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THE ORIGINS OF PLATE ARMOUR IN THE AEGEAN AND EUROPE

Barry Molloy

The earliest plate armour in Europe was developed in Greece by the fifteenth century BC. Evidence for the existence of armour occurs in written sources, depictions in art, and occasional finds of pieces of armour. The most complete set of armour comes from the site of Dendra and this possesses virtually all functional traits that were to characterise plate metal armour in Greece and much of Europe for a further thousand years. The paper will discuss the character and functional qualities of various materials used for the manufacture of armour. This is followed by an examination of the manners in which the complete suit from Dendra could have been used, what other forms may have been in use, how armour evolved over time, and finally the influence that Aegean armour traditions had on the rest of Europe. The question of whether metal plate armour was functional will be addressed alongside a brief consideration of the non-martial/display functions of armour. The objective is to provide new insights into for how such armour 'worked' and to challenge a percieved division between ceremonial and prestige interpretations.

Introduction

Few things mark out a warrior better than metal plate armour. Wearing this armour materially transforms the appearance and potential actions of the man, so that the creation of image and purpose are mutually constituted. From discussions on Mycenaean corslets to the display armour of medieval nobility, opinions divide about what context particular armours were intended to be used in. We may ask if they were effective for combat or were they intended more for show or ritual purposes? We need to also consider whether such armour was exceptional in prehistory or was it once more commonplace? This paper will address these questions in a prehistoric context by investigating the origins and functions of the earliest plate armour in the Aegean and continental Europe, and how connectivity affected trajectories in both areas. I will demonstrate through practical analysis and experimental archaeology that plate metal armour was effective for combat, while also could serve as magnificent display armour. It is suggested that while organic armour may have been in use, we have no secure grounds to assume that it was more common than metal armour or that it was more effective. Beginning with a brief survey of the current state of knowledge, the paper will

Fig. 1. Pauldron from Dendra, Tomb 8.

next assess the mechanical qualities of the material potentially used in the manufacture of prehistoric armour and the challenges these faced from contemporary offensive weapons. The functional properties of the 'Dendra Corslet' from the Argolid, Greece, will be discussed in some detail because it possessed all component elements (and more) of subsequent copper-alloy plate armour, particularly in terms of function. Using literary sources, art, and other more fragmentary finds of armour, the use of the Dendra type and other forms of prehistoric corslet will be assessed. A brief discussion of greaves will be followed by analysis of the relationship between items of plate armour from the Aegean and continental Europe. The role of armour in society will be considered next and finally it will be argued that dichotomies of martial artefacts in terms of symbolic vs. functional impoverish research by segregating martial from social practices.

Literary context

Suits of armour had long been predicted through their depiction as ideograms in the Linear B script used in the Aegean and Crete from the fourteenth century onwards. These depictions occurred on tablets from palaces at Knossos, Pylos, and Tiryns in particular. The discovery of a suit of plate armour in the 1960's confirmed what was apparent in the Linear B records. Excavation of tombs at Dendra in the Argolid revealed a well-crafted shoulder-guard (pauldron) made from copper-alloy plate, dated to *ca.* 1425, though this was initially misinterpreted as being a helmet (Fig. 1; Åström 1977). This was clarified soon thereafter by the discovery of a complete corslet in Tomb 12, dated to *ca.* 1400 (Fig. 2; Åström 1977), known thereafter as the 'Dendra Corslet' or 'Dendra Panoply'. It is noteworthy that the craftsmanship of the earlier pauldron is better than those from the complete set of armour from Tomb 12, hinting at a mature armouring tradition being well-established by 1400. Since these discoveries at Dendra, several finds made earlier at Mycenae chamber tombs 15 and 69 (Yalouris 1960, 57-59), and Phaistos (Hood/De Jong 1952, 60), and subsequent finds from Nichoria

Fig. 2. Corslet from Dendra, Tomb 12.

(McDonald/Wilkie 1992, 276-278), the acropolis of Midea (Walberg 1998: 158) and the 'arsenal' and palace at Thebes (Andrikou 2007), have been identified as elements of plate armour. The examples from Thebes, in particular, include the distinctive pauldrons of Dendra-type armour. It is significant that archaeologically, based on component elements from these sites, we can define perhaps eight suits of plate armour at best, and so this is considerably at odds with the textual records where many dozens are listed (Ventris/Chadwick 1973; Chadwick 1976; Shelmerdine 1999; 2001).

Just as the Linear B ideograms for corslets had changed over time, the forms of these armours appear to have changed over the decades, even centuries, they were in use. Forms appear to become more simplified through time, with fewer and smaller attachments and by 1200, they appear to be largely comprised of the main corslet itself protecting the chest and back, as suggested by the dimensions of armour depicted in vase paintings of LH IIIC. Contemporary to most of the Linear B texts of LH IIIB date, plate armour begins to be produced in continental Europe (in [Reinecke] Bz D or the early Urnfield period). It is perhaps not incidental that around this time the Naue ii[1] sword, round shields, and cast-socket leaf or flame shaped-spearheads become widely used throughout the Aegean, Italy, the Balkans, and central Europe. Early plate armour has been recovered from sites in Slovakia, Croatia, Hungary, and Italy of probable mid-13th to 12th century date (Harding 2000; 2007; Andrikou 2007; Karavanic 2009; Točík/Paulík 1960; Snodgrass 1964), and it survives well into the first millennium BC, and indeed is still found in Greece[2] in the 8th century in the form of the 'Argos Panoply' (Snodgrass 1964; 1999).

There have long been suggestions that plate armour was unsuited to combat use and intended primarily for parade or display (Coles 1962; Harding 2000; 2007). The 'Dendra Corslet' itself has alternatively been considered as intended for use in chariots and impossible to use on foot (Littauer 1972), or for use by infantry only and impossible to use in chariots (Drews 1993), or not suited to either and intended only for duelling (Peatfield 2008). As with most things archaeological, the answer is likely to lie between, and it will be argued here that such oppositional stances are unnecessary and untenable. Plate armour was at once effective and suited to display (if not necessarily 'prestige' equipment), and most corslets thus made were versatile enough to serve in many different contexts. This will be further supported by tracing developments in armour, rather than focussing on the single complete suit from Dendra, providing the historic context for the use and development of armour within a sequence.

Armour and materials

It has been suggested that organic armours (Coles 1962; Chadwick 1976, 160; Harding 2000; 2007; Waddell 2000) were commonplace in the prehistoric world and that metal armours were considerably rarer. The bias of preservation favours metallic over organic artefacts, such that suggestions of past 'preferences' for one

[1] These swords have received many names in the different areas they occur including Type Reutlingen, Type Nenzingen, Type II, Naue ii, and many subvarients of each. Naue II (an abbreviation of Naue Type ii) is the oldest name and is thus retained for clarity here.

[2] The accident of survival needs to be emphasised, particularly as the corslets depicted in Linear B were considered by many as fictitious until as recently as the 1960s when the finds at Dendra confirmed otherwise. Preservation of such objects relates to both depositional practices and archaeological recovery. Recovery therefore does not represent original patterns of circulation or frequency in any way accurately.

or the other are speculative, and it remains probable that only textual evidence has potential to incorporate large enough data sets to alter this picture. This said, we may note some broad supporting evidence for organic defensive equipment such as the posited use of leather and wood for making shields throughout much of Europe (Coles 1962; Molloy 2009; Connolly 1998; Uckelmann 2012). Contemporary comparative evidence may come from a suit of raw-hide scale armour recovered in the exceptionally well-preserved collection from the tomb of Tutankhamen, that Hulit and Richardson (2007) have demonstrated to be functional as armour, if not as protective as metal versions. More direct evidence in the form of a 14 layer thick fragment of linen from Shaft Grave V at Mycenae is likely to be a piece of organic armour (Chadwick 1976, 160), broadly similar to the Classical *linothorax* (Connolly 1998; Everson 2004). It was decided that experimental testing of some of these materials may help resolve their potential functions as armour, and so the author conducted test-cutting against armour manufactured from baked and waxed leather (*ca.* 5 mm thick), 10 layers of medium linen bonded with animal-hide glue, a sheet of 0.9 mm copper plate, and a sheet of 1.5 mm 10% tin bronze plate. These were all attached to a mannequin and struck with a variety of weapons, as detailed presently.

Leather armour

The leather used was a 5 mm thick piece of vegetable tanned bovine sole-leather. It was briefly heated in an oven and then impregnated with bees wax melted in a double boiler. Leather is inherently a very tough material, and so the waxing of the leather serves the primary purpose of hardening it, but also helps in preserving it from degradation by the elements. The leather can best be shaped by wetting, moulding, and drying before waxing, and when the wax dries, it becomes very rigid and feels as hard as wood to the touch.

Linen armour

The impregnation of fibrous linen with a resinous glue compound creates a material that very broadly compares with modern fibre-glass, whereby the fibres provide strength and toughness and the glue provides hardness and rigidity. The result is a light, slightly flexible, and very tough sheet of material. The more layers added in its manufacture, the tougher it could become, though there would be a commensurate decrease in flexibility and increase in weight.

Copper armour

Composition of plate armours would have varied, and the 'Dendra Corslet' for example was 10-12% tin (Taratori/Moschona-Katsarou/Karudas 2012). Armour was probably on the lower end of the hardness scale achievable with bronze[3] and so pure copper was considered to be consistent enough to sheet bronze to provide

[3] A very hard armour would yield by cracking and fragmenting rather than denting on impact, and so a lower tin content and a lightly annealed structure is most probable.

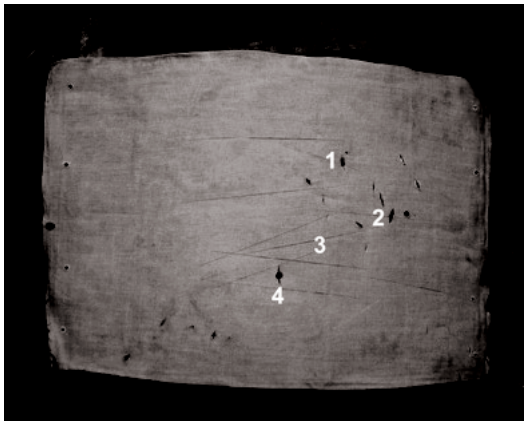


Fig. 3.
Test piece of linen armour: (1) thrust from type C replica sword; (2) thrust from type Fii sword; (3) sword cuts from various replicas; (4) penetration from cast light spear.

analogical data when testing, as it would be softer if anything. The 0.9 mm sheet was of the thinner gauge range of sheet used in manufacture of armour (see below), and thus represented the lower end of the scale in terms of material resistance. It was curved to fit the torso of the test-mannequin discussed below.

Bronze-armour
Along with the copper armour, a sheet of 1.5 mm thick bronze was used to represent armour at the thickest end of the scale. This was also bent to fit the test-mannequin.

Testing
Testing of the defensive properties of the armours was undertaken using a variety of bronze swords, spears, and arrows (fired from a thirty-five pound re-curved short bow). Complete details of the testing are presented in Molloy 2006, and here more general results are discussed. For all of the armours, none of the swords tested were capable of cutting through them using the blade edge (Fig. 3). It was observed, though not yet tested, that should these pieces of armour be on a thinner section test piece (representing the arm or leg), it is probable that the heavier swords could cut through the armour and injure the flesh. When testing against the (un-armoured) forelegs of recently slaughtered pigs, however, none of the swords were capable of cleanly severing the limbs (Molloy 2010), suggesting that even basic defensive armour on limbs would offer a high degree of protection against severe injury by bronze sword cuts.
In the case of the leather more than the linen test-piece, the armour 'dented' on impact resulting in the transferral of energy from the weapon to a smaller area of the target, potentially injuring bones and muscle on a living opponent. For thrusting or stabbing attacks, all forms of sword could penetrate the linen and leather armour with a strong clean thrust, but no sword was capable of penetrating the

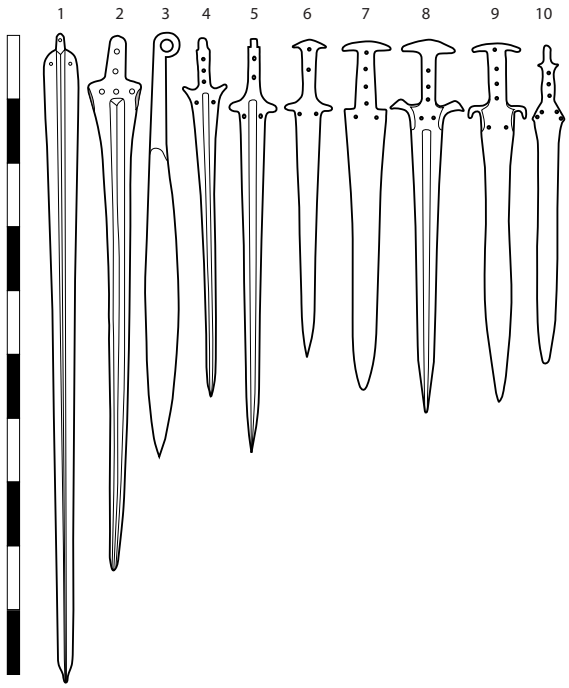
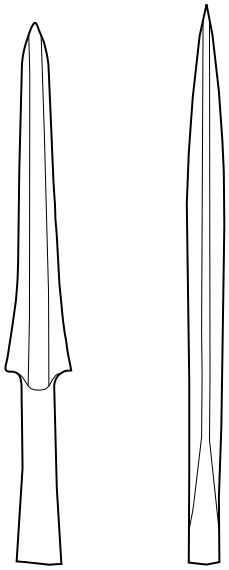


Fig. 4. Typology of Aegean swords: (1) type A; (2) type B; (3) single-edged sword; (4) type C1; (5) type Di; (6) type Dii; (7) type Fii; (8) type Gi; (9) type Gii; (10) type Naue ii.

copper or bronze armour. Wider point angles, along with blade width, geometry, and thickness, affected the depth of penetration of thrusts, as may be expected. Type C, D, and Gi swords penetrated more deeply than single-edged, Type F or Naue ii swords (Fig. 4; Sandars 1961, 1963; Kilian-Dirlmeier 1993; Molloy 2010). This may suggest a preference for shallow penetration that could inflict serious injury but be rapidly recovered by the swordsman. An abdominal injury penetrating as little as 50 mm can be lethal or immediately debilitating, and such penetration of the chest would puncture lungs/heart, and an attack to the head (particularly the face or temples) could be fatal. Rather than being less effective therefore, the later swords may be considered to serve different purposes than earlier ones when making thrusting attacks. The relative inefficacy of all swords against metal armour was in part due to the harder (than organic) character of the armour, but also because the smooth and curved plate deflected the point of the blades whereas the fibrous organic armour gave it grip and so the force was transferred more directly and smoothly to a focussed area.

Spears tipped with short and light bronze spearheads were able to penetrate the organic armours on a thrust, but they were deflected from the metal armours.



Type F Type H Fig. 5. Type F and type H spears.

When the spears were cast against the armour from 10 metres distance, they penetrated the 0.9 mm copper piece, but could not penetrate the 1.5 mm bronze piece. It was notable, however, that only the very tip of the spear penetrated the 0.9 mm copper piece and the weapon thus penetrated by *ca*. 10-30 mm. With a more experienced spearman, it is likely that the results would be different and that a cast spear could be lethal to all forms of plate armour, but it is also noted that the range of my casting was very close range and unencumbered by shields or offensive weapons. It is also probable that a heavy two-handed spear used with heavy bodily weight and force behind it would penetrate metal armours. The Types F and H spearheads found at Dendra (Fig. 5), Athens, and Knossos (Höckmann 1980) were very robust weapons and may have been deliberately designed as armour piercing heads, though no replicas have yet been tested.

Arrowheads tested were fired from 10 metres and were made of obsidian, flint, 0.9 mm copper sheet and a cast bronze javelin head (of LH IIIC form). All arrowheads penetrated the organic armours (Fig. 3 and Fig. 6) with sufficient distance to be lethal and the chipped stone examples could not penetrate either of the metal armours. The sheet copper arrowhead penetrated the 0.9 mm sheet by <10 mm, but the 'javelin head' when attached to an arrow shaft penetrated to a lethal depth (i.e. the head punched through and was followed by part of the shaft). No arrowheads tested could penetrate the heavier metal armour. Fired from a 35 pound bow on an upward trajectory of *ca.* 30°, the light sheet-metal tipped arrows travelled 95 meters and the heavier one travelled a little less at 73 metres. It is suggested on the basis of this testing that many so-called javelin heads were intend-

Fig. 6. Leather armour with sword cuts and LH IIIC 'javelin-head' on an arrow-shaft.

ed to punch through armour, especially if fired in high-arcing volleys whereby the weight of the head would ensure a higher velocity and higher force descent that could punch through helmets and armour.

The 'Dendra Corslet'

For a detailed discussion of this armour, the reader is referred to Åström (1977) and Verdelis (1977) and an excellent concise assessment by Everson (2004). In brief it can be described as a plain cuirass with separate chest and back plates, reaching from shoulder to the hips. Two pauldrons (shoulder-guards) were complemented by ancillary plates (Fig. 7) often interpreted as cheeck pieces from a helmet, and a high gorget protected the neck. On the front and back, three plates were suspended respectively, which offered protection to the groin and thighs.

The 'Dendra Corslet' was a developed form of armour with simpler predecessors being in existence at least *ca.* 25 years earlier, as evidenced by the shoulder guard found at the same site. The armour is manufactured from >1 mm plate bronze, and the numerous holes drilled through it were used to bind its constituent elements together, probably using leather thongs. When the plates suspended at the front and back are correctly bound, they can move up behind each other in an 'accordion' like manner so that they protected the groin and upper legs while still allowing manoeuvrability. It needs also be noted that the front and back suspend-

Fig. 7. Replica of ‘Dendra Corslet’ by Andrew Walpole.

ed plates were not bound together. A leather lining has been speculated by Verdelis (1977, 28) on the basis of traces preserved on the inside of some plates, though it is also possible that leather components were attached only in key areas such as across the edges of metal plate to reduce friction that may damage the bindings holding the suit together (Walpole, personal communication). Further element of an organic or leather interior may have been present that assisted in the weight distribution of the armour by anchoring it at the waste as well as shoulders.
A replica of this armour was commissioned by historical re-enactor Andrew

Fig. 8. Rear of 'Dendra Corslet' with loop on left shoulder (right) and folded edges to all ancillary plates.

Walpole, and he was kind enough to invite me to try this on and to use some of his replica spears and swords to ascertain potential constraints on movement (Fig. 7). The entire original suit weighed less than 15 kg, roughly the same as a small rucksack full of clothing, illustrating that its weight should not be exaggerated when discussing mobility within it. The weight distribution (even without ancillary elements) was considerably better than a modern rucksack, so that it did not unduly stress any discrete areas of the body (such as the shoulders). Leg movement was only nominally impeded by the plates, when connected as described above, though the pauldrons restricted arm movement to a small degree. It was possible to shoot a bow in this armour, and a spear could easily be held under arm. Raising the arm vertically above the head was restricted, though an over-arm spear grip does not require this and so could also be executed. The killing strike to the neck depicted on a handful of seal images from Mycenae and Crete was just possible, but all of the other strikes depicted in art were easily executed, along with most other arm movements required to use a sword effectively.

In reference to the gorget, it may be that it was to defend against abovementioned attacks to the throat, but it can also be noted that by hunkering down into the armour while wearing a contemporary design of helmet, it was possible to cover

the entire face apart from the eyes, affording a two-part version of full-face protection seen in a single piece in later forms of helmet (e.g. the Greek Corinthian helmet). A loop on the shoulder of the corslet may simply have served to suspend a cloak on the back, as supported by the rolled edges and corners of the shoulder plates on the back of the corslet to stop it snagging cloth (Fig. 8), whereas the equivalent areas on the front were left sharp and exposed.

Overall, the corslet is markedly different from medieval plate armour as it is considerably lighter, has fewer articulations around joints and generally allows more free movement than its somewhat 'clunky' appearance suggests. The plates hanging at the front terminate well above the knees and could move behind each other, so that a person could walk and even jog with relative ease from my experience, and there is equally little to impede him from riding in a chariot.

The thickness of the armour ranges between 1 and 1.5 mm in thickness, and, supported by the experimental work discussed above, it is suggested that between 0.7 and 1.5 mm was considered the optimum thickness: weight range for defensive equipment manufactured from copper-alloy in prehistory. This range can also be supported by reference to numerous other ancient cases such as an Etruscan muscled cuirass from Malibu (1.5 mm: Tuttle 1982), Late Urnfield cuirasses from Fillinges (0.5-1.1 mm: Harding 2007), bronze helmets from Knossos (1.5 mm: Hood/de Jong 1952), Pass Lueg and Alauftal (1 - 1.5 mm: Lippert 2010) or North-Western European shields (0.7-1.6 mm[4]: Coles 1962; Molloy 2009; Uckelmann forthcoming). Indeed, the well-known 'bell cuirasses' of Archaic to Classical period Greece were typically around this same thickness and weighed less than 5 kg – the earliest incarnation, the 'Argos Panoply', was less than 2 mm thick on average and weighed below 3.5 kg (Krentz 2010). A point of interest is that copper alloy armour became a favourite of Roman gladiators who were even facing superior iron or steal weapons, showing that it was a valuable material by virtue of it being suited to both display and defence.

In the case of the 'Dendra Corslet' the difficulties in penetrating it directly with sword or light spear meant that looking for the proverbial 'chinks in the armour' would be an effective way of attacking, and it is interesting that the armour has ancillary plates to directly impede such attacks, strongly implying that it was used in face-to-face confrontations. For archery to be effective against this armour, arrows would need to strike the face or other exposed areas, because with the low-poundage bows believed to have been in use in the Aegean Bronze Age, even at point blank range, it was difficult to penetrate this armour using contemporary forms of arrowhead (Avila 1983). With this armour we therefore have a well-designed defensive panoply that allows a wide range of offensive weapons to be used and provides excellent protection against these same weapons.

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[4] Very occasional examples, primarily in Britain, are as little as 0.3 mm and may not have been functional, as may have been the case for some of the larger thinner pieces.

The 'Dendra Corslet' was created at the dawn of significant changes in military equipment at the very end of the fifteenth century BC and shows the beginnings of a break with the preceding tradition that used large body-shields as the primary mode of defence. As shields dominate the control of space between comrades in a line of battle and between opposing lines of battle (Molloy 2009), this was to have profound effects by LH IIIB. The use of armour would have allowed the warrior to fight at much closer quarters to an opponent using a smaller shield, but the flexibility of movement which it allowed would still have made offensive strikes easy to execute. This is indicative of a major change in the modes of combat, and would appear to indicate elements of heavy infantry engaged in hand-hand fighting, but with lighter armed skirmishers perhaps involved also (as visible in the slightly earlier silver 'Siege Rhyton'). It is important to remind ourselves at this point that armour was not designed to stop its wearer being killed. It was intended to reduce the risk of injury to its wearer as part of a trade off between mobility and exposure. That is the balance between capacities for effective offense and defence.

The juxtaposition of corslets and chariots on specific tablets, including fourteen cases of two corslets to one chariot at Knossos (Ventris/Chadwick 1973, 375-379), indicate a relationship between the two items. Debating the role of chariots in war, however, goes beyond the scope of this paper, but it is noted that Drews' (1993) suggestion that they dominated war in the Aegean has no substantive basis (Dickinson 1999). This said, experiments wearing heavy bronze scale armour in an Egyptian chariot indicate that substantial body armour need not impede skilled chariotry (Hulit/Richardson 2007). The plate corslets of prehistoric Greece could in principle therefore be used for fighting both from a chariot (including archery) and for fighting as infantry. In light of the range of offensive weapons in use from 1400-1100, however, the latter appears to have been by far the more dominant aspect of combat practices. Wardle (1988, 476) suggests that, should the wearer fall over onto his back, it is difficult to regain his feet unassisted. However, there is little reason to suspect that warriors wearing this armour had an increased inclination towards falling onto their backs in combat and if they did, they may well have been killed if they could not regain their feet, this being the very nature of combat. My experience with the Walpole replica was that one could regain their feet with a little effort, though it took a few moments not necessarily available in battle. Peatfield (2008, 93) suggests that the 'Dendra Corslet' was designed for duelling based on a superficial comparison with medieval 'Tonlet' armour. If the Dendra corslet is seen in the context of other LH IIIA to LH IIIC armour from the Aegean, the duelling argument becomes problematic because refinements over time retain the general character of the Dendra armour, but lose any comparison with Peatfield's medieval panoply.

Other Aegean armour

It may logically be deduced that if we accept finds such as the 'Dendra Corslet' as being the items referred to in Linear B, that considerably more armour was in circulation than has survived to this day. This is further emphasised by the fact

that Linear B tablets record the very recent past (as little as 1 or 2 years), and so are likely in themselves only referring to a small portion of armour that would have been in circulation.
It was suggested above that organic armours may have been in use, and we can say with certainty that some items of armour such as boars tusk helmets and the fabric greaves depicted in art were made from organic materials. In other cases, it is possible that composite forms of armour were in use. An early possibility of this are the gold breastplates found in Grave Circle A at Mycenae, which may either be superficial attachments to organic armour or non-martial/symbolic representations of organic forms (Fortenberry 1990, 34-35). The classic case of organic and metal composite armour is a coat of metal scales sewn onto a leather or textile backing. There have only been three scales of bronze scale armour found in the Aegean, one in the Citadel House at Mycenae, one from Tiryns, and a recent discovery of one from Salamis bearing the cartouche of Ramses II. However, as Hulit and Richardson (2007) point out, in the entire Near East there has not been enough scales found to constitute a significant piece of a single suit of this armour, despite its frequency in the artwork. We need note also that these isolated finds can only have come from suits of armour, so that we have evidence for 3 suits of scale armour to compare with our 6 to 8 suits of plate armour, and some of these latter could even have been lamellar rather than plate armour proper. Composite linen and bronze armour was suggested by Chadwick (1976, 160; see also Schofield/Parkinson 1994, 168) based on tablet L 693 from Knossos that lists a linen tunic and a weight of copper and another tablet where *e-pi-ki-to-ni-ja*, 'tunic fittings', are mentioned together with the sign for copper or bronze. Such forms of armour in LM IIIA may have been in use alongside more complete suits of plate like the example from Dendra.

The Pylos tablets are from LH IIIB or around a century later than the records from Knossos. These tablets, along with contemporary ones from Tiryns, depict corslets akin to the Dendra suit, and the relationship between corslets and chariots is continued on some occasions. The Pylos tablets also mention varying numbers of bronze *o-pa-wo-ta*, which have been interpreted as sections of plate armour (Ventris/Chadwick 1973, 376). Of the twenty sets listed, sixteen have 'twenty large *o-pa-wo-ta* and ten small', the remainder 'twenty-two large ones and twelve small' (Ventris/Chadwick 1973, 376). It is uncertain how these plates may have been arranged, but they certainly would have been a robust compromise between scale armour consisting of hundreds of little plates and full plate armour, and Roman *lorica segmentata* is called to mind (Bishop/Coulston 1993). A LH IIIC sherd from Mycenae (Fig. 9) may be a slightly later depiction of the segmented armour composed of *o-pa-wo-ta.* Possible plates from this form of armour have been found in the LM IIIA:1 Tombe dei Nobili at Phaistos. This included two sizable fragments of bronze plate, one of which was 29.5 cm long and 12 cm wide and had holes on the periphery (Hood/De Jong 1952, 260, see also Ventris/Chadwick 1973, 375). These may have been to allow it to be stitched

Fig. 9. LH IIIC sherd from Mycenae possibly displaying segmented/lamellar armour with *op-pa-wo-ta*.

to an organic backing or to form a segmented armour. An alternative would be that this is a fragment of a plate similar to the ones suspended in the 'skirt' of the 'Dendra Corslet', though now narrower and so part of a more compact and/or shorter panoply. There is no extant evidence for the use of leather armour, despite its suitable qualities, but its use should not be ruled out given that raw-hide was used in the manufacture of Aegean shields.

The images on Linear B tablets were not intended as pieces of art, nor indeed may we even expect they were for the consumption of more than a few specialist record keepers. Other images exist that are more helpful, if far more rare. From Knossos a stone vase carved in the shape of a corslet has a simple bell-shaped form and two pauldrons, with no further appendages illustrated, suggesting a four piece panoply, though greaves, arm guards, or a helmet are obviously not referenced due to the form of the object. This suggests that the concept of armour from the LH II/IIIA:1 had become simplified as time went by. A LH IIIB sherd from Mycenae depicts what appears to be a high gorget and a simple embossed breastplate. This suggests that gorgets survived on some armours into LH IIIB and that embossed decoration common to LH IIIC/[Reinecke] Bz D corslets and helmets may have begun at this time.

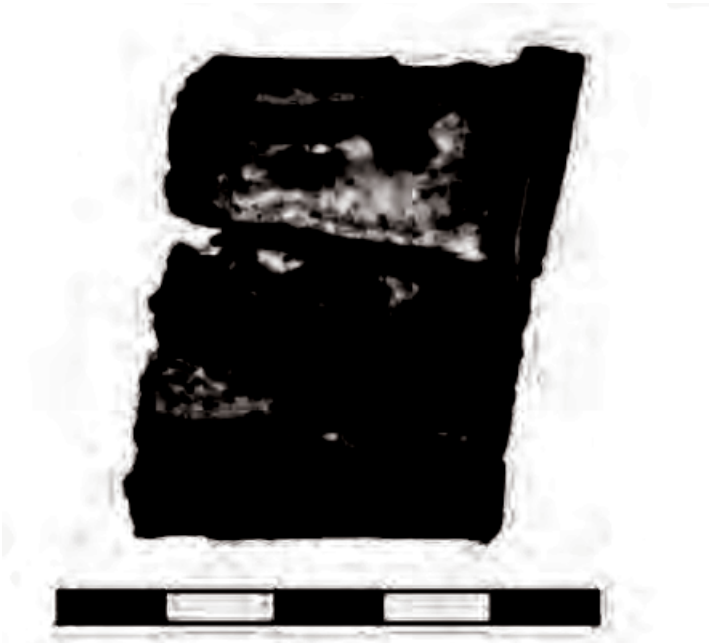

Fig. 10. Sheet metal fragment from Simanovci hoard, Serbia. Such pieces are common in hoards, the thickness and decorative style are similar to contemporary armour, but all are too small to identify the original artefact form.

The simplified take on plate armour suggested by the stone vase from Knossos is supported by the finds from the Tombe dei Nobili and others from Mycenae in particular. Whatever form of armour these bands were from, their narrower width implies a somewhat different form of armour than the 'Dendra Corslet', and the trend towards short waist length corslets visible in LH IIIC art may suggest that the smaller pieces imply a shorter variant of plate armour. This reduction in length and simplification is also visible in differences between the lengths in ideograms on Knossos tablets (LH IIIA) and Pylos tablets (LH IIIB). The recent find of a front and back plate of a corslet from the north-west of the palace at Thebes also appears to be from a more refined suit, though they link together the same as the Dendra armour and are unfortunately incomplete in their dimensions (Andrikou 2007). They do, however, have holes to attach some form of fittings to their base, perhaps like a shorter version of the Dendra skirt.

The artwork of LH IIIC has several images that appear to depict armour, but unfortunately, none are very clear in their execution. A sherd from Voudeni in the north Peloponnese depicts a warrior with a hedgehog helmet wearing a cuirass that appears to have embossed nipples; a typical feature of armour forms from central Europe. A further sherd from Iolkos and one from Tiryns likewise empha-

sise nipples on warriors, and several other LM IIIC sherds from the Argolid appear to depict embossed and ridged decoration on cuirasses, including a line of warriors with similar armour on the reverse side of the 'Warrior Vase' from Mycenae. We can note in this context that occasional examples of the contemporary Naue ii swords from Achaia originated in Italy, providing direct evidence for military technological exchanges between Greece and regions to the west and northwest (Jung/Moschos/Mehoefer 2008) at the time we find embossed short corslets appearing in Aegean art.

Another article of armour that must briefly be discussed is greaves. A single greave was found in Tomb 12 alongside the corslet at Dendra, though this could only have been functional if sown to an organic backing. Fortenberry (1990) has suggested that in some cases, a single greave may have been worn in combat. By LH IIIB, however, it seems certain that two greaves were typically worn, as best illustrated in the 'Battle Frieze' from Hall 64 at Pylos. Drews (1993) has suggested that organic (linen?) greaves may have been used widely outside of the context of war, including protecting against the extremely tough and thorny undergrowth of Greece in summertime[5], particularly if out hunting. By LH IIIC and into Sub-Mycenaean, examples of metal greaves are known from Kallithea (over 2 mm thick), Portes-Kephalouryson, Kouvaras, and the Acropolis in Athens, and they are quite simple curved disks that would certainly have had organic components between them and the skin of the shin. The embossed decoration on these greaves, as with that hinted at in art on the corslets and seen also on an 11th century helmet from Tiryns, may suggest further elements to the contact with warriors from north of the Mycenaean world. A single hand-guard from Chamber Tomb 15 at Mycenae (Yalouris 1960, 58) was intended to protect the most exposed element of a warrior, their sword hand, and suggests that ancillary pieces of armour may also have been in use, but these evidently do not survive well.

Northern armour

Sometime before 1200 BC the Naue ii sword began to appear in the archaeological record in the Aegean region and at this same time we begin to see round shields depicted in art. The sword form is widely believed to have been introduced from northern Italy and the Balkans (Catling 1961; Kilian-Dirlmeier 1993). Evidence for round shields of the size range we see in Aegean art has likewise been found in other areas of the continent, spread across Atlantic, Iberian, Appenine, Northern, and Central Europe (Coles 1962). In this context of shared martial assemblages but differential biases in preservation, it can be difficult to build a systematic argument on the spread of armour styles. The least problematic model to propose, however, would be that societies that shared forms of sword and shield, and had striking similarities in the technology and form of spears and helmets, would also have shared aspects of their body armour.

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[5] This function for organic greaves is mentioned in Homer, *Od.* 24, 228.

Working from this as a hypothesis, we can also see a correlation between the use of a front and back plate made of 0.7-1.5 mm thick bronze sheet that was flush with the shoulders and hips in both areas. This may appear a simple form of armour, but it is distinctly different to the responses made to defence requirements through armour by contemporary Egyptians or Hittites. The use of embossed decoration is evident in the art of LH IIIC and the possibility that they represent real embossed cuirasses is supported by finds of greaves with embossed decoration in the Aegean. The use of embossed decoration, particularly emphasising the nipples, on the corslets from outside the Mycenaean world would accord with the circumstantial evidence suggesting the similarity to the character of cuirasses from Greece.

There is, however, an issue of chronology. Many of the corslets from Europe are either poorly dated or are believed to be from the first millennium BC. However, sufficient examples survive to demonstrate that they were in use by the thirteenth century (Harding 2007). The fragmentary remains of cuirasses from Čaka and Dukové in Slovakia can be dated stratigraphically to the twelfth century BC, the larger fragments of a corslet from Čierna nad Tisou are likely to be [Reinecke] Bz D-Ha A in date, as are fragments from Nadap, Szentgáloskér, and Farkasgypü in Hungary (see Andrikou 2007 for further details). Perhaps most telling are the fragments from Pila del Brancón in the Po Valley, Italy, probably dated to [Reinecke] Ha A1, as these are unidentifiable scraps of sheet metal buried alongside (a) hoard(s) consisting only of weapons. Such fragments open up the probability that in the many fragments of sheet metal in the large hoards of mixed composition in the Balkans, many being over 1 mm thick, we might expect to find (if not easily identify) elements of greaves, helmets, and corslets: an example might be the piece in Fig. 10. A sole helmet plume identifiable in the hoard from Futog in Serbia may be suggestive. For confirmed pieces of armour, however, it can be noted that stratigraphic or absolute dating, rather than typological, is rare for most bronze plate armour from Europe. A further figurine from Kličevac by the Danube in Serbia, though heavily stylised, has star-shaped devices in the place of his nipples, strongly reflecting the known decoration on armour (Snodgrass 1971, 39). Furthermore, greaves make their first appearance in Europe at this time and they are ovoid as with examples from Greece, and they have embossed decoration. From Croatia, for example, comes a greave with embossed decoration of a four-spoked wheel, a device also used to decorate the greaves from Athens[6]. We also find examples of simple domed bronze helmets with cast buttons riveted to their top similar to LM IIIA example from Knossos.

Given the unequivocal exchanges in martial traditions taking place in the thirteenth and twelfth centuries, the adoption of plate armour in Europe should be considered as linked to and perhaps even originating in an Aegean tradition. This

[6] At the time of going to press, a study being prepared by J. Moedlinger deals with the chronology, typology, technology, and decorations, of greaves throughout Europe in thorough detail.

does not imply a one-way technological transfer, because it is during this period of interaction that the corslets in Greece become simplified and this could logically be the result of adaptations initiated by warriors from outside of the Mycenaean heartlands. We see a similar linkage in weapon evolution, if on a simpler scale, in the adoption of a pommel lugs on Naue ii swords in the Balkans and Italy following a nominal Aegean innovation of an intrusive technology. These changes took place within a new cultural milieu and range of exchanges taking place in LH IIIB-C/[Reinecke] Bz D-Ha A1.

Functions of armour

In terms of function, there is significant evolution between the 'Dendra Corslet' and the types of armour suggested for [Reinecke] Bz D/LH IIIB and Ha A1/LH IIIC, though the core of the armour (the front and back plate) remained functionally unchanged. The use of 0.7-1.5 mm copper alloy in most of these corslets suggests that they were as well suited to combat use as the more widely known bell-cuirasses of Archaic and Classical Greece. The twelfth century and later forms of this armour were very simple in character and did not much hinder the user's movement and so they remained functionally unchanged for several centuries both in Europe and the Aegean.

In terms of the role of cuirasses as parade objects, it is certain that when they were polished to a bright golden shine, and worn with helmets of gleaming bronze or boars tusks, with cloaks and greaves and more, the warriors wearing them would have appeared most striking. In relation to their being prestigious and the preserve of the elite, we may return to our comparison with Classical Greece. We know that thousands of these corslets were in use through our historical sources, yet a mere handful of these survive today. Similarly, in the Bronze Age, the Linear B records suggest that large numbers were in circulation and yet we have evidence for perhaps 6 to 8 plate cuirasses, though this is only marginally less than for Archaic and Classical Greece. The rarity of examples in our museums therefore does not reflect the rarity of these objects in the ancient world, and it relates to recycling, burial, and religious practices not past martial realities or social implications surrounding ownership of a corslet.

It seems that many warriors were in possession of good quality armour of plate and possibly composite forms in the Aegean, and we have no reason to suspect differently for other areas of Europe. A final observation on the gulf between archaeological visibility and past realities may be drawn from Bronze Age Ireland. No pieces of armour survive from the island, though it shared weapon forms with many European areas where armour was in use. Cahill (2005) has observed that the spectacular gold gorgets from Ireland mimic the nipples embossed on corslets from the rest of Europe. Not only are the nipples depicted but other decoration includes raised ribs and bosses, and most significantly, on the reverse side of some gorgets, imitations of the clasps and fittings of corslets are also depicted. The evidence suggests that the gold smiths had seen and imitated objects that have not survived for us archaeologists to see. The use of spectacular

gold ornaments derived from corslets also suggests that they were used as symbols of status and possibly power, but also that in some circumstances further embellishment in non-functional 'impressions' of armour may have been considered more important than real armour.

Conclusion

We can thus conclude that armour was at once functional, more widely available than commonly believed, was the possession of warriors of high social standing and was part of a warrior aesthetic that appears to have been celebrated widely throughout Europe and not just on occasions of ceremony. The origins of plate armour could have occurred as early as the seventeenth century BC, based on the Shaft Grave breastplates, but by the beginning of fourteenth century BC it was widely in use in the Aegean. It continued to be popular in that region for centuries, potentially until early Classical times, and in the thirteenth century BC it began to become widely used throughout Europe. The trajectory of simplification of Aegean armour and the similarity to European corslets, in conjunction with their dissimilarity to contemporary armours in other areas of the world, suggest that the general milieu of exchanges in military technology in the fourteenth to twelfth century BC included armour. This period of exchange decreased by the eleventh century BC and military traditions diverged in both areas once more.

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Barry Molloy
University of Sheffield
Department of Archaeology
Northgate House, West Street
Sheffield, S1 4ET
United Kingdom
b.molloy@sheffield.ac.uk