Welsby 1982 p42, 87; Haigh and Savage 1982 p33-147).

Milecastle 37 (Housesteads).

The site has produced 4th century coins (Welsby 1982 p87).

Milecastle 39 (Castle Nick).

Occupation continued here into the later 4th century, but most of the weaponry belongs to the later 2nd/3rd centuries. (Frere 1986 p387; letter from Mr J. Crow dated 10.1.89).

Milecastle 48 (Poltross Burn).

The end of occupation was initially set at c270AD, but this theory was later rejected. There is structural evidence for an early 4th century occupation, as well as a coin of Constantine I (Gibson and Simpson 1911 p460; E. Birley 1961 p260; Welsby 1982 p42).

Milecastle 50 (High House).

The coins from the excavations by F. G. Simpson included two of Constantine I and it was suggested that occupation ended about 325AD. There is possibly structural evidence to support an early 4th century phase. (Simpson et al 1913 p336, 345; E. Birley 1961 p260; Welsby 1982 p87).

Milecastle 54 (Randylands).

Later 4th century pottery has been found here, including sherds of Huncliffe ware and gritted jars. These suggest occupation in the mid 4th century and possibly later. The latest coin is of Claudius II (268-270AD). (Simpson et al 1934 p145-6; Simpson and Richmond 1935 p238; Allason-Jones et al 1984 p233, 235).

Milecastle 79 (Port Carlisle).

The site has produced 4th century coins and pottery (Welsby 1982 p87).

Milefortlet 5 (Cardurnock).

Part of the Hadrianic system on the Cumberland coast and the equivalent of a milecastle on Hadrian's wall. The site was excavated in 1944 and a starting date of c128AD was postulated. Later reduced in size, the fortlet may have been abandoned in the early 3rd century but the presence of 4th century pottery points to a later phase. The internal area is 130 x 95 feet. Nothing is known of the garrison. (Simpson and Hodgson 1948 p122-3; Breeze and Dobson 1984 p40, 216, 224).

Milton (Dumfries and Galloway).

There were at least two Flavian forts at this site, prior to the construction of the Antonine fortlet. There may have been a larger fort to the south predating all of these structures and there is another unidentified enclosure nearby. The Antonine fortlet measures 0.25 of an acre. Its garrison is not known. (M. J. Jones 1975 p168).

Mumrills (Central).

There appears to be very little evidence to support the long-held belief that there was a Flavian fort here. Occupation therefore began with the Antonine wall fort which covered 7.2 acres. In the first phase, up to c158AD the garrison was the Ala I Tungrorum and in the second period it was Cohors II Thracum equitata. The date of abandonment has generally been set at c163AD on the basis of the pottery and because of the lack of any coins later than the reign of Antoninus Pius. However pottery from destruction material in the outer western ditch was dated by Gillam to 170-185AD. (Macdonald and Curle 1929 p396ff; Steer 1961 p97-8; Hartley 1972 p40-2; Breeze and Dobson 1984 p94-5, 97, 113, 122, 256).

Neath (Glamorgan).

The fort was built c75AD and abandoned after c140AD. There may have been re-occupation in the late 3rd century. Area:6 acres. The size suggests that the garrison was a Cohors milliaria equitata. (Marvell 1984 p55-6).

Netherby (Cumbria).

An outpost fort of Hadrian's wall, mentioned in the Antonine Itinerary as Castra Exploratorum. There may have been a Flavian base here. The 2nd century garrison was a cohors quingenaria and in the 3rd century it was Cohors I Aelia Hispanorum milliaria. A unit of scouts (exploratores) must have been based here at some time, perhaps in the 3rd century. If Netherby can be identified with the "Axelodunum" of the Notitia - garrisoned by Cohors I Hispanorum - then a late 4th century occupation is proved. An alternative view has the fort being abandoned c367AD. (E. Birley 1961 p229; Stillwell 1976 p207; Welsby 1982 p103).

Nettleton (Wiltshire).

A small Roman fort was built here c47AD. From 230AD or earlier there was a religious shrine, connected with a civilian settlement. The latter was destroyed after 402AD. (Stillwell 1976 p621-2).

Newstead (Borders).

There were two Flavian forts here, one Agricolan, covering 10.5 acres, the other late Domitianic and 13 acres in extent. The garrison of these forts was perhaps a mixed force of legionaries and auxiliaries. The Antonine fort was occupied from c140-180AD, with perhaps a gap in the mid 150's. The evidence for destruction at the site at this time is however ambiguous. A Severan occupation of brief duration has been suggested. The Antonine fort was held by a vexillation of Legio XX and the Ala Vocontiorum. (Curle 1911 p23, 29, 74-5; Jarrett 1968 p83; Hartley 1972 p13, 40-2; M. J. Jones 1975 p169-70; Breeze and Dobson 1984 p107-8, 113, 127-8, 135).

Old Kilpatrick (Strathclyde).

There is no real evidence for an Agricolan occupation here, beyond some sherds of supposedly 1st century pottery. The Antonine fort covered 4. 7 acres. The suggested garrisons are a cohors quingenaria equitata or a cohors milliaria in the first phase and perhaps part of Cohors I Baetasiorum in the second phase. The date of abandonment is set at c163AD, based on pottery stamps. (Miller 1911 p12, 53, 57, 59; Hartley 1972 p40-2; Hanson and Maxwell 1983 p155; Breeze and Dobson 1984 p95, 97, 121).

Old Penrith (Cumbria).

Recent excavations have substantially altered the view of the chronology of this site. It is now thought that the fort was founded about 90AD and occupied until c120AD. The site was vacant between 120 and 163AD but was re-occupied about the latter date. The fort continued to be used until at least the mid 4th century, although the vicus was given up by c300AD. Since the fort is not mentioned in the Notitia it must presumably have been abandoned by c395AD. Area:More than 3 acres. The Cohors II Gallorum equitata is attested on several inscriptions, including one dating to the reign of Gordian III (238-244AD) and another to the reign of Phillip (244-249AD). A stone slab from Longh, south-east of the fort records the VEXILLATIO M (a) R (sacorum). The Marsacii were a German tribe who lived near the mouth of the Rhine. (Haverfield 1913 p177-198; M. J. Jones 1975 p172; Goodburn 1978 p424-5; information from Mr. Paul Austen).

Papcastle (Cumbria).

The chronology of this site is little understood. A Flavian phase remains a possibility but is unproven. There are two stone forts here, both as yet undated, but the timber internal buildings perhaps belong to the 2nd century whilst those in stone are perhaps 4th century. There may have been a long break in occupation in the 3rd century, with a major rebuild in the 4th. It has been suggested that the site was finally vacated around 367AD. Area:6 acres. Little is known about the garrison (s) of the site but its size is appropriate for an ala or a milliary cohort. Papcastle is no longer identified with the Aballava of the Notitia and the Cuneus Frisiorum Aballavensium mentioned on a mid 3rd century inscription (C. I. L.415) was probably not based here. Papcastle might alternatively be identified with Derventio, also mentioned in the Notitia, which was garrisoned by the Numerus Supervenientium Petueriensium. (E. Birley 1963 p96-125; Charlesworth 1965 p102-114; M. J. Jones 1975 p172; Welsby 1982 p46, 70).

Pen Llystyn (Gwynedd).

A fort of 3.85 acres was built here c78AD and demolished in about 90AD. A 1 acre fortlet was built here sometime between 100 and 130AD, but was only briefly in use. The garrison of the Flavian fort was perhaps a pair of quingenary cohorts. (Hogg 1968 p101ff; M. J. Jones 1975 p172-3; Wilson 1980 p34-5).

Pevensey (East Sussex).

The Saxon Shore fort is traditionally dated to c330AD, but coins and pottery point to a foundation date in the later 3rd century, perhaps in the reign of Carinus. In the Notitia the garrison of Anderida is given as being the Numerus Abulcorum. The Classis Anderetianorum must have been based here at one time, but in the Notitia it has a base in Gaul (N. D. OC. XLII, 23). (S. Johnson 1976 p56-9, 123; Cunliffe 1977 p6; information from Mr P. J. Casey).

Piercebridge (County Durham).

The starting date for this fort is now placed nearer 260 than 300AD on the basis of a study of the coins. The fort may have been given up in c312AD and reoccupied about 350AD. Area:11 acres. Piercebridge may be the "Morbium" of the Notitia, garrisoned by the Equites catafractariorum (Welsby 1982 p8, 15, 46, 92, 98; Breeze and Dobson 1984 p214; information from Mr. P. J. Casey).

Portchester (Hampshire).

Coins of the Tetrici and Carausius in the construction layer suggest that the fort was built in the 280's. The latest coins date to c390 AD, but there are very few for the period after 367AD. There are a few "Germanic" style finds from the site and it has been suggested that in the 5th century some semi-military settlers (laeti) may have lived here. Area:8.5 acres. Portchester may perhaps be the base called Portus Adurni mentioned in the Notitia. This fort was garrisoned by a Numerus Exploratorum, perhaps transferred from High Rochester, Risingham or Netherby in the wake of the "barbarian conspiracy" of 367AD. However Portus Adurni may equally have been the now vanished fort of Walton Castle. (Hassall 1970 p10; S. Johnson 1976 p60-2, 101; Cunliffe 1977 p1-6).

Ravenglass (Cumbria).

The first base here was a small fortlet, probably of Hadrianic date. The fort itself was begun c130AD and occupied down to 400AD or later. A break in occupation sometime between the mid 3rd and the mid 4th century has been suggested but there is no hard evidence for this. The last coin is of Valens but there is plenty of late 4th century pottery. In the Notitia the garrison is given as Cohors I Morinorum. No earlier garrisons are attested, but the size of the fort (c3.6 acres) would suggest that a cohors quingenaria peditata was based here. (Potter 1979 p3, 46; Welsby 1982 p41).

Reculver (Kent).

The first structure on the site was a Claudian fortlet. The Saxon Shore fort was built in the first half of the 3rd century. There may have been a period of disuse in the latter part of the century, but there was some activity in the 4th century. Two barracks seem to have been derelict by c300 AD and the coin sequence stops at 360AD. Cohors I Baetasiorum is recorded as being at Regulbio by the Notitia, but this unit may not have been the first garrison. Their may have been a base for the Classis Britannica at Reculver. (Wilson 1970 p304; S. Johnson 1976 p18, 44-5, 81; Cunliffe 1977 p1-6; Welsby 1982 p54, 57).

Ribchester (Lancashire).

The fort was built in about 79AD and covered just under 6 acres. The stone wall was constructed under Trajan. Occupation probably continued beyond 383AD. The Ala II Asturum is recorded on an altar (R. I. B.586). The Ala Sarmatarum perhaps arrived in Britain c175AD and was mentioned on two inscriptions from the site (C. I. L. VII 229-230) which are now lost. The Numerus Equitum Sarmatarum Bremetennacensium, attested on an inscription of 238-244AD (C. I. L. VII 218) is presumably the same unit under a different name, as is the Cuneus Sarmatarum listed by the Notitia as the garrison of this fort. (Hopkinson 1928; Richmond 1944 p15-29; M. J. Jones 1975 p175; Edwards and Webster 1985).

Richborough (Kent).

The first occupation at this site was a camp of the Claudian period. This was shortly followed by a supply base, which lasted until c85AD. The monument was built c85-90AD. Some sort of occupation, initially in timber buildings but later in stone continued up to the mid 2nd century, when there was a decline in activity. The site was probably occupied by civilians in this phase. Military occupation began again probably in the middle of the 3rd century with the building of a 1 acre signal station on the remains of the monument. The Saxon Shore fort (area c6 acres) was probably built in the period 276-285AD and occupation lasted into the 5th century at least. In the Notitia the garrison of Rutupiae is said to be Legio II Augusta, but only a fraction of that unit could have been fitted into a fort of this size. (Cunliffe 1968 p232-258; S. Johnson 1976 p50-1, 101, 112; Welsby 1982 p55, 131).

Risingham (Northumberland).

The fort had not yet been built in the Hadrianic period, but there is clear evidence for an Antonine occupation. It may have been given up c184AD but rebuilding is attested in the reign of Severus (R. I. B.1234). No firm date has yey been arrived at for an end to occupation at this site, although the case for an abandonment c312AD is perhaps stronger than the traditional view that the fort was held after 367AD. The garrison in the reign of Marcus Aurelius was the Cohors IV Gallorum Equitata. In the 3rd century three units are attested:- Cohors I Vangionum milliaria equitata (an inscription of 205-8AD), the Vexillatio Raetorum Gaesatorum (213AD) and the Exploratores Habitancenses (213AD). If all of these units were in garrison simultaneously then parts of them may have been outposted - but this would depend on how large the units really were. The fort is not mentioned in the Notitia. (Richmond 1936 p195; Casey 1978 p190; Welsby 1982 p32, 41, 62, 92, 103; Breeze and Dobson 1984 p127-8, 135, 220, 226, 248).

Rudchester (Northumberland).

This Hadrian's wall fort was destroyed in the barbarian uprising of the 180's, but immediately rebuilt. There was a period of inactivity from c270-370. There was complete rebuilding in the later 4th century. Area:4.5 acres. The Hadrianic garrison was perhaps a cohors quingenaria equitata. By the time of the Notitia the fort was manned by the Cohors prima Frixagorum - perhaps a copyists error for Frisiavonum. (Gillam 1973 p8; Breeze and Dobson 1984 p48, 76, 128, 140, 208, 213, 222, 243).

Scarborough (Yorkshire).

The older view that this and other signal stations were built by Count Theodosius after the disaster of 367AD has been superseded. It is now considered that they were constructed on the orders of Magnus Maximus in the early 380's AD (Casey 1979 p66-79; Wilson 1980 p83).

Silchester (Wiltshire).

There may have been a military occupation here in the 1st century AD, although no traces of barracks have yet been found. The Roman town - the civitas capital of the

Atrebates - was founded not long after 43AD and continued into the 4th and perhaps the early 5th century. Military objects suggest that there was a garrison in the 3rd/4th centuries. Some buckles and other objects are used as evidence (very tenuous in my opinion) for a garrison of Germanic mercenaries. (Boon 1974 p43, 66, 68, 75, fig 9).

Slack (W. Yorkshire).

The fort was founded by Agricola and occupied down to between 140 and 160AD, possibly with a reduced garrison after c122-5AD. Area:c2.8 acres. Stamped tiles of a COHORS III BRE (ucorum) have been found in the bath-house (Barber 1870 p1-11; Dodd and Woodward 1922 p1ff; Hunter et al 1967 p74ff; Breeze and Dobson 1984 p83).

South Shields (Tyne and Wear).

The stone fort has recently been re-dated to the Antonine period, but there may have been activity at this site going back to c80AD. The earliest timber buildings belong to c120AD. The fort was occupied down to the end of the 4th century or later. Area:4.1-5.2 acres. Many units are attested here on lead seals but many of them were probably not based at South Shields. The Hadrianic garrison may have been an Ala quingenaria. Cohors V Gallorum is known to have been based here from at least 222/3AD. The Numerus of Tigris boatmen mentioned in the Notitia may have been here from the 1st quarter of the 4th century. (Dore and Gillam 1979 p59-70; Breeze and Dobson 1984 p48, 75, 140, 230, 247; Frere 1986 p374-6; Bidwell 1987 p12-14).

Stanwix (Cumbria).

This fort, situated on Hadrian's wall, covered an area of 9.32 acres. There is no evidence for the date of its abandonment. The latest coin is one of 350-353AD, but as the site is mentioned in the Notitia it may have been occupied down to the close of the 4th century. Although the identification of the fort as Petriana has been challenged, the fort is the right size for a milliary ala and only one such unit (the ala Petriana) was ever stationed in Britain. (E. Birley 1961 p259; Breeze and Dobson 1984 p48, 245).

Strageath (Tayside).

The first fort on this site belongs to the Agricolan period. The Antonine fort covered 3. 7 acres. The suggested garrison for the first Antonine phase is two cohorts, one of them equitate. In the second phase it is thought that two infantry cohorts of 500 men were based here. The barrack arrangement at Strageath is difficult to interpret and these suggestions must be viewed with caution. (M. J. Jones 1975 p177; Frere 1979 p37-41; Hanson and Maxwell 1983 p159).

Templeborough (Yorkshire).

The first fort (of 6 acres) was built between 54 and 72AD and probably housed Cohors IV Gallorum equitata. There may have been some early 2nd century occupation (on pottery evidence) but there is a large gap in the coin sequence from Faustina II to Carausius. A quantity of late 3rd/early 4th century coins points to a re-occupation at this time. (May 1922; M. J. Jones 1975 p178; Breeze and Dobson 1984 p126, 254).

Tower 16A (Cote Howe, Cumbria).

Part of the Hadrianic Cumberland Coast defences, the equivalent of a turret on Hadrian's Wall. Hadrianic pottery was found here. Area: c20 feet square. (Richmond 1957 p66; Breeze and Dobson 1984 p42, 75).

Tower 16B (Cumbria).

Trial trenching took place in 1954. Examination of this structure (similar to the above) as well as of towers 13a and 15a, suggested that there was only one occupation, of fairly brief duration. (Bellhouse 1955 p42-7).

Hadrian's Wall Turrets (General).

Most turrets had been abandoned by c190-210AD, but a few show evidence for a 4th century occupation. They were abandoned when the Antonine Wall was built and most (perhaps all) were reoccupied in the 160's, some very briefly. Turrets 33B-41B were demolished in the 180's. A very few turrets were in use again in the later 4th century after a long abandonment. (Welsby 1982 p42, 87; Bennett 1983 p48; Breeze and Dobson 1984 p224; Allason-Jones 1988 p219-220).

Turret 7B (Denton Hall).

This turret was still in use in the early 4th century. (E. Birley 1930 p143ff; Welsby 1982 p87).

Turret 8a (West Denton).

No dating evidence available.

Turret 10A (Throckley).

The site may have been abandoned by c140AD (Bennett 1983 p48; Allason-Jones 1988 p198).

Turret 17A (Welton West).

Excavated in 1931. No chronological details are known. (E. Birley et al 1932 p255-9; Allason-Jones 1988 p198).

Turret 18A (Wallhouses East).

Excavated in 1931. No chronological details are known. (E. Birley et al 1932 p255-9; Brewis 1932 p198-204; Allason-Jones 1988 p198).

Turret 18B (Wallhouses West).

Excavated in 1959, the latest coin from the site is one of Antoninus Pius and there is no pottery later than the 2nd century. (Taylor 1960 p214; E. Birley 1961 p260; Woodfield 1965 p87ff; Allason-Jones 1988 p200).

Turret 25B (St. Oswalds).

Excavated in 1959. There is no pottery later than the 2nd century. (Taylor 1960 p214; Woodfield 1965 p87ff; Allason-Jones 1988 p202).

Turret 26A (High Brunton).

Two-thirds of the turret was excavated in 1959. None of the pottery postdated the 2nd century. (Taylor 1960 p214; Woodfield 1965 p87ff; Allason-Jones 1988 p203).

Turret 29 (Limestone Bank).

No coins were found in the 1912 excavations. The small amount of rubbish hinted at a brief occupation. The pottery is said to have ranged from the Hadrianic period to the end of the 2nd century. There were no characteristically 3rd/4th century sherds. Occupation may thus have extended over the period c120-200AD, with a break around 158AD (Newbold 1913 p62-3).

Turret 34A (West Grindon).

Possibly re-occupied in the 160's for a short time. Demolished in the 180's. (Charlesworth 1973 p97ff; Allason-Jones 1988 p208, 219).

Turret 35A (Sewingshields).

The suggested chronology for this site is the same as for West Grindon. (Woodfield 1965 p87ff; Allason-Jones 1988 p209, 219).

Turrets 48a/b (Willowford East/West).

There was no pottery of post 2nd century date from either turret. (Shaw 1926 p445-450).

Turret 50B (Appletree).

Excavated in 1911. No coins were found and the date of abandonment is not known. (Simpson et al 1913 p297ff; Allason-Jones 1988 p213).

Turret 51B (Lea Hill).

Excavated in 1958. Pottery of allegedly 4th century date was found. (Woodfield 1965 p87ff; Allason-Jones 1988 p213-5).

Verulamium (Hertfordshire).

The Roman town at St. Alban's was preceded first by a Belgic settlement and later by a Claudian fort. The fort was only occupied for a brief period. The town became a municipium and the capital of the civitas Catuvellaunorum. Occupation continued here until at least 450AD. (Frere 1958 p1-14; M. J. Jones 1975 p180-1; Stillwell 1976 p971-2).

Vindolanda (Northumberland).

The fort was founded before 90AD and was initially c3.5 acres in area. From c95-125 a series of 8 acre timber forts occupied the site. There was a period of disuse between 125 and 163AD before a new 4.15 acre fort was built, this time in stone. The vicus began earlier, perhaps around 140AD. The second stone fort (and the second phase of the vicus) perhaps belong to the reign of Severus Alexander. The vicus was probably abandoned by about 270AD, but the fort continued to be occupied until the end of the 4th century at least. The sequence outlined above is one possibility, but there is little agreement over the chronology of the site. Equally difficult to unravel is the sequence of garrisons. Cohors I Tungrorum and Cohors VIII Batavorum are recorded on pre-Hadrianic writing tablets. Cohors II Nerviorum may have been here in the Hadrianic period, if an inscription from Hardriding is relevant and Cohors III Nerviorum may also be attested at Vindolanda. There are inscriptions mentioning Legions VI Victrix and XX Valeria Victrix, but they need not imply that legionaries were ever in garrison here. Legionaries are only mentioned on one document out of nearly 1000 from the site, dating to after 105AD. Cohors IV Gallorum Equitata is first recorded on an inscription of 212-3AD (R. I. B.1705) and could not have arrived here before c170-180AD. The same unit was still in garrison when the Notitia was compiled. (R. Birley 1977 p108-9, 172; Welsby 1982 p169; Bidwell 1985; Donaldson 1989 p218).

Wallsend (Tyne and Wear).

The Hadrian's wall fort covered 4 acres and was perhaps built to house a cohors quingenaria equitata. Alternatively Cohors II Nerviorum was based here. Stamped tiles of legio VI Victrix and the Ala I Asturum have also been found. By the 3rd century the garrison was Cohors IV Lingonum Equitata (R. I. B.1299-1301) and this unit is also mentioned in the Notitia. Extensive industrial activity in the area may have largely removed the upper levels of the site and we are unlikely to learn much about the later history of the fort. (Daniels 1976 p10-11; Breeze and

Dobson 1984 p48, 68, 70, 76, 242, 272; information from Mr. Iain Watson, Wallsend Heritage Centre).

Watercrook (Westmoreland).

The turf and timber fort was built c90-95AD and had an area of c2.5 acres. The stone fort (Hadrianic?) was held down to c290AD, with gaps from c140-155 and c220-265AD. Suggestions that Watercrook should be identified with the "Aliona" of the Notitia, garrisoned by Cohors III Nerviorum are purely speculative. The fort may have housed a cohors quingenaria, but there is very little evidence. The only barrack excavated in 1944 may have had ten contubernia (North and Hildyard 1945 p156; Gillam 1950 p58; M. J. Jones 1975 p183; Potter 1979 p145, 205).

Whitemoss (Strathclyde).

This fort near Bishopton protected the flank of the Antonine wall. The area was almost 5 acres. Likely dates of occupation:- c140-163. Garrison:unknown. (Stillwell 1976 p994; Breeze and Dobson 1984 p98).

Wroxeter (Shropshire).

A legionary base (possibly not full size) occupied the site from c60-90AD. The auxiliary fort may have preceded or co-existed with the larger establishment. A tombstone of a trooper in Cohors VI Thracum Equitata has been found here. Other forts are known to the north and east of the later town. Wroxeter became the civitas capital of the Cornovii. There is evidence for Saxon settlement in the late 4th/early 5th century. Finds of plumbatae may imply a military garrison here in the 4th or 5th century. (Webster 1958 p65; Wilson 1964 p165; Barker 1970 p32-5; 1972 p19; M. J. Jones 1975 p185-6; Webster 1985 p57 note 5).

Wycomb (Gloucestershire).

This site may have been a religious centre. A number of houses have been identified, as well as a temple and possibly a theatre. (Lawrence 1864 p302-7; Stillwell 1976 p995).

York (North Yorkshire).

There may have been a pre-Flavian base here, although no structures have been identified. York was occupied under Petilius Cerialis (c71-74 AD), perhaps by a 50 acre legionary fortress held by Legio IX Hispana. This base had definitely been built by the time of Agricola's governorship.From 122AD legio VI Victrix was based here. That unit was still in garrison in the mid 3rd century - as is shown by a tile giving the legion the title GORDIANA. The fortress was rebuilt in the late 3rd/early 4th century, perhaps by Constantine. The legion was still here at the time of the Notitia. The vicus of the fortress grew into the Colonia of Eboracum and in the 4th century was known as Sexta , a name derived from the garrison. (Miller 1925 p176-194; Butler 1971 p97-106; Hartley 1971 p55-69; Wenham 1971 p45-53; M. J. Jones 1975 p186-7; Frere 1986 p384).

Appendix 2: Statistical Tables

Table 13: Relative Frequency of Weapons

Object Type.		Number of Sites.
Arrowheads.		42
Artillery.		2
Axes.		6
Ballista Balls.		27
Ballista Bolts.		40
Barbed Spearheads.		19
Bow Laths.		9
Daggers.		9
Dagger Handles.		2
Dagger Pommels.		1
Pilum Points.		16
Scabbard Bindings.		11
Scabbard Chapes	(Bone).	17
	(Bronze).	32
	(Iron).	5
	(Ivory).	2
Scabbard Runners.	(Bone).	6
	(Bronze).	28
	(Iron).	5
	(Ivory).	2
Sling Shots	(Clay).	15
	(Lead).	10
	(Stone).	16
Spearbutts.		21
Spearheads(Leaf-Shaped).		87
Standard Tips.		18
Swords(including fragments).		21
Sword Grips.		5
Sword Pommels.		3

NOTE: The Artillery fittings category includes the supposed crossbow components from Burbage. "Barbed spearheads" includes plumbatae,as well as larger barbed weapons.

The material for this study was drawn from c150 sites in Britain. First century finds have not been included.The figures are to the best of my knowledge complete,but of course new material is emerging all the time.They do at least serve to show in general how common the various categories of weapons are.Many finds from civilian sites have not been included in this corpus even though they fall within the time period covered.This is because slingshots and spears in particular could be used in hunting and do not necessarily imply the presence of a military unit.On the other hand objects like plumbatae and scabbard fittings have a definite military character.

Table 14: Finds Index(part 1).

Key: 1=Arrowheads, 2=Artillery fittings, 3=Axes, 4=Ballista Balls, 5=Ballista Bolts,6=Barbed spears, 7=Bow laths, 8=Daggers, 9=Dagger handles, 10=Dagger pommels, 11=Pilum points, 12=Scabbard bindings, 13=Bone chapes, 14=Bronze chapes, 15=Iron chapes

An entry marked + indicates a minimum total, whilst a ? denotes an unknown quantity of finds in that category.A few finds have multiple entries, when their precise function is uncertain.The totals are very approximate because of these factors.

FINDS CATEGORIES

SITE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Alchester				2?											
Aldborough															1
Bainbridge				3	2										
Baldock	c30?				?										
Balmuildy				6											
Bar Hill	12			110?			6	1	1		26				
Bath		*													
Bearsden	44				6						6				2
Beckfoot	1														
Benwell				1										1	
Bewcastle	1														
Birdoswald														1	
Birrens						1									
Bowness					1										
Brancaster	5-8		2		5?			1					1		
Brecon Gaer	1				3						2-3				
Brigstock	3														
Brough-under -Stainmore	2													1	
Burgh Castle						2									
Burbage		*													
Burnswark	9		2	23											
Brough-on-Noe				2											
Caerleon	19			2	4		74+	2			55		11	16	
Caernarvon	3?					3									
Caerwent						1									
Caister	5				4?						1?		1		
Camelon			2												
Canterbury														1	1
Carlisle	2			1	7+			1			1?	1			

							7	8	9	10	11	12	13	14	15
Carrawburgh	1											1			
Carvoran						1									
Catterick					1	2									
Chester	3			62+	1	1?					3?		2	3	1
Chesters				1?	1-2	6	2							7	
Cirencester						1								1	
Clausentum	1														
Colchester							1						1	1	
Corbridge	?			150+	20+	2?	5				25+	1	1	5	
Cowbridge	1				1										
Croy Hill	1			50?											
Doncaster					1?	1									
Dover													1		
Durisdeer				1?											
Earsdon				1?											
Ebchester	1														
Exeter													1		
Gadebridge	1														
Gellygaer								1							
Gestingthorpe														1	
Godmanchester	?														
Great Chester -ford														1	
Greatchesters				?		1								2	
Greta Bridge			1		1										
Haltonchesters				1										1	
High Rochester	?			?											
Holt					1										
Housesteads	800+			3?	3	1								2	
Ilkley									1						
Kenchester						2									
Kirkbride					5?										
Kirkby Thore	1				2?						3?		1	1	
Lancaster														2?	
London					6+		3	2					1	2	
Loudon Hill				2											
Lower Machen				1											
Lydney Park													1		
Lyne						1									
Manchester					1									1	
MC.9														1	
MC.35	2				1			1						2	
MC.37														1	
MC.39	2?				4?			2?							
MC.48								1			1?			1	
Milton				3											
Netherby														1	
Newstead	7+				?	1					2?	18		3	
Old Penrith	1				8?										
Peel Gap Tower					1										
Pen Lystyn					1										
Pevensey	1				2										
Piercebridge	2														
Portchester	1?				2?										
Ravenglass	1?				1?									2	
Reculver													2		
Ribchester				?											
Richborough	7+		2+		7+	5					6?		3	4	
Silchester	1				4		1						5		
South Shields			?			1	2+					1	6	6	

Stanwix					1?										
Temple -borough	1?										1?				
Turret 8a				1?											
Turret 18a				1											
Turret 25b	1											1			
Turret 26a												1			
Turret 35a												1		1	
Turrets 48a and 48b											1?	1			
Turret 51b												1			1
Verulamium							2?				1?			1	
Vindolanda	3				20+						?			7+	
Wallsend				15?	1										
Watercrook	22				2					1?		1			
Wroxeter	1					6								1	
Wycomb													1		
York	?				2?								2	2	
TOTAL	1000+	2	9+	442	134	39	96	12	3	1	135	28	41	81	6
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

N.B. The "Fremington" chape is included in the York entry.

Table 15: Finds Index(part 2).

Key: 16=Ivory chapes, 17=Bone runners, 18=Bronze runners, 19=Iron runners, 20=Ivory runners, 21=Clay slingshot, 22=Lead slingshot, 23=Stone slingshot, 24=Spearbutt, 25="Leaf-shaped"spearheads, 26="Standard tips",27=Swords, 28=Sword grips, 29=Sword pommels.

SITE	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Abergavenny						13								
Alchester								2?						
Aldborough										?				
Ambleside							17			12				
Ardoch						75				3				
Atworth			1											
Bainbridge										2				
Baldock										20+				
Balmuildy										3?				
Bar Hill								110?		2		1		
Bayford										1				

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Bearsden										4				
Beckfoot										1		1		
Bellshiels										1				
Benwell														1
Bewcastle									7	2				
Binchester										2		1		
Birdoswald							1				1			
Birrens							3			3				
Bothwellhaugh						1		3						
Bowness-on -Solway									1	1				
Brancaster										1	1			
Brecon Gaer									3	2				
Brigstock										1				
Broomlee										2				
Brough-on -Humber						1								
Brough-under -Stainmore			1							?				1
Burnswark							133			2		1		
Cadder										1		1		
Caerhun						30+								
Caerleon			22			1		2		20+	1		2	
Caerwent			1					5						
Caister									13	3				
Camelon										8		3		
Canterbury												2		
Cappuck										?				
Carlisle			5			3	2	7	1	11+	1	1	2	
Carrawburgh									3					
Catterick										6	1			
Chester			2			1				7+	2	1		
Chesters			8					9?	3	17	9			
Cirencester			1							10+				
Colchester		1	3								1		1	
Corbridge			6				9		7	?		1		
Cramond							2							
Doncaster										1?				
Gadebridge										1				
Gellygaer										1				
Gloucester			1											
Godmanchester										1				
Greatchesters		1								1				
Greta Bridge										1	2			
Halton Chesters										2				
Haltwhistle										12				
Hardknot							1?			3				
High Roch -ester										?				
Housesteads			1				1	?	1	10+	1			
Huntsham										1				
Ilkley										1				
Inveresk										1				
Kirkbride										1				
Kirkby Thore			1?	1?					1?	2				
Kinneil										2				
Lancaster												1?		
Llandough		1												
London	1	2	2	2	1					4	1	2	4	
Loudon Hill						41+				7				

Lyne										1				
Malton			1											
Manchester										2				
Maryport										3				
MC.35									2	7	2			
MC.39			1					1	2	10+	1	2-3		
MC.48						1			1?	4?				
MC.50										4				
MC.54									1	2				
MC.79										3				
Milefortlet 5										2				
Mumrills										8				
Neath						1								
Nettleton	1													
Newstead			1							?				
Old Kilpatrick						2		?		1				
Old Penrith			2	1						6	1		1	
Papcastle						1				1				
Peel Gap Tower								?						
Pen Lystyn										1				
Piercebridge										4				
Portchester										9?		2		
Richborough			3						5	25+	1			
Rudchester										1				
Scarborough										1				
Silchester			1	1					3	14	1	1		
Slack									1					
South Shields		2	5		1					4+		4-5		
Stanwix			1											
Strageath			1			?								
Templeborough										1				
Tower 16a										2				
Tower 16b										3				
Turret 7b										1				
Turret 10a										1				
Turret 18b										1?				
Turret 29b										1				
Turret 34a										1				
Turret 35a								1						
Turrets 48a and 48b										2				
Turret 50b			1											
Usk			1											
Verulamium									1	3		2		
Vindolanda			1	1			14		5?	40+	11	1		
Wallsend								15?	1	6	1			
Watercrook			1			2		?	1	8				1?
Whitemoss								1						
Whittlesey												1		
Wroxeter												1		
York		1	3?					12?				1		
TOTAL	2	8	77	6	2	173	183	168	63	383	39	33	10	3
	16	17	18	19	20	21	22	23	24	25	26	27	28	29

N.B. The "Fremington" runners are listed under York.

Some comments can be made on these statistics, although it is always worth bearing in mind that factors other than popularity influence our data base. Iron objects naturally predominate, in spite of the generally indifferent state of preservation. Many more objects may have gone unnoticed because of extensive corrosion. The widespread distribution of arrowheads is significant, supporting the view that all Roman troops received some training in archery. Lath finds are not common however. Some may have gone unrecognised, but perhaps the number of bows available for most units was small. Some small "javelin heads" might be from arrows. Spearheads form the bulk of the material, appearing on almost two-thirds of the sites at which weaponry has been found. This is a fair indication of the importance of this kind of weapon in the Roman army. The figure may be a little misleading, since spearheads were relatively cheap and easy to make. Swords on the other hand would have been more highly valued and would seldom be discarded. Thin sword blades are very suceptible to corrosion and this factor probably accounts for the relative dearth of swords in the corpus of material. Many of the surviving remains are only tips - which were presumably harder than the rest of the blade. As noted in chapter X there are problems with the identification of artillery projectiles both of iron and of stone. What little evidence that we do have suggests the use of artillery by some non-legionary units. This may also be true of the pilum, finds of which are exceedingly uncommon for this period. Again there are problems with identification. The number of daggers is small (about 10 sites out of c150) and many of these finds may not be weapons at all. With scabbard fittings (bindings, chapes and runners) there is an obvious preponderance of bronze examples. Such objects may have been made in iron more often than our sample suggests, for heavy corrosion might often prevent the survival or identification of these finds. Bone fittings on the other hand tend to survive in fairly good condition. The scarcity of ivory fittings surely reflects the expense of producing them. Finally the roughly equal use of clay, lead and stone slingshots may be noted (15, 10 and 16 sites respectively). There are problems with the identification of the first and third categories so those figures may be too high.

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