

ARMOUR NEVER WEARIES



SCALE AND LAMELLAR
ARMOUR IN THE WEST,
FROM THE BRONZE AGE
TO THE 19TH CENTURY

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Men soon grow sick of battle; when Zeus the steward of warfare tilts the scales, and cold steel reaps the fields, the grain is very little but the straw is very much. The belly is a bad mourner, and fasting will not bury the dead. Too many are falling, man after man and day after day; how could one even have a moment's rest from privations? No, we must harden our hearts, and bury the man who dies and shed our tears that day. But those who survive the horrors of war should not forget to eat and drink and then we shall be better able to wear our armour, which never grows weary, and to fight our enemies for ever and ever.

The Iliad, Book 1

Cover illustration. A cavalryman from the Stuttgart Psalter. (Württemberg State Library)

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About the author

Timothy Dawson's interest in medieval history, and especially military history and that of the Near East, was initially fostered by his participation in historical recreation ('re-enactment') and public education. Such interests led him to a career as a history educator and historical craftsman. He took a BA in Classical Studies at the University of Melbourne, Australia, followed by a doctorate at the University of New England (New South Wales, Australia). He has published widely on aspects of material culture and social history, particularly clothing and military matters, using a methodology which combines conventional scholarship with practical experience and reconstruction to make significant advances in certain areas. Timothy is the author of *Byzantine Cavalryman: Eastern Roman Empire, c.900–1204* and *Byzantine Infantryman: Eastern Roman Empire, c.900–1204* for Osprey Publishing and *One Thousand Years of Lamellar Construction in the Roman World*, *Levantia* Guide no. 8.

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INTRODUCTION

The question of whether men first contrived protective equipment for themselves to defend against beasts they set out to hunt, or whether it was the result of conflict arising between human communities, is likely to remain a mystery. What is beyond doubt is that once the need for such protection was perceived, the earliest manufactured form must have been small pieces of naturally occurring durable material, horn and bone, bound together with textiles or leather to create a fabric. This volume sets out to gather the hitherto dispersed evidence for external small plate armours as they were used in the West, to illustrate the permutations in form, and trace the fluctuating patterns of usage.

In defining 'the West', I use the conventional border of the line of the Ural Mountains, the 60° East meridian. This will, admittedly, take in areas that many people might not think of as 'Western', such as Iran and Arabia, but the former is certainly fitting, because external small plate armours were central to its military practices for a very long period of time, and because of the significant influence that region exerted on Mediterranean and Near Eastern societies in early times. The reason for this geographic restriction is primarily linguistic. It is very much harder for me to access source material from the Far East. The restriction is not absolute, however. From time to time I will refer to Oriental material for the sake of comparison where that is useful.

In its final realisation, the temporal parameters of this project have ended up being rather wider than anticipated. The starting point in the Bronze Age was noted by earlier scholars, and nothing has arisen in the last few decades to alter that. Rather unexpected, though, was the discovery that scale armour, at least, remained in functional military use much later than I imagined, beyond the middle of the nineteenth century. An epilogue to that is the use of scale armour in theatre and other pastimes which brings us to the start of the twentieth century.

Origins of the armour

The origins of external small plate armour are lost in prehistory. While scale armour begins in very elementary form and becomes more sophisticated over time, the very earliest surviving examples of lamellar and its representations already appear in sophisticated forms from the outset. That those early sophisticated forms do not survive and spread implies they they did not necessarily have a considerable prior history involving gradual technological development, but perhaps were localised products of some unusually inspired artisan or group. Lamellar is often thought to have been introduced to the West from Central Asia in Late Antiquity, yet in 1967 H. Russell Robinson observed that the earliest evidence for lamellar is actually found in the West. This observation still holds true despite all the research and archaeology that has been carried out since, with lamellar not reaching the Far East until Late Antiquity. Decades earlier, Bengt Thordeman felt able to be much more definitive writing that the evidence 'proves that lamellar construction originated in the Near East'.¹ With all due respect to Thordeman and many others, we should be wary of one assumption, which is very prevalent in studies of the history of art and technology. That assumption is that any basic technologic

innovation necessarily arises in one location alone and disperses outwards from there. The creation of segmental armours like lamellar and scale is a technology which could easily have been invented in more than one location independently, with the flows of dispersal from any one locus of invention fluctuating over time.

The genesis of these armours may in fact lie in the late Stone Age. Across Europe and the Caucasus graves have been found with assemblages of pieces of bone, horn or shell that have been pierced and somehow bound together as bodily adornments, sometimes in quite complex structures. It is notable that in some areas male bodies in particular had such structures encompassing their heads.² Otherwise wide bands might enclose the throat or elbows, and there are larger masses that suggest skirts.³ It is quite plausible to imagine that a man wearing such ornaments might well have found himself in a hunting incident or conflict situation which showed the potential protective value of such a bone or horn fabric and thereby led to the construction of a denser structure designed for that defensive purpose.

Another consideration to bear in mind in terms of technological development is that, just as it may not be singular and geographically contiguous, it also need not be chronologically continuous. A technology may die out and be revived, either anew or from artistic or physical survivals. This phenomenon is conspicuous in the cases of both these armours. For further discussion of this, see the introduction to the section on lamellar.

Sources for the armours

The sources for external small plate armours are fourfold:

Firstly, examples that have been preserved complete – or substantially so – in collections. These are confined to the modern era. Provided that the material has not been aggressively conserved, or modified to conform to contemporary tastes (as so much armour was in the nineteenth century), the information it provides can be taken at face value, and can shed light upon prior practice.

Secondly, archaeological finds. The condition, and hence information value, of this material can vary enormously. Much has been found as disarticulated fragments, and so these cannot in themselves be very informative. Even better-preserved examples have sometimes been misinterpreted by non-specialists dealing with the finds. A significant amount of the material in major collections was either excavated in what would now be considered an unacceptably unscientific manner, or else was acquired through the commercial antiquities market. The latter has long been prone to having the provenance details of artefacts embellished, or simply falsified, for a variety of reasons. Hence, one must sometimes be very sceptical of the information that accompanies some items.

Art works. This category forms the bulk of the source material, and is the most problematic. Ancient pictures and carvings are not photographs, nor are they technical renderings of any portion. They are works of contrivance, created for particular purposes: propagandistic, didactic, religious or entertaining. They are conditioned, at the least, by the social and ideological expectations of the sponsors and expected audiences, or by stylistic conventions, or both. The medium itself may constrain or determine the character of the depiction. Furthermore, artists varied in draughtsmanship skills, or in their familiarity with what they were employed to represent, or by the amount of effort expected of them in their execution, leading them sometimes to create sketchy or garbled renderings. Like films today, historical pictures are often contrived for visual clarity and drama, even when the

result is physically impossible. Such an example can be seen in illustration 34, where the arm and sword of the central attacking horseman must take on an Escheresque dimensional distortion if he is to strike the man he is pursuing. Specific issues lie in the observation that occasionally artists used a herringbone or scale pattern which can look very much like scales in order to represent mail,⁴ that horizontal banding which might be taken to be lamellar could be better interpreted as laminar or 'animal skin' armour,⁵ and in the proper identification of the pattern that nineteenth-century scholars called 'banded mail'. As a result of all these considerations, no work of art can be taken entirely at face value. The study of historical armour generally is bedevilled by people determined to treat ancient and medieval pictures as if they were literally and completely accurate. One need only think of the trellised and broad-ring armours which nineteenth-century writers and illustrators made of the schematic depiction of mail in the Bayeux Embroidery. Recent work encompassing external small plate armour, and especially lamellar, has seen a considerable number of instances of this.⁶ Another problem with pictorial sources is dating. Some art comes from archaeological contexts or with textual or other corroborations, which allows a degree of confidence. A great deal more, though, is only dated by the processes of art history analysis, which is purely impressionistic. Given a certain artwork, an art historian may decide that it looks sufficiently like some other piece which has a commonly accepted date to propose that it must come from the same cultural milieu and period. If enough of his/her colleagues agree, then it becomes a 'fact'. The problem is that the date of the reference artwork was probably established by the very same process, or may date back to the origins of the discipline in the nineteenth century when intellectual deference allowed historians of sufficiently recognised stature to simply make a decree and have it accepted as fact. Such issues are especially rife in the Art History of the Byzantine Commonwealth.⁷

The final form of evidence is textual material. This is the most marginal form. Just as with the artists, it was rarely relevant to the goals of authors to be detailed and technically precise about the armour worn by the people about whom they were writing. The exception is, of course, military manuals, which can provide some extremely useful information, especially when correlated with art.

Reconstruction

As this is an intensely practical subject, practical experience and experimentation can provide valuable insights. In contemplating a picture, one may ask, 'Can it be built to look like that using the techniques of the time?' and 'If it can be built to look so, is it functional?' The answer must be 'yes' to *both* questions before the reconstruction can be said to support an interpretation. Similar practical experience in making and using items can assist in seeing through the effects of damage or decay on archaeological items.⁸ Yet, even acknowledging those parameters, we must bear in mind differences in outlook between ourselves and people in the past. Men in the past have in many situations been willing to put themselves in harm's way to a degree that can seem inconceivable today. The point of armour was more 'harm minimisation' than 'harm prevention' for most warriors. On the other hand, that consideration varies with the quality of armour. If a high-quality armour is reconstructed in a manner that has significant vulnerability, then it must be incorrect.

Such practical considerations cannot, however, stand alone, nor can they override other evidence and analysis. It can be perfectly possible to build a functional item on the basis of flawed evidence and interpretation. I cite the example of my own early theory about banded lamellar which led me to build

a *klivanon* based upon Ian Heath's widely known oversimplified version of lamellar.⁹ That *klivanon* was reasonably functional, and the inventiveness of humans means that it cannot be said that it is impossible that somebody, somewhere, made such an armour, yet today I can say that it is inconsistent with the great mass of data now available and should be rejected. Hence, reconstruction must be an adjunct to methodical and methodologically well-informed research.

In preparing this volume, new theories (and, indeed, some old ones) which were potentially contentious were routinely tested by the manufacture of a sample.

Definitions of the forms

Past writers have struggled to come up with systematic definitions for these forms of armour.¹⁰ Part of the problem is the confusion caused by the pictorial literalism I discussed above. Another unhelpful thing is the old-fashioned use of the term 'splint' in relation to such armour. That term, in my opinion, should be confined to armour made of long, narrow strips, normally used for limb protection.

I suggest a simple system, that external small plate armours are divided into three categories: lamellar, scale and a category for which there is no widespread term.¹¹ The overarching distinction between the first two is straightforward. When used in the *primary protection zone* (such as the torso of a human):

- scale armour overlaps *downward*, and is predominantly mounted on a continuous substrate, usually of textile or leather.¹²
- lamellar overlaps *upwards*, does not have a continuous substrate and its structure is created using some sort of cordage.

There are a few exceptions to these rules, but they are just that – exceptions, necessarily of limited scope.

The principal exception in the case of scale is the so-called 'semi-rigid scale' armour used in the early Roman imperial era, where the entire structure is made of scales fastened together with metal staples or ties, with no use of textiles or cordage as substrate or fastening. This only breaches the substrate aspect of the definition, for all surviving instances overlap downward, where a piece is sufficiently complete to infer its orientation. As discussed later, there is a very limited set of pieces where scales overlap upward, but they are not used for the primary protection zone.

There are pictures suggesting inverted lamellar on the primary protection zone; however, it should be noted that those few pictures occur in a very limited period and cultural context. They are all Byzantine or areas artistically derivative of it, and primarily clustered in the eleventh and twelfth centuries. They are also almost entirely in religious art, and are very often garbled in ways other than simply the inversion of the fabric of the armour. Their existence can be explained by the phenomenon discussed above – artists required to depict something with which they were not directly familiar and having to rely either on other pictures, which might themselves be defective, or on descriptions given to them.¹³ There are even more cogent practical reasons for dismissing inverted lamellar in the primary protection zone. In the first instance, the 'amorphous' forms of hanging lamellar (see below for an explanation of these terms) do not hang in a stable manner when inverted. Depending upon where the suspension laces run from and to, the material will be prone to fall open to some degree.

Once on the body they will be a little more stable, but the tendency to drop open would itself make the armour much harder and slower to put on, as each row would have to be arranged to hang flat. A still more pointed (pun intended!) counter-argument is explained in the following section on the protective functionality of the armours (see [here](#)).

There are rare instances, however, where lamellar construction is employed overlapping downwards for human (as opposed to equestrian) use (once again, confined to pictures from the Byzantine Commonwealth of the eleventh and twelfth centuries) but, as with scale armour, this application is only for limb pieces, and never in the primary protection zone.

Lamellar is itself divided into two micro-structural variants – ‘solid-laced’ and ‘hanging’. In solid-laced lamellar, the vertical connection between the rows is close and tight, allowing little movement. This tends to be a characteristic of earlier forms. In hanging lamellar the rows are suspended on loose laces, allowing considerable vertical flexibility.

Hanging lamellar harnesses may themselves be divided into two macro-structural categories – ‘amorphous’ and ‘structured’. (Solid-laced lamellar, and, indeed, scale armours, are inherently structured.) In amorphous hanging lamellar the only constraint governing the movement of rows relative to each other is the suspension laces. Hence, an amorphous lamellar is capable of telescoping more or less completely into itself, and when extended may undergo considerable lateral movement. Structured hanging lamellar has some sort of continuous binding at the ends of its rows to stabilise its fabric. This practice makes the armour much easier to use in donning and doffing, and more durable, although at the cost of making it harder to store and carry when not worn. The amorphous form was by far the more widespread and longest-lasting, being the dominant form in the East.

Terms for individual components of the armour will be used consistently and exclusively throughout. *scale* = a plate used in scale armour; *lame* = a plate used in lamellar armour.

The third form of external small plate armour unnamed above is an unanticipated inclusion in this volume. Sometimes associated with the French term *broigne*, or more fully ‘*broigne* of plates’, it is a form of armour with (usually rectilinear) plates fixed flat to a substrate garment without any sort of overlapping. In modern hypothetical reconstructions they are commonly riveted to the base, although modern re-enactors will also stitch on panels of (sometimes hardened) leather. Even though this type of armour is a staple of quasi- or pseudo-historical movies, there is virtually no evidence for it in the historical record. The origin of the idea of externally plated armour lies in the same habit of uninformed pictorial literalism of nineteenth-century antiquarians that produced the similar fanciful ideas of trellised and broad-ring¹⁴ armour. There is a picture conjectured to be a *broigne* of plates in the *Stuttgart Psalter*, which shows a man whose chest is covered with a square lattice with dots in the centre of most compartments.¹⁵ It has even exerted some appeal over recent archaeologists. Researchers investigating an early eleventh-century site at Lake Palandru in south-east France found a small group of iron plates about 50mm square with a single central rivet, and decided they came from such an armour. Their reconstruction shows plates spread very sparsely over a short jerkin, leaving great expanses of unprotected leather.¹⁶ Facsimiles of this hypothesis made by re-enactors more sensibly place more plates closer together and sometimes even slightly overlapping, but this does nothing to alleviate one of the most basic problems with the theory. With a single central attachment a plate might rotate, disrupting the coverage pattern, where there is one. Furthermore, as the garment flexes with the wearer’s movements, any edge of the plate could peel away, allowing a weapon behind it not to pierce the base garment and wearer, then possibly to tear the plate from the garment. Other hypothetical reconstructions of a *broigne* of plates employ the greater security of rivets in all corners, but all share the fundamental vulnerability of unprotected intervals between the plates. The supreme

armament of Antiquity and the Middle Ages was the spear, a thrusting weapon. Any gaps between plates are obviously at risk. Nor are metal plates a foolproof defence: a committed thrust, especially at any angle to the surface, will skate and drop off an edge into the unprotected gap. For these practical reasons and for the lack of any persuasive evidence, externally plated armour must be rejected as fiction, except for the one Western example which has come to light, which can be found in the discussion of *culets* in the scale armour section.

Materials

Surviving items of exterior small plate armours are, not surprisingly, overwhelmingly made of metal. Iron is predominant, with various copper alloys less common. Organic materials were certainly used in lieu of metal. The more limited survival of these is supplemented by literary references to horn, and more robust forms of leather such as ox hide. There is limited evidence to support the idea of more mundane types of leather being treated by processes such as boiling or wax impregnation in order to be used for these armours, although no one can say it was never done. Pragmatically, however, it is unlikely, for leather of that sort can be used to make large plate armours with much less effort.¹⁷ One thing is quite clear – that leather is used for external small plate armour reconstructions in both re-enactments and films far more often than the evidence justifies.

The protective functionality of the armours

In combat that does not involve firearms, armour is confronted with four types of challenge: sharp impacts, blunt impacts, cuts and stabs. The following observations are based upon several decades of the author's involvement in re-enactment and military living history and in researching, practising and teaching Western historical combat forms.¹⁸

High-powered projectile impacts, whether sharp or blunt, from weapons such as ballistae, heavy crossbows and catapults, can be counted upon to overwhelm any man-portable armour system and should be discounted from this discussion. Lighter projectile impacts, from arrows, quarrels, darts, javelins and sling stones, have the characteristic of being a momentary challenge to the resistance of the armour. Up to a point, small plate armours have an advantage in that a pointed projectile impact is more likely to penetrate something rigid, while the limited flexibility of small plate armours can have the effect of absorbing and dispersing much of the energy of the projectile. The author's tests have shown that this flexibility, combined with the multi-layering that is found in many versions of these armours, is outstandingly effective in resisting sharp projectile impacts.¹⁹

The primary protection zone is rarely a target for hand-held blunt impact weapons (i.e. maces) as they are much less likely to do debilitating damage in that area. Once again, the limited flexibility of small plate armours tends to disperse the impact and make such attacks even less effective. Sharp impacts from hand weapons, such as axes, and back spikes on axes and hammers, are more problematical, for they have the potential to compromise the integrity of the armour as well as transmitting impact. The limited flexibility will have some impact-dispersal benefit, but ensuing damage will leave the wearer vulnerable to a further attack even if the armour does not fail catastrophically at the first assault.

Both scale and lamellar armours are highly effective against cuts. It might seem at first that the exposed lacing of lamellar might be a vulnerability, but in practice this is not so. The sheer quantity of

laces that must be cut in order to compromise the integrity of the fabric is so great as to forestall it.

It is against stabs to the torso that the performance of different forms of exterior small plate armour vary most. In the less common situation of downward stabs, the imperviousness of scale armour hardly needs to be explained – the attacking blade will simply tend to skate off. In the case of lamellar in its normal overlapping-upward form, while the blade will lodge against the top of a row, the density of the structure prevents it from displacing plates enough to penetrate. Should the angle be so acute that the blade could slip down between the rows, it will have great difficulty in penetrating the body of the wearer. In practice, the majority of stabs, whether from spear or sword, are in the low alignment and from there tend to angle upward to some degree. On scale armour, the effect will depend upon which construction variant is involved. With the most basic form, where the scales are attached one at the top and do not overlap laterally (*fig. 1*), a point skating upward can lift a single scale or a couple of scales and slide up underneath, thereby gaining access to the textile or leather substrate and penetrating it. To prevent this danger, various expedients were devised. A common approach was to punch holes near each edge a portion of the way down each scale (*fig. 2*) then to overlap the scales horizontally, allowing those holes to be used to fix all the scales in one row together, and sometimes to the backing as well. This meant that a thrust would have to lift almost the entire row in order to penetrate the garment, a rather more difficult thing to do, especially with the rows curving around the body. A further method was embodied in ‘semi-rigid scale armour’, used almost exclusively by the Romans of the early imperial era. In this type of armour, an additional pair of holes was made at the centre of the lower edge or point of each scale (*figs 3 and 4, and ill. 5*), and these were used to fasten the final loose facet of the scale down to that below. This style was essentially impervious to a thrusts, although its near rigidity limited its usefulness. Against (overlapping-upward) lamellar, once again the result is obvious – the point will skate upwards, at worst catching on the upper edge binding if it exists. Should hanging lamellar be used inverted in the primary protection zone, it suffers a degree of vulnerability to upward-directed thrusts that is midway between that of the simplest form of scale armour and form with adjacent scales overlapped and bound together. A blade will skate up the lamellar plate, and then simultaneously lift the row above and push the impact row in and down. An amorphous hanging lamellar is extremely vulnerable to this phenomenon, and a structured hanging lamellar not much less so. Solid-laced lamellar is less acutely vulnerable, but still may suffer penetration through parting of the binding laces. Outside the primary protection zone, the precise dynamics of the threats are slightly different. The mobility of the arms means that cuts often arrive with less force, and makes them less of a target for thrusts, thereby reducing the lamellar/scale distinction noted above. Whereas thrusts to the torso tend to have a somewhat upward slant, thrusts to the thighs always have a downward angle. All the most forceful cuts are downward, and while they fall on the torso quite perpendicular to the surface, below the waist they may arrive at an acute angle to the surface, potentially offering a greater threat to lamellar in the usual overlapping-upward orientation. These considerations explain why lamellar torso armour was sometimes combined with mail, scale and inverted lamellar upper sleeves and skirts (*ill. 28*). This practice in fact predates the widespread use of lamellar in the Roman army, as there are representations of Roman armours with scale skirts as early as the first half of the first century of the Common Era (CE).^{[20](#)}

Forms of the harness

An autonomous cuirass of exterior small plate armour may be constructed in four overall forms which occur in both fabrics:

Chest and back only, with shoulder bands of leather or lames at right angles (may have separate skirts, possibly of the same material).

Chest and back only, continuous over the shoulders (may have separate sleeves and/or skirts, possibly of the same material).

Chest, back and legs continuous.

Chest and back with sleeves and legs continuous.

In addition, with lamellar, and the less flexible forms of scale armour, the portion that encircles the chest must open for access. Such an opening may be on one or both sides, or down the centre from front to back. Front opening was rare, for it is a primary area of vulnerability. There is no evidence – whether archaeological, artistic, or by comparison to more recent surviving examples from further East – to suggest that cuirasses might open at the rear, and such a configuration is inherently very much less practical. Nevertheless, it cannot be said that a rear opening was never used.

Fastenings

Two methods of fastening can definitely be said to have been in use with both forms of exterior small-plate armour. Lacing (that is, ties) was the most widespread practice across the broadest spread of time. Strap-and-buckle arrangements were introduced much later, with some of the earliest definitive evidence being in the Niederstotzingen lamellar harness. Inspired by occurrences of mushroom stud connectors in early Roman use, the author has found an arrangement of straps and mushroom studs riveted into metal lamellae very effective (*ill. 37*), but this is a completely speculative arrangement which could be more prone to failure in high-stress combat situations.

Caveats

Finally, a note on what is wrong with this volume, and similar summary treatments. Ancient and medieval workmanship was nothing like what we may expect from our post-Industrial Revolution viewpoint. The scales and lames that survive are enormously variable in form, size and quality, even within a single contiguous armour piece, let alone within a deposit of material. Nor are they even geometrically precise. Hence, all the diagrams in this book falsify what they represent by not showing the variation, and even more so by standardising and rectifying the form of any plate shown. Those who want a more authentic impression should read the archaeological reports.

Another caveat is that there is a tendency both with archaeologists and with secondary treatments, including this one, to assume that any given scale or lame represents a continuous fabric. Where only one plate or a few plates have been found, this assumption is questionable, for specialised plates were often made to facilitate tailoring and finish edges and openings. For an example of this practice contrast the edging plates on the Bourke scale helmet hanging (*fig. 11, type 1.11*) with those in the bulk of the piece (*fig. 11, type 1.10*).

Terminology

Historians and antiquarians of the nineteenth and early twentieth centuries studying historical and ethnographic arms and armour adopted foreign and historical terminology for less familiar items in English with great enthusiasm. Unfortunately, they did not employ an equivalent level of consistency, nor, it often seems, a similar level of understanding about how the terms were used in their origin.

context. More recent writers have not conspicuously remedied the situation.²¹ Hence, I will generally avoid the use of such terminology, except in specific areas where my own training allows me a degree of confidence (i.e. Latin and Greek). With work in that early period being such a formative factor in modern museology, a great deal of such variable language is still embedded in museum records. A good starting place for those who want to familiarise themselves with such antique terminology in order to facilitate searching is George Cameron Stone's *A Glossary of the Construction, Decoration and Use of Arms and Armour in All Countries and in All Times, Together With Some Closely Related Subjects*.

Notes

- ¹ Bengt Thordeman, *Armour from the Battle of Wisby, 1361* (Stockholm: Alqvist and Wiksell, 1938), p. 276. This pattern of origin and spread is acknowledged by Hiroshi Kajiwara: 'On lamellae: Lamellar armor from a Eurasian viewpoint', *Tohoku Fukushi University Serizawa Keisuke Art and Craft Museum Annual Report*, vol. 1, 2009, p. 57.
- ² A.F. May, *Der Schmuck aus jungpaläolithischen Bestattungen in Frankreich und Ligurien* (Jewellery from early Palaeolithic burials in France and Liguria) (Berne: Fritz Marti, 1962), illustrations on p. 71.
- ³ See note 2.
- ⁴ See, for example, David Nicolle, *Medieval Warfare Sourcebook*, illustration on p. 137, which is typical of practices around the Byzantine periphery. Contrast that with the illustration on p. 69, where what Nicole identifies as stylised mail could just as easily be scale.
- ⁵ Once again, David Nicolle's work exemplifies how ideas might evolve. In *Medieval Warfare Sourcebook* (p. 91) he identifies lamellar a picture showing an armour with no characteristics other than horizontal banding, while later in *Companion to Medieval Arms and Armour* he discusses a leather banded (or, as he calls it, 'hooped') armour which would produce an identical appearance: 'Jawshan, Cuirie and Coats-of-plates: An Alternative Line of Development for Hardened Leather Armour' pp. 179–221.
- ⁶ While I cordially salute Mamuka Tsurtsunia for bringing the Georgian evidence for external small plate armours (and Slavic scholarship) into the English-speaking realm, he also falls into the pictorial literalism trap in respect of some of those sources. 'The evolution of splint armour in Georgia and Byzantium, lamellar and scale armour in the 10th–12th centuries', *BYZANTINA SYMMEIKTA*, 21, 2011, pp. 65–99.
- ⁷ Once again, this dating issue is one which Mamuka Tsurtsunia does not take sufficiently into consideration in his attempt to claim credit for banded lamellar for his homeland.
- ⁸ There are still those who reject practical experimentation and experience as inputs to scholarship. Discounting the dying breed of old-fashioned academics who simply dismiss such things as irrelevant or inimical to scholarship, there are some potentially valuable points to be considered. Rafaele D'Amato, who has written a number of books on ancient and medieval military equipment, asserts that modern manufacturers cannot match the skills of ancient and medieval craftsmen who spent their lives working within a living craft tradition which doubtless included techniques handed down from master to apprentice and never committed to any record which might have come down to us (personal communication). There is some justice in this view, but only in limited areas, such as particular aspects of high-quality metalworking. In other areas modern artisans can achieve equivalent results, albeit more slowly and less easily. The construction of external small plate armours is a technology which requires no such sophisticated input, and so is very amenable to effective reconstruction.
- ⁹ Timothy Dawson, 'Banded lamellar – a solution', *Varangian Voice*, no. 23, August 1992, p. 16. Heath's version of lamellar unfortunately remains enshrined as canonical for many historical recreationists. Ian Heath, *Byzantine Armies: 886–1118* (Oxford: Osprey, 1980), p. 8.
- ¹⁰ See Tsurtsunia (p. 65) for a discussion of this in relation to the eastern European scholarship. A notable case of this confusion

to be found in J. Kim Siddorn, *Viking Weapons and Warfare* (Stroud, UK: Tempus, 2000). On p. 59f the author says there is no evidence for the use of lamellar among Vikings, but goes on to declare that ‘a very thin case can be made for the use of scale by returning members of the Varangian Guard from Constantinople’. He accompanies this statement with figure 24 which shows a lamellar corselet clearly based upon Byzantine pictures, but which is labelled ‘Scale, note the overlap is upward’. One can only speculate on what Siddorn thinks of as being lamellar.

[11](#) Doubtless there will be some people who will chide me for an omission in this volume – broad-ring armour: the type composed of rings laced or stitched to a leather garment. The persistence of that nineteenth-century invention in the popular imagination is perversely admirable! I will admit that as a young and ignorant re-enactor I made such an armour myself, although it only took the first thrust to arrive painfully at my chest without any metal contact to tell me that there was something fundamentally wrong with the concept.

[12](#) Tsurtssumia, p. 67.

[13](#) The most familiar examples of such misrendered lamellar can be seen in the illuminated Madrid manuscript of the *Chronicle of John Skylitzes* on ff. 126 (a particularly clumsy example), 135, 140v (again, extremely garbled), 153v, 154v and 212v. The *Madrid Skylitzes* manuscript was illustrated in Sicily around the middle of the twelfth century, and while some of the illustrators were at least very familiar with Byzantine iconography and almost certainly working from earlier Byzantine pictures, and may even have seen some lamellar, others were manifestly not so familiar and did not understand what they were meant to be representing. The most recent comprehensive study of the manuscript is Vasiliki Tsamakda, *The Illustrated Chronicle of the Ioannis Skylitzes in Madrid* (Leiden: Brill, 2002). Some of the Georgian pictures show the same sort of garbled representation. See Tsurtssumia (figs 12, 15, and 26) for Georgian examples.

[14](#) See note 11.

[15](#) *Stuttgart Psalter*, f. 70v.

[16](#) <http://www.culture.gouv.fr/fr/arcnat/charavines/en/legende/190.htm> for a picture of the warrior reconstruction. <http://www.culture.gouv.fr/fr/arcnat/charavines/en/legende/194.htm> shows a plate.

[17](#) See David Nicolle’s article on banded armour made of treated leather referred to in note 5. See also Arkadiusz Michalak, ‘Was leather armour used on Polish lands in the Medieval period?’ for a discussion of the spread of evidence for leather armour in Antiquity and the Middle Ages.

[18](#) A published excursion in this field is T. Dawson, ‘The Walpurgis Fechtbuch: an inheritance of Constantinople?’, *Arms and Armour*, Royal Armouries Museum, 2009.

[19](#) Tests originally detailed in T. Dawson, ‘*Kremasmata, Kabbadion, Klivanion*: Some aspects of middle Byzantine military equipment reconsidered’, *Byzantine and Modern Greek Studies*, 22, 1998, p. 45.

[20](#) Rafaele D’Amato, *Arms and Armour of the Imperial Roman Soldier: from Marius to Commodus, 112 BC–AD 192* (London: Frontline Books, 2009), p. 102.

[21](#) A very valuable recent contribution from someone with the requisite linguistic knowledge is Manouchehr Moshtagh Khorasan ‘Linguistic terms describing different types of armour in Persian manuscripts’, *Gladius*, XXXI, 2011, pp. 149–188. Note especially the discussion of *jōšan*, which deconstructs its use in English publications of recent years.

SCALE ARMOUR

Scale armour has the widest use of these two armours by far. The components of scale armour vary enormously in size and shape, even within the same period and cultural context – and, indeed, sometimes even within the same harness. Its variability in terms of construction, however, was much less extensive than that of lamellar. At the end of the nineteenth century, while studying the material found at Carnuntum in Austria, and presumed to be Roman,²² Von Groller created a typology of scale armour seemingly based upon factors of overall size and shape, and the size, shape and placement of the holes.²³ Von Groller's typology is, on one hand, unnecessarily complex, comprising nine types on the basis of distinctions which he does not precisely define. On the other hand, it fails to accommodate types of scale not employed within the cultural milieu of the deposits he examined. A simple universal typology can be defined based upon the construction method, which determines how a given scale fabric functions in use.

Typology

Scale armours may be classified by the method of fixing, and hence their flexibility and protectiveness, thus:

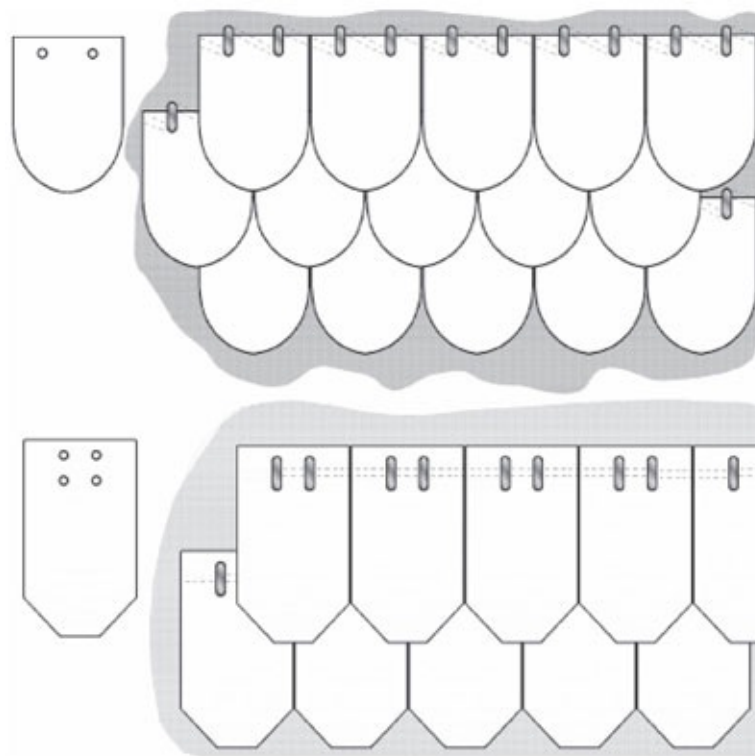


Fig. 1 The most common basic forms of scale assembly. Above, Type 1. Below, Type 2. The binding may also cross the edge on Type 2.

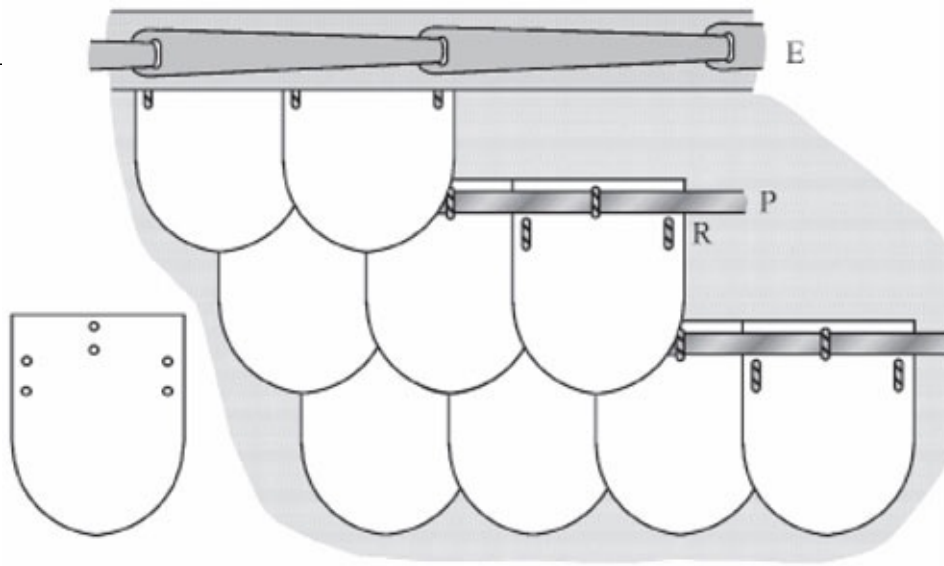


Fig. 2 A sophisticated Type 4 assembly from Carpow, Scotland. E: edge binding. P: padding cord

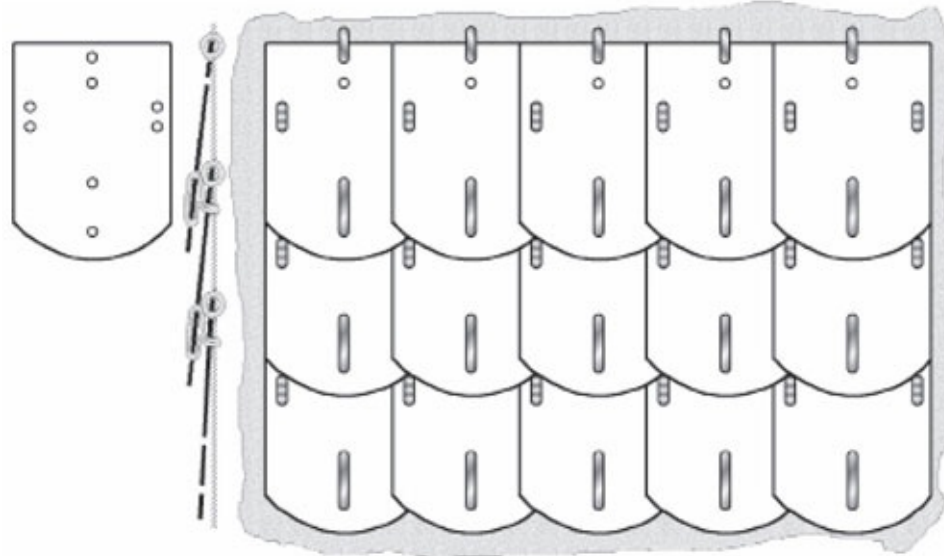


Fig. 3 A semi-flexible Type 5 construction from Carnuntum.

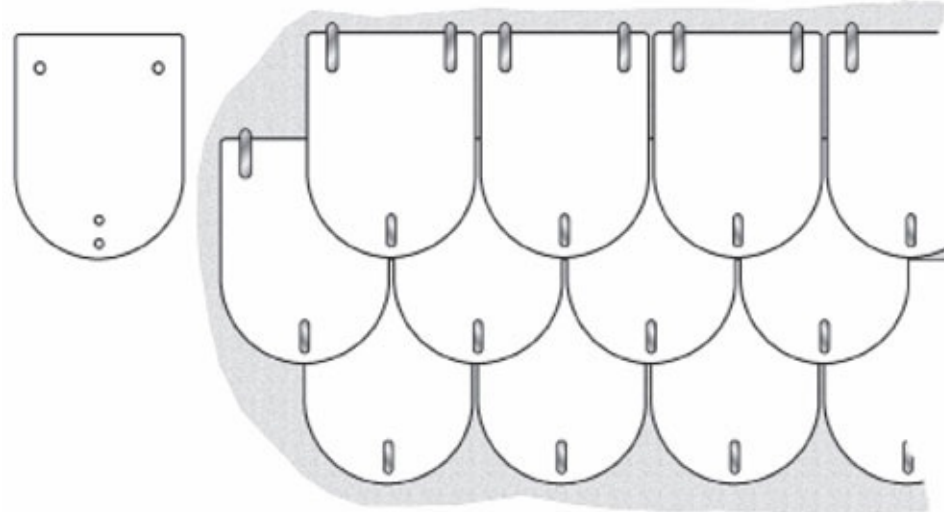


Fig. 4 A semi-flexible Type 5 construction from Carnuntum.

Type 1 – secured only near the concealed edge through a single row of holes.

- Type 2 – secured only near the concealed edge through a double row of holes.
- Type 3 – ~~secured near the concealed edge by either of the above methods, but with an additional fastening through a single hole partway down.~~
- Type 4 – secured near the concealed edge by either method, but with additional ties through pairs of holes partway along each edge.
- Type 5 – secured near the concealed edge by either of the first two methods, and at the opposite point through one or two holes and often on all four cardinal points ('semi-rigid scale').

The collection of examples of scales from archaeology in Figure 1 is organised according to this typology. Types 1 and 2 are ubiquitous and occur across the entire duration of this study. The rare type 3 occurs almost exclusively in medieval Russia. A question must remain over the distribution of type 4. To date, all surviving examples are believed to be Late Antique and from Roman, or closely related, contexts. However, in addition to the caveat in note 22, the great majority of the medieval sources for the use of scale armour is pictorial and offers no evidence of the method of construction except in suggesting that it is not type 5. Type 5 is the other form which appears from all present evidence to be culturally and temporally localised, used from the second to fourth centuries in the Roman empire. Even in the Roman realm, the semi-rigid scale is clearly a minority form.

Figure 1 shows that the size and shape of the plate are unrelated to its typology according to construction. This constructional typology is more significant because it relates inversely to the flexibility of the fabric created with the scales, and consequently relates directly to the protectiveness of the armour. Type 1 armours are most flexible, but least protective, because they are most prone to the possibility of plates being lifted by an attacking weapon, especially by a thrust, allowing penetration through the substrate. The more extensive binding of type 2 means that the base material must be moved more in order for the plate to lift, and is therefore more resistant, while type 3 takes this premise further. Type 4 scales are commonly overlapped laterally and fastened together, thus requiring most of a row to be lifted for access to the interior to be gained. At the other extreme, the variety of type 5 that is made without a backing and the plates fastened together with metal staples (type 5b) is the most protective, but a virtually rigid material (5). The degree of rigidity determines how any given scale fabric may be used.

Other pragmatic observations on the modes of construction of the various types are thus: A lateral overlap on type 1 and type 2 scales with holes near the centre confers little advantage. Where type 3 scales have holes close to the edges, lateral overlap can be used with common binding to gain some stability advantage. Type 3 scales are said to have been riveted at their lower fastening.²⁴ While that is likely to be true for examples such as those shown in Figure 1, type 3.5 (*fig. 5, top*), for the others with a hole close to the edge this additional fastening is more likely to be textile like the top attachment and protected by the overlap of the adjacent plate (*fig. 5, bottom*). Type 5 is commonly known as 'semi-rigid'; however, with the type assembled from plates fastened together with wire ties, there is very little 'semi' about it! The expression would be more fitting for the backed variety where the lower fastening can be arranged to allow some flexibility (*figs 3, 4*). In deference to established terminology, here I use the term 'semi-flexible' for type 5a.

The flexibility of scale armour, and the potential for tailoring in the substrate, allowed it to be used for an extremely wide range of applications, from modest discrete pieces such as helmet hangings and gorgets, to complete garments covering the whole body. One area upon which scale was hardly ever used for functional armour was the head. This may seem at first to be a questionable comment, given that scaled helmets do appear in art, and there are even surviving examples, but it is an area in which the flexibility of scale is precisely *not* what is needed. The surviving scaled helms are solely among

the 'karacena' armours popular in Poland in the seventeenth century. They were, however, purely parade armours (see below). In addition to sporadic Roman depiction (*ill. 1*), scaled helmets occur from time to time in Greek vase painting. Several factors indicate that those represent decoration rather than construction. The helms in question are perfectly ordinary Corinthian styles in overall form, and the scaling covers only the crown, leaving the lower portions plain, representing solid metal, or very occasionally patterned in a different manner. Furthermore, there are parallel examples where the crowns of such helmets are patterned in ways that do not even approximate hypothetical construction methods.²⁵ They must consequently be taken to be purely applied decoration.

Construction

There are three methods of construction employed in making scale armours. They are: stitching, tying with textile or leather, riveting, and tying with wire. The first is by far the most common, the last the least used. Riveting is confined to late examples that are either for parade use, or a peripheral pieces that will be subject to fewer attacks or stresses. The reason for this is durability and repairability. First, riveting is not suitable for a textile base garment because the very process of making a hole or driving the rivet through damages the structure of a textile, making failure more likely. When scales attached to the substrate by organic material fail, the failure is usually in the binding material, leaving the foundation material less damaged and hence the armour more repairable. Failure in riveted scale armour invariably involves significant damage to the base material. Wire ties were not used for anything other than binding metal scales together in type 4 armours where the lateral fastening does not involve the substrate, and in type 5b armours.²⁶

The Bronze Age to the Hellenistic Era

The earliest evidence for scale armour appears in Egypt in the second millennium BCE. A considerable number of bronze scales have been found in various locations from as early as the start of the fourteenth century. Correspondingly, a scene from the tomb of Ken-Amun at Thebes shows scale armour in golden colour. Plates found in the palace of Amenhotep III (1410–1372 BCE) at Malqat Western Thebes, had residues of a linen backing, while a reference in the *Annals* of Thutmose I (1525–1516 BCE) implies leather substrate.²⁷ Early Egyptian armour scales are uniformly of type 1 and rounded. A dominant characteristic is they are squat, often wider than they are deep (*fig. 11, 1.1–3*).

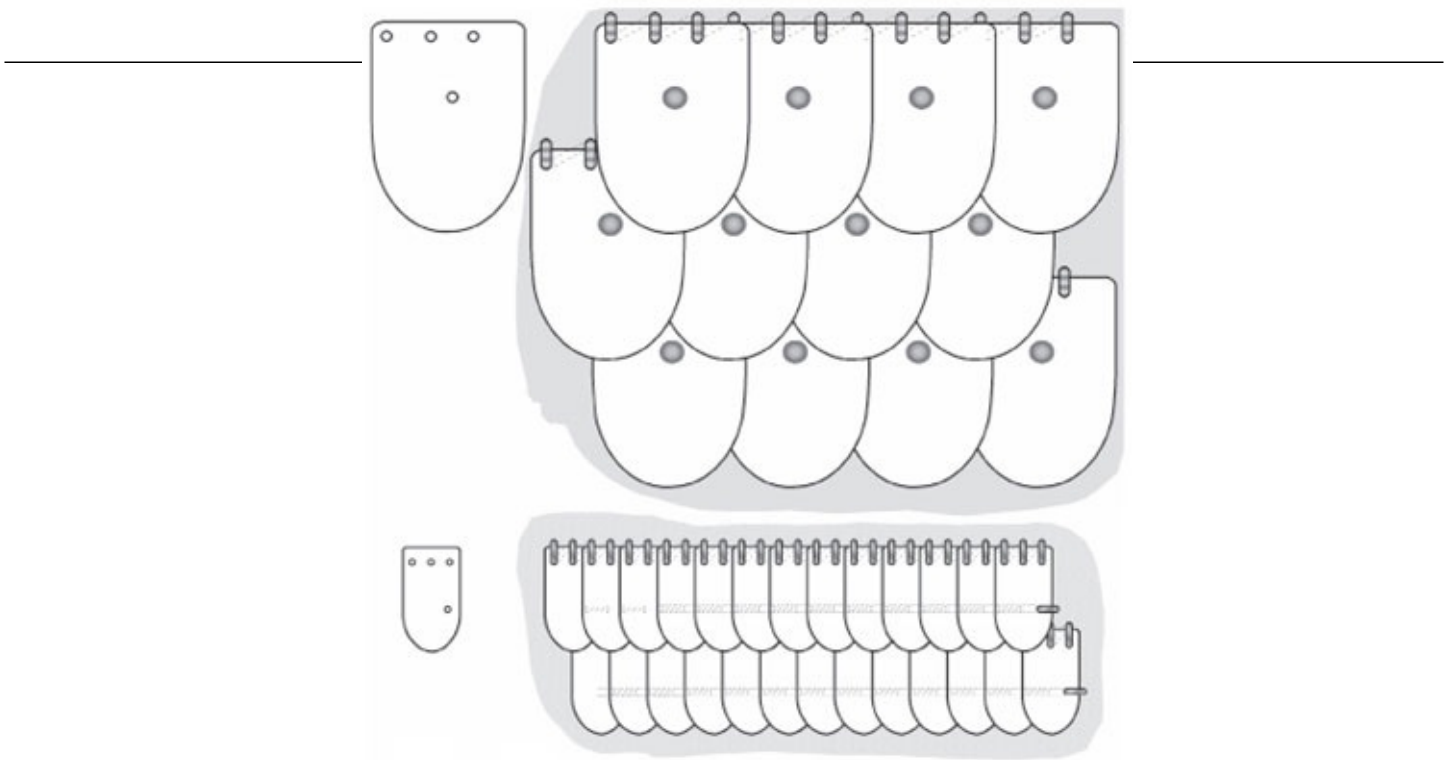


Fig. 5 Type 3 scale assemblies. Above, with supplementary rivet. Below, with supplementary textile binding.

Skythian tombs in the region of northern Ukraine dated to the early fifth century BCE yielded extensive scale armours in various configurations. Bodies were found clad from neck to ankle in scales. One example has been reconstructed as a hip-length, long-sleeved shirt, accompanied by full-length leggings similar to chaps.²⁸ Another seems to have been a single garment with body, sleeves and legs all in one (*fig. 6*).²⁹ The latter armour, especially, looks forward to the entirely scale-clad Roxolani horsemen of Trajan’s Column. Unfortunately, the records of these finds were lost, and much of the material itself suffered a similar fate. It may be inferred, though, that these armours must have been predominantly, if not entirely, composed of type 1 or type 2 scales, for no other would allow the flexibility that such all-encompassing armours require.



Fig. 6 Reconstruction of the Skythian scale harness from Alexandrovka, end of the sixth century BCE

The ever popular paintings of warriors produced in many contexts in ancient Greece frequently show corselets of the classic form – a short breast and back with shoulder straps fastened by ties at the front and having a skirt of *pteruges* below. The scale coverage shown on these corselets can be quite variable. Some have them only on the body itself, leaving the shoulder straps and *pteruges* plain. Others have scaled body and straps, with plain *pteruges* only, while others are scaled in all portions. Overwhelmingly, the scales are the organic scale shape, and small, appearing to be about 40mm wide and of similar overall length. One Greek vase found in Italy shows a curious hybrid. The upper part of the chest down to the armpits shows scales like those just described, while the lower portion has large square scales very much like those shown on Etruscan artworks (see below). The question arises whether this was a product tailored to the Etruscan market, or whether the larger scales were used in Greece as well as in Italy. A *kylix* by the Sosias Painter (*ill. 2*) showing Akhillês bandaging Patroklos shows outstanding detail – the side view of Akhillês confirms that the form behind the shoulder is the same as seen on other Greek and Etruscan armours, and the unlaced shoulder strap of Patroklos's corselet reveals the profile of the chest-piece. The lack of any surface detail on the scales lends further support to the conclusion that these, too, were made of type 1 or 2 scales. Furthermore, the fact that centuries of Classical collecting and archaeology have yielded scarcely any traces of such armour suggests that they were rarely, if ever, made of metal, but rather of the less durable materials of leather, horn or bone.

The Greek colonisation movement planted so many cities in southern Italy during the eighth and seventh centuries BCE that the Romans referred to it as 'Magna Graecia' or 'Great Greece'. Such extensive contact resulted in a great deal of trade, and the sharing of military technology between the Greeks and the Etruscans. Although the prolific finds of armour consist overwhelmingly of muscle cuirasses in bronze, Etruscan artworks and Greek-style works found in Italy show scaled corselets, b

generally with detail quite distinct from Greece itself. The corselets are of familiar Classical construction, yet the scales shown on the artworks in Etruria are large, rectilinear and decorated (*ill. 3*). These scales are depicted as being about 80–100mm long by 60mm wide, and are most likely to be made of embossed or incised leather.

Herodotos makes several references to scale armour, although not in connection with the Greeks. He states that the Persian and Median soldiers of Xerxes' army invading Greece wore 'intricate sleeved garments ... covered in iron scales like fish to the sight'.³⁰ This description suggests a rather more sophisticated and protective style of armour than that of the Greeks, having something in common with the contemporary Skythian examples previously discussed. In connection with the Battle of Plataia (479 BCE), Herodotos tells us that the scale armour of the Persian cavalry commander who fell there, Masistios, was gilded.³¹

Late Antiquity

Rome: Republic and early empire

The Romans of the early imperial era were past masters of scale armour. Their enthusiasm for it seemed to know no bounds. It is represented in countless works of art, and to confirm that this was not merely creative contrivance, physical remains of scale have been found across the length and breadth of the empire. The general Latin term for a scale corselet was *lorica squamata*. A special expression, *lorica plumata* ('feathered') was reserved for armour made with scales having a rib down the centre. Precisely when they added scale armour to their repertoire is open to debate. The Royal Ontario Museum has a very impressive *lorica squamata* said to have been found at Lake Trasimene in 1863. Unfortunately, this armour was an early twentieth-century acquisition from the commercial antiquities market, where provenance details were (and are) often very unreliable, and it is recognised as a composite assemblage incorporating some modern elements. Even if the location were accurate, there would be no basis for associating it with the battle which took place at Lake Trasimene in 218 BC. Nevertheless, the majority of the material of the armour is accepted as being ancient, and so it is worth noting that the approximately 600–650 scales are bronze, of type 1 with two holes, mostly rounded, and 25–40mm wide by 41–57mm long, except for those which have been placed along the hem in the (modern) reconstruction which are distinctly longer (80–85mm).

A great deal of more reliably dated art and archaeology does, however, show that scale armour was already well established in Roman use in many variants by the turn of the Common Era (CE). It is significant to note that, contrary to Greek and Etruscan precedents, and contrary to the preferences of the Romans themselves maintained for centuries for mail shirts and for having semi-detached shoulder straps drawn forward and fastened on the chest, from the earliest depictions Roman scale armour shows integral vests running unbroken up the chest and over the shoulders. This suggests that Roman scale use was influenced from the outset by 'barbarian' practice, rather than from within the Classical world. This influence may have come from the north-east, from the Skythians, or from Egypt, perhaps from both directions at once.

The Campidoglio Monument (*ill. 4*) erected by Emperor Domitian (81–96 CE) is an important early example. It shows a *lorica plumata* in the form of a sleeveless Classical *thôrax* of the form known from elite muscled cuirasses, with ornate *pteruges* below. This may represent a triumphal parade armour, yet its form defines a modular practice in Roman scale armour which will persist for mo-

than 1,200 years. In the context of it possibly being a parade armour, the originally gilded bone scales from Pompeii may be the remnants of just such a piece.³⁴

A funereal stele in the Verona Museum shows another interesting permutation. The man commemorated wears a shirt that fully encloses his shoulders and has a hint of sleeves, and terminates on the thigh in a skirt composed of a double layer of scale-covered tabs which are themselves scale-shaped.³⁵

Roman archaeology has yielded scales of all types except type 3. Type 4 seems to predominate across the late republic and empire. The type 5 secured with wire survives in the largest pieces, due to its intrinsic durability, but does not come into use in the second century and seems not to survive beyond the fourth.³⁶ Across that span of time it does appear across the breadth of the empire. A particularly interesting example of type 5b is an assemblage found at Carlisle in England. It comprises three rows of scales wired together, each scale being somewhat teardrop-shaped and the elements in each row graduated in size so that the entire piece forms an arc. The scales of the bottom row have notches at their ends, and so we know that was as far as the piece was intended to go (*fig. 11, type 5.3 and type 4.4*). It may originally have been a gorget. Similar tailoring can be seen in a much larger piece found in Palestine (*ill. 5*). The best evidence for types other than type 5 suggests that heavy cloth was the most common base for Roman scale armours, with finished pieces sometimes being edged with leather (*ill. 6; fig. 2*). Type 4 scales were assembled in two different ways. One construction binds overlapping scales together with wire ties without involving the base fabric. The other binds them to the substrate as well as to each other with a textile binding. The latter method produces a substantially less flexible, but somewhat less vulnerable, armour.

More extensive encounters with peoples to the north-east through the second and third centuries evidently broadened the Romans' scale armour repertoire. The booty shown on the reliefs on the base of Trajan's Column includes finely rendered scale shirts providing greater coverage than had been seen on earlier Roman sources, including elbow-length and wrist-length sleeves, and helmets with scaled neck guards (*ill. 7*). Pictorial material confirms the continuity of scale armour in Roman use to the fall of the western provinces.³⁷

In addition to type 5b, the Romans indulged in another unique application of scale. It is a hybrid of scales and mail (*lorica hamata squamataque*, sometimes erroneously called *lorica plumata*).³⁸ Type 5 scales have the top bent backward at ninety degrees to allow them to be linked into the fabric of a mail shirt. Very little of this form of armour has been found, just four deposits, from Vize in Thrace dated to the early first century at one extreme of geography and time to Newstead in Scotland, dated late second century, at the other. The specimens are in both iron and copper alloy. The very nearly complete corselet from Vize follows the common form of an early imperial mail shirt in the Classic arrangement of being mounted on a leather base with semi-detached straps folding forward over the shoulders fastened with bronze hooks. Its scales are unusual, as they are tapered but squared off at the bottom with rounded corners. It has a vertical strip of plain mail down the right side. This will have been left to facilitate donning and doffing, for the combined mail and scale fabric would not have the degree of horizontal expansion of normal mail. The suggestion has been made that *lorica hamata squamataque* was parade armour, although that is a contentious idea.³⁹ It is certainly not at all clear that this construction would have had any protective advantage, given the lightness of the material required to make it feasible, and flexibility of the scale to mail linkage. This armour may have been no more than an example of Roman conspicuous consumption.

The Near East

The empires of the region encompassed by modern Iran are in many ways the great untold story of the ancient world. The historical record from the end of the Greek invasions to the advent of Islam is rather patchy and often inaccessible in the English-speaking world. There is certainly no reason to assume that scale armour would have fallen out of use in the 500 years following the Persians' defeat by the Greeks in the Persian Wars, yet at the same time there is very little hard evidence to shed light on the situation. There were no developments which could begin to replace it, even with contacts with Mesopotamia bringing lamellar more to their attention. Moving into the Common Era, evidence becomes more prolific. From 238 BCE to 224 CE Iran and adjacent regions were included in the Parthian empire under the Arsacid dynasty. After a period of decline in the late second and early third centuries CE, Persians from eastern Iran overthrew the Arsacids, ushering in the Sassanian era, which lasted until 642. The transition period of warfare generated a slew of large-scale stone-carved depictions of crucial moments in the conflict, some of which are well enough preserved to offer good evidence for armour. Mail clearly predominates in these sources, but scale does appear. Noteworthy is the battle scene of Hormuzd II (302–309) at Naqsh-e Rostam which shows Hormuzd and his standard bearer clad in scale armour.⁴⁰ Elsewhere, when mail is the primary body armour, scaled collars and helmet hangings can be seen. Type 2 and type 5a scales, along with lames and perforated metal plates of a perhaps more specialised function, were excavated at Old Nisa dating from the first or second century CE.⁴¹ Early in the Sassanian era the Persians moved against the Roman empire, destroying the Mesopotamian city of Dura-Europos in 256. That siege left a great deal of military equipment behind which remained well preserved in the dry conditions. A large amount of scale is among those remains. Some is regarded as being Roman, but an intact scale horse armour has been attributed to the attackers. This barding is a single piece designed to cover the horse from shoulder to rump, with a panel around the chest, and an opening in the centre to allow for the saddle. It leaves the horse's neck undefended. The scales are bronze, type 4, as are the great majority of those from Dura-Europos (ibid. 6). They are quite large, in the vicinity of 50mm square, and very bluntly rounded. The likelihood is that even though the evidence from the whole of the Sassanian period shows that mail was the preferred armour for man, and one or other exterior small plate armour for horse, were the dominant practices, it is likely that some use of scale armour for men persisted, perhaps for infantry soldiers.

The Middle Ages

The Roman empire after the fall of the western provinces (Byzantium)

Traumatic as the fall of the western provinces of the Roman empire was for Western Europe, in the East, it was mostly business as usual. The evidence is clear that continuity prevailed militarily, albeit a continuity which adapted and evolved to accommodate social, economic and technological change as had always been the case. The crucial technological development of this era was the advent of the stirrup, which the Roman army adopted in the late sixth century. The adoption of the stirrup fundamentally changed the balance of effectiveness in the forces. Prior to this, cavalry was the secondary arm, useful primarily for scouting, harassing and skirmishing. Riding into fully fledged combat without stirrups could be done, but required a high level of skill. With stirrups, men with lesser equestrian skills could fight effectively from horseback, taking the fight directly to the enemy.

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