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THOUGHTS ON A MILITARY APPRECIATION OF THE DESIGN OF HADRIAN'S WALL

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IT CAN hardly be in dispute that the contemporary orthodoxy on the function of Hadrian's Wall fails to carry conviction, and this is probably to no small degree a consequence of a traditionalist, not to say doctrinaire, approach to the evidence by historians and archaeologists alike. The aim of this paper is simply to re-examine the design of the Wall from an unashamedly purely military point of view, and, because one cannot isolate design from function, perhaps thereby encourage improvements in future postulates on the intentions of its builder. Three factors will be examined: threat perception; the Roman art of war—termed *ratio belli* by Caesar;¹ and the state of the art of Roman military technology at the time of Hadrian.

Hadrian had inherited two highly undesirable legacies from Trajan, namely a depleted treasury and overstretched military resources. His political response to these problems was to contract the confines of empire, and in general he contrived to match the imperial frontier defensive arrangements with his military capabilities. After their general withdrawal from Scotland c. A.D. 105 the Romans had established themselves along the shortest possible frontage—roughly across the Tyne–Solway isthmus—so further withdrawal was neither desirable nor necessary in Britain. There is clear enough evidence of a change in frontier policy in Britain early in Hadrian's reign, but what is not immediately obvious is why the Romans changed from an open *limes*—a military operational zone which faced outwards—to what appears to be a linear preclusive defensive system by building a wall, which was certainly not only built by the military but also military in concept. It is most unlikely that the Wall was merely a replacement for a less obtrusive demarcation of the limits of Roman rule, but not of influence, or that it was built to satisfy the emperor's whim, so we have to look elsewhere for answers to the fundamental questions: why was it built and what were the principles behind its design?

Strategy is determined by threat perception, which can be defined as the identification of possible adversaries and the assessment of their relative military capabilities with a forecast of their likely intentions and courses of action. As a matter of course threat perception is the foundation for the detailed military appreciations upon which contingency planning is based. Although the process of contingency planning has to be conducted according to a logical system, there is an inevitable weakness in that the first premiss, threat perception, is not a truth but the sum of a number of variables and conjectures. That is why the element of surprise plays such an important role in the conduct of war, and why, with the wisdom of hindsight, so many military errors can be

seen to have been avoidable. That you must know your enemy is a military truism, but to what extent this has ever been realistically possible is a very vexed question. Brian Dobson expresses regret over our total ignorance of the Romans' adversaries in North Britain,² but what is critical in the context of the Wall is not what these Britons really were like but how the Romans saw them. In essence, the Wall must have been built as a reaction to a perceived threat, and from its siting and design it should be possible to deduce with reasonable accuracy the thought processes which led to its construction.

There were plausible military arguments for building a continuous obstacle to mark the division between the Roman province and the northern barbarians. First, it covered all possible axes of advance into the province; second, it minimized the likelihood of surprise incursions; third, it would slow down an attacker's rate of advance and withdrawal; fourth, it could provide cover for defending forces; fifth, it restricted the enemy's opportunities for intelligence gathering; and finally, it could only be outflanked from the sea. The Wall, however, was not only a physical obstacle, it was also a psychological barrier. It created at once an impression of power from without and a sense of security from within. The scale of the Wall was probably as much a reflection of Hadrian's personality as anything else, in architecture he tended towards the grandiose as can be seen from the Pantheon at Rome and the remains of his palace at Tivoli, but it is suggested that the actual design is to all intents and purposes the adaptation of the tactically commonplace to a strategic innovation.

The concept of tactical building is not easily assimilated by the contemporary mind. To us building and earthworks are the antithesis of mobility. The Romans on the other hand were superb combat engineers; indeed it would hardly be an exaggeration to assert that the legions campaigned as much with the spade—or perhaps more precisely with the *dolabra*³—as with the sword, and to the Romans buildings of a temporary nature were essential to their *ratio belli*. Turf and timber structures were part and parcel of Roman tactics during the republican and earlier imperial periods. Examples of the Roman use of tactical building are encountered in the *de Bello Gallico*, where we read that Caesar's army: built a wall nineteen Roman miles long and sixteen Roman feet high with associated *castella* to divert the tribal migration of the Helvetii;⁴ built a siegework at Alesia of eleven Roman miles with twenty-three associated *castella*;⁵ in order to protect the flanks of their battle line dug ditches approximately 650 yards long and on their ends built *castella* equipped with *tormenta*;⁶ sent predetermined fire signals from *castella* to give warning of a major attack.⁷ In classical Latin *castellum* meant anything from a camp capable of accommodating a cohort to a small fortification, and in the above contexts it means a fortalice integral with an earthwork. It can be seen that Caesar's *castella* could be used for observation, tactical signalling, and as fighting and "artillery" platforms, and it is not difficult to detect a conceptual connexion between them and the milecastles on Hadrian's Wall. In a revealing passage we learn that Caesar's *castella* were not necessarily fully manned all of the time, "*ibique castella viginti tria facta, quibus in castellis interdum stationes ponebantur, ne qua subito eruptio fieret: haec eadem noctu excubitoribus ac firmis praesidiis tenebantur.*"⁸ Caesar's deployment of skeleton watches by day and strong garrisons by night in his *castella* may very well have been in the mind of the designer of Hadrian's Wall.

Another Roman tactical edifice was the *turris*, which was obviously a fortification smaller than the *castellum*. Basically it appears that *turres* were incorporated into earthworks as elevated firing platforms to give the defenders an additional advantage; it is manifestly more effective to discharge missiles downwards. In Gaul a legion under the command of Quintus Cicero, one of Caesar's legates and the brother of the more famous Marcus Tullius Cicero, when under extreme pressure built some 120 *turres* on the rampart of their camp in the space of one night.⁹ At the siege of Alesia Caesar built *turres* at intervals of approximately twenty-eight yards along the full length of his siegeworks,¹⁰ and at the siege of Uxellodunum Caesar built a special *turris* of ten storeys to bring down fire from *tormenta* on the approach path to an enemy major water supply.¹¹ The *turris* of the Roman fieldworks was as versatile as the *castellum*, the difference was mainly in size. Again one can discern analogous concepts, on this occasion between the temporary tactical *turres* of the army in the field and the permanent turrets incorporated in the fabric of Hadrian's Wall. Once it had been decided to erect a permanent continuous obstacle to secure the frontier, it was obviously sensible to follow well established practices and it seems most likely that the legions employed on its building merely constructed permanent replicas of their temporary tactical works.

The regularity of the spacing between the milecastles and turrets on the Wall, and the apparent total disregard for topographical variation, can give an overall impression that they were perhaps as much decorative as functional. It may even appear that the intervals were selected arbitrarily by surveyors primarily concerned with aesthetic effect, but this is extremely unlikely. It is suggested that in all probability the intervals conformed with standard operational practices of the Romans, and were determined by the tactical deployment of *tormenta* and tactical signalling.

Tormenta is the Latin generic term for missile-discharging engines, which depended on the elasticity of torsion for their power. Although the English convention is to translate *tormenta* as "artillery", it is not satisfactory. It is better by far to stay with the Latin term, because, as I have indicated on another occasion, the anachronistic use of military terminology can only lead to a misrepresentation of the capabilities of combatants in different eras.¹² In the nineteenth century, when there was considerable interest in the Roman art of war, the English translation was not entirely inept, as at that time smaller field pieces were deployed tactically in a manner comparable with the Roman use of arrow-shooting *tormenta*. Today, however, that role is the preserve of the machine-gun.

There were two categories of *tormenta*, arrow-shooting and stone-throwing. Originally the former were termed *catapultae* and the latter *ballistae*, but by the fourth century A.D. the usage changed and *ballista* and its compounds came to mean arrow-shooting engines, and this has led to some confusion among historians. As we are primarily concerned with tactical deployment in this paper, it is only necessary to touch on the technical data of *tormenta*: but for those who wish to pursue the technology further there is in English the excellent two volume work by E. W. Marsden,¹³ and in German the earlier monograph by E. Schramm now reprinted with an introduction by D. Baatz.¹⁴

Tormenta are encountered frequently in the Roman historians, and even that most

unlikely field commander Marcus Tullius Cicero, who was nevertheless hailed *imperator* by his victorious troops,¹⁵ refers to their use in significant numbers when he reduced a brigand fortress in the mountain fastnesses of Cilicia in a demi-official letter to Marcus Cato at Rome.¹⁶ The Caesarian *commentarii* have numerous references to the use of *tormenta*, and it is clear that they played a major part in sieges, not only as offensive weapons but also in a defensive role to protect siegeworks. These engines were used against area and point targets, and ancient authorities supply us with examples of how accurate they could be. Caesar records how a *scorpio*, a small *catapulta*, was used to pick off individual Gauls, who were attempting to burn down a *turris* on the Roman siegeworks,¹⁷ and Ammianus Marcellinus relates how a prince of the Chionitae, who was conspicuous from his height and bearing, was spotted from the defences of Amida by an experienced observer, *contemplator peritissimus*, and dispatched with an arrow from a *tormentum* as soon as he came within range.¹⁸

We are immediately concerned with the smaller arrow-shooting *tormenta*, because it is most likely that they were the weapons mounted by Caesar's armies on *castella* and *turres*. To obtain a satisfactory arc of fire from these buildings—the minimum would have been 180°—the most obvious solution would have been to use a flat roof as the firing platform. To get these weapons on the roof should have presented no great difficulty, especially if they were of a size that could be manhandled in mountain warfare, or comparable in scale with Ammianus Marcellinus' *leviores ballistae*, which were swiftly redeployed to deal with an unforeseen crisis,¹⁹ or with the *carroballistae* depicted on Trajan's Column.

At this point it is necessary to establish precisely what *carroballistae* were. It has been convincingly demonstrated that the *tormenta* portrayed on Trajan's Column were direct lineal descendants of the arrow-shooting engine described in the treatise attributed to Hero Mechanicus of Alexandria.²⁰ There are seven examples on the frieze: three mounted on two-wheeled carts attended by legionaries;²¹ two mounted unmanned on a parapet;²² one mounted ready for action on a wooden tower manned by a crew of two legionaries;²³ and one ready for action on a palisade manned by two men in cloaks, who are clearly not legionaries.²⁴ The representations raise more questions than answers, but there are a couple of certainties. First, the weapons can only have been mounted on the carts to be transported and had to be off-loaded to be brought into action; as the two-wheeled carts could not have been sufficiently stable to provide a satisfactory firing platform for a weapon which was designed to engage point targets. Second, a firing crew of only two men was required to bring them into action. Although it is not critical to the theme of this paper, it is nevertheless worthwhile to consider briefly the identity of the non-legionary crew. It has been asserted that they are Dacians resisting a Roman assault.²⁵ This identification, however, seems unsatisfactory to me for the following reasons. First, Tacitus made the point that a major difference between the Romans and the barbarians was that the former were especially skilled in the use of engines of war, whereas the latter were exactly the opposite.²⁶ Barbarians rarely attempted to copy the Roman use of machines, and as one of the objects of Trajan's Column was to display the absolute superiority of the Roman army over its adversaries, it is hardly probable that the exhibition of such an initiative by the Dacians would have been acceptable. Second, the form of dress worn by the two crewmen in the relief is indistinguishable from that

of Roman auxiliaries on the column. Third, we know from Hadrian's *allocutio* to his troops in Africa in A.D. 128 that tasks, which had been traditionally undertaken by the legions, were now also carried out by the *auxilia*. His address to the *equites cohortis VI Commagenorum* is particularly interesting, "*addidistis ut et lapides fundis mitteretis et missilibus confligetis.*"²⁷ Here we see that mounted troops were now additionally practised, of necessity dismounted, to throw stones from slings, according to Vegetius an exercise performed by legionaries of the *antiqua legio*,²⁸ and "engaged in conflict with missiles". It is certainly not beyond the bounds of probability that these indeterminate missiles were launched from *tormenta*. It is not an ill founded conclusion, therefore, that the non-legionary *tormentum* crew on Trajan's Column were Roman auxiliaries, and that from early in the second century A.D. some units of *auxilia* were equipped with *tormenta*.

In Europe during the nineteenth and early twentieth centuries there was a great deal of interest in the capabilities of *tormenta*, and reproductions, some to full scale, were built following descriptions in the original Greek and Latin texts. The most thorough work was carried out in Germany by Erwin Schramm, a professional artilleryman, who, as Baatz has indicated, was fortunate in having the services of craftsmen of a bygone age, who were proficient in working with both metal and wood.²⁹ Baatz holds that Schramm spent decades employed in experimental archaeology, but that is at best only a half-truth.³⁰ It does, of course, depend on how one defines experimental archaeology, but Schramm was certainly not engaged in trying to justify hypotheses based on archaeological finds and scattered snippets from written sources—an activity which has to be treated with more than a little circumspection. He was involved in verifying the data and performance of *tormenta* described at length in the ancient specialist technical treatises, and he was sceptical from the beginning and also remained sceptical at the end of his efforts.

Schramm had his successes. He built a full scale *catapulta* after a description in Vitruvius,³¹ which he demonstrated before Kaiser Wilhelm II on 16 June 1904, and firing a thirty-five inch bolt he achieved a maximum range of 404 yards.³² Now Vitruvius was an exact contemporary of Julius Caesar, and the likelihood is that in Gaul Caesar used *tormenta* identical to that described by Vitruvius. At first sight it looks as if the range achieved by Schramm's experiment would produce ideal interlocking arcs of fire from weapons sited at the ends of ditches 650 yards long, but the truth is not so simple.³³

The impressive result with the Vitruvius' reproduction was achieved by firing the machine at ground level with its stock set at an angle of elevation of 40°. In reality, however, the maximum range attained was unimportant, because, as Baatz has correctly pointed out, the military requirement for an arrow-shooting machine was that it could hit its target, and that the projectile inflicted effective damage, but at maximum range the probability of an effective hit was extremely low.³⁴ Furthermore, the low velocity on discharge and the relatively slow speed of flight on such a high trajectory means that the missile can be spotted and avoiding action taken, an undesirable characteristic in an anti-personnel weapon. So it can be seen that Schramm's result can be misleading, but his trials proved that the weapon worked, and the problems of the effective range can be resolved.

There are very good reasons for suspecting that Schramm failed to get the best

possible results from his Vitruvian engine. He used horse-hair for his torsion springs, whereas the ancients' preference was animal sinew.³⁵ He claimed, without supporting proof, that no significant improvement in range was likely to be achieved by using animal sinew or women's hair, but this may in part be because he did not succeed in making a sinew spring.³⁶ Vitruvius does state that women's hair is superior to horse-hair,³⁷ and so on balance it does look as if Schramm used the least efficient of the three materials available to the Romans. Much more important, however, is that the arms of his reconstruction were straight, when Vitruvius' text specifies curved arms; and although this may seem a minor deviation it represents a difference of some 12° in the angle of run-out, an improvement of about 33%, which would make a significant increase to the thrust exerted on the projectile, with a corresponding advance in performance. It is obviously not possible to be precise over the effects of these differences, but it is certain that the original would have required a considerably lower angle of elevation than Schramm's 40° to achieve the same range, and that represents a distinct improvement, but whether it was adequate to solve ballistics and sighting problems encountered by the Romans in their tactical deployments is another matter, and there is evidence that it did not.

The performance characteristics of stone-throwing and arrow-shooting *tormenta* were quite different. Because of the mass of the former's missile the angle of impact was not crucial; therefore a high trajectory was not necessarily an impediment to the effectiveness of a hit. The missile of an arrow-shooter, however, depended on penetration to be effective, so it had to travel on a flatter trajectory, which was achieved by laying the stock at a lower angle of elevation from the horizontal, and consequently shortening the range. Furthermore, as the arrow-shooter was a point-target anti-personnel weapon the firer had to select his target, estimate the range, winch back the stock slider to the appropriate tension for that range, take aim and keep his target in his sights until he discharged the missile. Aiming involved focusing along a line of sight from the centre of the target to the tip of the projectile head (the foresight), continued through the aperture in the frame shield of the engine, along the centre line of the projectile shaft and weapon stock to a simple fixed U backsight, and finally to the firer's eye. That, of course, is a best case situation. In the event of a moving target or strong wind, allowance would have to be made for aim-off, but the target had always to be in the field of vision through the shield aperture. Whatever the situation, however, angles of elevation in excess of 20° must have been impractical, because the trajectory would have been too high, and, in addition, the firer would not have been able to hold his point of aim. The solution to both these problems was extremely simple. Range was increased and trajectory and angle of elevation lowered by the expedient of raising the firing platform from ground level, and this is what Caesar did to ensure full coverage of his obstacle trenches. He placed his *tormenta* on *castella* at the ends of the ditches.³⁸ From the foregoing it can be seen that raising the firing platform was a tactical practice and that D. B. Campbell's claim that, "Thus, height is only crucial when the artillery (*sc. tormenta*) is required to combat an opponent in an elevated position," is patently incorrect.³⁹

By Hadrian's time the *carroballista* was standard equipment in the Roman legions, and it incorporated a refinement, which made it markedly superior to the Vitruvian

catapulta available to Caesar. The *carroballista* frame, as can be clearly seen from Trajan's Column, was made from iron, which gave it immediate advantages over Vitruvius' wooden-framed engine. First, the stress tolerances were increased; second, the arms had an increased angle of run-out; third, overall dimensions were reduced and so simplified handling and transportation; and last, but by no means least, the iron frame provided the firer with a very much better field of vision and thereby made aiming simpler.

Marsden concluded that the iron-framed arrow-shooting *ballistae* issued to the Roman army after A.D. 100 were effective up to 500 yards, which represents a 25% increase in range over previous norms.⁴⁰ This is an educated estimate, which I suspect is probably on the optimistic side, but not sufficiently so to affect my postulate that these weapons deployed on the flat roofs—and by extension raised firing platforms—of the milecastles and turrets of Hadrian's Wall would have produced interlocking arcs of fire covering its whole frontage. Furthermore, if we accept the flat roof proposition, then there was in reality an unrestricted 360° field of fire, which means that the Wall itself could be swept by fire from the milecastles and turrets, and any suggestion that special bastions were required for enfilading fire can be dismissed outright as academic special pleading. The effect of this would be similar to that of machine-gun fire on troops trying to negotiate a barbed-wire obstacle, barbarians scrambling over the Wall would have presented sitting targets to the crews of the Roman *ballistae*. The corollary is that it was never contemplated as necessary to man the curtain wall. It could be secured against anything short of a major invasion by firepower from *tormenta*, and a further implication is that as the actual wall was never intended to be anything more than an obstacle the refinements of parapets, crenellations, and wall-walks so frequently depicted in artists' reconstructions would have been totally redundant.

Having established the technical feasibility for the deployment of *tormenta* along Hadrian's Wall, we now have to address ourselves to the equally important question of the capability of the Romans to undertake such a commitment. Vegetius informs us that the *antiqua legio* had an establishment of one *carroballista* for each century, a total of fifty-five.⁴¹ He goes on to claim that in addition the legion had ten stone-throwing *onagri*, one per cohort, but his figures were questioned by H. M. D. Parker, who postulated that the old legion really had a total of fifty-five engines, the *onagri* being included in this figure, not additional to it.⁴² It is, however, a sterile exercise trying to pin down exact numbers in military matters, and we have to adopt a pragmatic approach. It is certain that the legions had a fixed allocation of *tormenta*, although in practice this would be a paper figure as they would seldom, if ever, be up to establishment. The three legions in Britain were probably capable of deploying something in the region of 150 engines, and such a number would require a supporting infrastructure capable of supplying spares and carrying out major repairs. Without doubt such an organization would have been capable of manufacturing *tormenta* from scratch. Given sufficient political will, the supply of sufficient *tormenta* to cover the Wall's operational requirements should not have presented the Romans with intractable problems. If there was pressure on legionary manpower, the allocation of *tormenta*, perhaps even on a temporary basis, to crack units of *auxilia* is certainly not

impossible. I am in no doubt that the Romans had both the technical and numerical capability to cover the original Wall with adequate firepower from arrow-shooting *tormenta*, if they deemed it operationally necessary. Admittedly, there is, as far as I can ascertain, no archaeological evidence for the tactical deployment of arrow-shooting engines by the Romans in the environs of Hadrian's Wall, and Tacitus, in contrast with his other works, does not mention *tormenta* in the *Agricola*. Absence of evidence, however, is not conclusive evidence of absence. We know from Maiden Castle that the Romans used them during the conquest,⁴³ and in Scotland bolt finds are not uncommon,⁴⁴ and it seems to me that it would be a worthwhile exercise for archaeologists to sweep the probable arcs of fire at selected northern sites with metal detectors in a deliberate search for bolt heads. Discoveries are not likely to be frequent, as bolt heads must have been valuable, and both Romans and barbarians would have made every effort to recover them, but the discovery and careful recording of only a few would give valuable data for further investigation and analysis.

It is blindingly obvious from a comparison of the length of the Wall with the manpower pool available to Hadrian in Britain that the Wall can never have been visualized as a continuous fighting platform. Yet if the Wall was to have even a minimal deterrent effect on the barbarians, it had to be defensible along its whole length, and, not only that, it had to be seen by the enemy to be both defensible, and defended. To achieve that end it was not necessary for the Romans to provide all of the milecastles and all of the turrets with full garrisons all of the time; they could put their trust in superior firepower not only to deter but also to hold off sizeable incursions, and this was not an occasion when the tactical concept could be frustrated by the inadequacy of the weaponry. At approximately every 540 yards weapons, with an effective range at ground level not far short of 500 yards, could be mounted on raised firing platforms, and thereby their range increased to provide interlocking arcs of fire to cover the whole frontage of the Wall. If need be the height of a milecastle or turret could have been raised to increase range, where there was likely to be an intersection problem. There is, after all, absolutely no reason why the milecastles or turrets had to be of uniform height, the priority was operational requirement, not uniformity. It was not, of course, the best tactic to open fire on the barbarians forward of the Wall, the most opportune time to catch them was in the ditch or on the curtain wall when they were trapped in a killing zone where their movements were impeded, but there obviously would be occasions when it was desirable to engage a target forward of the obstacles. In principle an even distribution of resources could achieve security simultaneously at all points, although in practice there would be a judicious thinning out on the less active sectors. For low-intensity frontier warfare there could hardly be a more attractive policy, for it conserved manpower, and by limiting the necessity for individual engagements inevitably lowered the chances of the defenders suffering casualties.

At this point we can make an assessment of the effects of a defensive system founded on *tormenta* firepower upon the northern barbarians. First, they would have been hopelessly outranged, for the bow which was the longest ranged weapon available to them was no match for an arrow-shooting engine. W. McLeod's review of

the evidence suggests that in the ancient world, "bowmen were quite accurate up to 50–60 metres; that their effective range extended at least 160–175 metres, but not as far as 350–450 metres; and that 500 metres was an exceptional flight shot."⁴⁵ I would make the point that Baatz, Marsden and I interpret "effective range" differently from McLeod. We mean the range at which a deliberately aimed shot can hit and destroy or disable its target, whereas McLeod means the maximum range at which the arrow could kill or disable, independently of the point of aim of the archer. Second, the barbarians had no personal protection against the Roman missiles, for their small shield, described as *caetra* by Tacitus,⁴⁶ would have proved of no avail against *tormenta* arrows. Vivid examples from the literary sources leave us in no doubt over the effects of the latter on their victims: "... *scorpione accuratius misso, atque eorum decurione percusso et ad terram defixo, reliqui perterriti fuga se in castra recipiunt*,"⁴⁷; and, "... *et translatae leviores quinque ballistae, contra turrim locantur, quae ocuis lignea tela fundentes, non numquam et binos forabant, e quibus pars graviter vulnerati ruebant, alii machinarum metu stridentium praecipites acti, laniatis corporibus interibant*."⁴⁸ There are two aspects to each of these passages, the physical and the psychological. As far as the physical effects are concerned, in the first case the decurion was pierced through by the bolt and was literally pinned to the ground; in the second those who were hit fell gravely wounded, and on occasions a bolt would pierce two men at the same time. There is archaeological confirmation of the literary accounts. In the Dorset County Museum at Dorchester there is an exhibit from Maiden Castle of a human spine with a bolt head stuck firmly in the vertebrae. The descriptions of the psychological effects are equally impressive. In the first example the men were panic-stricken and fled back to their camp, and in the second the sound of the *ballistae* was sufficient to drive men to leap to escape and perish as mangled corpses. It is very significant that in both examples the men involved were battle-hardened campaigners; in the first, Roman cavalry in the Civil War campaign in Africa in the winter of 47–46 B.C., and in the second, picked Persian archers from the king's bodyguard besieging the Romans in Amida in A.D. 359. The effect of arrow-shooting *tormenta* on barbarians attempting to cross the ditch and Wall cannot have been other than extremely demoralizing, and that in itself is surely a cogent argument for their deployment by the Romans on the milecastles and turrets.

On the subject of the deployment of arrow-shooting engines by the Romans along the Wall as it was originally envisaged, I have demonstrated technological feasibility, military capability, and tactical desirability or even requirement, and I can now return to the second influence on the choice of intervals between the milecastles and turrets, tactical signalling. Caesar records the use of both fire and smoke to transmit prearranged tactical signals from *castella*,⁴⁹ and there can be little doubt that simple tactical messages were passed between *castella* using other methods, certainly visual and perhaps acoustic.⁵⁰ The interval between posts in any line of sight signalling system depends on three factors: intervisibility; climatic conditions; and optimum operating range. The first and second are self-evident, but the third may require some clarification. For military purposes in a visual signalling system optimum operating range is the maximum distance at which signals can be read with consistent accuracy by average operators under active service conditions. Because no means of image

enhancement were available to the Romans, they had to rely on the powers of resolution of the human eye, and it follows that their operating ranges had to be very short by modern standards. Although we cannot be accurate to the yard, we can estimate the probable Roman optimum operating range in north Britain by reference to the remains of the observation towers strung along Gask Ridge, and from this one can reasonably conclude that it was somewhere in the region of 1650 yards.⁵¹ The milecastles on Hadrian's Wall are spaced within the postulated optimum operating range, and it seems safe to conclude that in the original plan they were intended to be able to intercommunicate.

The milecastles could obviously play the triple role of surveillance tower, firing platform and tactical signalling post, but it seems to me that they could have also had a local command and control role. The relationship of the milecastles to the turrets is misunderstood, and this springs from the fact that descriptions of the Wall frequently describe the arrangement as two turrets between milecastles, whereas a soldier would more naturally think of it as a milecastle between two turrets. From a milecastle fire control could easily be exercised over its adjacent turrets using the simplest of predetermined visual signals, and thus make the firepower of *tormenta* much more effective.

We can now posit that the Wall was built according to a well-established pattern, and a Roman soldier looking at the original construction would have recognized instantly a direct descendant of the standard siegeworks designed to blockade an enemy.

A few points of detail remain, which require some comment. First, the gates of the milecastles present some minor problems. Undoubtedly sally ports were included in the design of *castella*, and it looks as if they were built into the milecastles as a matter of course. It must have been obvious *ab initio* that a goodly number of them served little or no useful purpose, and these would have been blocked off very early on. Others which were required for ingress or egress during *bona fide* transit would have been kept open, but their tactical use must have been very limited. Tactical scenarios like Ian Richmond's use of the milecastle gates to effect surprise may seem credible in a paper *Kriegspiel*, but in reality no commander in his right mind would filter his troops in penny packets through milecastle gates, command and control would have been extremely difficult, and what may have been gained in surprise would have been lost by slowing down the reaction time, a critical factor in all low-intensity operations and especially in frontier warfare.⁵² Second, there is the question of manning. I have already indicated that it was unnecessary to man all of the milecastles and turrets all of the time, but certain posts must have been selected for permanent manning even during periods of quasi-peace, if only to show the flag and provide bases for patrols. The question of patrolling is a contentious issue, because the concept of intensive patrolling from the milecastles has its fervent, albeit misguided, adherents. It is certainly true that patrolling is an essential activity for the security of frontier areas, but active patrolling is extremely manpower intensive, and to maintain reasonable levels of activity on a permanent basis would have required more men than the milecastles were capable of accommodating. My belief is that in the original plan limited reconnaissance patrols and occasional fighting patrols were envisaged to

gather intelligence and dissuade potential reivers, but large-scale patrolling would only have taken place during a major alert when the forward line was reinforced. Finally, there is the question of command structure. Brian Dobson's scepticism over the suggestion that the *praefectus* of the *ala Petriana milliaria* may have had overall responsibility for the Wall is well founded, but, on the other hand, there must have been a clear command system.⁵³ It is inconceivable that the *limes* was not divided into operational sectors, and units must have worked according to standing operating procedures within well defined boundaries, otherwise the whole frontier would have disintegrated into military chaos. That in no way contradicts H. Wolff's conclusion that auxiliary units were directly responsible to the provincial governor.⁵⁴ In fact there was no need for a separate command on the *limes*. Normally the units stationed on the frontier would have worked perfectly well together without operational direction from above, and in the event of a major crisis assumption of operational command by the governor was inevitable, thus to have had an intermediate headquarters could have added nothing to efficiency, and the *praefectus* of the *ala Petriana milliaria* would have had enough on his hands in any case.

Although I have postulated design principles and a *modus operandi*, some detailed consideration has yet to be given to the original concept of the Wall. It has already been shown that military policy has its roots in threat perception, but we have little from the historical sources to enlighten us on the security situation in Britain c. A.D. 122. There is the familiar passage from the SHA stating that Hadrian built the Wall to separate the barbarians from the Romans,⁵⁵ and the less frequently quoted short passage of the same provenance, "*Britanni teneri sub Romana ditione non poterant*,"⁵⁶ which would indicate that at one stage during Hadrian's reign the security situation in the province was out of hand. The SHA is a notoriously unreliable source. Dessau was the first to suspect that the work was the product of a single author and not of six individuals as was claimed,⁵⁷ and since then its validity has been much questioned and debated, but although Dessau's thesis has been disputed it has never been confuted. R. Syme's judgement on the SHA, "The author of the HA makes no secret of the pleasure he takes in deception. An earnest and political design becomes difficult to credit",⁵⁸ is not in accord with A. H. M. Jones' sentiment on the *Vita Alexandri*, "the whole life is a fantasy, a portrait of the ideal emperor painted for the edification of the monarch to whom it was dedicated, who is stated to be, and probably was Constantine",⁵⁹ but both these eminent scholars were agreed that the SHA cannot be accepted as a reliable historical source.

The SHA, however, even though largely fictional, cannot be dismissed as totally useless, for there had to be sufficient truth in it to give it some credibility with the author's contemporaries, but it must be regarded with the utmost suspicion and have no status as an authority unless corroborative evidence is available from some independent and more trustworthy source. The *Vita Hadriani* is as corrupt as any of the other lives, but on the subject of the Wall we have epigraphic evidence, and on the security situation in Britain there is confirmation of troubles in the province from an enigmatic comment in a letter from Fronto to Marcus Aurelius on heavy Roman casualties at the hands of the Britons, "*avo vestro Hadriano imperium tenente quantum militum ab Judaeis, quantum ab Britannis caesum*."⁶⁰ Dating the troubles,

there may have been more than one outbreak, cannot be done with absolute certainty, but there is numismatic evidence for a campaign in A.D. 118 during the governorship of Quintus Pomponius Falco.⁶¹ The decision to build the Wall some years later gives weight to the belief that the really serious problems came at a later date.

The overall strategic aim for all the imperial *limites* was simply preservation, but each *limes* had its own individual operational strategy based on local threat perception, and the original concept of the Wall seems like a mechanical response to a perceived threat, probably it was a spasm reaction to experiences during Falco's governorship. It was the application of well tried tactical principles to deal with what was essentially a strategic problem, and Hadrian's Wall relied on a combination of magnificent scale and firepower to impress and deter. The original design had serious intrinsic defects in the event of a significant increase of the external threat to security. Because there were no major units actually based on the Wall, and because the exits were too small and too far apart to allow the rapid deployment of troops in effective numbers on the barbarian territory, hot pursuit was impossible. Effectively the original Wall was a self-impeding obstacle for the Romans. Doubtless hot pursuit was never envisaged in the original planning, but something happened which made the Romans modify the Wall not long after the initial stages of building were complete to give them both the facility for hot pursuit and the capability for rapid reaction on the Wall itself. It is not difficult to suppose that this was an unexpected major incursion. Can it be that the Roman threat perception had been wrong, and, if it was, who can reasonably criticize them for that? Who, for instance, would have suspected after the Six Day War of 1967 that the Egyptians would be capable of mounting a successful opposed crossing of the Suez Canal six years later? Certainly not the Israelis.

The subsequent building of the forts on the Wall and the digging of the Vallum indicate that the original design proved to be inadequate. Territory cannot be secured by fortification alone: in the final analysis it is the fighting men on the ground who win battles and wars, and obstacles like Hadrian's Wall can only be part of a strategy and have never had more than a limited use in the conduct of war. In all probability the monument's reputation has far exceeded its utility: its function was to deter and impede and it must have proved to be an impediment to both Roman and barbarian alike. The later modifications and uses to which the Wall was put are beyond the scope of this paper, but it is to be hoped that some clarification has been made on some of the military issues, and that active debate will be stimulated along new lines on the whole subject of Roman frontier policies in Britain.

NOTES

¹ BC *passim*.

² Brian Dobson, "The Function of Hadrian's Wall, *Seventh Horsley Lecture* (1985)", *AA*⁵, 14 (1986), 1-30, 22.

³ Frontinus, *Strategemata*, IV, 7, 2: "*Domitius Corbulo dolabra hostem vincendum esse dicebat.*"

⁴ BG I, 4.

⁵ BG VII, 69.

⁶ BG II, 8

⁷ BG II, 33.

⁸ BG VII, 69.

⁹ BG V, 40.

¹⁰ BG VII, 72.

- ¹¹ BG VIII, 41.
- ¹² G. H. Donaldson, "Modern Idiom in an Ancient Context", *Greece & Rome*, Second Series 9, 2, 1962, 134-41.
- ¹³ E. W. Marsden, *Greek and Roman Artillery*, (i) *Historical Development*, (ii) *Technical Treatises*, Oxford, 1969, 1971.
- ¹⁴ E. Schramm, *Die antiken Geschütze der Saalburg*, Berlin, 1918. Reprinted as a *Beiheft zum Saalburg-Jahrbuch, mit einer Einführung von Dietwulf Baatz*, Bad Homburg, 1980.
- ¹⁵ *Ep. ad Atticum*, V, 20.
- ¹⁶ *Ep. ad Familiares*, XV, 4.
- ¹⁷ BG VII, 25.
- ¹⁸ XIX, 1, 7.
- ¹⁹ XIX, 5, 6.
- ²⁰ Marsden, op. cit. 1971, *Cheiroballistra* I.
- ²¹ C. Cichorius, *Die Reliefs der Traianssäule*, *Tafelband* I, Berlin, 1896, 104-5, 163-4.
- ²² *Ibid.* 165.
- ²³ *Ibid.* 166.
- ²⁴ *Ibid.* 169.
- ²⁵ Lino Rossi, *Trajan's Column and the Dacian Wars*, London, 1971, 166.
- ²⁶ *Annals* XII, 45.
- ²⁷ CIL VIII, 18042.
- ²⁸ *De re militari*, II, 2.
- ²⁹ Schramm, op. cit. *Einführung*, iv.
- ³⁰ *Ibid.* xiii.
- ³¹ Op. cit. 66-8.
- ³² Op. cit. *Einführung* viii.
- ³³ Caesar, BG II, 8.
- ³⁴ *Loc. cit.* ix.
- ³⁵ Marsden, op. cit. 1969, 87.
- ³⁶ Op. cit. 20 n. 5.
- ³⁷ X, 11, 2.
- ³⁸ BG II, 8.
- ³⁹ D. B. Campbell, "Ballistaria in first to mid-third century Britain: a reappraisal", *Britannia* 15, 1984, 75-84, 79 n. 29.
- ⁴⁰ Op. cit. 1969, 91.
- ⁴¹ *De re militari*, II, 25.
- ⁴² H. M. D. Parker, "The *Antiqua Legio* of Vegetius", *Classical Quarterly* 26, 1932, 148.
- ⁴³ Mortimer Wheeler, *Maiden Castle*, London, 1951, 9.
- ⁴⁴ W. S. Hanson and G. S. Maxwell, *Rome's North West Frontier—The Antonine Wall*, Edinburgh, 1986, 25.
- ⁴⁵ W. McLeod, "The Range of the Ancient Bow", *Phoenix* 19, Canada, 1965, 1-14, 8.
- ⁴⁶ Agricola, 36, 1. British *caetrae* appear to have been leather-covered, rectangular in shape, and smaller than the Roman legionary or auxiliary shields.
- ⁴⁷ *Auctor Belli Africani*, XXIX, 3.
- ⁴⁸ Ammianus Marcellinus, XIX, 5, 6.
- ⁴⁹ BG II, 33; BC III, 65.
- ⁵⁰ G. H. Donaldson, "Roman Military Signalling on the North British Frontiers", *AA*⁵, 13 (1985), 19-24, 21.
- ⁵¹ G. H. Donaldson, "Signalling Communications and the Roman Imperial Army", forthcoming *Britannia* 19, 1988.
- ⁵² Dobson, op. cit. 22-3.
- ⁵³ Op. cit. 7.
- ⁵⁴ *Ibid.* 27 n. 48.
- ⁵⁵ SHA, *Vita Hadriani*, 11, 2.
- ⁵⁶ *Ibid.* 5, 1.
- ⁵⁷ H. Dessau, *Hermes* 24, 1889, 337 et seq.; *Hermes* 27, 1892, 561 et seq.
- ⁵⁸ R. Syme, *Ammianus and the Historia Augusta*, Oxford, 1968, 214.
- ⁵⁹ A. H. M. Jones, *The Later Roman Empire 284-602*, II, Oxford, 1964, 650.
- ⁶⁰ Cornelius Fronto, II, 22.
- ⁶¹ H. Mattingly and E. A. Sydenham, *The Roman Imperial Coinage*, London, 1923, 577 a.

