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The papers had been subject to reviews and comments by the Scientific Committee. Additionally, further observations and comments were made during the discussion that followed their oral presentation at the Conference.

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IRON ARMS AND ARMOUR FROM MACEDONIAN GRAVES

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Abstract. The luxurious early Hellenistic burials found in the excavations of Macedonian cemeteries during the last thirty years have yielded a large number of iron findings, mainly weapons and armour. During the reign of Alexander the Great the use of iron is no longer limited to lances (spears and javelins) and swords, but extends to defensive weapons as well (helmets, peritrachelia, body armour and shields), excellent examples of which have been found in tombs of Macedonia, testifying the technological developments in iron working during the Asian Campaign of Alexander III. A distinctive feature of these pieces of weaponry is the high craftsmanship that ensured their reliability and efficiency and their opulent decoration with precious materials (gold, silver, ivory, glass, purple dye) and elaborate motifs that lend luxury and magnificence. The archaeological iron, a material difficult for conservation, in the case of these weapons is found in two different types of condition.

The first includes weapons deposited in the graves after they were placed on funeral pyres. Thus, the material is affected by the high temperatures which it suffered during the burning of the deceased warrior. They are found stripped of organic materials that perished in fire, bearing the evident effects of burning, often stuck together and covered in parts with other materials of the funeral pyre. The second category includes iron weapons that were placed in the tombs as they were. Their iron surfaces are found bearing remnants of organic materials, ivory, wood and fabric, originating either from their own structure or from their straps and cases or sheaths. Impregnated with the products of iron corrosion the organic materials preserved much of their original form, providing important evidence for the construction of the weapons, presenting however serious difficulties for conservation. Moreover, the iron sheet surfaces are usually found covered by layers of corrosion that conceal their decoration. This paper presents iron weapons and armour found in the most important Macedonian funerary contexts, those of Vergina, Derveni and Pydna, focusing on the construction details they preserve and the condition of their surfaces which raise serious issues and challenges for conservators.

Keywords: Weapons, armour, iron, weapons manufacture, Alexander the Great, Macedonia, Vergina.

ΣΙΔΕΡΕΝΙΑ ΟΠΛΑ ΑΠΟ ΤΑΦΟΥΣ ΤΗΣ ΜΑΚΕΔΟΝΙΑΣ

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Περίληψη. Είναι γνωστό ότι ο σίδηρος χρησιμοποιείτο σε όλη την Ελλάδα για την κατασκευή επιθετικών όπλων, π.χ. για λόγχες, ξίφη και βέλη, ενώ για τα αμυντικά όπλα, κράνη, θώρακες, ασπίδες, και κνημίδες, χρησιμοποιείτο αποκλειστικά ο χαλκός. Όμως, στο δεύτερο μισό του 4ου αι. π.Χ. για την κατασκευή αμυντικών όπλων χρησιμοποιήθηκε και ο σίδηρος. Αυτό το άλμα της τεχνολογικής εξέλιξης στην οπλοποιία, διαπιστώνεται σε ευρήματα των τάφων της Μακεδονίας του τέλους του 4ου και των αρχών του 3ου αι. π.Χ. Πρόκειται για τάφους βετεράνων στρατιωτικών που συμμετείχαν στην εκστρατεία του Μ. Αλεξάνδρου στην Ασία. Το όπλα που βρέθηκαν ήταν κράνη, οπλιτικές ασπίδες, θώρακες, περιτραχήλια, ακόμη και κνημίδες, που είχαν κατασκευαστεί από σίδηρο.

Η κατασκευαστική ομοιομορφία σε αυτά τα όπλα, κυρίως στις ασπίδες, και η σύγχρονη παρουσία τους σε τάφους της Μακεδονίας, δείχνουν ότι υπήρχε οργανωμένη, ελεγχόμενη και μαζική παραγωγή από μια κεντρική εξουσία, που θα ήταν η βασιλεία του Μ. Αλεξάνδρου. Το γεγονός αυτό πρέπει να συνδεθεί με το εξοπλιστικό πρόγραμμα του Μ. Αλεξάνδρου, προκειμένου το εκστρατευτικό σώμα των Μακεδόνων να θωρακιστεί καλύτερα ώστε να γίνει πιο αποτελεσματικό.

Γνωρίζουμε από τον Πλούταρχο ότι και ο ίδιος ο Μ. Αλέξανδρος στις μάχες στην Ασία φορούσε σιδερένιο κράνος και σιδερένιο περιτραχήλιο. Η χρήση του σιδήρου στα αμυντικά όπλα ήταν ένα πρωτόγνωρο τεχνικό επίτευγμα που ενίσχυσε κατά πολύ την αντοχή των αμυντικών όπλων, θωρακίζοντας αποτελεσματικά αυτούς που τα χρησιμοποιούσαν.

1 Iron Arms and Armour from Macedonian Graves

Excavations in the cemeteries of Vergina, Sindos, Archontiko (Giannitsa) and Agia Paraskevi, as well as of other cemeteries in the area of Thessaloniki, Bottiaia, and Upper Macedonia, have revealed a large number of weapons and armour, as the custom of burying warriors with their weapons continued in Macedonia even after the end of the eighth century, when it was practically abandoned in southern Greece.¹ Continuing the centuries-

¹ On Iron Age arms from Vergina, see Andronikos 1969, 261-273, figs 101-108. For arms and armour from the Sindos cemetery, see *Sindos III* 2016, 289-360. For the recent excavations in the cemetery of Arhontiko, Giannitsa, in the vicinity of Pella, see Chrysostomou A. and P. 2008, 477-

old technology bronze constituted the principal material for making defensive weapons in Macedonia until the time of Alexander the Great.² Until then, iron was used only for making cutting and thrusting arms—swords, lances of various types and arrowheads—which required blades with sharp edges.

From time immemorial, war has exploited and often stimulated technological progress. The more furiously a war rages, the stronger the impetus for scientific advance and technological innovations. The subject of this report is the watershed in arms production that occurred during the years of Alexander's Asian Expedition (334-323 BC) an expedition of unprecedented scale in history.

At the time when their kingdom was in its heyday, in the Early Hellenistic period, the Macedonians, who had long accorded their dead men arms as grave goods, came to bury their dead with entire panoplies, sometimes even more than one or two, as with those from the unplundered grave at Vergina and the graves at Derveni near Thessaloniki.³

The characteristic features of these panoplies is their advanced degree of technical sophistication, which ensured reliability and effectiveness, and their elaborate ornamentation, with beautifully executed motifs and expensive materials (gold, silver, ivory, glass, murex purple) that conferred an air of luxurious magnificence⁴ (fig. 1).

The Greeks thought that richly decorated arms lent confidence and enthusiasm to their bearers and inspired awe to the opponents (Xen. *Anabasis* 2.3.3. Xen. *Hellenika* 5. 3. 17). The use of the most expensive weapons a warrior could afford was also dictated, according to this notion, by the two opposite possibilities for the outcome of the battle; if victorious, only brilliant armour would be fit for the winner; if the warrior got killed in the field it was appropriate to end his life in fine armour (Xen. *Anabasis* 3.2.7).

Thus, Greek armour regardless of material has always been a display of the warriors' economic status as both an expression of the technological standards of its time and a reflection of the aesthetics and the decorative styles of each era. However, during the reign of Alexander III and the Early Hellenistic period, the economic boom that resulted from Alexander's Campaign to Asia, offered the warriors the historically unique opportunity to demonstrate their desire for richly decorated and finely crafted arms free from financial constraints.⁵ Certainly this is evident mostly to the burials of the Macedonian elite, but

487. On the finds of the cemetery at Agia Paraskevi, east of Thessaloniki, see Sismanidis 1987, 795-796, pl. 164.1.

² On the weapons and armour of the Macedonians, see Snodgrass [1967] 1999, 114-130, 139-141. Faklaris 2011b, 357-372. On the *sarissa*, see Andronikos 1970, 91-107. Lumpkin 1975, 193-208. Anderson 1976, 1-6. Markle 1978, 483-497. Markle 1982, 87-111. Manti 1983, 73-80. On the Macedonian shield, see Liampi 1998.

³ Vergina: Andronikos 1984, 131-145, figs. 91-103; 180-189, figs.146-151; 217, figs.185. Faklaris 1994, 105-113, figs. 106-112. Derveni: Themelis and Touratsoglou 1997, 46-48, 84-85, 109.

⁴ Andronikos 1984, figs. 91-93 (shield with gold and ivory decoration), 95-96 (corslet with gold strips), 99-101 (sword with gold attachments), 146-149 (gold-plated quiver), 151 (gold-plated gorget). Bessios 2010, 186 (sword with ivory and silver attachments), 199 (gold-plated gorget). Themelis and Touratsoglou 1997, pl. 94 (no. B106a) sword with ivory decoration. Stamatopoulou 2004, figs. 137-145 (shield with gold and ivory device from Derveni).

⁵ On the immense profits from Alexander's Campaign to Asia, see Themelis and Touratsoglou 1997, 186-188. Touratsoglou 1998, 235-242.

similar arms and armour with expensive decoration and the same technical standards though in smaller numbers, also appear in graves of ordinary men of the same period.⁶



Figure 1. Vergina. Great Tumulus: Burial Chamber of Tomb II. Linenoid corslet. Detail from its left shoulder-piece (epomis) decorated with gold strips along the edges. The gold attachment in the shape of a lion's head held in place one of the golden rings that fastened the corslet to the chest of the warrior by leather straps. (photograph by P. Faklaris).

Macedonian burials of the last third of the fourth and the beginning of the third centuries reveal a significant change that leaves its mark in the arms manufacture of the period. Among the grave goods, defensive arms made of iron make their appearance for the first time and archaeological finds testify that the use of iron is launched at the same time in every piece of defensive armour.

The considerable advance in iron-working that took place in the reign of Alexander III made possible working iron into very thin sheets.⁷ This development broke ground for its use

⁶ See e.g. fine swords from Kozani and Veroia decorated with gold, Kallipolitis and Feytmans 1948/49, 98, 105, figs. 6-7, 15b. Archaeological Museum of Kozani. Touratsoglou 1983, 614-625, fig.1, dr. 2-4. Archaeological Museum of Veroia.

⁷ Iron metallurgy in antiquity was substantially different from methods employed for other ores, as iron was not liquefied but repeatedly heated and hammered on an anvil. On the technological stages in the development of iron working in Greece, see Pleiner 1969. Forbes 1972², 187-224, 283-288.

in body armour. Iron sheet, cheaper and stronger than bronze, got rid of the disadvantage of heavier weight when reduction of its thickness was achieved and dominated the manufacture of body armour ever since. The use of iron, by reason of the peculiarities and restrictions of its processing, introduced new manufacturing characteristics, improvements in design and new shapes into all pieces of the armour of this period.

In written sources this watershed is also discernible. Making mention of iron as the material of pieces of Alexander's armour after Gaugamela, ancient historians suggest thereby this switch in armour manufacture. In Granicus (334 BC) Alexander came close to dying in a single combat with a Persian nobleman from a strike on his head that split and destroyed his helmet (Plut. *Alexander* 16. 10. Arrian *Alex. Anabasis* 1. 15. 7. Diod. 17. 20. 6). In Gaugamela (331 BC) he did not take any chances. He wore a helmet specified as iron, manufactured by Theophilos, one of the very few armor craftsmen known by name, indicating how famous he must have been for his work. This iron helmet was so finely crafted that "gleamed like polished silver" (Plut. *Alexander* 32). Prior to Gaugamela, ancient historians do not bother mentioning the material of Alexander's armour; it is obvious. After Gaugamela, a change has occurred and the material requires specification.

The introduction of iron led to decisive design changes particularly evident in helmets.⁸ Helmets of this era are commonly of the Phrygian pilos and the Chalkidian type, while new types appear, resulting from every possible combination of individual elements of older types. Six iron helmets have been found in Macedonia and two in Epirus; none as yet in other Greek areas. Among them the one from the unlooted tomb at Vergina is the only entirely preserved⁹ (fig. 2). It consisted of many parts assembled together as required by its material. Its iron sickle-shaped crest, imitates the Phrygian pilos helmet and its *ampyx* is decorated with an embossed bust of the goddess Athena. The hinged cheek-pieces have iron rings attached to their ends for fastening the helmet in place with a strap. As often happens with helmets of this period, this helmet does not fit into an established helmet-type, but combines elements of the Attic and the Phrygian pilos type.¹⁰

Two additional helmets were found in a burial at Prodromi in Thesprotia, one of which is silver plated,¹¹ and segments of such helmets have also been found in the "Ionic tomb" and the "tomb of Eurydice" at Vergina,¹² at Aiani (Kozani), (Karamitrou-Mentessidi 1989, 49, fig. 8, and Karamitrou-Mentessidi 1993, 48), and at Agios Athanasios (Thessaloniki), (Tsimbidou-Avloniti 2011, 359-360, figs. 7-9). The helmets from Prodromi survived in a good condition. From the helmet found in the "Ionic tomb" at Vergina only part of the crown and its iron crest have survived and from the one in the "tomb of Eurydice" only nearly half of the crown. From the helmets of Aiani only the cheek pieces have been found. The helmet from

Healy 1978, 182-189 and 231-236 (on the processes of iron working). On iron working in the classical period see Konophagos and Papadimitriou 1981, 148-160.

⁸ For the helmets of this period, see Dintsis 1986.

⁹ Andronikos 1984, 140-42, figs. 97-98. The helmet is dated to the last third of the 4th century BC. The burial is dated after 316 BC. See Faklaris 2011a, 345-347.

¹⁰ On the type of the Vergina helmet, see Dintsis 1986, 40 and Waurick 1988, 174, 176-177.

¹¹ Horemis 1980, 15, figs. 7-8. For its dating to the end of the 4th -beginning of 3rd century, see Dintsis 1986, 276 n. 214.

¹² Drougou 1987, 92, fig. 12. The large Macedonian tomb with an ionic façade was discovered robbed and severely damaged in 1987 right next to the town hall of Vergina. It is dated to the beginning of the 3rd century BC. On the "Tomb of Eurydice" see mainly Andronikos 1987, 375-379. Andronikos et al. 1987, 128-132. For the need to revise its original dating to 340 BC for a chronology around 325 BC, see Rhomiopoulou and Brecolaki 2002, 108, note 3.

Agios Athanasios preserves only the cheek-pieces and part of the brim. The combination of parts of different helmet-types into new hybrid ones and the common technical features shared by all the finds, testify to the dating of these iron helmets to the last third of the fourth and the early years of the third centuries BC.

The gorget (*peritrachēlion*) a piece of defensive armour for protecting the neck and the front of the throat that was a special element of the panoplies of Macedonian officers, emerged as an addition to the corslet for the first time in this period, with iron as its principal material and a covering of cloth, leather and gilded silver plate (Faklaris 1985, 1-16. Archibald 1985, 165-185). Alexander at the battle of Gaugamela (331 BC) wore a gorget made of iron and decorated with precious stones (Plut. *Alexander* 32).



Figure 2. Vergina. Great Tumulus: Burial Chamber of Tomb II. The iron helmet (photograph by P. Faklaris).

In Greece, seven gorgets have been found: one in Katerini, four at Vergina, one at Pydna and one at Agios Athanasios (Thessaloniki). Three of them, those from Katerini, Pydna and the antechamber of Tomb II of Vergina, are decorated with a gilded silver sheet fully covered with various ornaments in concentric arrangement. Three similar gorgets, with gilding and similar decoration have also been found in Mezek, Varbica and Jankovo, in Bulgarian Thrace.¹³

Iron, in combination with cloth and leather, was also used to make cuirasses in this period. The two main types of cuirasses were both in use. The muscle cuirass, made of

¹³ Katerini: Despini 1980, 207-208, figs. 5-6. Despini 1985, 46, figs. 5-6. Vergina: Andronikos 1984, 189, fig. 151. Faklaris 1994, 106-108, 110, fig. of page 112. Pydna: Bessios 1985, 54. Faklaris 1985, 1-16, pls. 1b-7. Agios Athanasios: Tsimbidou-Avloniti 2011, 358. On the gorgets from Thrace, see Filow 1937, 67-72, figs. 75-77. Hoddinott 1981, 106, fig. 100 Ognenova 1961, 527 ff., figs. 15-18, pl. XVII. Faklaris 1985, 8, pl. 8α.

metal hammered in the shape of anatomical details of the torso, and the *linothōrax*, made of multiple layers of linen quilted together, a technique still employed in contemporary bullet-proof vests. In fact these cuirasses were complex artefacts, made of several materials, attachments and parts riveted, hinged or sewn together, designed to provide maximum impenetrability with minimum obstruction of warrior's the movements, without disregarding the factor of splendour and luxury that the warriors wanted for their armour. These new cuirasses translate the form of cuirasses made from other materials, namely the bronze muscle cuirass and the linen cuirass, into iron. Furthermore, various combinations of the individual elements of these basic types of cuirasses were developed. Only three corslets of this kind have been found in Greece and possibly a fourth one: The iron cuirass found at Prodromi, Thesprotia (Horemis 1980, 10-11, figs. 4-6) decorated with gold attachments, is a regular muscle cuirass in every other part except its shoulder-pieces (*epomia*), which are characteristic of the *linothorax*. Another muscle cuirass is very likely to be among the fragments of iron armour that came to light recently by L. Stefani, in the antechamber of the looted magnificent Macedonian tomb of Lefcadia, Naousa known as "the tomb of Judgment" or "the Great Tomb".¹⁴ Another mixed type of corslet has appeared in Vergina and Agios Athanasios. The first was found in the chamber of Tomb II of Vergina. It is decorated with gold strips and attachments and its metal parts are nearly intact (Andronikos 1984, 137, 140, figs. 95-96. Faklaris 1994, 106, fig. of page 106). The one from Agios Athanasios, very similar to that from Vergina, was reassembled from dozens of fragments (Tsimbidou-Avloniti 2011, 355-358, dr. 1, figs. 3-6). These corslets are designed as linen ones in all their individual parts. However, for providing additional protection, they were reinforced internally with iron plates, which being covered with layers of linen cloth, were not visible. Thus, these corslets would not fit into the type of regular linen corslets, therefore we named them "linenoid" as, except for the addition of iron plates, they retain the exact form and the look of the linen corslet.¹⁵ Their metal part, conforming to the pattern of the linen corslet, makes very few concessions to the contours of the trunk. This was normal for a corslet made of linen, which had a degree of flexibility and with use adapted to the curves of the trunk. However, for a linenoid corslet, this geometric form must have been a factor of encumbrance and discomfort for the warrior and probably this explains why the warrior of the chamber of Tomb II in Vergina in addition to this had a regular linen corslet as well that gave priority to his mobility in battle.

These panoplies were as a rule combined with a pair of copper or bronze greaves. Despite the predominance of iron in the rest of the armour, copper and bronze persist in greaves throughout the reign of Alexander and the Early Hellenistic period. These metals gave greaves pliability that allowed them to be bent open from the back in order to be put on

¹⁴ See, Stamatopoulou 2004, 295 n. 393. The "tomb of Judgment" was found in 1956 and published in 1966 (Petsas 1966). However its antechamber had not been investigated until 1998 because of the shaky statics of the façade wall which prevented the removal of the soil that had filled the antechamber. For the excavation in the antechamber and a brief description of the finds, see Stefani 1998, 418-419 (nos. ΣΟ 4-5 and ΣΟ 25, 27). On the tomb see Petsas 1966.

¹⁵ The introduction of new cuirass-types did not make the traditional types extinct. In same tomb in Vergina three more corslets had been placed, belonging to the regular linen type. From these only their gold and silver attachments survive. See Faklaris 1985,10. Faklaris 1994, 105. Few remains of another linen corslet, similar to the ones of Vergina, was found in the "tomb of Sismanidis", in Agia Paraskevi, east of Thessaloniki. Sismanidis 1986, 95, pl. 25b.

or taken off the shin, as is shown in several arming vase-paintings.¹⁶ The rigidity of iron must have been the reason that hindered its domination in greaves as well.¹⁷ The need for luxury must have been served with golden-colored alloys of bronze as seen in Derveni and Vergina. This conclusion is reinforced by the fact that the copper pairs of greaves found in the antechamber of the same tomb (Tomb II of the Great Tumulus of Vergina) and in Tomb III, which because of their material did not have a golden color, received gilding.

In this period, iron also appears in the attachments on the interior of hoplite shields that mainly constitute their double-handle system (Stamatopoulou 2004, 136-257, 282-286).

It is used in the form of very thin sheets, one to one point five millimetres in thickness, in combination with wood, cloth, and leather, the other materials which make up the shield. Ten shields with iron internal attachments have been found in Macedonia: at Vergina, Derveni, Lefkadia, Agios Athanasios, and in Pieria.



Figure 3. Derveni. Tomb A. Trapezoid iron plate with pair of lions au repoussé, for the attachment of the arm-band (porpax) on the wooden body of the shield (photograph by P. Faklaris).

¹⁶ E.g. vase-painting with arming of hoplites. Red-figured kylix by Douris, circa 480 BC. Vienna, Kunsthistorisches Museum, no. 3694. Beazley 1963², 427, 3. Snodgrass [1967] 1999, fig. 45.

¹⁷ In tomb II of the Great Tumulus of Vergina, four pairs of greaves have been found. The three found in the chamber are made of bronze and the one in the antechamber of gilded copper. See Andronikos 1984, 145, fig. 103, 186-89, fig. 150. *Search for Alexander* 1980, 182 no. 159. Faklaris 1994, 105. In the chamber of tomb III of the same tumulus one pair of gilded copper greaves has been found. See Andronikos 1984, 217, fig.185. Faklaris 1994, 113. The cist graves A and B of Derveni have yielded three pairs of bronze greaves (Themelis and Touratsoglou 1997, 48 nos. A85α-β, A15, pls. 7, 54. 84; no. B38, pl. 95). It was recently reported that in the Tomb of Agios Athanasios west of Thessaloniki, some iron plates found in very fragmentary condition belonged to iron greaves (Tsimbidou-Avloniti 2011, 360-62, fig. 10).

The iron sheets of all these shields receive unaltered the form and decoration of earlier shield attachments made of bronze. This simple decoration is for the shield-bands a palmette ending and for the trapezoid plates of the *porpax* (arm-band) pairs of lions, all executed in repoussé. The circular shield-bands are left plain except for the regular pairs of lines along the edges. Three such shields have been found in Vergina, two of them in Tomb II of the Great Tumulus (Andronikos 1984, 119, 137. Faklaris and Stamatopoulou 1997, 122, fig. 7. Stamatopoulou 2004, 284-86, figs. 301-303. Last third of the fourth century BC), and one on the acropolis of the ancient city, a rare incidence of a find like this in a settlement excavation (Faklaris and Stamatopoulou 1997, 122, fig. 7. Stamatopoulou 2004, 284-86, figs. 301-303). Three hoplite shields with iron fittings have been also found in cist-graves at Derveni, in fragmentary condition: two in grave A (fig. 3) and one in grave B.¹⁸

Few fragments of the iron fittings of a similar shield have been found in the Macedonian tomb excavated by Kinch in Lefcadia, Naousa¹⁹ and pieces of another in the antechamber of the nearby "Great Tomb" or the "Tomb of Judgment" (Stefani 1998, 418-19. Stamatopoulou 2004, 295), in the tomb of Agios Athanasios, Thessaloniki (Tsimbidou-Avloniti 2005, 106. Stamatopoulou 2004, 293-294), and in "Tomb D" in Kitros, Pieria (Stamatopoulou 2004, 127-129, figs. 113-115). Close similarities in technical and decorative elements speak about their manufacture from a common production center (Stamatopoulou 2004, 498-499). At the same period, a noteworthy improvement has also been observed in iron offensive weapons, whose variety, form, and ornamentation provide evidence for the first time of consistent quality and a high degree of specialisation. Blades were made of multiple hammered layers of iron, ensuring greater strength with quenching. Lances acquire very heavy midribs, sharper edges, greater length, and more complex sections.²⁰

Particular stress was put on the fashioning of recurved sabres (*kopides* or *machairai*), the single-edged swords that were used mainly by horsemen. The *kopis* was a very strong cutting sword with a heavy curved blade and a distinctive hilt shaped to give a secure grip, with a projection on the cutting side shaped either like the head of a bird (eagle or swan) or like the head of a panther or a lion²¹. Archaeological finds and information provided by textual sources refer to the power of this weapon (Arrian *Anabasis* 1.15.8). As a cavalryman, Alexander mainly used *kopides*; the one he used in the battle of Gaugamela, was a magnificent weapon, exceptionally light and superbly well-tempered, a present from the king of Kition, Cyprus (Plut. *Alexander* 32). Sabres from this period have been found in tombs of

¹⁸ Grave A: Stamatopoulou 2004, 139-214, figs. 119-229. Themelis and Touratsoglou 1997, 45-46, pls. 50-51. Grave B: Stamatopoulou 2004, 215-47, figs. 230-287.

¹⁹ Stamatopoulou 2004, 248-251, figs. 288-293. See also, Rhomiopoulou and Touratsoglou 1971, 153, 163, fig. 2, top and bottom left, where the two iron sheet fragments of the shield are erroneously identified as iron attachments of a door.

²⁰ See e.g. the lances in Andronikos 1984, 144, fig. 102. *Search for Alexander* 1980, nos. 167-169.

²¹ On *kopides* in red-figured vase paintings see Sandars 1913, figs. 17-18, 23-25. *Kopides* have been used from the archaic period onward. See Snodgrass [1967]1999, 97, fig.50. In a male burial of around 540 BC in Sindos a *kopis* was found with a hilt shaped like a swan's head. See *Sindos* III, 2016, 306 no. 623, figs. 35, 658. The *kopis* found in the burial at Prodromi with the iron helmets and the iron muscle cuirass has a similar hilt. See Horemis 1980, 15-16, figs. 9-10. Two *kopides* belonging to bronze statues have been found in the sanctuary of Dodone. One with a panther's head for a hilt from the statue of a Krison and a similar with an eagle's head. Archaeological Museum of Ioannina, nos. AMI 1372 (end of third century BC) and AMI 1373 (end of 3rd-beginning of 2nd century BC). See, Zahos 2008, 157, 158.

the last quarter of the fourth and the first quarter of the third century BC at Pydna, Vergina and Lefkadia.²²

The consistently high quality of manufacture shown by the iron weapons and armour of this period exceeds the capabilities of the local smiths that had manufactured military equipment down to the reign of Philip II, each according to their own technical traditions and designs. From now on, weapons and armour most evidently corresponded to specific technical specifications which can only have originated from a common centre of power and been a result of centralized large-scale production and distribution. Thus, only in the late fourth and early third centuries does it become possible for the first time in the manufacture of iron weapons and armour to recognise the products of the same workshop though found in different areas of Macedonia. Examples of origin from a common armory are the iron shields of Vergina and Derveni the gorgets from Vergina, Katerini, and Pydna (Faklaris 1985, 14), the spearheads of Vergina and Derveni,²³ and the swords of Vergina, Veroia, Pydna and Koukos (Pieria).²⁴

According to Diodorus, Alexander left Macedonia with an army of approximately 32.000 infantrymen and 4.500 cavalrymen, leaving another 13.500 behind (Diod. 17.17.4.4 and 17.17.5.3). His forces would later be greatly increased. It is indicative that when his army was at the area of Hydaspis arrived from Greece allied and mercenary troops, more than 30.000 infantry and about 6.000 cavalry, bringing with them 25.000 outstanding (*diaprepeis*) suits of armour, which were distributed to the soldiers (Diod. 17.95.4). These unprecedented numbers make it clear that the requirements for equipping this army demanded organised preparation and called for a mass production of armour and weapons that would fulfil detailed common specifications, attracting for this purpose the leading craftsmen of this age, who had the expertise to meet the qualitative and quantitative demands of a production of this sort. Subsequently, in the course of Alexander's campaign mobile armourers' workshops accompanying this vast army covered both the need to repair or replace arms and armour damaged in battle and the soldiers' need to spend on prestige objects part of the immense profits they had acquired by participating in the campaign and plundering Persian treasures.

Bronze, which until this period had predominated defensive equipment, obviously presented disadvantages in terms of sturdiness and cost. Since its creation in the seventh century, the hoplite panoply had developed toward reducing the weight of the arms and

²² Pydna: Found in 1994 by M. Bessios in Tomb 156 in Louloudia, near Pydna. Last third of the 4th century BC. Archaeological Museum of Thessaloniki. Unpublished. Vergina: Eagle's-headed hilt and silver rings for the strap of the sheath. See Kottaridi 1996, 87. Lefkadia: Found in the Macedonian Tomb excavated by K. Kinch. Only a small fragment of the blade has survived and thus it had not been recognized in the publication where it is described as an "undiagnosed iron fragment". See Rhomiopoulou and Touratsoglou 1971, 153, fig. 2 (bottom right). A picture of the owner of the tomb, evidently an *hetairos*, dominated the burial chamber on a now perished wall-painting that showed him on horseback wearing a helmet very similar to the one found in Tomb II at Vergina and charging with a cavalry *sarissa* against a barbarian infantryman.

²³ For the spearheads from Derveni, see Themelis and Touratsoglou 1997, 44-45 nos. A91α-A91β, pls. 48-49, 109; nos. Δ48-50, pl. 119. Thessaloniki, Archaeological Museum.

²⁴ For the sword from Vergina, see Andronikos 1984, 142-44, figs. 99-101. Faklaris 1994, 110, figs. of pages 108 and 109. For the sword from Veroia, see Touratsoglou 1983, 614-625, fig.1, dr. 2-4. Archaeological Museum of Veroia. For the sword from Pydna, see Bessios 2010, 186. Last third of the 4th century BC. Archaeological Museum of Thessaloniki. For the sword from Koukos, see Bessios and Noulas 2010, 138, figs. 6-7.

armour, even by sacrificing part of their effectiveness in favour of the warrior's ease of movement and endurance. The introduction of the use of iron in defensive weapons seems to have been a response to the disadvantages of bronze and became possible thanks to the newly acquired capability of craftsmen to transform it into very thin but resistant sheets with a thickness reaching just one millimetre. These sheets could furthermore take gilding, silver plating or embossed decoration often transferring the traditional repertoire of ornaments to this material.

Defensive arms are complex products composed of a combination of organic materials and metal. The newly introduced use of iron for these pieces of equipment, as the organic materials were saturated with products of iron corrosion, has in many instances preserved (though in most cases mineralised) these materials, which in different conditions would have been lost, furnishing invaluable technical information for these artefacts.

Thanks to its iron, the gorget from Vergina has retained the larger part of its organic materials. On the back side it had three layers of leather, and even the thread with which the leather was stitched onto the iron core has survived (fig. 4).



Figure 4. Vergina. Great Tumulus: Burial Chamber of Tomb II. The back side of the gorget (peritrachelion) with organic materials (photograph by P. Faklaris)

Remnants of the leather and cloth lining have also been preserved on the Vergina helmet. The leather lining of the cheek-pieces, ornamented with overlapping rows of scales, was known only from vase paintings until the discovery of this helmet.²⁵ On one of the helmets from Prodromi survive remains of the two plumes that once adorned it, as on the helmets of Lamachus and Alexander known from textual sources.²⁶

The cuirasses have also preserved remains of their organic constituents. On the outside they were covered with linen, while on the inside they were lined with cloth and leather, which were attached with stitching along the edges of the metal parts. On the cuirass from Vergina, the only as yet surviving pieces of the leather flaps (*pteryges*) were also preserved.

²⁵ See e.g. red-figured kylix by Douris, circa 480 BC. Vienna, Kunsthistorisches Museum, no. 3694. Beazley 1963², 427, 3.

²⁶ Lamachos's helmet was adorned with ostrich plumes and Alexander's with two white plumes of great size. Aristoph. *Acharnenses* 1103, 1105. Plut. *Alexander* 16.7.

On the ten shields with iron attachments from Macedonia, the organic components that have been preserved fill in our knowledge about every detail of their construction, as sections of the concave wooden part as well as the leather and cloth linings survive owing to the iron rust. On the shield from Vergina wood and all the other materials used in its construction, leather, cloth, and ivory have been preserved (fig. 5).

The shield from Tomb A at Derveni also has pieces of leather and wood preserved (Stamatopoulou 2004, 208-214, 225-247, 253-254, figs. 226-229, 245-265, 268-287, 295-296). On the swords from Pydna and Vergina, the iron has preserved their wooden scabbards, covered with leather and tipped with ivory at both ends (see supra note 26).

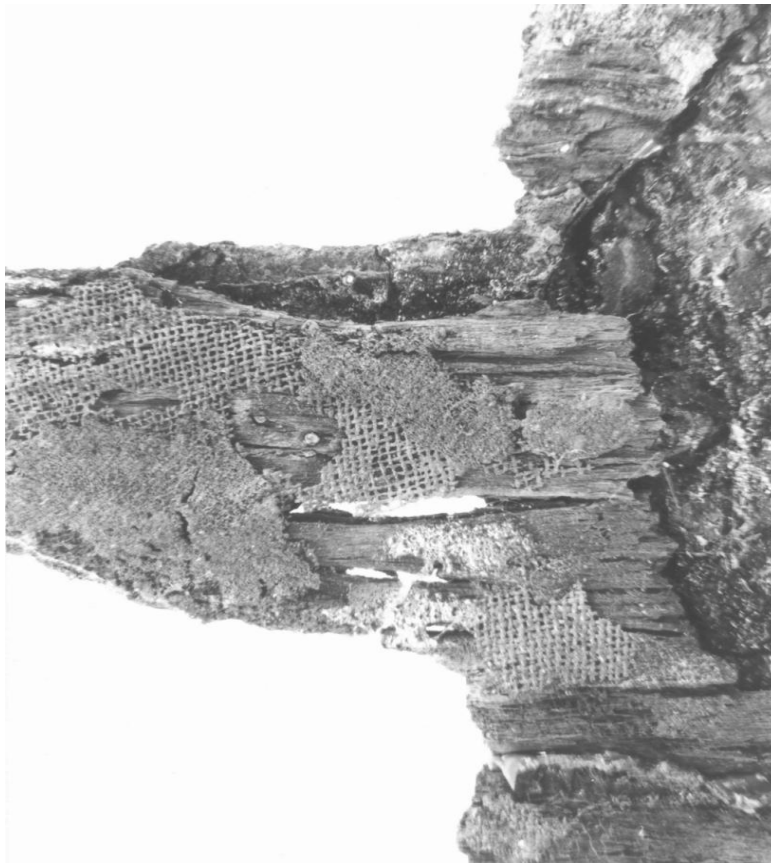


Figure 5. Vergina. Great Tumulus: Burial Chamber of Tomb II. Detail of the external side of the shield with the preserved organic materials (photograph by P.Faklaris).

A diametrically opposed picture is presented by the iron weapons and armour that come from funeral pyres. Affected by exposure to high temperatures during the cremation, the iron plates or blades are usually found in small fragments, but also free from the swelling and exfoliation caused by corrosion. Stripped of their organic materials, they bear the evident results of burning, often stuck together or with other materials in the funeral pyre such as gravel, charcoal, or other metal objects. In the funeral pyre of the Vergina tomb two swords, spears, a gorget, and a hoplite shield were burned (Andronikos 1984, 97. Faklaris 1994, 107). They permit observations to be made that would be impossible in analogous finds covered by organic materials. Spears and a hoplite shield have also been found in the pyre of Derveni Tomb A (fig. 6) (Themelis and Touratsoglou 1997, 30).



Figure 6. Derveni. Tomb A. Iron spearheads from the funerary pyre. Inv. no. A86 (photograph by P. Faklaris).

The use of iron in defensive weapons would continue throughout the Hellenistic period. Nevertheless, military equipment of this high quality appears in burials dated to the last third of the fourth and the first decades of the third century BC that obviously belong to Macedonian warriors who fought on the side of Alexander and constitute archaeological documents of the outstanding historical event of the Macedonian Expedition to Asia.

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ΑΙΓΙΔΑ

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Υπουργείο Πολιτισμού

ΧΟΡΗΓΟΙ



ΤΕΧΝΙΚΟ
ΕΠΙΧΕΙΡΗΜΑΤΙΚΟ
ΕΛΛΑΔΑΣ



ΟΜΙΛΟΣ ΤΕΚ ΤΕΡΝΑ

ΥΠΟΣΤΗΡΙΞΗ



ΜΕΓΑΡΟ
ΜΟΥΣΙΚΗΣ
ΑΘΗΝΩΝ