

5. The bolt-shooter: accuracy, range and effects

Dramatic archaeological evidence comes from the Claudian invasion of Britain which began in AD 43, during which the future emperor Vespasian commanding the Second Legion fought thirty battles, defeated two tribes and captured more than twenty hill-forts and the Isle of Wight. Archaeologists believe that they have located evidence of his artillery in action at two hill forts in Dorset.



1. Artillery victim at Maiden Castle

Iron bolt head from a Roman catapult lodged in the spine of a Briton buried at Maiden Castle, Dorset (Wheeler 1943, Plate LVIII A and page 352, Skeleton P7A “adult male, aged 20-30 years”). The bolt appears to have travelled uphill and entered around his belly-button. The 10-11mm internal diameter of the socket is too small for a three-span bolt-shooter (and for a thrusting spear) and was probably shot from a Xanten-Wardt size of catapult (section xx below). The large numbers of socketed bolt heads found on the Hod Hill site since the 19th century and now in the British Museum have been recorded and analysed by Professor Bill Manning (Manning 1985). A large percentage of them have this small diameter of socket, as have the heads recorded from Vindolanda by Robin Birley, and those from many other sites; a bolt head of this size has been found in the current excavations at Ham Hill, Dorset. Compare this leaf-shaped blade with a similar one from Hod Hill in figure 15 right and the comments in the caption there. (Skeleton now in the Dorset County Museum, Dorchester. Excavation photograph copyright The Society of Antiquaries of London.)

At Maiden Castle near Dorchester Sir Mortimer Wheeler interpreted his discovery of forty skeletons of Britons buried in shallow graves close to the east gate as a ‘war cemetery’ and evidence of a great massacre of the British defenders, with the legionaries storming the gate under the cover of artillery fire (Wheeler 1943, 61-3). However re-

examination of the fifty-two skeletons discovered to date reveals that only fourteen have battle wounds and may not have died at the hillfort (Sharples 1991, 124-5). There is one victim of Roman artillery with the iron point of a bolt in his spine (figure 8). The square hole in the skull of another victim has now been technically examined and proved (Feeley, Wilkins and Wilkinson: Ancient Discoveries' *Ballistics* TV programme) to have been caused by a *pilum* thrust; a catapult bolt would have shattered the bone around the impact hole. Wheeler's battle casualty figures have been disproved, but his report (1943, 62 and 281, fig. 93) records a few catapult bolt heads in the hornwork of banks and ditches protecting the east gate, and his picture of the Roman technique of assault under cover of artillery fire is authentic and a Vespasian speciality. There is an eyewitness description (Josephus, *Jewish War* III, 166-8) of him clearing enemy battlements with such a barrage from his three legions at the siege of Jotapata (Palestine) in AD 69: *'Vespasian ordered his artillery, numbering a total of 160 machines ...to fire at the defenders on the wall. In a coordinated barrage the catapults sent long bolts whistling through the air, the stone-throwers shot stones weighing one talent, fire was launched and a mass of arrows. This made it impossible for the Jews to man the wall or even the area behind it that was strafed by the missiles. For a mass of Arabian archers, spearmen and slingers was in action along with the artillery.'*

Like most of the enemies of Rome, the Maiden Castle Briton struck by the catapult bolt would not have been wearing body armour. A writing tablet from Vindolanda (Birley 2002, 96), critical of British fighting tactics, appears to describe the Britons as wearing no armour (*nudi*). Our tests with a reconstructed bolt-shooter of this period against steel plate (figure 28) show that even if he had been wearing body armour he would have been put out of action.



2. Marsden's three-span at Maiden Castle: a television first

Dr Eric Marsden shooting at the ramparts of Maiden Castle, Dorset with his three-span *scorio*, for the pioneering BBC television programme on the site by Sir Mortimer Wheeler. See also figure 7. (from Paul Johnstone, *Buried Treasure*, Phoenix House, 1957, Plate 61).

5.1 Hod Hill, Dorset

25 km north north east of Maiden Castle, at the Durotriges' hill-fort of Hod Hill, unique proof of the accuracy of the Roman bolt-shooter was found when Sir Ian Richmond examined two round huts and a very large palisaded enclosure which had come under attack. A total of seventeen iron bolt heads was found, most of them still embedded in the chalk surface in the position where they had landed, their wooden shafts having rotted away. Sir Ian conjectured (Richmond 1968, 31-3) that they had been fired in an arc starting with four bolts in the rectangular enclosure outside Hut 36a, and one inside that hut. No less than eleven had landed inside Hut 37, and only one had overshot to land in the adjacent Hut 43; none had undershot into the adjacent area of Hut 56. The slope of the site in the direction from which the bolts came, and the existence of other huts on that alignment interfering with the line of sight, would have made it necessary to shoot from a high viewpoint; Sir Ian suggested a portable siege-tower not less than 50 feet high to overlook the rampart.

The range from such a position would have been about 170 metres. An alternative scenario that I have proposed below is that the shooting was from a position on the

rampart itself, at a range of some 130 metres.

Sir Ian surmised that the chieftain's hut was selected as an artillery target to intimidate the defenders into surrendering: '*The lack of evidence for an assault on the hill-fort, or for subsequent devastation within it, would strongly suggest that capitulation was then and there induced by showing dramatically what concentrated fire could do.*' (Richmond 1968, 33). There was no sign of victims in shallow graves, as found by Sir Mortimer at Maiden Castle, or of any battle debris in Sir Ian's trenches across the ramparts or at the gates. It is unlikely that this dramatic and attractive scenario will ever be proved or disproved. An alternative possibility that has been suggested is that these bolts were shot at a later date during target practice by the legionaries living in the Roman fort that was built in the corner of the hill-fort. This seems less likely because after its capture the Romans had levelled the huts in the hill-fort (Richmond 1968, 33): Sir Ian noted a worn coin of Germanicus '*dropped when the timbers of the palisade [of Hut 36a] were removed.*' (Richmond 1968, 22).

5.2 The palisaded enclosure and Huts 36a and 37

The complex occupies a commanding position on the steep slope that looks down onto the ramparts. Even when the ramparts were at their original height, there would have been a good field of view to the SSE from the doorway of Hut 37 to the high ground south of the present hamlet of Ash (figure 4) and to the south in the direction of the village of Stourpaine. This would have allowed the inhabitants of the huts to observe the fateful arrival and ominous size of Vespasian's army. Conversely Vespasian would have a clear view of the complex when planning his attack (figure 10). Information from prisoners and/or activity in and around the enclosure and the huts, perhaps the presence of war-chariots, may have confirmed the importance of this selected target.

There are other huts of similar size visible on the air photograph of Crawford and Keiller (*Wessex from the Air*, 1928, 36 plate I), but it is the unique size of the palisaded enclosure that was one of the factors that led Sir Ian to decide that it belonged to an '*especially significant personage*'. Dave Stewart's important 2007 magnetometry survey of the whole area inside the Iron Age ramparts confirms the enclosure's uniqueness. Its Hut 36a contained two iron spear heads in the place next to the entrance where other excavated huts, numbers 43, 56 and 146, contained large caches of sling stones: possession of spears is a further indication of high status. O.G.S Crawford pointed out that one of the tracks that begin at the main Steepleton Gate heads straight for this enclosure.

5.3 Which bolt-shooters were used?

Through the kindness of Dr Ralph Jackson of the British Museum I have been able to examine the records of the bolt heads from Huts 36a and its enclosure and Hut 37. These and large numbers of other Hod Hill bolt heads drawn and analysed by Professor Bill Manning (Manning 1985, 170-77, Fig 34 and Plates 82-5) have sockets between 10 and

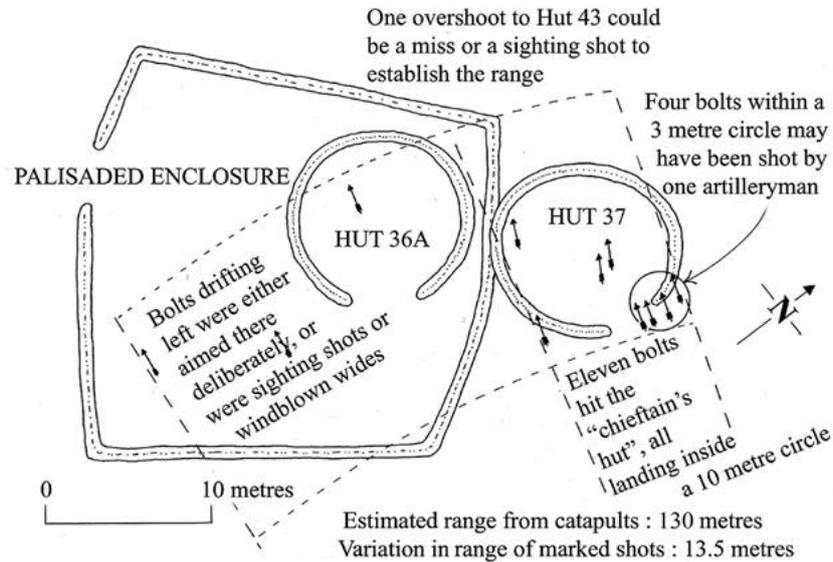
12 mm in internal diameter, the calculated size for the Xanten-Wardt *scorpio minor*, and too small for the 18 - 18.5mm outer diameter, 15 – 17mm inner diameter, attested for the heads of the three-span *scorpio maior*. The diameter of the bolt for the various sizes of bolt-shooters can be calculated from the size of the exit aperture in their spring frames (figure 12).

This means that the attack was probably mounted not by three-span scorpion bolt-shooters, but by one or more scorpions of the lighter Xanten-Wardt size that can easily be carried on one shoulder, even by octogenarians like myself. This allows a slight change to be made to Richmond's account, discarding the need for a bolt-shooter to be raised onto a portable siege-tower, the time taken for which would have destroyed the element of surprise.

5.4 Vespasian's battle plan

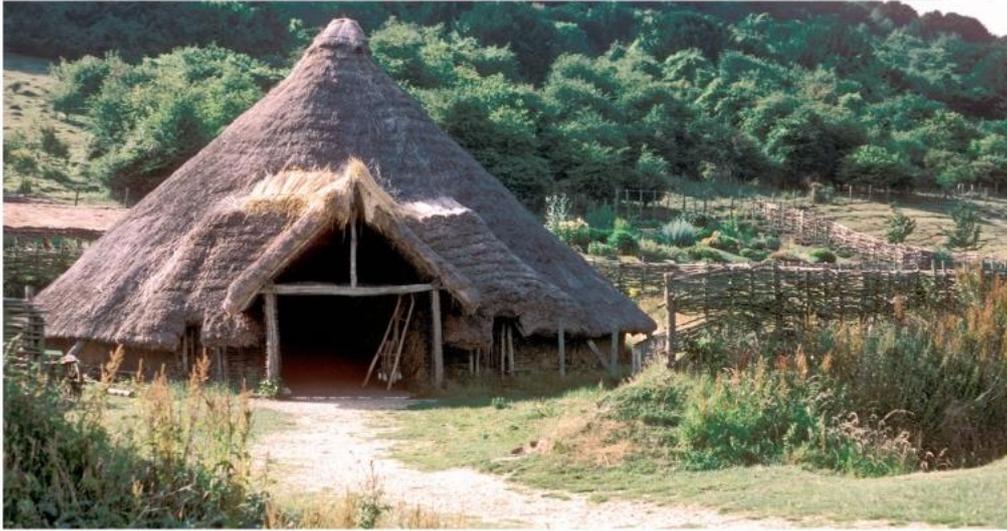
Vespasian's personal courage and leadership in battle are frequently vouched for, and make it likely that he led the assault on the main hillfort gate: Suetonius (*Vespasian* IV,6) '*...in the storming of a fortress he was struck on the knee by a stone and received several arrows in his shield.*' Josephus (*Jewish War* III, 151) '*...when Vespasian had positioned his archers, slingers and the whole of his long range artillery and ordered them to shoot at the Jews, he himself advanced with the infantry up the slope to the spot where the defensive wall was weak...*'

It is important to note that the assault on Hut 37 was mounted from a position well away from the hill-fort's two gates which the defenders would surely have expected to be the main focus of the Roman attack. In order to seal the defenders in and prevent the emergence of their highly skilled, fast-moving charioteers and cavalry, Vespasian would have had to position his *Legio II Augusta* in front of both gates, probably under cover of darkness (figure 10). Dawn would have revealed to the unarmoured Britons a sea of iron-clad Roman infantry and cavalry, interspersed with archers, slingers and artillerymen.



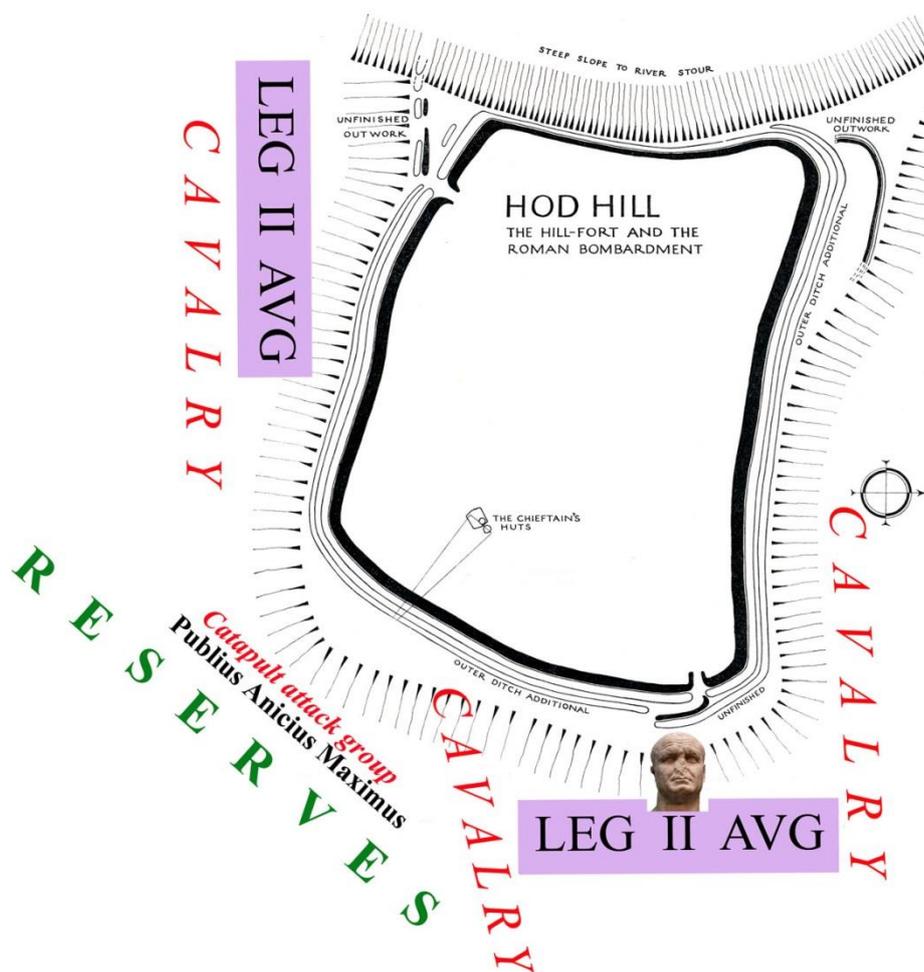
3. Plan of bolt heads targeting the chieftain's huts and enclosure

Unique evidence for the accuracy of Roman bolt-shooters. The author's analysis of Sir Ian Richmond's Hod Hill 'target'. Sir Ian's plan only marks the missile heads that appeared to be still embedded in their position of impact. The analysis shows accuracy of the kind that will regularly knock out troops and horses at this range, "*demonstrating then and now the deadly and devastating precision with which the ballista could be handled.*" (Richmond 1968, 33). Sir Ian discussed this drawing with me at length, explaining that he had noted the bearings of the heads that were still in position embedded in the chalk ground surface, and kept a sharp lookout for other bolt heads in all the huts that he excavated and in the areas around them, the white surface making them easy to spot. The two bolts in the centre of Hut 37 are on a slightly different alignment from the four at the entrance: my belief is that they have caught the left hand frame of the doorway on the way in and ricocheted. (After Richmond 1968, Fig.14).



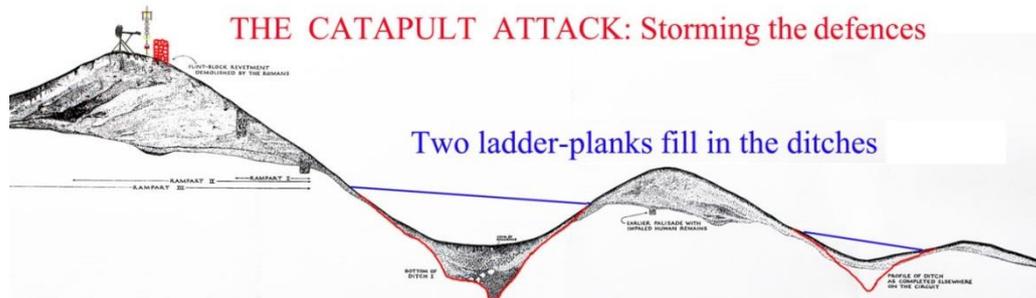
4. Reconstruction of an Iron Age hut

Reconstruction of an Iron Age hut and adjacent enclosure at the Butser Ancient Farm site in Hampshire. (photograph: the author)



5. Vespasian's plan of attack

Suggested positions for Vespasian's assault, blocking the two gates of the hill-fort (after Richmond). Portrait of Vespasian in the British Museum. Incidents in the later war against the Jews prove him to be a general who fought alongside his troops and led from the front.



6. Vespasian's plan of attack – crossing the ditches

The catapult attack group crosses the hill-fort's ditches and sets up the legionary standard and catapult(s) on the rampart. (after Richmond).

The battles at the two gates would have drawn the Britons' attention away from the catapult attack on Hut 37. Vespasian's briefing documents for his campaign against the tribes of Southern Britain would surely have included the information recorded by Strabo (*Geography* IV, 4, 2) that the whole Gallic race was war-mad and quick for battle, coming out for a fight all together without circumspection, so that they could be easily dealt with by anyone who was willing to use a stratagem.

Vespasian's stratagem could well have been the surprise assault on the huts housing the chieftain, his family and entourage. For the 2013 Channel Five TV programme "*Beat the Ancestors – The Roman War Machine*" I suggested that this assault could have been led by the legion's *praefectus castrorum* Publius Anicius Maximus, previously the *primus pilus* of the Syrian *Legio XII Fulminata*. (Unfortunately this TV programme was trimmed to fit the time slot, and the discussion of the Durotriges, mention of Maximus and many details of the assault were edited out). The inscription from Antioch set up in Maximus' honour (*C.I.L. iii. Suppl. 6809*) records that he was awarded the *corona muralis* (gold mural crown in the shape of a turreted city wall) by the Emperor (Claudius) for his action in this British campaign. This very rare decoration was for being the first to cross the enemy battlements and plant the standard on them, by implication an action that contributed to the capture of the fortress or town. Of course he could have won it at one of the other sieges of the Durotriges' hill-forts, but it fits in well with Richmond's hypothesis that the accurate missile shooting caused the surrender.

While Vespasian was launching a thunderous missile attack of catapult bolts, arrows and sling bullets at the wooden gates and adjacent ramparts, making it difficult for the Britons to man them, Maximus could have led a fast-moving small detachment of artillery marksmen, using boarding planks to bridge the two defensive ditches, which were far shallower and less of an obstacle than those of Maiden Castle. On setting up one or more of the smaller Xanten-Wardt size of scorpion bolt-shooters on the hill-fort's rampart, he would have looked straight across into the entrance of Hut 37 at a range of about 130

metres. (figure 11) One can only speculate where the tribal chieftain, his family and servants were when the lethal barrage thudded into the huts and the palisaded enclosure.

5.5 The evidence of the bolt heads

The most intriguing feature of Sir Ian's discovery also demands an explanation: why were the bolts left embedded in the chalk in their position of strike? No attempt appears to have been made to pull them out by their wooden shafts. It is most unlikely that the shafts had separated from the iron bolt heads on impact: in many years of shooting replica bolts we have found that this only happens very rarely, even when bolts penetrate hard targets, such as the replica iron shield bosses backed by 18mm ply pierced in figure xx below. When pulled out from deep penetration of the ground surface, the pinned socketed heads remain firmly attached to the shafts. It is tempting to suppose that the projecting shafts were displayed straightaway to the hill-fort's chieftain and the inhabitants, to drive home the threat of the devastating accuracy and strike power of this unfamiliar weapon. They may have been left on show, partly to continue to trumpet this warning and partly because of the artillerymen's pride in their awesome marksmanship. There is no way of knowing how many other bolts had struck the hut, perhaps lodging in the roof or walls, or hitting its occupants. As noted above (in the caption to figure 9), Sir Ian kept a sharp lookout for bolt heads in the areas around the enclosure and Huts 43, 37 and 56, but found none.

No finds of *ballista* balls are recorded in the Maiden Castle report, or in the two volume report on Hod Hill. Vespasian appears to have relied on the bolts of *catapultae*, whose velocity, weight, accuracy and extreme ranges easily outclassed the Durotriges' weaponry and made the defeat of all the Iron Age tribes of Britain inevitable.



7. Filming at Hod Hill for Channel 5, June 2012

(left) The author and Dick Strawbridge are standing on the hill-fort's rampart at the estimated position of the catapult(s) for the shoot at the chieftain's hut. The high ground in the background would have afforded Vespasian a good initial view of Huts 36 and 37 and the palisaded enclosure, which are at the top of a slope. (photograph: Tom Feeley) **(right)** Tom Feeley arming his reconstruction of the Xanten-Wardt scorpion. (photograph: the author)



8. Scorpion and Hod Hill missiles

(left) Len Morgan's Xanten-Wardt scorpion, with Vitruvius' curved arms. The 26mm wide aperture in the front plate limits the size of bolt. (centre) Two of the socketed Hod Hill bolt heads on display in the British Museum's Roman Britain gallery, the nearer one, 8.1cm long, is of the standard type with pyramidal bodkin head, the other has a leaf-shaped blade which would be much quicker to manufacture in an emergency; this is similar to the bolt in the spine of the Maiden Castle victim in figure 7. (right) The tanged Hod Hill bolt head referred to below, 118mm long, probably from a 2-cubit bolt-shooter. (Hod Hill photographs by kind permission of the British Museum)

Another find from the site in figure 15 (Richmond 1968, Figure 58, B1a), recorded as a carpenter's bit, found in a pit just outside Barrack 1 of the Roman fort, is a large catapult bolt head of the tanged type found at Qasr Ibrim (below, figure 27) and now being recorded on many sites. This has a length of 118 mm, some 40% longer than the Qasr Ibrim bolt head; one of those from Vindolanda (Birley 2000, fig.13, no. 94) is of a similar size at 116 mm, and weighs 35 gm. Both these are likely to belong to a two-cubit bolt-shooter, which would have had an arm span of about 175 cm. This should dispel any doubts about whether legionaries were garrisoned in the fort.

5.6 Artillery platforms (*tribunalia*) at Hod Hill

Sir Ian's excavation of the small Roman fort tucked inside the Iron Age defences examined two platforms next to the East and South Gates, in the position for artillery platforms recommended by the text book on constructing fort defences (*de munitionibus castrorum*, 58, "you should remember to...construct platforms [tribunalia] for torsion artillery around the gates..."). Sir Ian suggested (Richmond 1968, 73) that the two platforms were *ascensus*, sloping access ramps up which the catapults could be manoeuvred onto the ramparts. He describes the south one as "22 feet [6.7m] in width and 20 feet [6m] from its tail to the back of the 10-foot [3m] rampart, against which it very clearly buts. It is formed by a platform of chalk rubble rising at an angle of 26 degrees from ground level at the back..." He identified narrow turf built staircase-ramps on either side of the platform and parallel to the rampart. The 22 foot width of the feature would have allowed more than the pair of catapults suggested by Sir Ian to be mounted

on the rampart. If they were two cubit *catapultae*, whose presence in the fort is vouched for by the large tanged bolt head described above, three could be accommodated with ample space for the crews; and if the other platform at the East Gate had the same allocation this would give a ratio of one for each of the six legionary centuries.

5.7 Accuracy

Writers of all periods confirm the accuracy of the bolt-shooters, which were more suited to precision shooting than stone-throwers. Caesar (*Gallic War* VII, 25) records that at the siege of the Gallic hillfort of Avaricum (52 BC), a *scorpio* killed a Gaul attempting to set fire to the Roman siegeworks, and then killed a succession of Gauls who picked up the same firebrand. During the siege of Leptis Magna in the Civil War in Africa (46 BC) a decurion commanding a cavalry squadron was struck and pinned to his horse by accurate fire from a *scorpio* (*War in Africa*, 29, 3). The incident not only caused the rest of his squadron to flee back in terror to their camp, but also made them scared of attacking the town again. The fact that these are Roman cavalrymen on the receiving end of a Roman missile familiar to them makes this a particularly impressive example of the panic caused by artillery fire. Livy describes the more controlled reaction of the Roman general Scipio in 205 BC when attacking the walls of Locri:

“Scipio had advanced towards the wall when the man who happened to be standing next to him was struck by a scorpion. The danger implied by this incident alarmed him and he moved his camp well out of the range of missiles”. (Livy XXIX, 7, 6)

5.8 Range

There is a lack of evidence for the ranges achieved by Republican and early Imperial bolt shooters. Agesistratus' 3½ stades (640m) with a three-span is recorded by Athenaeus *Mechanicus* (Wescher 1867, 8) with the comment, *“Agesistratus surpassed his predecessors to such an extent that anyone reporting the information about him is not easily believed.”* This implies that the average legionary artilleryman would achieve a much more modest maximum range, possibly in the order of 400 metres or more. Much would depend on the build quality of each legion's machines, there being no uniformity of performance as in modern factory produced weapons. Josephus notes (*Jewish War* V, 269) that the Tenth Legion's catapults at the siege of Jerusalem were superior, *“their scorpions were more powerful and their stone-throwers larger.”*

What mattered in the end for Roman generals was the ability to easily outrange the enemies' conventional missiles. Tacitus (*Annals* XV, 9) confirms this in describing Corbulo's success in AD 62 against the Parthians, when he drove them back with catapults, *“their stones and bolts travelled further than the Parthians' answering salvoes of arrows”.* The Parthian bows of Scythian type probably had the longest effective range of the weapons fielded by Rome's enemies. Roman units of *sagittarii* used them, and Vegetius (II, 23) says that they and slingers set up bundles of brushwood as targets at a range of 600 feet (177 metres, hitting them *saepius* (“quite frequently” or “more often

than not”). When accuracy was less important than range, no doubt the Parthian bow could exceed 200 metres. See the discussion by Ureche 2013.

The introduction of the metal frame arch strut bolt-shooters at the end of this century increased the arc of the arms’ travel from 50° to 70° and would have guaranteed an even greater maximum range. The sixth century writer Procopius (Goth. i. 21. 17 in Marsden 1971, 247) describes their stocky, wooden-flighted bolt being “*hurled out with such force that it reached not less than two bow shots*”. The double negative is equivalent to a strong positive: assuming that the “*two bow shots*” range refers to the Parthian/Scythian bow, Procopius implies that the arch strut bolt shooters achieved well over twice that range, probably something well in excess of 400 metres.