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QUEENSLAND WARGAMER.

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QUEENSLAND WARGAMER is the journal of the University of Queensland Wargaming Society, published five times a year.

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EDITORIAL

Those readers who care for such things may notice that this issue of QW, like others this year, is a little late in appearing. There are two major and one minor reasons for this, and in that order they are:

(a) the remarkable paucity of adequate contributions for publication;
(b) variable delays inherent in the production system we have adopted; and
(c) my own growing distaste for expending effort on the production of a club magazine in which there appears to be no interest.

I would like to discuss these statements in more detail.

To begin with, there is a lot of research and discussion which needs to be done and written up, in all aspects of wargaming. We are of course all agreed on the desire for historical authenticity in our figurine armies, and the tactics they may adopt. We are naturally eager to read articles which provide useful information on these topics, and no doubt grateful to those who have done the research, thought out the problems, and presented the results in a clear and careful article for our delectation.

Yet it appears that few of us are prepared to do anything remotely like the hack-work required to generate such articles. It is not hard to put pen to paper - even our illustrious secretary does so on occasion! I am not necessarily asking everyone to produce work of John Gerson's high standards, but surely it is not too much to ask that more of our members talk about their favourite armies - how they came to choose them, how they selected troop types from the Red List and so on.

With regard to production schedules, some of you will be aware that we have adopted a system which ensures a product of fairly high quality at a remarkably low cost to UQWS. Unfortunately, this system uses private channels, and is thus at the mercy of personal engagements and other delays. The club could, of course, use commercial production facilities and ensure a rapid delivery of the finished product - but the cost would be considerably higher, by a factor of four or five. We simply cannot afford this.

As for my third statement, I have remarked on the lack of interest in previous editorials. There can be no doubt that QW does serve a purpose, and a handful of wargamers are keen to see the results of research published and thus made available to all

wargamers. There have been criticisms that other interests (e.g. fantasy gaming) are not catered for, but these critics have yet to contribute any articles that I can publish.

In short, the members of UQWS do not seem to have enough interest in their club magazine to make them active participants in its continued existence. QW needs articles continuously on all aspects of wargaming; this is not simply a means of puffing off my editorial pride - or even of the club's corporate vanity in producing a magazine. It is a necessary part of wargaming that new ideas and new information are constantly being presented.

I would, of course, love to be able to produce a glossy full-colour monthly like Military Modeller, but that is obviously impossible. However, there is no reason why we shouldn't be able to fill five issues of QW each year with interesting and/or informative articles - except that most UQWS members refuse to pull their fingers out and do the necessary.

One last word: QW will appear for the last time in February 1981 unless I receive a large number of articles in good time for next year's issues. You have been warned.

David Thorpe

MINI-HARANGUE

His Excellency the Hon. and Noble Secretary, OBE and bar

For those of you who do not know, this club does in fact have a secretary, and he actually does (sometimes) put pen to paper. To those club members, and others, who have attended the club's meetings in the past, I must apologise. This article was not primarily directed towards you, though you may be guilty of some of the other heinous sins listed below. (There are some awful black sinners out there!) Here is a brief account of what the seven deadly sins are currently held to be.

1. You all know what day the club meeting is held on. (Ending a sentence with a preposition is something up with which I will not put - W. Churchill) For those of you who have not witnessed this debacle in a long time, let me refresh your memories. It is the second Saturday of each month. It is held in either the Conference Room or the Library at Union College, Upland Rd., St.Lucia. Owing to the University holidays, there are no meetings in December or January. If you cannot attend the meetings, let myself or someone (anyone) know, and give them your proxy vote and your apologies for not attending. This is important, as we do vote occasionally - and it's partly your money in the club.

2. I do not have powers of unlimited ESP, so could you please let me know if you have changed your address; and in some cases, let me know what it is at present. Failure to do so will result in your receiving notices of meetings too late. Also, the club magazine may be posted out in future, and if you want a copy there could be hassles.

3. There are a lot of unclaimed magazines accumulating in the club's cupboard. Let me know if you missed one, and if possible you will get a copy. Also, the magazine could always use some contributed articles.

4. In the third issue of Queensland Wargamer, and at the last couple of meetings, people have been asked to send in lists of their armies and boardgames. I have waited. And waited. This is for your benefit, as there may be a game or opponent out there doing nothing because no-one knows. Lists will be published as soon as they are received.

5. There was a small request at the bottom of the last meeting notice. If that could be returned as soon as possible it would

be appreciated. For those that have not received the last notice, could you please let me know if you are still interested in remaining a member of the club, and which day of the month you can attend/ not attend meetings. For non-members: if you want to become a member, please either attend a meeting or let a member know of your existence.

6. Are members letting prospective members know of our existence? This is very important, as we could always use some more members in the club.

7. The last point is delicate for all of us. HAVE YOU PAID YOUR 1980/81 MEMBERSHIP DUES??? If not, see our treasurer Graham Rawlings or contact him at 18 Rossmore Ave., Coorparoo. A point to note here is that club membership cards were made available at the November meeting, and that without them you WILL NOT GET the 10% discount at the hobby shops in town. If you do not attend meetings you will have to see me to get them (and I bite!).

So that is basically all I have to gripe about - for this issue. If you think it was too much, wait until next issue. The club has plans to discuss the O-week display at the next meeting, along with other similar wonderful trivia, so please make the effort and come along.

Gripefully yours,

Geoff Turk

ARMS AND ARMOUR OF THE GREEK FOOT-SOLDIER, 300-100 BC

John H. S. Gerson

The death of Alexander the Great in 323 BC is usually taken to mark the end of the world of Classical Greece and the beginning of the Hellenistic (or Late Greek) period. Nowhere was there a clearer division between Classical and Hellenistic history than in military matters.

In the area of arms and armour, three main trends separated the Hellenistic soldier from the Classical warrior. Firstly, armour for cavalry (both horse and rider) increased in weight, parallel to the increased importance of cavalry in the early Macedonian and Hellenistic periods (350-c.200 BC).

Conversely, the weight of armour worn by infantry decreased, a trend that had started as early as the fifth century BC. During the third century BC this decline was arrested when the phalanx of heavily-armed citizen soldiers came back into prominence. Cavalry now declined in importance on the battlefield; a Macedonian army of 200 BC had only half the proportion of cavalry to infantry of a Macedonian army a century earlier, but it remained just as heavily armoured.

The third - and final - trend was the adoption by Greeks of "barbarian" Roman arms and armour after 150 BC. In the first century BC, the armies of the surviving Hellenistic states either used Roman-styled weapons, or had a nucleus of legionary or Celtic troops armed in Roman fashion. The wheel had come full circle: in the sixth century BC, the "barbarian" Romans had borrowed the Greek hoplite panoply - now the "decadent" Greeks copied the methods used to beat them.

Pikes and spears

The principal infantry weapon of the era was the sarissa, a long thrusting spear or pike wielded with both hands. There is much controversy about the length of this weapon; Theophrastus, writing closest to the time of Alexander (c.300 BC), says that the longest sarissae were 12 cubits. Reckoning 46 cm (18 inches) to the cubit, a sarissa was 5.7 metres in length. Tarn refused to accept that the late fourth century pike was this long, because some cavalry units were at this period armed with sarissae, and he felt that a 5.7 metre spear was too much for a bareback rider to manage.

To resolve what he considered a serious difficulty, Tarn

postulated a short Macedonian cubit of 35 cm, thus bringing the sarissa down to 4.2 metres. Tarn's short sarissa was accepted by many later historians, but there is no concrete evidence that the Macedonian cubit was shorter than cubit standards used elsewhere. Furthermore, it does not necessarily follow that the sarissae of the cavalry and infantry were of the same length.

For the second century BC we have the expert testimony of Polybius. According to him, the sarissae of the first half of this century were 14 cubits (6.5 metres) long; he adds that earlier (i.e. in the third century) a 16-cubit (7.4-metre) sarissa had been in use. Polybius gives the best description of the use of the sarissa, and details can be filled in from what is known about later pikes.

The left (shield-bearing) arm gripped the shaft about 2 metres from its butt, the right hand being placed mid-way between left hand and butt. The iron head of the sarissa therefore protruded about 4.5 metres in front of the soldier's shield.

Since Macedonian soldiers dressed with 1 metre between each rank, the pikes of the first four or five ranks projected beyond the front of the phalanx. The following ranks held their pikes slanting upwards, both as a barrier against missiles and to avoid piercing the backs of the soldiers in front. If a soldier in front fell, they could step into his place and lower the pike for action.

In practice, the sarissa was an extremely formidable - though cumbersome - weapon. If it had the same average diameter (4 cm) as the later pike, it would have weighed at least five kilograms. The point was kept from dropping when the sarissa was couched by a counterweight at the butt - probably a long metal shoe. The sarissa was difficult to manage on the march, because of its weight and immense length; both hands were needed to carry it, the small round shield (aspis) being slung on the back.

In battle, a direct hit by a sarissa could pierce any shield or body-armour. If the point became wedged in a shield, however, any sturdy push (say about 15 kg weight) could bend and break the slender shaft: the Romans are reported as having tried this at the battle of Pydna. The sarissa was not a weapon to be used by single men or in open order because it was far too cumbersome to turn quickly, and in any case it was useless if the enemy got inside its reach of 4.5 metres. Its effective used depended on the maintenance of perfect dressing in the phalanx.

The phalanx, a moving forest of pikes, its front protected by a wall of shields and a quadruple row of spear-heads, filled even Roman consuls with dismay. However, on broken ground gaps often appeared in the shield wall, and enemy soldiers could dodge the pike-points to get to close quarters. When this happened, the disintegration of the phalanx was rapid. As each pikeman threw down his now-useless sarissa to draw his sword, his fallen pike only hampered those of his comrades who were struggling to maintain formation. It was for this reason that beaten phalanxes signified their surrender not by dropping their weapons, but by raising their sarissae to the upright position.

Swords and sabres

The usual sword of the Greek hoplite had a leaf-shaped blade about 60 cm in length. The hilt had a slim metal cross-bar and a knob-like pommel. The hoplite sword was carried in a scabbard slung on the left hip by a baldric (shoulder-strap); the scabbard had a circular or semi-circular chape (end-piece).

Many swords like this are shown in Hellenistic art. The hoplite sword was now much shorter (about 40 cm) and used primarily for stabbing. The Hellenistic soldier carried his sword high up under the left armpit.

Another popular Hellenistic sword was the machaira, a slashing weapon with a curved blade about 45 cm in length. The earliest type of machaira (from Italy) has a rounded point and single cutting edge, like a machete, and could only be used for slashing. The later Spanish and Macedonian types of machaira were double-edged cut-and-thrust weapons; the early blunt type remained in use in Italy into the second century BC. The hilt curved around the hand, the pommel being shaped like a bird's head or (after 300 BC) a a horse's head. The scabbard, which hung on a baldric, was usually shod with a simple chape.

In their use of the sword, the Greeks were at a grave disadvantage compared to the Roman legionaries who, under the influence of the Celtic peoples, had adopted a heavy cut-and-thrust sword as their primary weapon. Up to the mid-third century BC the Romans had used a hoplite sword; but as a result of their campaigns in Spain, they had by 190 BC adopted a short sword of La Tene I type, the famous "Spanish sword". This formidable weapon had a double-edged blade about 55 cm long with an acute point. Properly handled, it could deliver a deadly thrust as well as a powerful cut.

As early as 209 BC, Roman legionaries are described practising their sword-fighting on the drill-field, an exercise that is never spoken of in connection with Greek military training. At the battle of Pydna (169 BC) the Romans, armed with the Spanish sword, slaughtered the Macedonian phalanx, whose little hoplite swords were powerless against the Roman shields, while their own bucklers could not resist the violence of the Romans' slashing blows.

Body armour

The standard armour of the hoplite after the sixth century BC was a non-metallic corselet. The corselet is referred to by fourth century sources as a thoraka lineoi or linen cuirass, or as a spolas. According to recent authorities, the linen cuirass was made of several layers of cloth glued together to form a stiff shirt. The spolas is said to have been made of leather, but it appears to have been on the same pattern as the linen cuirass, since only one type of rigid non-metallic corselet is shown in Classical art.

As shown in figure (i), a linen cuirass consisted of two parts: a body unit (A) and a pair of shoulder guards (B). The lower edge of the body unit was cut into strips called pteryges to make it easier for the wearer to bend down; a second layer of pteryges was placed on the inside to cover the gaps in the outer layer. When arming, the body unit was pulled about the chest and waist, and tied together on the left side. The stiff shoulder-guards were then laced to a pair of studs on the chest. The small flap at the back between the shoulder-guards remained standing up to protect the nape of the neck.

After the late fourth century BC, the linen cuirasses shown in art are short, stopping at the waist. Flexible pteryges were worn, at thigh and shoulder; these appear to have been part of a linen shirt or "arming doublet" worn beneath the cuirass.

The mechanical properties of the linen cuirass were probably similar to those of modern laminated material, such as Doron body armour - which is essentially a linen cuirass made from fibreglass cloth and epoxy resins. These materials are not easily dented; the linen cuirass must have been proof against low-energy weapons such as swords. The strongest linen cuirasses were reinforced with iron or bronze scales or plates. Assyrian-style lamellar plates are shown on Etruscan linen cuirasses of the fourth and third centuries BC. The strongest reinforced cuirasses weighed over 18 kg; ordinary cuirasses probably weighed not more than 5 kg.

Linen cuirasses were strong, light and easily made; but they had a low moisture resistance and must also have been stiff. In the third century BC the linen cuirass began to be replaced by mail, which was more flexible and durable.

Mail consists of iron or bronze rings linked together, four to each other, to form a shirt of metal mesh. Varro, writing in the first century BC, said that mail was of Celtic origin. Finds at Hjoortspring and Thorsbjerg (Denmark) and Ciumestu (Romania) prove that mail was in use in Celtic Europe as early as the third century BC. Mail begins to appear in Hellenistic art around 200 BC. It spread to Greece and the East from western Europe via the Galatians (a Celtic tribe which settled in Asia Minor after 280 BC) and the Romans, whose armies also used it.

The cut of the Greco-Roman mail coat was very similar to that of the linen cuirass which it superseded. As shown in figure (ii), it comprised a sleeveless shirt of linked iron rings, to which was attached a pair of leather shoulder-guards - which were sometimes faced with mail. The shoulder-guards were hooked to a fastening fixed on the chest.

A typical mail shirt weighed about 10 kg. Because mail was very supple, it did not need pteryges; but its flexible structure transmitted the shock of blows, and so a leather coat (sometimes with pteryges) was worn underneath. Mail was proff against edged weapons, but the sharp points of projectiles could rupture the rings. After the close of our period (50 BC), legionaries are recorded as having worn improvised quilted jackets over their mail as a defence against arrows.

THE RECONSTRUCTION DRAWINGS.

1. Fourth Century BC Greek Hoplite

The Greek hoplite was the basic stock from which all other Classical heavy infantry evolved. The hoplite illustrated is based on sources pertinent to the late fourth century BC. He is armed with a hoplite sword and a thrusting spear about 2.5 metres in length. Hoplite spears had a pointed bronze butt which could be used offensively if the iron spearhead was cut off. The shield which gave the hoplite his name, the hoplon, was 80-100 cm in diameter, and had a convex centre and a flat rim about 5 cm across. It was fixed to the left arm by a bronze band or porpex about the forearm, the hand gripping a handle. Detail 1a shows the bronze face of the shield

with its blazon painted on. Various types of open-faced helmets were worn; the example illustrated is the Attic helmet, which had hinged cheek-guards and a tiara-shaped frontlet embossed on its brow. Bronze greaves were sprung onto the legs by the metal's elasticity. The figure wears the usual linen cuirass, this example being reinforced by iron scales.

As discussed above, reinforced cuirasses were extremely heavy; at the battle of the River Crismus (341 BC) the Carthaginians' hoplites were so burdened by their iron corselets that once overthrown, they were unable to rise. However, the general tendency during the fourth century BC was away from heavy body armour for infantry. The evidence of Xenophon and late Classical art shows that cuirasses and greaves were not always worn.

2. Late Fourth - Early Third Century Macedonian Phalangite

The equipment of the phalangite (phalanx soldier) of Alexander's immediate successors probably differed little from the arms of Alexander's own soldiers. This figure is intended to represent a pikeman of Epirus, whose king Pyrrhus had a borrowed Macedonian phalanx. He is armed with the long sarissa (7.4 metres) used in the early third century. The long blunt butt was used to counterbalance the pike; it was not intended as a weapon, as the butt of the hoplite spear was. His sword is the popular machaira, an example of which has been found in Epirus.

The most popular helmet of this period was the Thracian, which had a combined eye-shade and brow-guard. The fairly typical example shown here is from the bust of Pyrrhus now in the Naples Museum. Macedonian soldiers also wore greaves, at first of the spring-on type, but after 300 BC they were strapped to the leg.

G.T. Griffith has demonstrated that Alexander's phalangites were not universally equipped with a cuirass, and the same conclusion probably applies to Pyrrhus' phalanx. Those soldiers who possessed armour probably used a linen cuirass or a metal breastplate.

The Macedonian shield or aspis was not a hoplite shield. The hoplon could not be used with the two-handed sarissa, since the broad shield-rim got in the way of the left hand. The aspis was a round, slightly convex shield about 60-65 cm in diameter; it was made of wicker, covered with a bronze sheet upon which there were ornate designs. The aspis was supported by a shoulder-strap which was used to sling the shield on the back when on the march.

3. Late Third - Mid Second Century Macedonian Phalangite

The cuirass appears to have come into use by phalanx troops during the third century. This is suggested by the increasing sluggishness of Hellenistic tactics. The first (and only) references to the use of breastplates by phalangites are in Polybius (xi.9.1-6) and Plutarch (Philopoemen ix), referring to the Achaean army of c.208 BC. By now the major Greek city-states and Leagues had adopted the sarissa and the tactics for its use; Sparta, Megalopolis and the Achaean League made the change in the last quarter of the third century. The other states soon followed suit, since by the mid-second century Polybius could refer to Greek soldiers in general as having difficulty in carrying their sarissae on the march. The sarissa was not, however, used in Magna Graecia (Italy and Sicily) or Carthage.

Figure 3 is based on the frieze at Pergamum (c.190 BC), the monument of Aemilius Paulus (c.169 BC), and other second-century sources. Phalangites of the other Successor Empires and Greek states were probably similar in appearance. He is armed with the 6.5 metre sarissa described by Polybius, and a short hoplite sword. The Macedonian shield pattern was based on several crescents surrounding a circle and star; this example is from a shield design on the monument of Aemilius Paulus (note the similarity to the early third-century design in figure 2).

The soldier wears a late type of Thracian helmet, strap-on greaves and a short linen cuirass. A short muscle cuirass (see figure 6) could be worn instead. The linen cuirass and pteryges were white, the tunic red, and the shield design red or black on a bronze face. Hellenistic armour was brightly polished, and often gilded.

4. Mid Second Century BC Seleucid Phalangite

The army of the Seleucid Empire in Syria and Persia was based on the army of Alexander the Great. Its nucleus was a Macedonian-type phalanx, whose members until the mid-second century probably retained a close resemblance to true Macedonian troops. The figure is based on the description of the Seleucid army at the battle of Beth Horon (154 BC) in the Book of the Maccabees (book 1, chapter 6 verses 33-39). The Syrian forces are described as being armed with bronze shields and helmets, and coats of mail.

Hellenistic infantry wearing mail are shown on the temple of Artemis Leucophyra at Magnesia (Turkey). The cut of their mail

shirts is very similar to the mail-coats worn by Roman infantry on the Altar of Domitius Ahenobarbus, thirty to forty years later. The coats had leather shoulder-guards and a slight overhang at the shoulders.

Conical helmets were very popular in Syria, both before and after the Hellenistic period. This figure wears a conical Boeotian helmet featured on Seleucid coinage; detail 4a shows the form of the original Boeotian helmet in the second century. Thracian and Attic helmets were also used.

5. First Century BC Pontic Phalangite

After the Roman victories at Magnesia and Pydna, the Hellenistic kingdoms realised the superiority of Roman arms and methods. In 165 BC, just four years after the battle of Pydna, the Seleucid king Antiochus IV held a great military review at Daphne; pride of place in the parade was given to a regiment of 5000 men armed "after the Roman fashion and wearing corselets of mail" (Polybius xxx.25.3). Imitation legionaries were not new to Hellenistic armies; in the third century BC both Pyrrhus and Hannibal had used Roman weapons to a certain extent.

The equipment that the Greeks regarded as characteristic of the Roman legions was the huge oval shield (sometimes called a Ligurian - i.e. Italian - thureos) and the heavy slashing sword, which inflicted dreadful wounds. With the benefit of hindsight, Polybius declared that the cumbersome weapons of the phalangites were inferior compared with Roman arms (xviii.28-32). Considerations such as this encouraged the adoption of legionary techniques.

The history of the kingdom of Pontus on the southern shores of the Black Sea is a case in point. As late as the First Mithridatic War (87-85 BC), the Pontic army consisted of the basic Hellenistic phalanx plus chariots and light troops. At Chaeronea (86 BC) the Pontic phalanx was defeated by the Romans. Following this, King Mithridates VI Eupator reformed his army on the Roman model, equipping his heavy troops with large oval shields and heavy swords.

The reconstruction drawing depicts a Pontic phalangite as he might have appeared before Mithridates' reforms. He is armed with a bronze shield, a characteristic type of short sword and a sarissa. Asclepiodotus, writing at this time, says that the sarissa was between 10 and 12 cubits (4.6-5.5 metres) long. Over his richly-coloured Scythian tunic and trousers, he wore a gilded cuirass of

iron or bronze. This figure wears a short linen cuirass covered with lamellar plates; the sculptures from Palmyra show that Hellenistic lamellar armour remained in use in the East until 100 AD. His helmet is a late third century type often depicted on Pontic coinage from 120 to 63 BC; detail 5a shows another type of Hellenistic helmet used after 100 BC.

6. Late Third - Mid Second Century Pergamene Officer

The army of the kingdom of Pergamum in Asia Minor consisted of Macedonians and Greeks, mercenaries, and Mysian javelineers and bowmen. Pergamene military equipment is depicted on the large frieze of the Altar of Zeus (c.170 BC) and on the carved balustrades of the Temple of Athene Nikephoros (after 190 BC).

Hellenistic officers invariably wore body-armour: either a shaped cuirass with a breast and back plate, or a hemithorakon (half armour), which is thought to have been a breastplate only. Since junior officers fought in the phalanx, they were armed with a sarissa and an aspis. Officers appear to have had no insignia of rank, apart from the magnificence of their armour and their scarlet or purple clothes.

The officer depicted here is wearing greaves and a type of muscle cuirass shown on the Athene Nikephoros frieze. It has a pair of bronze shoulder-guards attached by hinges to the upper edge of the back-plate. His helmet is a late Thracian type, known from a surviving example and from the Altar of Zeus; its neck-guard curved around the side of the head and covered the ears, in the manner of a sixteenth-century burgeonet. Detail 6a shows an Attic helmet with the same feature; it was very popular in third-century BC Egypt, and Alexander the Great is shown wearing an ornate example on the famous sarcophagus at Sidon.

7. Seleucid Thureosophoroi Peltast

During the fifth century BC, the hoplite phalanx had been supported by unarmoured footmen or peltasts armed with javelins and small shields. The wicker shield for which they were named, the pelta, was most commonly round or crescent-shaped. It sometimes had a single handgrip and sometimes the hoplite-shield grip. The first peltasts were Thracians - the pelta was a Thracian shield - but later the term "peltast" came to be applied to any soldier armed with this shield.

Peltasts were originally regarded as inferior troops, suitable only for skirmishing. But in 390 BC an Athenian general called

Iphicrates astounded everyone by using peltasts to destroy a brigade of Spartan hoplites. Iphicratean peltasts were midway between true peltasts and hoplites; they wore light quilted body armour, and were thus able to evade the ponderous charge of a phalanx. Their comparative lack of body armour was compensated for by their having heavier swords and longer (3.6 metre) spears than hoplites.

Iphicratean peltasts were never widespread in Classical times, but partly-armoured peltasts equipped with spears became very popular in the Hellenistic period. However, Greek and Roman writers now applied the word "peltast" to a broader range of light troops, and not just those using the pelta; as the peltasts' functions were taken over by the argyraspides and hypaspists they became confused with them. The pelta, now faced with sheet bronze, survived into the second century, but became progressively rarer. In the first century BC it was only used by tribesmen.

The pelta began to be replaced as the light-infantry shield about 250 BC by an oblong shield called a thureos. Oblong shields had been used in Achaea since Mycenean times; however, the Hellenistic thureos was of Celtic origin. It was 100-200 cm long and half as wide, and had a ribbed spine and "butterfly" boss; it was made of wicker, and because of this was sometimes called a gerra (after a Persian wicker shield). The wicker-work was usually covered by white leather.

The thureos was certainly introduced to Greek armies by Celtic warriors, but a reference by Polybius (vi.52.8) to "the soldiers armed with the thureos (thureosophoroi) and the Gauls" of the Seleucid army proves that it was not only used by Celts. Typical Seleucid thureosophoroi peltasts are depicted on the late third - early second century painted monuments at Sidon. Their uniform, depicted in figure 7, consisted of a helmet (usually Thracian) with red plumes, a russet tunic and a white thureos.

They were armed with a short sword or machaira, and a spear of up to 3.6 metres in length. A contemporary painting of a Ptolemaic thureosophoros shows two 1.2 metre javelins carried as well. In keeping with the Celtic origins of the thureosophoroi, I have reconstructed figure 7 with a type of Celtic helmet used in Hellenistic armies.

Polybius mentions another type of Seleucid peltast, the thorakitas or cuirassed troops. These appear to have been armed in

Celtic fashion with a helmet, thureos, sword, spear and a cuirass (thorax) of mail. The Achaean armyalso possessed thorakitas - who are not specified as light troops, but were neither phalanx troops nor skirmishers (psiloi). The use of body armour by peltasts was foreshadowed by Iphicrates' reforms. Armoured peltasts were used to support heavy infantry, and were probably introduced in response to the increased weight of the phalanx.

The increase in weight of the peltast's protective arms was paralleled by an increase in the mass of his weapons. As noted above, the Hellenistic peltast used a spear as a primary weapon; even the Thracians, originators of the peltast, were now armed with a sarissa or a heavy sickle-sword (rhompaia). The Carthaginians, whose armies were organised on Hellenistic lines, also used spear-armed peltasts called lonchophoroi, after the short throwing and thrusting spear (lonchos) which they carried in addition to a thureos.

8. Third - Second Century BC Macedonian Hypaspist

An important part of Alexander's army was a corps of hypaspists who served as the King's personal standing infantry force and as the royal bodyguard. The title "hypaspist" originally meant "shield-bearer" or "esquire" (of a nobleman); Appian (Mithridatic Wars vii.4) even refers to the shield-bearing guard of a Roman general as "hypaspists". Alexander used the hypaspists on the battlefield as a link between the pike phalanx and the cavalry.

Their equipment is the subject of much debate. Tarn suggested that Alexander's hypaspists were armed identically to the phalanx, but their higher mobility on certain occasions could imply that they carried lighter equipment - probably a shorter sarissa. Most modern authorities believe that the hypaspist was a development of the Iphicratean peltast.

The only relevant archaeological evidence is the contents of the Macedonian tomb at Vergina, which is thought to be the tomb of Philip II. If this is true and the armour in the grave comes from one panoply, then the armour is likely to be similar to the hypaspists', with whom a Macedonian king is likely to have fought. The tomb contains a spolas reinforced with iron plates, an iron Thracian helmet, four pairs of spring-on greaves and a hoplon shield, plus at least one spear much longer (3.6 metres) than a hoplite spear. On the basis of this find Barker (1979) argues that Alexander's hypaspists were equipped with a hoplon, helmet,

greaves and a 3.6 metre Iphicratean spear. However, it is more likely that the lightly-armed hypaspist would carry a shield lighter than the massive hoplon. That this was indeed the case is suggested by the fact that later hypaspists were confused with peltasts.

Alexander's hypaspists were organised in three chiliarchia (1000-man regiments), one of which served as the Royal Guards and was called the agema of the hypaspists. The hypaspists changed their name in India to argyraspides or "silver-shields", and retained their new title in the armies of the Successors until about 300 BC. Thereafter they were known as hypaspists in Ptolemaic Egypt, argyraspides in Seleucid Syria, and peltasts in Macedon. The agema of Royal Guards was now called Hypaspists in Syria and the agema of the peltasts in Macedon.

The controversy over the equipment of Alexander's hypaspists also applied to the Seleucid argyraspides and the Macedonian hypaspist-peltasts. What is thought to be a record of the equipment of Macedonian hypaspists was found in the River Strymon at Amphipolis. This inscription, dating from the reign of Philip V (ruled 220-179 BC), lists a konos (Macedonian helmet), sarissa, machaira, greaves, aspis and kotubos; the function of the latter is unknown, but is thought to be identical with the perizoma, a semi-circular apron of scale armour worn over a quilted linen coat (the perizoma is very common in third-century Etruscan art).

Apart from the Amphipolis inscription, the only evidence for hypaspist equipment is the name "peltasts" attached to them, and the fact that a Seleucid hypaspist of 285 BC is recorded as having a pelta. However, the pelta and the Macedonian aspis were very similar, and were occasionally confused with each other.

Both Macedonian hypaspist-peltasts and Seleucid argyraspides are described as fighting in a Macedonian-style phalanx, but this need not imply that they used the 6 metre sarissa of the heavy infantry; theu use of hypaspist-peltasts to secure river crossings and cover the main phalanx suggests that their pikes were shorter and more manageable. Hypaspists occasionally used even shorter spears; one of Alexander's palace-guards is recorded by Arrian (iv.8) as carrying the short lonchos.

Figure 8 is a hypothetical reconstruction of a third-century BC Macedonian hypaspist-peltast, based on the Amphipolis inscription and the theory that the hypaspist was a development of the

Iphicratean peltast. He wears a pair of greaves, and a quilted linen coat reinforced by leather shoulder-pieces and a kotubos. He has the Boeotian helmet, which was popular with both infantry and cavalry.

His shield is a pelta or aspis (virtually the only difference was that the aspis was convex and the pelta was not); as their name suggests, the argyraspides used silver-plated shields (Livy xxxviii.40). The figure is armed with a machaira and a short pike, probably midway between an Iphicratean peltast spear and a sarissa in length (4-5 metres). There is no evidence that hypaspists were armed with javelins or other missile weapons.

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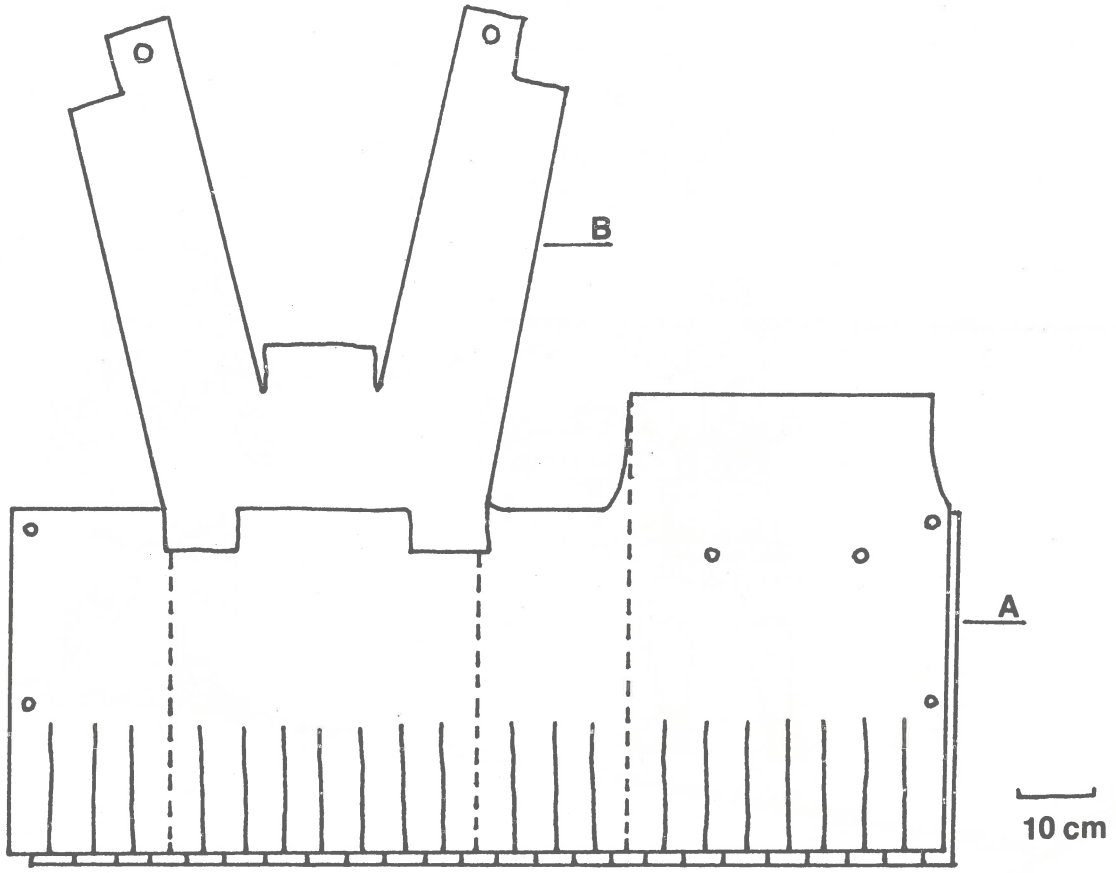


Figure (i) Rear view of linen cuirass

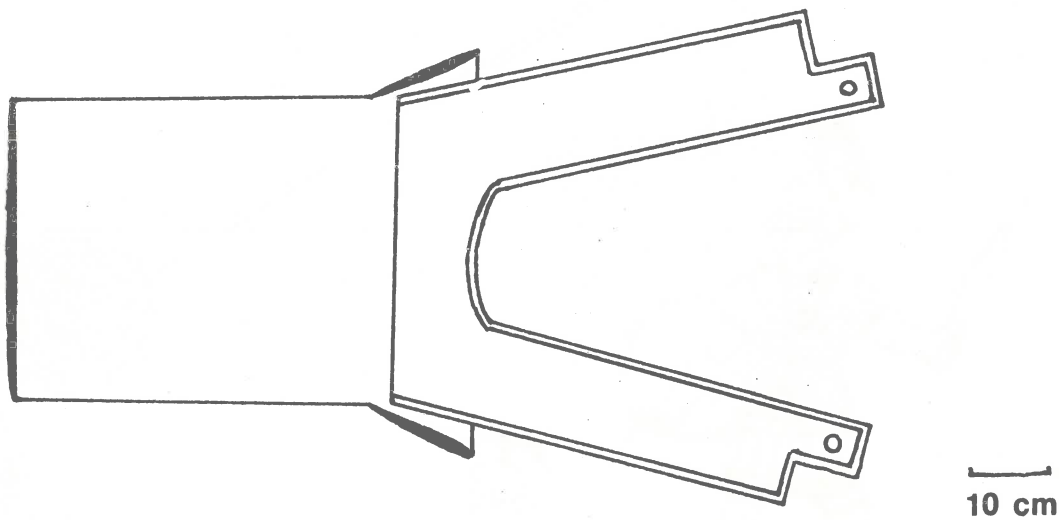
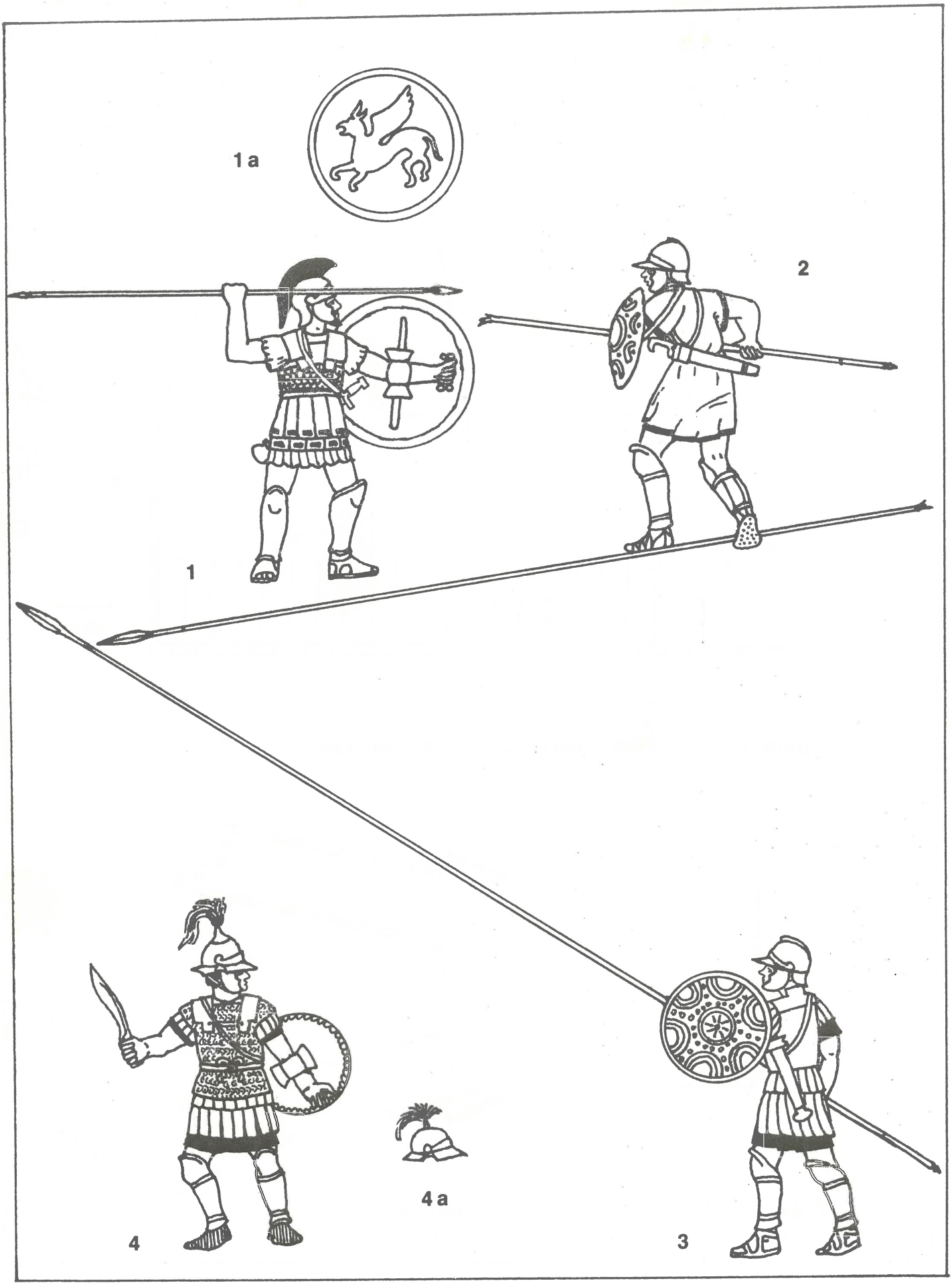


Figure (ii) Rear view of mail shirt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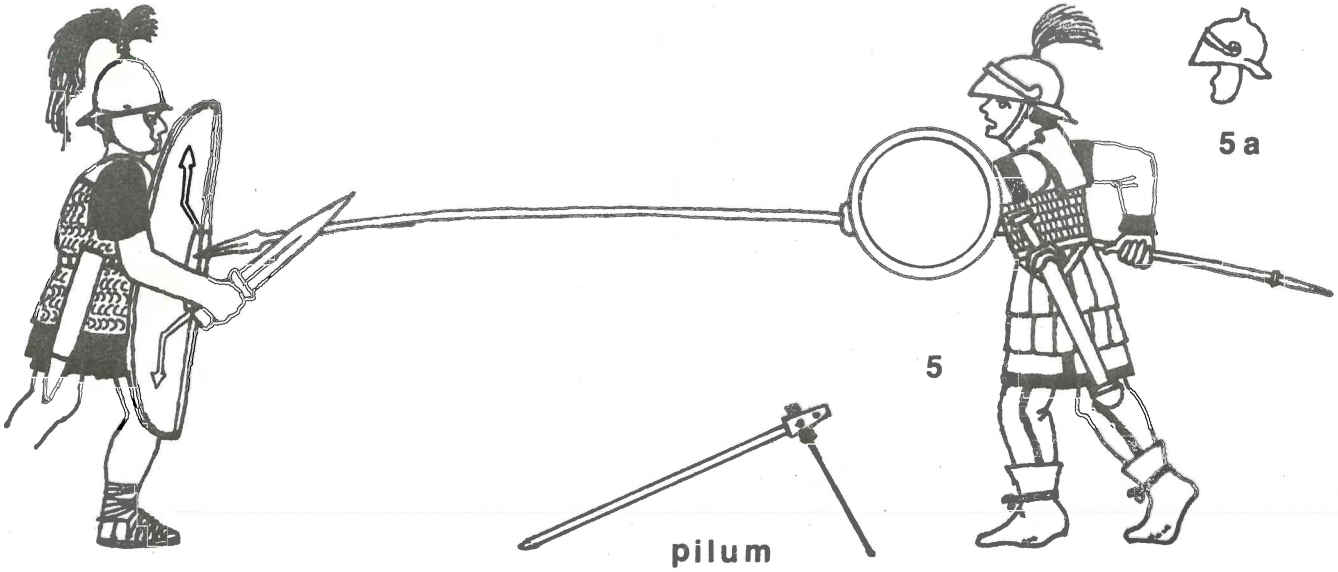
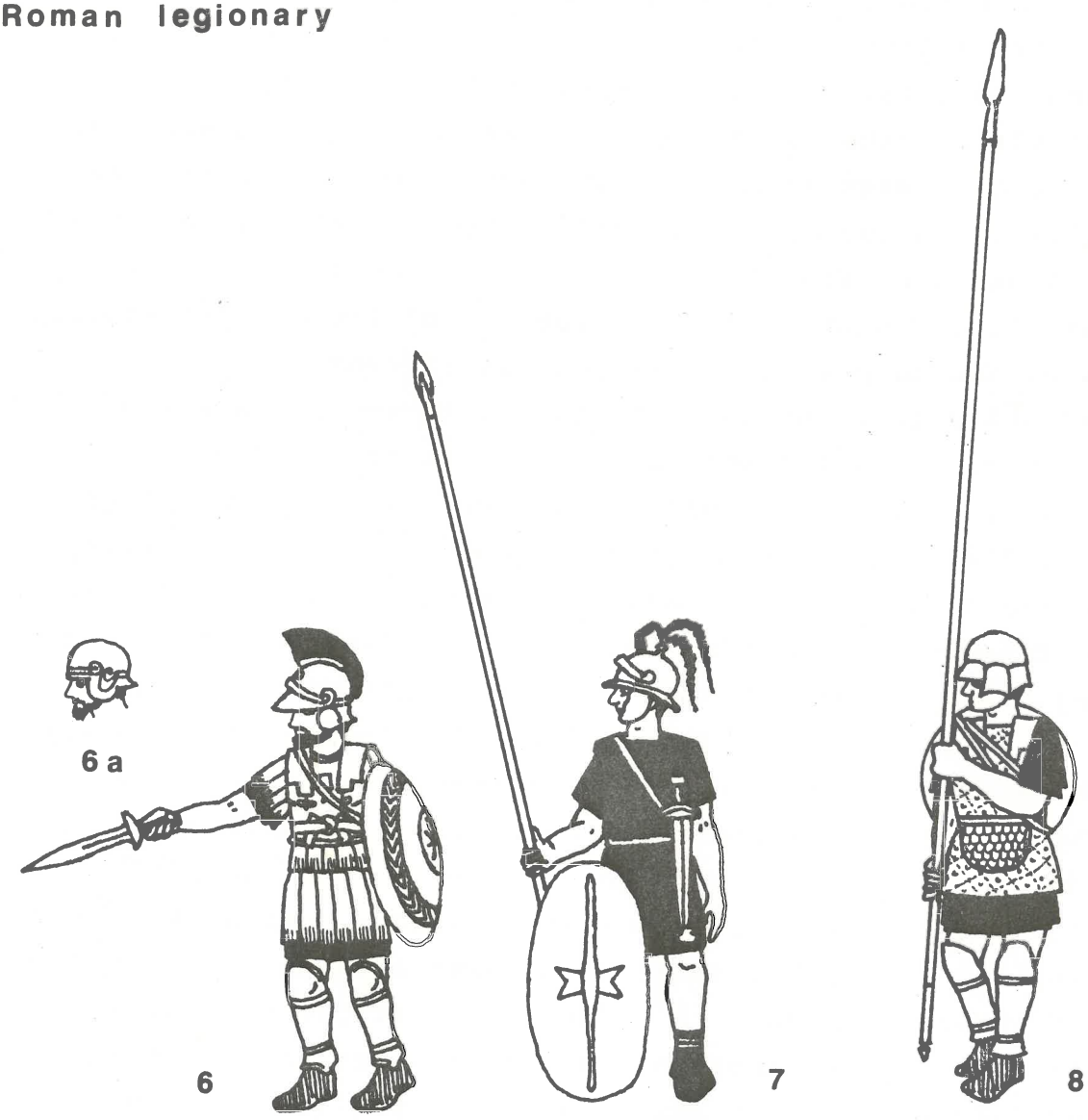


Roman legionary



OPINIONS IN REVIEW

BY KEVIN FLYNN

It has been at least six months I believe since I wrote an article for this esteemed journal about the merits of fantasy role playing games as compared to 'figurining'. As you may, may not remember David Bugler made the assertion that figurining was superior to all other classes of gaming, I replied that this was not true and that each held its own merits. My opinion here has not changed, however I do believe the 6th edition WRG Ancients rules will be a huge success and put new life back into figurining. My opinions of other games (one in particular) is what the rest of this article is about.

To put it bluntly, D&D has become a bore. The only fantasy role playing game that I have played or read that shows rational and believable (if one can use that word in this context) mechanics is Chivalry & Sorcery (C&S). Dragon Quest (DQ), the SPI companies attempt to break into the market is full of good ideas but just doesnt sit together as a whole. Travellor, which shows promise, tends to boil down to who has the most money or skills (or possibly that's the people I play with). Gamma World, which I have only read, shows some promise in that it is like the original D&D rules, that is, it is unclear and unspecified? The game gives you the basics of how to play and lets you run it from there.

D&D is definately the worst of them all; the men are too powerful, the monsters too weak and magick is too easy (and plentiful). Its only blessing is that it is simplistic, giving it good playability. Playability is not what I look for in FRP, I prefer depth of believability; after all the lunatics I play with make it difficult enough as it is without the rules helping. The most outstanding problem with D&D that springs to mind is the monsters. Dragons, for eg., which were the supreme life form of chinese and medievil history as well as countless fantasy novels, have been lowered and insulted to a position where players look forward to meeting one. This is not my opinion of a Dragon. In D&D a 10th level hero has a pretty good chance of beating a dragon in melee (considering the magical items he would have attained and not counting the breath weapon); in DQ and C&S a single hero of equivalent skill and similar experience would not stand a chance in Hades of besting a Dragon unless it had just swallowed 3 ton of Valium. In DQ and C&S honors and massive rewards await the slayer of a dragon, in D&D you get a few million gold pieces if your lucky and the fight is forgotten shortly after.

Next on the list is magick. In D&D it is all so simple and easy that no one considers exactly the implications of what he is doing, Magick is a mysterious and powerful force not to be thrown around with the wave of a finger. I realise that D&D is striving for simple methods but some of their spells are just a bit much. In both DQ and C&S magick is an involved and risky business, often requiring careful and lengthy preparation. D&D spells hit the target and it saves if possible, in the other games you have to throw the spell successfully, hit the target and then he gets a chance to save against its effects.

Permanent magical items abound in D&D and generally make or break a players future. Items simply appear in a treasure without reason or cause, some players become walking tanks of magick wiht the devices they end up carrying around. DQ solves the problem by not having any truly permenent magical devices (such as a ring of invisibility). C&S has optional rules for limiting the number and nature of magical items, especially those of great power, as well as having rules such that devices of power take so long to prepare that one can feel safe that no man will have more then a few devices about him

Lastly are the rules themselves. D&D has been so popular for so long now that everyone has his/her ideas about how it should be played or what effect soem spell orrule has on the game. The D&D rules have not been well produced and as a result many arguements evolve during play. I do not like this attitude and can only suggest the old law of 'what the GM says, stays'.

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NOTES ON NAVAL TECHNOLOGY DURING THE FIRST AND SECOND PUNIC WARS

by

Lieutenant J Gerson R A N

The aim of this article is to cover some technical aspects of Roman and Carthaginian naval history not treated fully in other works. References are not quoted in the text but a list of useful books and journal articles is to be found at the end of the article.

The standard warship of the Classical Mediterranian was the galley, along wooden ship propelled at high speed in battle by oars. Like later sailing ships ancient galleys were given a numerical rating of their size and fighting power. Whereas sailing ships were rated by the number of guns (H M S Victory 100) oared warships were classed by the number of rowers on each vertical group of oars. The galley used in Greek navies between 500BC and 330BC was the trireme or three: it had three horizontal rows of one-man oars one above the other. The quadrireme or four was a Carthaginian invention of about 400BC: it probably resembled a trireme with two men on the upper oars, making 2 + 1 + 1 = 4 rowers on each vertical group of oars. The quinquereme or five appeared shortly afterwards, having at first probably two men on the upper and middle oars and one on the lower, giving it the rating 5 = 2 + 2 + 1. By 350BC a six had been developed, and within the next hundred years ships up to a 30 had been built. The great ships were too heavy and slow to be of much use, whilst the 5 offered a compromise between speed and size (it was almost as nimble as a trireme, yet carried three times the number or marines). For these reasons the quinquereme became the standard ship of the line of the Mediterranian in the late fourth to the second centuries BC.

1. CARTHAGINIAN QUINQUEREME, THIRD CENTURY BC

The Punic navy consisted almost entirely of quinqueremes, plus a few quadriremes and triremes. Smaller vessels such as the pentekonter (an old fashioned galley with 25 one-man oars per side) were also used. The naval establishment stood at 200 ships, based chiefly at the cothon (internal harbour) at Carthage.

The dimensions of the naval docks at Carthage and Cyrene in Greece show that a Greek and Punic five were the same size: about 5 metres in breadth and 35 metres in length. In 1971 an ancient

warship measuring 5m x 35m was found in shallow water at Marsala, just north of Lilybaeum, the major Punic base in Sicily. A vessel this size can hardly be anything smaller than a quinquereme: if it had a rating less than 5 it would have been underpowered.

The Marsala ship was shown to have been Carthaginian by inscriptions and was dated by radiocarbon and pottery to the second half of the third century BC. It, and a similar Punic wreck discovered nearby, was carvel built: the outside planking was laid edge-to-edge and the ribs were inserted afterwards. The ribs were lettered in Punic in alphabetical order starting from the stern. This suggests that an early form of mass production was used. The Romans, who used Carthaginian shipbuilding techniques, could construct quinqueremes at an amazing rate (220 ships in three months in 254BC, 30 ships in 45 days from the felling of the timber in 205BC).

The only ram found at Marsala belonged to the second ship. The ram was an unusual Illyrian type shaped like a sput curving up from the keel to the waterline. Coins and inscriptions from Carthage usually depict the Hellenistic ram, which had a trident shaped blade. The wooden ram was plated with bronze, whilst the hull of the second ship was protected from marine organisms by a lead sheath.

The reconstruction drawing is based on the finds at Marsala and a contemporary Punic coin from Spain. The coin, which must depict a capital ship (almost certainly a 5), suggests that the oars were on two levels with three men on the upper bank and two on the lower bank (3 + 2 = 5). According to Polybius, a Punic quinquereme had the same number of crew as a Roman 5, which is known to have carried 300 mariners, 270 of whom were probably oarsmen. Therefore a Punic 5 had 54 oars per side. The oars were supported by outriggers to increase their leverage.

Carthaginian ships fought by ramming and consequently did not require a large complement of marines for boarding or counter-boarding actions. Between 50 and 120 soldiers were carried on the raised fighting deck, most of them being slingers and archers and many of them mercenaries. The large number of animal bones found

in the Marsala ship may imply that there were Celtic or Spanish troops aboard: Carthaginians and Libyans lived mainly on cereals. The Punic coin from Spain shows the railings lined with Celtic or Spanish oval shields.

2. THE CORVUS, 260BC - ?255BC

The Carthaginian Navy relied on manoeuvre tactics: they attempted to use their superior speed to outflank the enemy and ram him in the beam. Ancient fleets normally deployed in line abreast with about 20 metres between each ship and sometimes a second or even a third line behind. Since the radius of a galley's turning circle was about 40 metres the flanks of an individual ship in line were well protected from ramming. Fast moving fleets, such as the Carthaginians', could either outflank the entire enemy line or break the line by a series of bow-to-bow collisions. Individual ships could then be picked off by ramming.

Ramming tactics had the disadvantage that whilst the rammer and his victim were in momentary contact, the rammed vessel could grapple the other and board him. To achieve this the Romans adopted a boarding bridge with a spike on the outer end to seize an enemy vessel. This appliance was nicknamed the corvus or raven because of its metal beak.

The corvus is fully described by Polybius (Book 1, Ch 22-23) and a convincing reconstruction was proposed by Dr W T Wallinga in 1956. As shown in the drawing it consisted of a gangway 11m long and 1.2m wide with an iron prong underneath it as its outboard end. A rope was attached to the top of the prong and ran ghrough a pulley at the head of a 7.2m post erected in the bows. This post passed through a short slot in the gangway about 3.6m from the inboard end. The corvus was raised by the rope and hung poised above the bows. In battle, when the enemy attempted his initial bow-to-bow ramming, the corvus was dropped before the rammer could disengage. The Roman marines boarded by the gangway in double files protected by their oblong shields on the knee high bulwarks. If the enemy came alongside the corvus was swung around its pole to grapple him and the marines boarded by leaping from ship to ship.

The corvus had obvious disadvantages. It could only be used to

grapple a stationary or slowly moving ship. The kinetic energy of a quinquereme at top speed was 2.5×10^6 joules (equivalent to a ten tonne truck travelling at 80kph). Since wood can only absorb about 100 joules of mechanical energy per kilogram without damage a corvus robust enough to be dropped onto a 5 at top speed without being smashed would weigh about 25 tonnes. The pole described by Polybius can only lift about a tonne without exceeding its working load. Therefore a corvus strong enough to grapple a ship underway would be too heavy for its lifting gear.

Another disadvantage was the corvus' limited traverse. At best it could protect only the forward 20% of the ship's length. To overcome this drawback its effective use required formations whereby the ravens of following friendly ships covered the vulnerable sterns of the vessels ahead. Once Roman seamanship had improved the corvus represented too much of a performance handicap and was abandoned, sometimes between 256BC and 242BC.

3. ROMAN HEAVY QUINQUEREME, 260BC - 240BC

As early as the mid fourth century BC Rome possessed a tiny fleet of 20 triremes. Counting refitted ships and drafts of triremes and pentekonters from the Italian allies, at the start of the First Punic War the Romans had only 60 light ships to oppose twice their number of Carthaginian fives. The Senate therefore ordered the construction of quinqueremes. As no Italian state had built anything larger than a 3, a captured Punic warship was used as a guide to shipbuilding methods. The Carthaginian and early Roman 5 did not resemble each other. Polybius (Book 1 Ch 50-51), Frontinus (Stratagems Book II Ah 3) and Zonaras (Epitome Book V111 Ch 11) are agreed that the Roman ship was larger and sturdier and consequently slower and less manoeuvreable. Early battles show that Roman 5s were easily outmanoeuvred by Punic ships.

The reason why a Roman 5 was larger probably lies in the oarage system used. The Romans, not being a seapower, had an acute shortage of skilled rowers. Rather than use two or there banks of oars the Romans probably employed a single bank of five-man oars. This system required only the innermost rower on each oar to be experienced in order to keep the time for the other four. This obviously meant a great saving in manpower.

A galley with five men per oar will be about 7 metres wide at the gunwales, reckoning 60cm per rower and allowing a passage amid-ships. The ship probably measured 50m along the waterline (galleys had a length: beam ratio of at least 7:1) and displaced between 200 and 300 tonnes. It was probably a bit smaller than the Spanish galleys (fours) that fought at the battle of Lepanto or about the same size as a modern ocean-going patrol boat.

The reconstruction drawing depicts an early Roman five. The vessel was intended to act as a floating platform for a corvus and soldiers and was probably modified accordingly. It is probably no coincidence that the diameter of the corvus' turning circle on deck (7m) corresponds with the likely width of the deck. The ornate Hellenistic prow has been removed to allow the corvus to drop over the bows. There are 27 oars per side, corresponding with the number of rowers (270). Up to 120 marines were carried, of whom 40 were proletarii (men who did not have the property qualifications to be legionaries) and 80 a draft of legionaries put on board for an actual battle. Proletarii used cheap versions of legionary armour. Roman marines fought with missile weapons - javelins (pila) and short spears (lancea) - of which an immense quantity (perhaps 16 weapons per man) was carried on board. Projectile throwing engines were also carried for anti-personnel use. It has been argued that artillery was too heavy for use aboard ship, but even a stone thrower and 100 rounds of ammunition weighed less than 30 legionaries.

The heavy quinquereme was superceded about 242BC when the Romans launched a fleet of fast quinqueremes built on the model of another captured Punic ship. The new 5s resembled the Carthaginian ship illustrated in figure 1. They were rowed by two or three banks of oars. There is a well known passage in Livy (Book XXV111 Ch 30) taken to mean that late in the third century BC a Roman 5 had more rows of oars than a Punic 3. This implies that either a Roman 5 had four or more rows of oars or that a Punic trireme had only one or two rows. Both these conclusions are unlikely and in fact what Livy is saying is that a five had a higher rating than a three and hence was more powerful.

Heavy fives rowed by multi rower oars may have remained in service until the end of the century. They were perhaps used at the seige

of Syracuse in 212BC; Livy (Book XXIV Ch 34) says that when two quinqueremes were lashed together as a base for a floating seige-tower, the inner row of oars was removed. As late as 191BC Antiochus III of Syria described Roman warships as being unskillfully construcred and unwieldy.

4. PERFORMANCE

It is easy to fall into the belief that ancient galleys were absurdly slow and clumsy. The reason that this idea persists is that until recently no attempt has been made to assess their performance. Establishing performance figures on a full scale trireme would be prohibitively expensive. However it is possible to calculate a trireme's propulsive power and water resistance from which the maximum and cruising speeds can be estimated. The method is described by Dr J G Landels in Engineering in the Ancient World (1978). The maximum horsepower of an oared ship depends on the number of rowers and the horsepower of each man. An ordinary fit man can generate about 0.33 h.p. for a short period (10 to 20 minutes) and about 0.1 h.p. for several hours. Allowing for the mechanical efficiency of the oars, the maximum propulsive power of a trireme was about 40 h.p. (3×10^4 watts) and a quinquereme 64 p.p. (4.8×10^4 watts).

From these figures the total thrust on the vessel at different speeds can be calculated. Since the power is the product thrust x velocity, the thrust diminishes as the speed increases, so that the graph of thrust against velocity is a byperbola, as shown in figure 4. As the speed increases the water resistance or drag encountered by the ship increases, so that the ship will accelerate until the falling thrust and rising reistance equal and exactly cancel each other out, that is, where the two curves intersect in figure 4.

The figure which is based on Landel's work shows that a 12.5 knots (24kph) the trust on a trireme operating at full power equals the water resistance at that speed, that is, the top speed of a trireme was 12 - 13 knots. The calculated top speed is much higher than older estimates.

On long trips, two thirds to three quarters of the oarsmen were allowed to rest whilst the others worked the oars at a lower

cadence (0.1 h.p. per man). Thus when cruising the galley's power was a tenth of its maximum propulsive power. Therefore a trireme's cruising speed can be found by dividing the thrust curve in figure 4 by ten and finding its new point of intersection with the drag durve. This lay at 6 knots. Real galleys which had to contend with unfavourable currents usually travelled at 3 knots. If a trireme was under sail it could, in theory, attain 15 knots. Despite this improvement in speed galleys did not use sails in battle because they could not sail against or across the wind and consequently their manoeuvreability was limited.

Dr Landels does not supple performance figures for ships larger than a trireme but his method can be extended to higher ratings. I have calculated the thrust and drag curves for the Marsala Punic ship (assumed to be a 5) and a heavy Roman 5 of the First Punic War. (My computations for the trireme gave the same results as his which was encouraging.) The calcuated graphs are shown in figures 5 and 6 and the maximum and cruising speeds obtained are recorded in the Table.

Ship	Displacement	Power	Top Speed	Cruising Speed
Trireme	60 tonnes	40 h.p.	12.5 knots	6 - 7 knots
Marsala Ship	120 tonnes	64 h.p.	12.5 knots	6 - 7 knots
Roman 5	300 tonnes	64 h.p.	10.0 knots	5 - 6 knots

These figures can be checked by the rule of thumb that the speed of a ship is proportional to the cube root of its power divided by the fourth root of the displacement.

The Table shows that the Marsala ship, though larger than a 3, was as fast. This explains why the Carthaginians were able to use their 5s as though they were 3s in rapid ramming tactics. The heavier and broader Roman 5 was at least two knots slower. In fact a Roman 5 would probably not exceed 8 knots owing to the inexperience of its rowers. A Punic 5 could easily evade any ponderous Roman attempts to ram, and this explains why the Romans were driven to use boarding tactics.

The high speeds of ancient galleys made ramming difficult. A

trireme at top speed took only 5 seconds to cover its own length. Therefore a moving 3 was in the sights of an enemy for only a few seconds.

Successful ramming required good control of course and speed. The latter depended on the rowers' loyalty and effort: for this reason only sitizens, allies or freed men were employed as rowers on ancient galleys. The course depended on the rowers (who used their oars to back water on the side that the captain wished to turn to) and the helmsman. Galleys were steered by steering oars (really rudders) attached to the after end of the outriggers. These rudders were quite efficient and galleys had a tight turning circle. The radius of a trireme's turning circle has been estimated as 35m. In theory, a 3 could complete a 180^{o} turn in 20 seconds! A Punic 5's performance was probably just as good. Punic warships had two steersmen, one per oar, rather than a single steersman handling both oars as on Greek and Roman ships. The Punic system enabled larger forces to be applied to each oar, thus decreasing the turning circle. The heavy and unskillfully handled Roman quinquereme had about three times the turning circle of a trireme and would have taken one to two minutes to put about.

5. STABILITY

As well as being wrongly thought of as slow and slumsy, galleys are believed to have been very unstable. Tarn, writing in 1930, stated that "a quinquereme was a comparatively light machine of shallow draught and low freeboard, and rather crank (top heavy)" and that it was as stable as "a glorified racing eight". In support of his theory, Tarn quoted Livy's description of the battle of Corycus (191BC) from Book XXXVII Ch 44. The Roman flagship (at least a 5) is recorded as finding it necessary to dip her oars in the water before she threw grapnels. In fact this passage has nothing to do with ship stability. The Roman oarsmen were slowing the ship by "holding water" with their oars, preparatory to grappling and boarding.

The likelihood of a ship capsizing depends on its <u>transverse stability</u> - the ability of a ship to right itself after rolling away from the vertical. The transverse stability of a galley cannot be calculated without more data than is presently available

to archaeologists. In general a boardbeamed vessel with a shallow draught (eg a tug or barge) has a high transverse stability. Though such a boat is very hard to capsize, the large forces that keep it upright causes it to roll violently at sea. The board beamed Roman 5 probably had a high transverse stability which was necessary in view of the large number of heavily equipped legionaries on the weather deck. The resulting "short and sharp" rolling motion must have made the poor fellows constantly sea sick. The sea sickness of legionaries is proverbial in all books on the Roman navy! The slimmer trireme and Greco-Punic quinquereme must have been less stable than a Roman 5. A trireme must have been particularly unstable. Not only was the 3 relatively narrow (transverse stability is proportional to the beam), but it had a large crew per tonne of displacement which added to the top weight (4 men per tonne for a Hellenistic trireme, compared to less than 2 men per tonne on a Roman 5). There is some evidence that triremes and other small ships could be capsized by sudden movements by the crew or by ramming.

The ability of a ship to return to the proper trim (correct forward and after draughts) after the bow or stern have been forced down is its longtidudinal stability. Since this property depends almost solely on length and beam, which are known for a quinquereme, we can calculate a 5's longtitudinal stability and compare it with the velles's known stability as described by ancient authorities. It can be shown that if all the marines on a Greco-Punic quinquereme moved aft, then the bows would rise by 70cm, which is sufficient to bring the ram out of the water. This shows that a quinquereme could be rapidly trimmed bh moving the marines about on deck. Frontinus (Strategems Book 1 Ch 5) and Polybius (Book XVI Ch 4) describe 5s being trimmed in action so that the rams either rose out of the water, enabling the vessel to slide over shallow obstacles, or sank deeper in, delivering an underwater flow to the enemy.

If a sufficiently large force was applied at bow or stern, the opposite end would become submerged and the ship would sink. At the seige of Syracuse in 214BC the Greek physicist Archimedes was able to destroy attacking Roman 5s by lifting their beaks out of the water with grabs fitted to cranes. The Roman marines were

trireme at top speed took only 5 seconds to cover its own length. Therefore a moving 3 was in the sights of an enemy for only a few seconds.

Successful ramming required good control of course and speed. The latter depended on the rowers' loyalty and effort: for this reason only sitizens, allies or freed men were employed as rowers on ancient galleys. The course depended on the rowers (who used their oars to back water on the side that the captain wished to turn to) and the helmsman. Galleys were steered by steering oars (really rudders) attached to the after end of the outriggers. These rudders were quite efficient and galleys had a tight turning circle. The radius of a trireme's turning circle has been estimated as 35m. In theory, a 3 could complete a 180^{o} turn in 20 seconds! A Punic 5's performance was probably just as good. Punic warships had two steersmen, one per oar, rather than a single steersman handling both oars as on Greek and Roman ships. The Punic system enabled larger forces to be applied to each oar, thus decreasing the turning circle. The heavy and unskillfully handled Roman quinquereme had about three times the turning circle of a trireme and would have taken one to two minutes to put about.

5. STABILITY

As well as being wrongly thought of as slow and slumsy, galleys are believed to have been very unstable. Tarn, writing in 1930, stated that "a quinquereme was a comparatively light machine of shallow draught and low freeboard, and rather crank (top heavy)" and that it was as stable as "a glorified racing eight". In support of his theory, Tarn quoted Livy's description of the battle of Corycus (191BC) from Book XXXVII Ch 44. The Roman flagship (at least a 5) is recorded as finding it necessary to dip her oars in the water before she threw grapnels. In fact this passage has nothing to do with ship stability. The Roman oarsmen were slowing the ship by "holding water" with their oars, preparatory to grappling and boarding.

The likelihood of a ship capsizing depends on its <u>transverse stability</u> - the ability of a ship to right itself after rolling away from the vertical. The transverse stability of a galley cannot be calculated without more data than is presently available

to archaeologists. In general a boardbeamed vessel with a shallow draught (eg a tug or barge) has a high transverse stability. Though such a boat is very hard to capsize, the large forces that keep it upright causes it to roll violently at sea. The board beamed Roman 5 probably had a high transverse stability which was necessary in view of the large number of heavily equipped legionaries on the weather deck. The resulting "short and sharp" rolling motion must have made the poor fellows constantly sea sick. The sea sickness of legionaries is proverbial in all books on the Roman navy! The slimmer trireme and Greco-Punic quinquereme must have been less stable than a Roman 5. A trireme must have been particularly unstable. Not only was the 3 relatively narrow (transverse stability is proportional to the beam), but it had a large crew per tonne of displacement which added to the top weight (4 men per tonne for a Hellenistic trireme, compared to less than 2 men per tonne on a Roman 5). There is some evidence that triremes and other small ships could be capsized by sudden movements by the crew or by ramming.

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If a sufficiently large force was applied at bow or stern, the opposite end would become submerged and the ship would sink. At the seige of Syracuse in 214BC the Greek physicist Archimedes was able to destroy attacking Roman 5s by lifting their beaks out of the water with grabs fitted to cranes. The Roman marines were

driven aft by catapult fire, thus raising the bows and depressing the stern. A powerful crane exerting perhaps 20 tonnes upward force then lifted the prow a further metre or two. Sunce 5s had a low freeboard (probably about 2 metres) the stern would be submerged and the vessel begin to sink. When the grab was released the ship fell back violently and either capsized or was totally swamped.

Galleys were often lost in large numbers in storms and this is said to have been due to the low stability of the ships. In particular the stability of a Roman 5 is held to have been seriously reduced by the heavy corvus in the bows. However the effect of a topweight of less than a tonne on a borad beamed vessel displacing 200 - 300 tonnes in negligable, evan if the corvus was swung out to its full extent.

Galleys were lost in storms because it was impossible to row them in rough water. Once the ship was unable to make way against the seas it would toss about out of control until it was swamped or driven ashore and broken up (as happened to a Roman fleet in 255BC).

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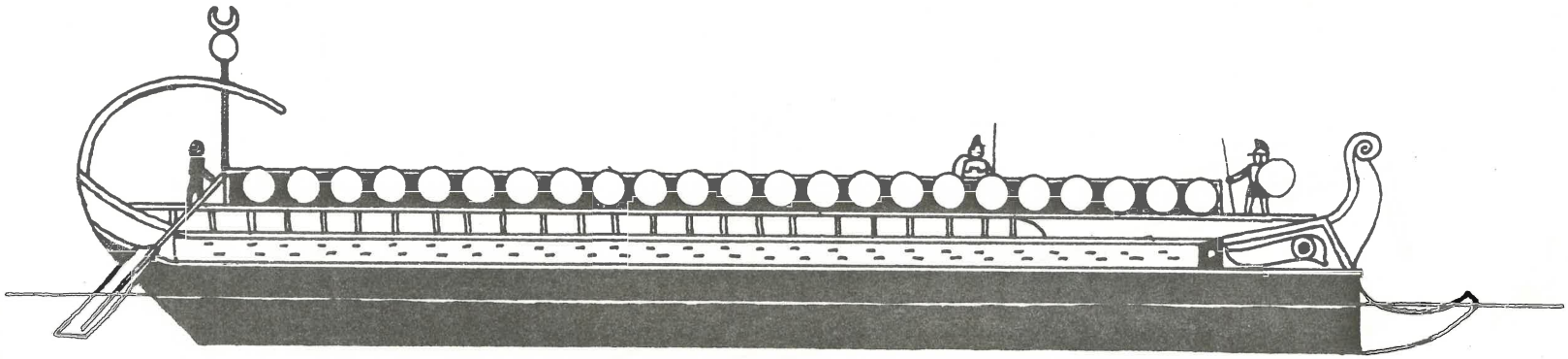
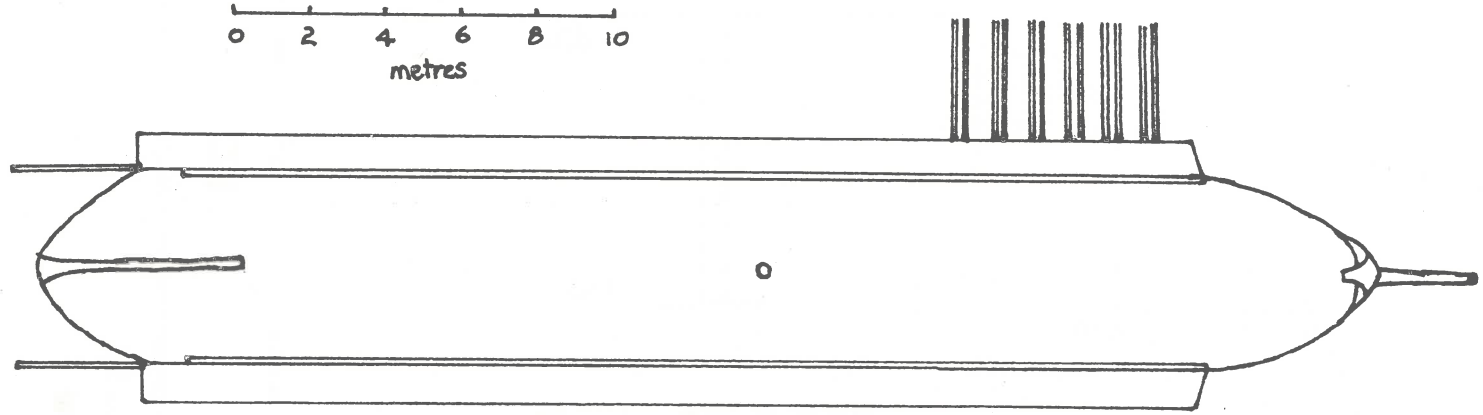
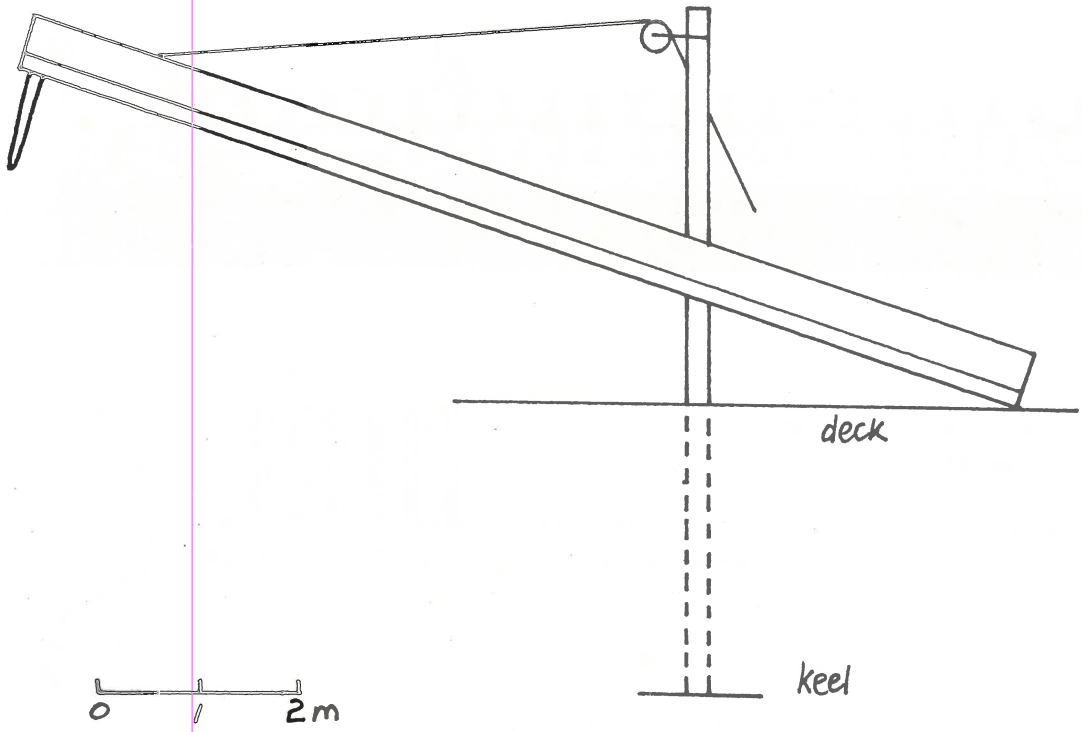
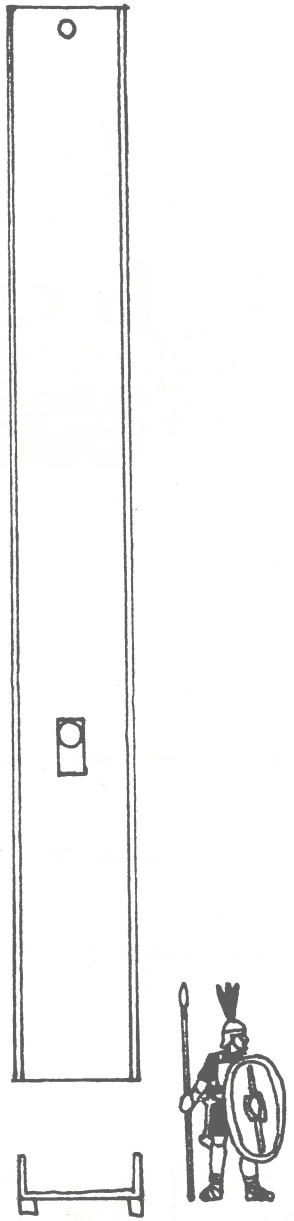




length: 35 metres
beam: 7m outriggers
5m hull
draft: 1·2 metres
displacement 120 tonnes.

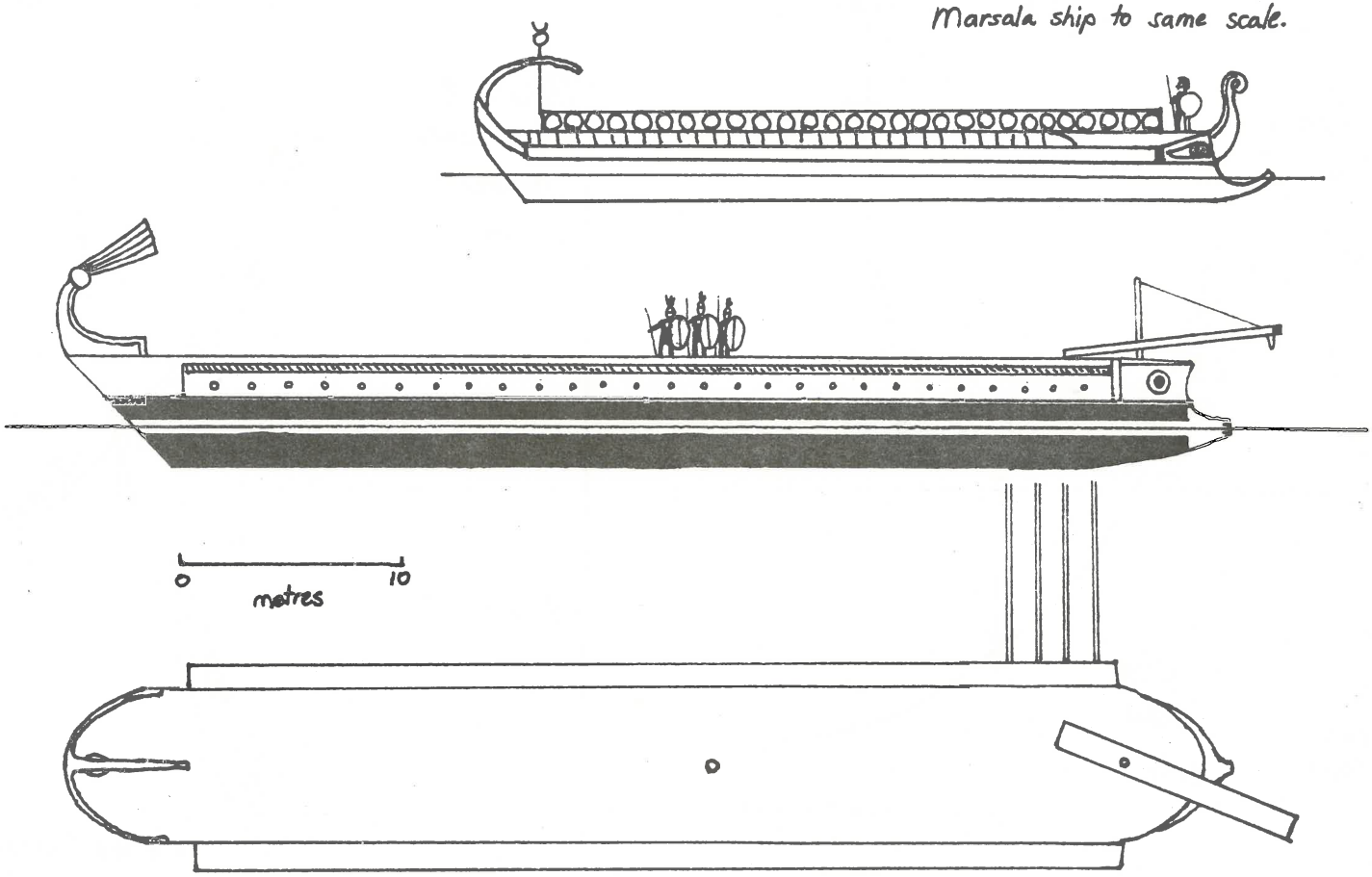
1. The Marsala Punic Ship.





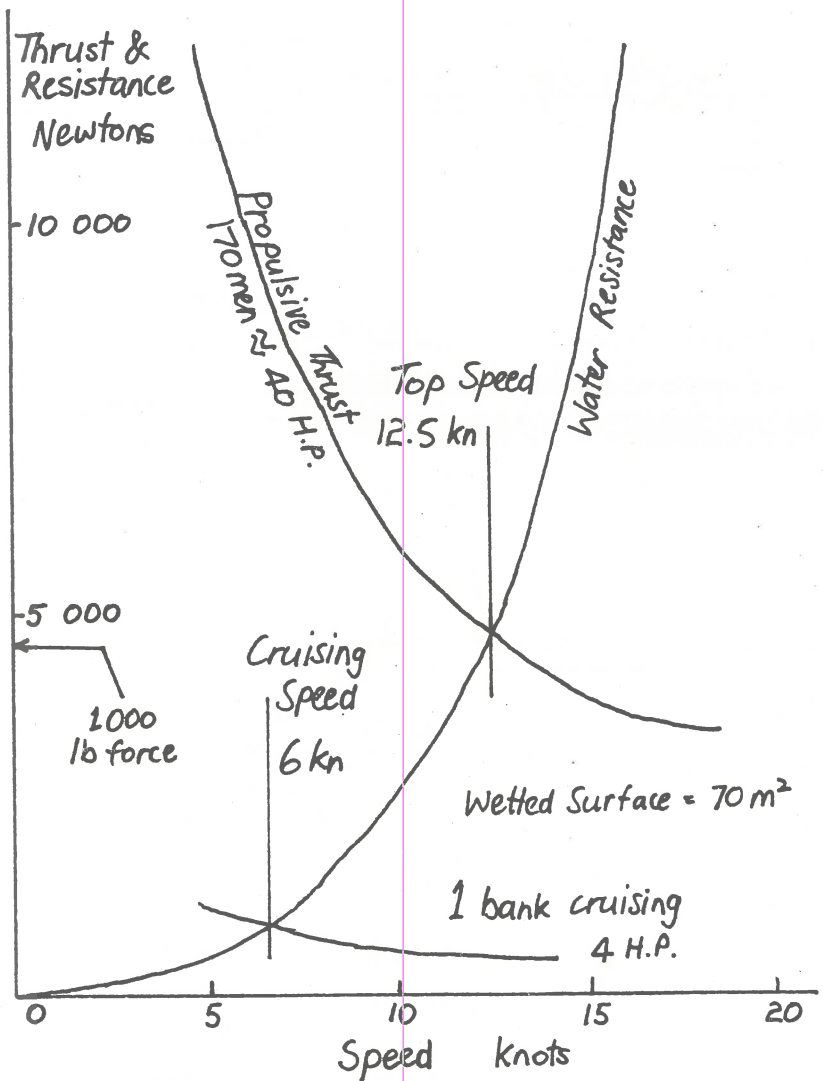
Mass of Pole 200 kg
Mass of Bridge 600 kg
Total Mass 800 kg

2. The "Corvus"

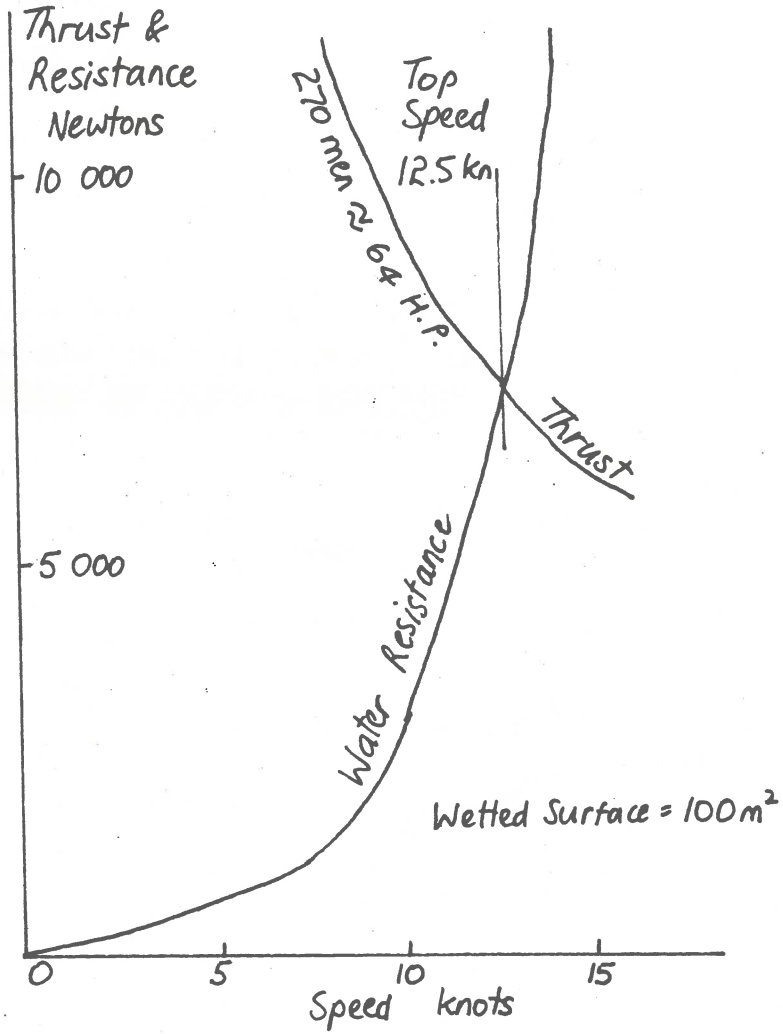


length: 50 metres
beam: 9m outriggers
7m hull
draft: 1.4 metres
displacement: 300 tonnes.

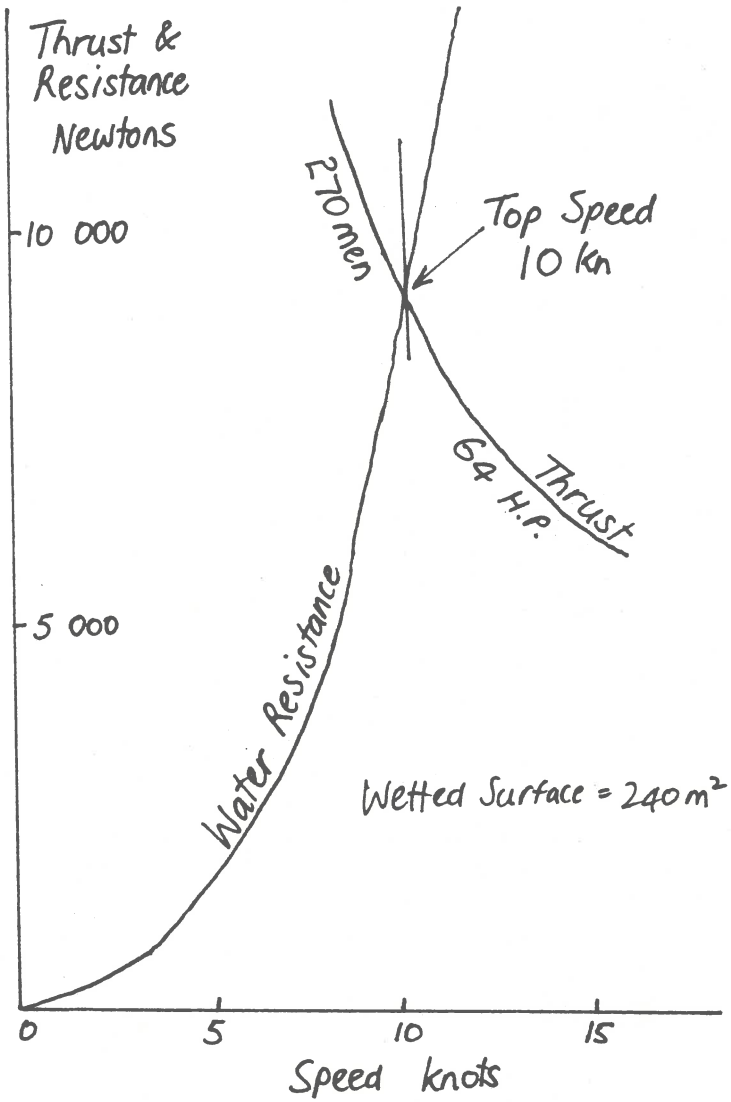
3. Roman Heavy Quinquereme.



4. Top Speed of a Trireme



5. Top Speed of the Marsala Ship



6. Top Speed of a Roman Quinquereme