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The Combat Archaeology of the Fifth-Century BC *Kopis*: Hoplite Swordsmanship in the Archaic and Classical Periods

Thomas O. Rover
University of Texas at Austin, Austin, Texas, USA
ThomasRover@utexas.edu

Abstract

'Traditionalist' scholars of historical Greek warfare assert that hoplites formed a close-order formation that moved slowly and deliberately to overwhelm its enemies. Opposing them the 'revisionists', claim that hoplites fought in an 'open-order' formation resembling Homeric combat well into the Archaic and even early Classical periods. Existing studies of the physical remains of Greek arms and armour, iconographic representations of hoplites in combat, and literary descriptions of Greek warfare are not decisive. Combat archaeology, i.e. the reconstruction and testing of arms and armour, remains a largely untapped source of evidence. This article presents the results of an experimental archaeological reconstruction of the *kopis,* a curved sword used in Greek combat from the mid-sixth to fourth centuries BC. A more complete understanding of the use of the *kopis* sheds light on the realities of hoplite combat and offers strong support for the traditionalist position.

Keywords

Hoplite – Experimental Archaeology – *Kopis* – *Makhaira* – Sword – Archaic – Classical – Greek

Introduction

The scholarly field of ancient Greek warfare is divided. It should perhaps come as no surprise that even the scholarship of war engenders profound conflict.

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For the past several decades, the community has argued extensively over a basic question: in what formation did hoplites fight? There are two main positions, which I have termed the 'traditionalist' and the 'revisionist'.

Traditionalists[1] believe that hoplites fought in a 'close-order' phalanx. This phalanx, they argue, was comprised of men who stood so close together that their shields overlapped and who lumbered slowly forward in a tightly coordinated mass of bristling spears and clanging bronze to engage its opposing phalanx. In the traditionalists' minds, a hoplite battle consisted of two phalanges pressing against one another, first at spears-length, then at swords-length, and finally with shields grinding against opposing shields until one side overcomes the other through sheer pressure.

Revisionists,[2] on the other hand, contend that hoplites fought in an 'open-order' phalanx throughout the Archaic period and into the fifth century. The

1 See Jock K. Anderson, "Hoplite Weapons and Offensive Arms", in *Hoplites: The Classical Greek Battle Experience* (New York, 1993), 15–37; Paul Cartledge, "Hoplites and Heroes: Sparta's Contribution to the Technique of Ancient Warfare", *The Journal of Hellenic Studies* 97 (1977), 11–27; Walter Donlan and James Thompson, "The Charge at Marathon: Herodotus 6.112", *The Classical Journal* 71 (4) (1976), 339–343; Walter Donlan and James Thompson, "The Charge at Marathon Again", *The Classical World* 72 (7) (1978), 419; Victor D. Hanson. 'Hoplite Technology in Phalanx Battle", in *Hoplites: The Classical Greek Battle Experience*, (New York, 1993), 63–84; Victor D. Hanson, "Hoplite Battle as Ancient Greek Warfare: When, Where, and Why?", in *War and Violence in Ancient Greece* (New York, 2000), 201–232; Victor D. Hanson and John Keegan, *The Western Way of War: Infantry Battle in Classical Greece* (New York, 1990); Eero Jarva, "Arms and Armor of the Greeks", in *The Oxford Handbook of Warfare in the Classical World*, (New York, 2012), 395–417; Donald Kagan and Gregory Viggiano, "The Hoplite Debate" in *Men of Bronze*, (Princeton, 2013), 1–56; John W.I. Lee, "The Classical Greek Battle Experience", in *The Oxford Handbook of Warfare in the Classical World*, (New York, 2012), 143–161; Christopher Matthew, "When Push Comes to Shove: What Was the '*Othismos*' of Hoplite Combat?", *Historia* 58 (4) (2008), 395–415; Adam Schwartz. "The Early Hoplite Phalanx: Order or Disarray?", *Classica et Mediaevalia* 53 (2002), 31–64; Adam Schwartz, *Reinstating the Hoplite: Arms, Armour and Phalanx Fighting in Archaic and Classical Greece*, (USA, 2013); Adam Schwartz, "Large Weapons, Small Greeks: The Practical Limitations of Hoplite Weapons and Equipment", in *Men of Bronze* (Princeton, 2013), 157–176; Anthony Snodgrass. "The Hoplite Reform and History", *The Journal of Hellenic Studies* 85 (1965), 110–122; Anthony Snodgrass, *The Arms and Armour of the Greeks,* (Baltimore, 1999).

2 See George L. Cawkwell, "Orthodoxy and Hoplites", *The Classical Quarterly* 39 (2) (1989), 375–389; A. James Holladay, "Hoplites and Heresies", *The Journal of Hellenic Studies* 102 (1982), 94–103; Peter Krentz, "Fighting by the Rules: The Invention of the Hoplite *Agôn*", *Hesperia* 71 (1) (2002), 23–39; Peter Krentz, *The Battle of Marathon,* (New Haven, 2010); Peter Krentz, "Hoplite Hell: How Hoplites Fought", in *Men of Bronze: Hoplite Warfare in Ancient Greece* (2013), 134–156; Robert Luginbill, "*Othismos*: The Importance of the Mass-Shove in Hoplite

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adherents of this school of thought argue for a more flexible and nimble phalanx than the slow juggernaut espoused by traditionalists. Revisionists believe that the phalanx acted like a swarm of bees or a school of fish, with individual hoplites darting in and out of direct combat. In such a battle, revisionists believe missile weapons still played an important role, and that individual hoplites would have been able to duel with their opponents in the manner of Homeric heroes.

Scholars on both sides of this debate have examined the physical remains of hoplite arms and armour, poured over the literary accounts of hoplite combat, and analysed depictions of hoplites in the iconographic record. These efforts have resulted in an impasse, which in turn points to the conclusion that the evidence that has been considered to this point is, in and of itself, incapable of resolving the debate between traditionalists and revisionists.

The purpose of this article is to bring forward a new form of evidence that has not to date played any significant role in discussions of the nature of hoplite warfare. That form of evidence consists of a program of combat archaeology centred around a particular type of hoplite sword called a *kopis*. The reconstruction and testing of ancient weapons – what has been called combat archaeology – has been practiced with notable success by scholars such as Barry Molloy of University College Dublin. Molloy, who coined the term 'combat archaeology', was able to determine the usefulness and battlefield effectiveness of a broad array of Aegean Bronze Age swords after a program of experimentation and analysis.[3]

In carrying out a program of combat archaeology I commissioned a reconstruction of a *kopis*, and with it performed a series of experiments that explored the weapon's strengths and weaknesses and how it might have been used in hoplite combat. That program of experimentation, taken in conjunction with the standard collection of archaeological, literary, and iconographic evidence, offers strong support for the traditionalists' position.

Warfare", *Phoenix* 48 (1) (1994), 51–61; Hans van Wees, "The Homeric Way of War: the Iliad and the Hoplite Phalanx (I)", *Greece and Rome* 41 (1) (1994), 1–18; Hans van Wees, "The Homeric Way of War: The Iliad and the Hoplite Phalanx (II)", *Greece and Rome* 41 (2) (1994), 131–155; Hans van Wees, "The Development of the Hoplite Phalanx: Iconography and Reality in the Seventh Century", in *War and Violence in Ancient Greece*, (London, 2000), 125–166.

3 Barry Molloy, "Swords and Swordsmanship in the Aegean Bronze Age", *American Journal of Archaeology* 114 (3) (2010), 403–428. For other combat archaeology studies, consult Matthew, "When Push Comes to Shove," and Krentz, "Hoplite Hell," 134–156.

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There were two types of Greek iron or steel sword:[4] *xiphos* and *kopis* (Figure 1).[5] I chose to reconstruct the *kopis* because far less research has been carried out on this type. The *kopis* is particularly instructive for the modern-day scholar because it was introduced into hoplite combat in the sixth century,[6] well within the hoplite period. This means that *ab initio* its only design consideration was its use in hoplite combat. The *xiphos*' predecessor, the so-called 'Naue II', originated in the wholly different world of Bronze Age combat.[7] I am tremendously indebted to Marek Verčík and Catherine Parnell for their work proving that the *kopis* was in fact Greek and was used by hoplites.[8]

Before proceeding, it is worth mentioning the problems of Greek weapon nomenclature. Most modern scholars call the two types of Greek swords '*xiphos*' and '*kopis*', but the idea that these two words alone correspond exactly and only to these types is a modern one. Modern desires to categorise weaponry do not necessarily reflect ancient terminology. The Greeks themselves were highly inconsistent with their nomenclature. There are very few literary references to the *kopis* in a military context. In one notable example, Xenophon[9] refers to the same sword type with two different words: *kopis* and *makhaira*.[10]

4 Swords of the Bronze Age have their own extensive typology. For a detailed examination, consult Molloy, "Swords and Swordsmanship."

5 Greek plurals: *kopides* and *xiphê*. For visual aids and detailed analysis of the development of these sword forms, consult Peter Connolly, *Greece and Rome at War,* (London, 1998).

6 All dates are BC unless otherwise indicated.

7 Bronze Age weaponry and armour were constructed with different concerns in mind. The presence of chariots, the fact that bronze still predominated over iron and steel, and the palace system around which the armies were organised resulted in large body-shields suspended on shoulder-straps, solid bronze swords, and either armour made of ephemeral materials or great suits of bronze plate (e.g. the Dendra Panoply). For a more detailed discussion of the separate world of Bronze Age combat, consult Molloy, "Swords and Swordsmanship."

8 There had been, for years previous, a suspicion that the *kopis* blade form was not native to Greece, or even used by Greeks. Marek Verčík and Catherine Parnell, cited specifically later in this work, prove definitively, in my opinion, that this weapon was not only Greek, but used by hoplites in infantry combat.

9 Xenophon, *Peri Hippikês*, 12.11–12. This word, plural '*makhairai*', is taken to have a general meaning closer to "knife" or "machete" than the more specific *kopis*. I have elected to use *kopis*, reflecting the scholarly convention as set by Snodgrass, see *The Arms and Armour of the Greeks,* 97.

10 A temple inventory (IG II² 1424) from sixth-fifth century Athens even records a 'bronze *xiphomakhaira*', a portmanteau that is confusing and alien to the literary record, and in a

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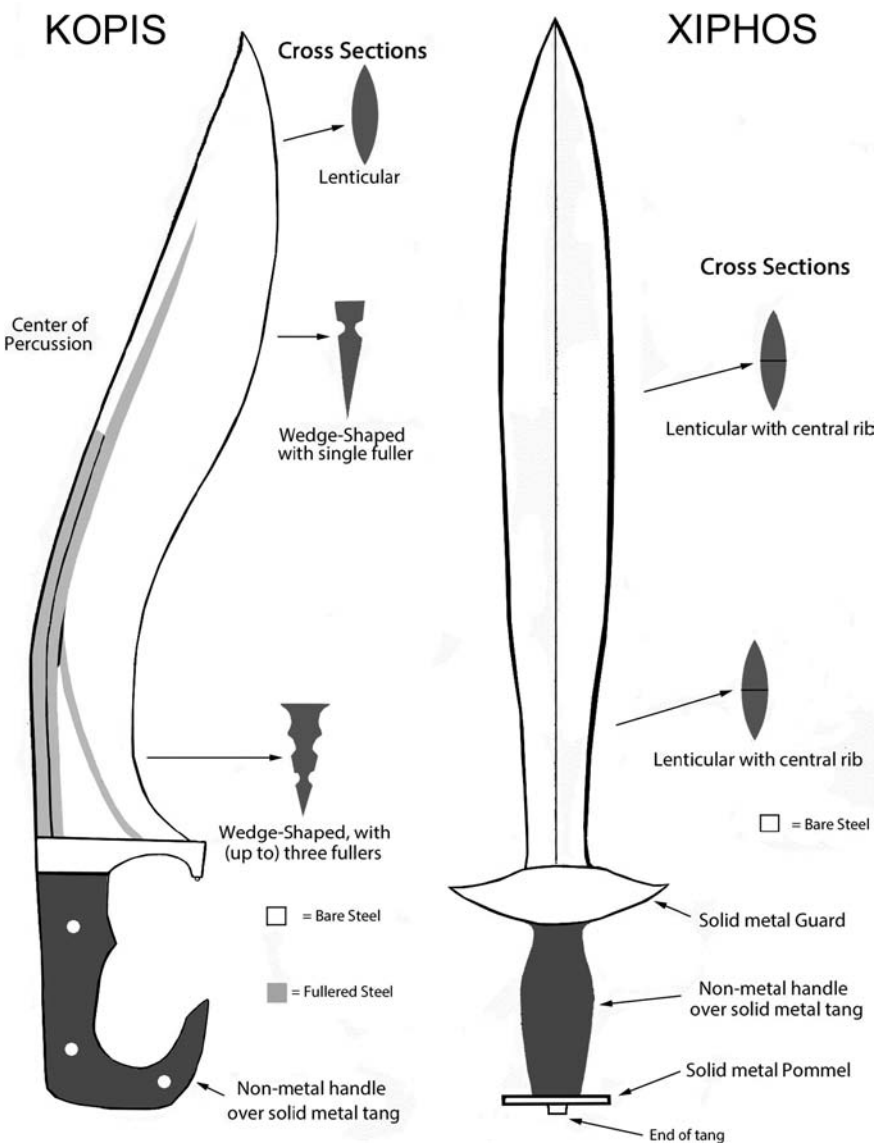

FIGURE 1 Drawn diagrams of a typical (Verčík Type 4) kopis and a typical xiphos with cross-sections of the blades. (Author's drawing).

material not suitable for the military *kopis/makhaira* blade form. It is difficult to understand object names as the ancient people outside the literary classes would have. See also Diane Harris, *The Treasures of the Parthenon and the Erechtheion* (UK, 1996).

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Archaeologists have never found (and undoubtedly will never find) a sword helpfully labelled 'I am the *kopis* of Eteoklês'. As such, scholars have had to infer which term would have applied better to which shape.[11] *Xiphos* is the most common word for sword in classical Greek, and scholars have traced the roots of the word back to the Mycenaean Greek *qi-si-pe-e*.[12] A petaloid-bladed short sword is the most common historical Greek sword and is directly descended from the Naue II sword of the Late Bronze Age, so scholars have connected the terms *qi-si-pe-e* and *xiphos* to this form. The other, forward-curving, sword form has been identified as *kopis* because the word *kopis* comes from the verb κόπτω, 'to cleave, chop, or cut', like a butcher's cleaver. We can be fairly certain that these words, *xiphos* and *kopis,* would have been understood to describe these two blade forms, but due to the nature of the evidence, we can never be totally certain.[13]

Swords are highly sophisticated weapons. A sword can perform three different types of attack: a stab, a slash, and a hack.[14] A stab seeks to puncture the opponent's body to damage internal organs; a slash seeks to draw the blade along the opponent's body, opening a deep flesh wound and harming connective tissue; a hack seeks to chop down on the opponent's body, using percussive force to break bone or even dismember. Each of these three attacks requires different emphases in the design of a sword. A given sword type can be optimised to perform one of the three attacks superbly, but only at the cost of becoming significantly less capable of carrying out the other two attacks. Alternatively, a sword design can include a series of compromises that make it good at all three attacks, but superb at none.

The *Kopis*

The corpus of extant *kopides* and identified fragments has been examined by Marek Verčík, whose extensive morphological research and analysis has yielded a useful system of classification. Verčík describes five distinct types of Greek forward-curving blade. Types 1 and 2 lack guards and are thus unlikely to be military and so have been disregarded (Table 1). Type 3 *kopides* usually measure ca. 50-60cm long. They have the distinctive curved blade, hooked pommel, and

11 For a non-Greek parallel to this problem consult Ewart Oakeshott, *The Archaeology of Weapons: Arms and Armour from Prehistory to the Age of Chivalry* (London, 1960).

12 Alfred Heubeck, 'Mykenisch' (Mycenaean [Language]), *Minos* 6 (1958), 58.

13 Snodgrass, *Arms and Armour*, 97.

14 Thomas O. Rover, *"Kopis vs Xiphos Explanation."* (2016). Available at: <https://youtu.be/b1pLWLaRT3Q>, 4min 12s.

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TABLE 1 Catalogue of *kopides* (Types 3–5) from Verčík, 'Die barbarischen Einflüsse'.

Catalogue #	Type	Length (cm)	Max. Width (cm)	Grip Width (cm)	Publication Information
34	3	<17>*	<2>	–**	Letica 1981, T. VII, 6
35	3	<44>	<4>	3	Kilian-Dirlmeier 2002, 87 Taf. 87, 1386
36	3	52	8	–	Tziafalias 1978, 175 Εικ. 19a
37	3	<49>	<6>	–	Tziafalias 1978, 175 Εικ. 19b
38	3	58	7	4	Baitinger 2001, 235 Taf. 64, 1327
39	3	50	6	3	Jacopi 1929, 243 Fig. 241
40	3	45	5	3	Vokotopoulou 1985, 168 Εικ. 269
41	3	54.8	6	4	Πολυκεντρικό Μουσείο Αιγών Inv. # BM 3182
42	3	<22>	<5>	<3>	Schmitt 2007, 511 Taf. 106, 489
43	4	<27>	<3>	–	Nazarov 2001, 172–174 Fig. 3
44	4	60	5	3	Quesada Sanz 1997, 142 Fig. 77, 5
45	4	<24>	<4>	–	Čović 1956, tb. I, 14
46	4	–	–	–	Nazarov 2001, 174 Anm. 6
47	4	<40>	<4>	<2.5>	Rusjaeva - Černenko 1980, 99–100 102 Рис. 4
48	4	<22>	<4>	<3>	Fiala 1899, 80 fig. 6
49	4	51	4	3	Fiala 1899, 110 fig. 175
50	4	<44>	<4>	<2>	Marić 1964, tb. XV, 29
51	4	<43>	<5>	<4>	Schmitt 2007, 511 Taf. 106, 490
52	4	<32>	<4>	<2>	Parović-Pešikan 1982, 26 Taf. II, 3
53	5	<82>	<8>	<4>	Filow 1934, 117 Οδρ. 140
54	5	58	5	3	Dieterle 2007, 378
55	5	50	4	4	Marić 1964, tb. XV, 30

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TABLE 1 Catalogue of *kopides* (Types 3–5) from Verčík, 'Die barbarischen Einflüsse'. (*cont.*)

Catalogue #	Type	Length (cm)	Max. Width (cm)	Grip Width (cm)	Publication Information
56	5	<46>	<5>	<3>	Truhovič 1970, 69, sl. 1
57	5	<32>	<4>	<2>	Truhelka 1902, 11 Fig. 7
58	5	<58>	<5>	<3.5>	Nikolov 1965, 185 Abb. 26
59	5	77	4	3	Choremis 1980, 15–16 Εικ. 9
60	5	51.5	5.5	3.5	Graekos 2011, 75–92 Inv. Nr. BM 2398
61	5	53	6	4	Mikulčić 1964/65, 230 sl. 6
62	5	43	4.5	3.1	Αρχαιολογικό Μουσείο Πολυγύρου Ι.166.82
63	5	<31>	<6>	–	Kilian 1975, Taf. 47, 1–5

** – Indicates that the measurement represents the damaged extant remains and are not indicative of the original values.*

*** – Indicates that there were no recorded values, either because that element of the weapon has decayed away, or the value was never recorded by archaeologists.*

single *quillon* projecting from the guard. This type appears around 550, making the *kopis* a weapon only late in the Archaic period. Type 4 *kopides* usually measure ca. 55-60cm long. They are similar to Type 3 blades, except for the addition of a ridge on the back *ricasso*[15] edge of the blade and a general wider, longer, and heavier form. Type 4 blades are fairly standardised, indicating a generally accepted optimal shape and size. This type appears toward the end of the sixth or beginning of the fifth century. Type 5 *kopides* measure anywhere from 60cm to 80cm long. These blades are much heavier than Type 3 or 4 blades, likely rendering them more difficult to wield.[16] This type appears at the end of the fifth century but is characteristic of the fourth century.

15 A ricasso is an unsharpened portion of the blade of a sword. The addition of a back edge ridge indicates that Type 3 had been prone to bending under combat stress, and designers and wielders sought to reinforce the blade.

16 Marek Verčík, *Die barbarischen Einflüsse in der griechischen Bewaffnung* (Barbarian Influence on Greek Weapons) (Rahden, 2011), 46, 52, 57–69.

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This article will focus on the Type 4 *kopis*, since it is the most highly developed form still likely to have been used in hoplite combat. Type 5 blades are longer by a full third of the Type 4's average length. Xenophon, himself a fourth-century commander of hoplites and Greek cavalry, recommends that the *kopis/makhaira* be used by cavalry.[17] Historically, long swords are preferred for cavalry combat, and shorter swords for infantry. Prior to the Type 5's length increase, the Type 4 *kopis* would have been unsuitable for cavalry combat, and thus must have been used as an infantry weapon.

The Type 4 *kopis* is highly distinctive. The blade curved forward from the hilt in a shallow arc and widened to its maximum breadth around two-thirds down its length. The fully sharpened cutting edge (or 'forward' edge) of the final third of the blade curved back to the tip, forming an S-curve in the forward edge (Figures 2–5). The hilt hooked forward under the wielder's fingers, likely to prevent the weapon from slipping out of the swordsman's hands. The guard had a single *quillon* that projected below the forward edge of the blade to prevent the hand from sliding up onto the blade (Figures 2–5). The blade was sharpened throughout the length of the front edge and the third of the back edge closest to the tip. The blade terminated in a sharpened tip (Figures 2–5).[18]

The *kopis* in this form appears to have been developed from butchers' cleavers and sacrificial tools of the seventh and sixth centuries. As a weapon it is found in small numbers in Greek contexts from the late Archaic to the Classical period (Tables 1 and 2).[19] Average weights of these weapons are hard

17 Xenophon, *Peri Hippikês,* 12.11-12. Furthermore, in the *Anabasis Kyrou*, when describing the Persian cavalry attending Kyros at the Battle of Kounaxa in 401, Xenophon writes that they carried *makhairai Hellênikai*, that is *Greek makhairai,* into battle (1.8.7). This suggests that the Persians adopted the *kopis/makhaira* from the Greeks and put it to use in the fourth century as a cavalry weapon. Earlier Persian swords, identified by archaeologists as *akinakai*, were straight-bladed short swords used by infantry (Duncan Head, *The Achaemenid Persian Army* (UK, 1992), 28). Most scholars, and indeed most ancient Greek sources from after the Persian Wars, such as Xenophon, who write on Persian cavalry weapons state that the primary weapon was the light spear or javelin called the *palta* (Head, *Persian Army,* 33–38; Christopher Tuplin, "All the King's Horse: In Search of Achaemenid Persian Cavalry", in *New Perspectives on Ancient Warfare* (USA, 2010), 114–115). These cavalrymen would of course have had secondary weapons, but the evidence for Akhaimenid weaponry is extremely limited, so it is difficult to say exactly what this secondary weapon would have been. A sword or axe is not unreasonable, however.

18 Snodgrass, *Arms and Armour,* 84–85, 88; Verčík, *Die barbarischen Einflüsse,* 46, 52, 57–69.

19 Marek Verčík, "Waffenschmiede und Waffenherstellung in der antiken Vasenmalerei", (Weaponsmiths and Weapon-smithing in ancient Vase Painting), *Forschungen und Methoden vom Mittelraum bis zum Mitteleuropa, Anodos Supplementum* 5 (2010), 9.

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FIGURE 2 Two Greek kopides, fifth century (Metropolitan Museum cat. nos. 2001.543 and 2001.346). (Image Courtesy of the Metropolitan Museum of Art CC0)

FIGURE 3 Set of three falcatae from the fifth century excavated in southern Spain (British Museum cat. nos. 1890.8-10.1, 1890.9-18.1, and WG2426). All three display similar morphological characteristics, such as complicated fullers, robust blade ridges, riveted guards, and solid tangs (Image ©Trustees of the British Museum).

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FIGURE 4 Set of two falcatae from the fifth century excavated in southern Spain (British Museum cat. nos. 1890.8-10.2 and WG1954). Both display similar morphological characteristics, such as thin blades, tangs that have been welded to separate handles, and simple fullers (Image ©Trustees of the British Museum).

FIGURE 5 Set of two falcatae from the fifth century excavated in southern Spain (British Museum cat. nos. WG2427 and WG1955). Both display similar morphological characteristics, such as very wide blades, thin tangs, small handles, and simple fullers (Image ©Trustees of the British Museum).

to determine given the paucity of fully preserved extant examples[20] and the corrosion of most that have survived.

20 Holger Baitinger, *Die Angriffswaffen aus Olympia, Olympische Forschungen XXIX* (The Offensive Weapons from Olympia, Investigations on Olympia vol. 29) (Berlin, 2001), 80–93.

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TABLE 2 Contextual Data for *kopides* of Verčík's Types 3–5

Context	Region/Country of provenance	Site	Date	Type (Verčík cat. no.)
Grave	Pešter, M. Sjenica, Bosnia Herzegovina	Koštam, Tumulus 1	Mid-Late Archaic	3 (#34)
Grave	Hagios Georgios, N. Larisa, Greece	"Constantinos Nanoulis" field, Grave 2	Late Archaic	3 (#36)
Grave	Hagios Georgios, N. Larisa, Greece	"Constantinos Nanoulis" field, Grave 2	Late Archaic	3 (#37)
Grave	Rhodes, N. Dodekanesos, Greece	Ialysos	Late Archaic	3 (#39)
Grave	Sindos, N. Thessaloniki, Greece	Sindos Necropolis	Late Archaic	3 (#40)
Grave	Vergina, N. Imathia, Greece	Aigai Necropolis	Late Archaic	3 (#41)
Grave	Bayrakli, Izmir, Turkey	Mt. Sophylos, Tumulus	Late Archaic	4 (#44)
Grave	Čarakovo, E. Pijedor, Bosnia Herzegovina	Zecovi Fortress, grave 3	Late Archaic	4 (#45)
Grave	Sanski Most, E. Sanski Most, Bosnia Herzegovina	Sana Necropolis	5th Century	4 (#48)
Grave	Sanski Most, E. Sanski Most, Bosnia Herzegovina	Sana Necropolis	~5th Century	4 (#49)
Grave	Duvanlij, E. Plovdiv	Golemata Tumulus	5th Century	5 (#53)
Grave	Donja Toponica, E. Toplica, Bosnia Herzegovina	Necropolis	4th Century	5 (#56)
Grave	Lipnica, E. Vraca, Bulgaria	Starči krak	4th Century	5 (#58)
Grave	Prodromos, N. Thesprotia, Greece	G. Philippou field, grave mound	4th Century	5 (#59)
Grave	Vergina, N. Imathia, Greece	Aigai burial field	4th Century	5 (#60)
Grave	Beranci, E. Mogila, FYROM	Crkvište	4th-3rd Centuries	5 (#61)

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Sanctuary	Philia, N. Karditsa, Greece	Athena-Itonia Shrine, G 1963 section 1	Mid-Late Archaic	3 (#35)
Sanctuary	Olympia, N. Elis, Greece	SW district, H/M, Spring 78 SO	Late Archaic	3 (#38)
Sanctuary	Kalapodi, N Phthiotis, Greece	Sanctuary of Artemis and Apollo of Hyampolis	Classical	3 (#42)
Sanctuary	Kalapodi, N Phthiotis, Greece	Sanctuary to Artemis and Apollo of Hyampolis	4th Century	4 (#51)
Sanctuary	Dodona, N. Ioannina, Greece	Sanctuary of Zeus	4th Century	5 (#54)
Settlement	Berezan, E. Mykolajiv, Ukraine	Settlement find, NW part of room B, Pit no 79	Late Archaic	4 (#43)
Settlement	Olbia, E. Odessa, Ukraine	Settlement find, residential building	Late Archaic	4 (#46)
Settlement	Olbia, E. Odessa, Ukraine	Settlement find, residential building	Late Archaic	4 (#47)
Settlement	Donja Dolina, E. Bosanska Gradiška, Bosnia Herzegovina	Fortress-settlement find	4th Century	4 (#50)
Settlement	Donja Dolina, E. Bosanska Gradiška, Bosnia Herzegovina	Fortress-settlement find	4th Century	5 (#55)
Settlement	Gorica, E. Grude, Bosnia Herzegovina	Crematorium, settlement find	4th Century	5 (#57)
Unknown	Glamoč, E. Glamoč, Bosnia Herzegovina	F. Bulić field, single surface find	not datable	4 (#52)
Unknown	Unknown site, N. Chalkidike, Greece	Single, surface find	not datable	5 (#62)
Unknown	Štrpci, E. Štrpci, Bosnia Herzegovina	Surface find	not datable	5 (#63)

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Physical Evidence

Verčík's catalogue of extant examples of *kopides* indicates that the vast majority come from north of Greece, and those that are found in graves do not come from Greece at all (Table 2). The paucity of extant *kopides* from Greek contexts is not grounds for claiming that it was not a Greek weapon, however.

All across the Greek world, contemporaneous with the advent of the *aspis* and other elements of the hoplite panoply, such as the *xiphos* and the bronze helmet raised from a single sheet of bronze, the number of weapons found in Greek graves and sanctuaries drops dramatically, but remains the same in neighbouring cultures.[21] There are, for example, a great many spearheads and *xiphê* found in graves and sanctuaries from the Early Iron Age, but the number decreases significantly around the beginning of the seventh century such that there are very few by the fifth century.[22] The initial deployment of hoplite equipment in the Greek cultural world is thus one of the more significant events in the Archaic archaeological record.[23]

Why did this profound change in depositional practices occur? Finding an appropriate answer to that question would, in itself, take a great deal of effort and time to fully explore, but in the opinion of this author, the nature of hoplite combat is the cause.[24]

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21 Baitinger, *Angriffswaffen*, 90–93. See also John Carter, *The Necropoleis*: *Vol. II: The Chora of Metaponto* (Austin, 1998); Elizabeth Gebhard and Frederick Hemans, "University of Chicago Excavations at Isthmia, 1989: I", *Hesperia* 61 (1) (1992), 1–77; Elizabeth Gebhard and Frederick Hemans "University of Chicago Excavations at Isthmia, 1989: II", *Hesperia* 67 (1) (1998), 1–66; Elizabeth Gebhard, Frederick Hemans, and John Hayes, "University of Chicago Excavations at Isthmia, 1989: III", *Hesperia* 67 (2) (1998), 405–456; Imma Kilian-Dirlmeier, *Kleinfunde aus dem Athena Itonia-Heiligtum bei Philia* (*Thessalien*) (Small Finds from the Sanctuary of Athena Itonia at Philia (Thessaly)) (Mainz, 2002); Claudia Lang-Auinger, *Forschungen in Ephesos* (Ephesos Studies) (Vienna, 2003); Claire Lyons, *The Archaic Cemeteries, Vol. V, Morgantina Studies* (Princeton NJ, 1996); Hans-Otto Schmitt, "Die Angriffswaffen", (The Offensive Weaponry) in *Kalapodi II* (Mainz am Rhein, 2007), 423–526; Photeini Zapheiropoulou, *Paros,* (Athens, 1998).

22 Kilian-Dirlmeier, *Kleinfunde*, 8, 87, 142–147, Taf. 2, 87. An exception to the lack of weapons seems to be shortened, non-combat versions of the *kopis* usually called *enkheiridia* or *makhairidia* identified as sacrificial knives in the case of the sanctuary of Athena-Itonia at Philia in Thessaly.

23 The presence of Greek weapons in sanctuaries and graves is a contrary ethnic litmus test. If there is an abundance of Greek weapons from the hoplite period in a settlement's graves, it is a strong indication that the people buried there are *not* Greek. See Carter, *Necropoleis*, 824; Lyons, *Archaic Cemeteries*, 109.

24 This is a classic example of the change of an artefactual class from a prestige item to a common one. For example, armour such as that of the Argos Panoply grave of

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Armour and weapons were expensive, and most hoplites were not wealthy men. It is likely that more often than not in hoplite families, weapons and armour were passed from one generation to the next, being repaired rather than replaced when necessary so as not to render the hoplite's *oikos*, his household, destitute. With the arrival of massed combat (in wars between *poleis*) at close quarters (with the heavy armour, thrusting spears, and short swords of hoplite warfare) came an increased desire for heavy protection, and the deposition of any set of armour in a grave or at a sanctuary by an individual would have been wasteful. Swords, more than any other offensive weapon, require a great deal of time and skill to craft well. Spears required less, and arrowheads even less. Tellingly, there are more arrowheads than spearheads, and more spearheads than swords deposited in both graves and sanctuaries, indicating that the level of skill, the expense, and the amount of material required to create weapons dictated whether they were removed from circulation and deposited in graves or dedicated in sanctuaries.[25]

The problem of the lack of weapons found at sanctuaries is of a different kind. The economic argument that applied to a single hoplite's household does not apply to the scale of wealth that a *polis* like Athens, Korinth, or Sparta could draw on. Dedicating a few swords is not a significant sacrifice for a large community. Rather, for sanctuaries, the problem is most likely that whatever the number of swords deposited, few survive.

One possibility is that few swords were deposited in sanctuaries in the first place. Individuals were unlikely to dedicate weapons and armour for the economic reasons outlined above. Starting in the mid-seventh century, communal dedications at sanctuaries consisted primarily of treasuries and statues, with *tropaia* and weapons as a small but significant minority.[26] Sculptures and sculptural groups in bronze and stone dedicated at sanctuaries would have been on public display and would certainly have made a strong statement of a community's wealth, power, and prestige. Trophies were easier to create than bronze statues or statue groups, and thus may have been viewed as less valuable dedications. Since representatives from all major Greek communities would come to these panhellenic sanctuaries, grand public monuments would make a more impressive statement than weapons.

A second possible reason for the lack of weapons from sanctuaries is that despite however many were deposited, few survived. A tenth (*dekatê*) of captured arms could have been a fitting tribute to dedicate at a sanctuary after a

725–700 BC went from a marker of high status to a mass-consumed, but still valuable, class of items.

25 Baitinger, *Die Angriffswaffen*, 85.

26 Baitinger, *Die Angriffswaffen*, 82–86.

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TABLE 3 Measurements of the British Museum *falcatae* taken by the author, along with the measurements of the commissioned replica *kopis*.

Sword	Length (total)	Length (blade)	Max. Width	Weight	Center of Percussion	Point of Balance
1890.8-10.1	575mm	460mm	57.0mm	654.8g	290mm from guard	130mm from guard
1890.8-10.2	590mm	465mm	52.1mm	500.4g	280mm from guard	140mm from guard
1890.9-18.1	540mm	440mm	51.4mm	580.0g	290mm from guard	140mm from guard
1882.4-24.1	585mm	475mm	52.6mm	565.0g	295mm from guard	Impossible to determine
WG 2427	565mm	460mm	54.2mm	381.3g	290mm from guard	160mm from guard
WG 2426	570mm	470mm	56.3mm	630.2g	285mm from guard	130mm from guard
WG 1955	595mm	505mm	54.0mm	630.8g	305mm from guard	155mm from (missing) guard
WG 1954	540mm	430mm	20.4mm	401.5g	290mm from guard	165mm from (missing) guard
Commissioned Replica	570mm	461mm	50.4mm	943.5g*	290mm from guard	105mm from guard

*The extra weight of the test sword requires explanation. The *falcata* I examined were corroded and pitted, which would reduce the weight of a metal object by a noticeable-to-significant amount depending on the extent of the damage. Several were damaged and were missing all or parts of their hilts, in addition to the universal lack of handles, which would have been made of perishable material. Taking all of these factors into account, I do not think it would be out of the question to state that the average *kopis/falcata* could have weighed between 800–900 grams. The difficulty inherent in forging such a complicated blade presented challenges to Mr. Morrow, and he did an admirable job in keeping the weight of the replica as low as he did. This may be a little bit heavier than ancient examples, but only because its back edge ridge is thicker, and therefore the blade itself is more robust, making it ideal for repeated testing. Furthermore, the point of balance on the replica *kopis* was shifted toward the hilt by a slightly thickened back edge ridge and the existence of perishable handle material.

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victory. These arms and armour would either have been placed in the open air (where they would have corroded rapidly) or stored in temples or treasuries. The contents of temples and treasuries at sanctuary sites would have been extremely valuable, and therefore subject to large-scale looting, either in periods of disturbance (such as the Third Sacred War) or in post-antique depredations that continued for centuries.[27]

Due in part to the paucity of extant, well-preserved examples of *kopides* from Greek sites, the evidence from non-Greek sites assumes greater significance. An enormously important piece of physical evidence for the *kopis* is the strikingly similar sword type from Iron Age Celtiberian Spain known in Latin as the *falcata*.[28] This sword is identical in design to the *kopis*, indicating either a Greek origin, a Celtiberian origin, or that both the Celtiberian *falcata* and the Greek *kopis* had the same ancestor (Figures 3–5). In October 2015, I travelled to the British Museum to examine a set of eight fifth-century *falcatae* excavated from the Iberian peninsula (Figures 3–5). I handled, measured, and weighed each in detail, recording all relevant information, such as the location of the point of balance, the length, thickness, width, and condition of the blade.

I have assembled four tables that describe the *kopides* surveyed for Verčík's 2011 book, as well as my own personal measurements of the eight *falcatae* in the British Museum (Tables 1–4; Figures 3–5). It is clear that the *falcatae* fall well within the parameters established for *kopides* of Types 3 and 4. I was unable to handle, measure, or find measurements of a set of two *kopides* in the Metropolitan Museum in New York, but visual inspection indicated these weapons to be highly similar to British Museum's *falcatae* (Figure 2).

27 The word *kopis* does not occur in the temple inventories of the *Inscriptiones Graecae,* which is not unexpected. It became a weapon worth dedicating only around 550 BC, around a century after votive deposition of weapons began to taper off precipitously. That being said, IG II^2 1388, the temple inventory for the mid-sixth century Peisistratid temple of Athena on the Athenian acropolis (known commonly in modern scholarship as the 'Hekatompedon') records one *makhaira* with an ivory scabbard dedicated to Zeus. The majority of inventory is comprised of a very large number of crowns, '*stephanoi*', wine mixing vessels, '*kratêres*', statuettes of Athena, '*Palladia*', other assorted goods in precious metals, and a single cuirass, '*thôrax*'. A similar inscription, IG II^2 1423, also from the Hekatompedon, records one iron *makhaira* with an ivory scabbard, perhaps the same sword.

28 Plural '*falcatae*'. For an in-depth analysis of the *falcata* in its Celtiberian context, consult Fernando Quesada Sanz, *El armamento ibérico: studio tipológico, geográfico, funcional, social, y simbólico de las armas en la cultura ibérica* (*siglos VI-I a.C.*) (Iberian Weaponry: A Typological, Geographic, Functional, Social, and Symbolic Study of Weapons in Iberian Culture, 6th-1st centuries BC) (USA, 1997).

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There were three distinct morphological groups in the *falcatae* I examined in the British Museum. The first and most plentiful group, demonstrated by weapons 1890.8-10.1, 1890.9-18.1, 1890.4-24.1, and WG2426, all have wide blades and guards comprised of two bracing pieces riveted and welded on to the tang (Figure 3; Tables 3 and 4). This first groups' measurements correspond exactly to Verčík Type 4 *kopides*. The two *kopides* from the Metropolitan Museum, cat. nos. 2001.543 and 2001.346, also appear to be Type 4, due to their striking similarity with this group of *falcatae*. This suggests that the smith(s) making this group of *falcatae* had strong connections with the Greek world (Figure 2). The second group of *falcatae*, comprising weapons 1890,8-10.2 and WG1954, are thinner and narrower than the other swords, with handles welded and riveted onto the tang separately (Figure 4; Tables 3 and 4). These correspond to Verčík Type 3. *Falcatae* in the third group, weapons WG2427 and WG1955, have the broadest blades, thin blade ridges, and solid guards integrated into the tangs (Figure 5; Tables 3 and 4). This third type is either a Verčík Type 4 or a transitional style in between Types 3 and 4.[29]

I will not investigate the origin of the *falcata*, or the possible functional differences these three forms display in the ancient Iberian peninsula: this article deals with the specific uses of the Greek *kopis* in its fully developed fifth-century form in Greek warfare, not its origins nor its connections with typologically related swords.[30] In any case, trying to determine an origin from a very limited sample size, much of which is heavily corroded and poorly documented, would be almost impossible.

29 The *falcatae* in the British Museum are more standardised than Verčík's *kopides*, which could reflect more specific temporal and geographic concentration of the *falcatae* compared to those of the *kopides*. All eight of the *falcatae* were recovered from the same context type (warrior grave of the fifth century) around Córdoba and Almedinilla, whereas the *kopides* Verčík examined come from different contexts, places, and time periods. To expect the same degree of homogeneity of Verčík's *kopides* versus the *falcatae* in the British Museum is unrealistic.

30 Marek Verčík, "Die griechische Bewaffnung im Lichte des kulturellen Austausches", (Greek Weaponry in light of Cultural Exchanges), *Anodos 10* (2010), 321–334. Quesada Sanz, Connolly, and Verčík have all sought the origin of this weapon. One of the most compelling theories states that the blade form originated as a butcher's knife or a sacrificial knife somewhere along the Adriatic coast in either the Balkan peninsula or the Italian peninsula in the eighth or seventh centuries. Machetes and butchers' cleavers today are both forward curving, allowing them to chop through thick material with relative ease. However, the addition of the quillon to the guard, and thus the blade form's transformation into a weapon of war, occurred in the sixth century in the Greek world.

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TABLE 4 Dimensions of the *kopides* from Verčík's catalogue compared with the corresponding measurements of the British Museum *falcatae* and the commissioned replica *kopis*.

Swords (Types 3 and 4)	**Total Length (cm)**	**Max. Width (cm)**	**Grip Width (cm)**
V* 34 (3)	<17>	<2>	Ø
V 35 (3)	<44>	<4>	3
V 36 (3)	52	8	Ø
V 37 (3)	<49>	<6>	Ø
V 38 (3)	58	7	4
V 39 (3)	50	6	3
V 40 (3)	45	5	3
V 41 (3)	54.8	6	4
V 42 (3)	<22>	<5>	<3>
V 43 (4)	<27>	<3>	Ø
V 44 (4)	60	5	3
V 45 (4)	<24>	<4>	Ø
V 46 (4)	Ø	Ø	Ø
V 47 (4)	<40>	<4>	<2.5>
V 48 (4)	<22>	<4>	<3>
V 49 (4)	51	4	3
V 50 (4)	<44>	<4>	<2>
V 51 (4)	<43>	<5>	<4>
V 52 (4)	<32>	<4>	<2>
BM 1890.8-10.1	57.5	5.7	3
BM 1890.8-10.2	59	5.2	2.6
BM 1890.9-18.1	54	5.1	2.5
BM 1882.4-24.1	58.5	5.3	2.5
BM WG 2427	56.5	5.4	2.4
BM WG 2426	57	5.6	2.4
BM WG 1955	59.5	5.4	2.5
BM WG 1954	54	2	2.3
Commissioned Replica	57	5	2.4

*V stands for Verčík catalogue

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Representational Evidence

Catherine Parnell of University College Dublin has worked extensively on representations of the *kopis* with a particular emphasis on depictions on black- and red-figure pottery.[31] She analysed 125 depictions of the sword type, the overwhelming majority on Athenian red-figure vessels, with an eye to the ethnicity, appearance, and actions of the wielder. Most wielders of weapons identifiable as *kopides* are Greek, not foreign nor any mythological race like the Amazons or Giants. The majority of wielders are warriors, often wearing other elements of the hoplite panoply or holding an *aspis*. These *kopis*-wielding warriors are universally infantrymen, regardless of ethnicity.[32] They are usually represented about to strike their opponent with an overhead blow, their right arms raised and the *kopides* poised menacingly behind their heads.[33] Such an arm position would be an ideal place to start a hack at an enemy's head, shoulder, collarbone, or arm (Figures 6–9 here).[34] This position is found in other media as well, such as the Lion Hunt mosaic at Pella (Figure 10 here). Parnell concludes, compellingly, that the *kopis* was a thoroughly Greek weapon, and was used in infantry combat by men armed as hoplites.[35] Parnell's work also suggests that the Greek considered the *kopis* to be a weapon that lent itself best to downward, heavy blows.

Experimental Evidence

Based on my measurements of the British Museum *falcatae*, my observations of the Metropolitan *kopides*, and the data from Verčík's book, I created an average set of dimensions for a Type 4 *kopis*. I then contacted a local blacksmith who requested his name not be published to commission a *kopis* replica according

31 Catherine Parnell, "Portrayals and Perceptions: Greek Curved Blades in Black- and Red-Figure Iconography", *Journal of Conflict Archaeology* 8 (1) (2013), 3–21, Table 2.

32 Parnell, "Portrayals," 4–17.

33 Parnell, "Portrayals," 16, 17; Figure 10.

34 The *kopis* became a weapon around 550 when its hilt gained a guard (Type 3). It is also around this time that the red-figure technique and its Athenian innovators became dominant in the Greek ceramic record. Thus, there was little chance for the forward-curving *kopis* to be represented in the black-figure technique in military context. Those few examples are discussed in Catherine Parnell, "Curved Blades in Ancient Greece", Ph.D. diss. (University College Dublin, 2013); Parnell, "Portrayals."

35 Despite the prevalent myth in the scholarly community of a 'barbarian' origin for the *kopis* (Verčík, *Die barbarischen Einflüsse*, 49–51).

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FIGURE 6 Fragment of a red-figure *loutrophoros* attributed to Hermonax, ca. 460, depicting a youth wearing a pilos helmet using a kopis in the starting position for an overhand cut. The crosshatched section behind the youth seems to be the shield of another warrior (Parnell 2013a, 15). ARV^2 488.81, CVA Deutschland 52, Tübingen 4 (1894) 28, pl. 8.1 Tübingen, Eberhard-Karls-Universität, Archäologisches Institut: S101624.

to these dimensions (Figure 11 here). This blacksmith specialises in historical methods of smithing ancient and pre-modern sword forms, from Roman *gladii* to Japanese *katana*. We decided to use a relatively low-carbon steel alloy with inclusions of silicon and chromium called 5160 spring steel. This blend is similar to the low-carbon weapons steel that the Greeks would have been able to smelt.[36] The blacksmith hand-forged this *kopis* and sharpened it to combat effectiveness (Figure 12 here).[37] It is as close in form, weight, and material to an ancient *kopis* as possible without starting from scratch and smelting iron from Greek ore.

I then designed a program of experimental archaeology determine how the *kopis* would have been used. I had a series of questions: how was it held; which

36 Vagn Buchwald, *Iron and Steel in Ancient Times* (Copenhagen, 2005), 40; Maria Kostoglou, *Iron and Steel in Ancient Greece: Artefacts, Technology and social Change in Aegean Thrace from Classical to Roman Times* (Oxford, 2008), 18.

37 Thomas O. Rover, "*Kopis Forging*" (2016). Available at: <https://youtu.be/eJrQsiFqpsQ>

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FIGURE 7 Detail of a kylix of the Brygos Painter, ca. 480–475. This detail depicts the Iliouper-sis, with a draped and bearded Trojan (top left of the image, below the handle), falling while raising a kopis in his right hand to defend himself against a fully armed and clothed hoplite with an aspis with a snake blazon who is about to strike at the Trojan with a kopis with a backhand cut. ARV² 369.1; Paris, Musée du Louvre G152; Roux 1964, 10.4 (Image Courtesy of the Musée du Louvre, Dist. RMN-Grand Palais / Les frères Chuzeville / Art Resource, NY).

of the three types of strikes – stab, slash, and hack – was it designed to perform; how was it used in conjunction with a shield; how effective was it against flesh; how effective was it against non-flesh targets. Using this list as a guideline, I performed seven tests.[38] I videotaped the important segments of these tests and have included YouTube links to these videos in the bibliography.

38 As far as replicating the physicality and techniques of hoplites themselves, I am a fairly good substitute. By happy genetic coincidence, I am very similar in build and weight to an ancient Greek farmer. Based on a series of anatomical examinations of skeletal remains of ancient Greek citizen-farmers (the hoplite class) from the Archaic and Classical periods, the average ancient Greek male was roughly 162–165 cm tall and weighed about 60–65 kg (Kagan and Viggiano, "The Hoplite Debate", 166–167). I am exactly 166 cm tall, and at

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FIGURE 8 Kylix attributed to the Penthesilea painter, fifth century. The scene in the tondo depicts a heroically nude draped youth wearing a laurel crown and holding a bow and arrows in his left hand (Apollo?). Apollo wields a kopis in his right arm, which is raised behind his head in preparation for a backhand cut at an unarmed bearded man raising his right hand to ward off the oncoming stroke (München Museum antiker Kleinkunst 2689; Georges Roux, "Meurtre dans un Sanctuaire sur l'Amphore de Panagurište" [Murder at a Sanctuary on the Amphora of Panagurište] Antike Kunst 7 (1) (1964), pl. 10.5; Wikimedia Commons CC0).

The Hilt

In my first experiment, I determined the proper way to grip the sword.[39] The handle of the *kopis* swells at the guard and tapers at the opposite end. Historically, most sword handles are symmetrical, making the *kopis* highly unusual. In addition, the *kopis*' handle has a pointed swelling in the middle. This point divides the hand in between the third and fourth fingers, fastening all the

the time of writing weighed 68 kg. In addition, I fenced competitively for ten years and competed in gymnastics for eight years. I therefore have a rough analogue of the physical training and familiarity with fighting that hoplites would have received. In addition, like hoplites outside of Sparta (Plutarch, *Apophthegmata Lakônika* 216D.1), I am an amateur.

39 Rover, "*Kopis vs Xiphos*."

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FIGURE 9
Detail of the tondo of a kylix by the Triptolemos Painter, ca. 480–470. A hoplite on the right is using a kopis in a backhand cut to kill the fallen Persian on the left, who is wielding some sort of sabre, perhaps the Persian akinakês, in his right hand and a bow in his left. (Edinburgh Royal Scottish Museum inv. 1887.213, ARV^2 464.46) (Wikimedia Commons CC0).

FIGURE 10 Detail of the Lion Hunt Mosaic from Pella, fourth century (Pella Archaeological Museum). The weapon in this youth's hand has the characteristic forward curve, reinforced back edge ridge, hooked hilt, and single projecting quillon of a kopis. Note that the youth depicted here wields a kopis in a backhand stroke (Wikimedia Commons CC0).

fingers in their positions on the hilt so as to prevent them from slipping when gripping the hilt (Figures 1–5). A straight handle that does not taper at either end facilitates what is called the 'hammer grip', the natural grip of a hammer,

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FIGURE 11 The finished replica *kopis* (Author's photo).

FIGURE 12 The replica *kopis*, after three cycles of heating in the forge and hammering (Author's photo).

in which the haft of the hammer is perpendicular to the arm when clenched tightly in a fist (Figure 13 here). The *kopis*' unevenly tapering handle tilts the blade about thirty degrees away from perpendicular, with the blade and tip leaning away from the swordsman's body and shifts the hand position to that of a handshake-like grip, rather than the hammer grip.

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FIGURE 13 Left: hammer-grip on a straight-handled hammer. Right: handshake-grip caused by the tapering-handled *kopis* (Author's photo).

The Point of Balance and Centre of Percussion

Second, I determined the location of the point of balance, the point at which the weight of the sword on either side is even.[40] There is no way to determine this on a sword without holding it in one's own hand. I found the point of balance on all the *falcatae* and my replica *kopis* to be roughly 14cm from the guard, which in terms of swords of this length is relatively far from the guard.

Third, I found the *kopis*' centre of percussion, the point on the sword at which the swordsman can exert the maximum force of impact with the least amount of vibration.[41] This can also only be determined from holding the sword in one's hand, since in order to find it, one must tap an object with different sections of the blade until the 'sweet spot' where vibration is minimal is found.[42] The *kopis*' centre of percussion was forged on average about 29cm from the guard, at roughly two-thirds the blade length (Table 3). This location is also where the blade swells maximally, and thus the first part of the blade to make contact with the target. Since the sword is short and the point of balance is far from the guard, there is a lot of weight relative to blade length concentrated at the centre of percussion. It is worth noting that the great majority of use-wear on the *falcatae* in the British Museum was clustered around their centres of percussion, roughly two-thirds down the length of the blade (Figures 3–5).

Design Features

The *kopis'* design indicates that it was a hacking sword. The hilt forces the hand to adopt a handshake grip, tilting the blade forward. The forward curve of the

40 Rover, "*Kopis vs Xiphos*", 1min 23sec.

41 Rover, "*Kopis vs Xiphos*", 2min 53s.

42 Molloy, "Swords and Swordsmanship", 414.

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blade accentuates the forward tilt caused by the hilt, making the centre of percussion the first part of the blade to make contact with the target. The point of balance is so far from the guard that the weighting of the blade is concentrated on the centre of percussion. The combination of these factors greatly augments the amount of hacking force the wielder can exert. The additional thirty degrees of blade rotation caused by the *kopis'* handle would allow the cut to bite more deeply into the target. In its fifth-century version (Verčík Type 4), the *kopis* had a strong ridge on the unsharpened, non-cutting 'back' edge, reinforcing the whole blade for the stresses inherent to hacking strikes.[43]

These factors also indicate that the *kopis* was not primarily intended as a stabbing sword. Swords designed for stabbing usually have straight blades, since the efficacy of a stab depends on how deep the point can be driven into the target, and it is easier to force a straight sword through a target than a curved one. Due to the mechanics of the human wrist, swords that curve backwards can be used to stab in an underhand motion, but it is more difficult, and runs the risk of straining the attacker's wrist. It is very difficult to stab with a weapon that is uniformly forward-curving, like a sickle. The *kopis*' S-curved blade makes it easier to stab with than with a sickle. The handshake grip that the hilt forces the hand to take also reduces the risk of straining the wrist during the motion. Stabbing swords' points of balance are closer to the guard, whereas swords designed for either slashing or hacking have points of balance that are relatively closer to their tips.[44] The reason for this difference is that stabbing blades need to be light to grant the swordsman greater aiming control over the tip, and slashing and hacking blades need to have enough weight to cut through tough material.

Wielding the Kopis without a Shield

For the fourth test, I performed four basic strikes.[45] All strikes were downward, reflecting the types of strokes represented in the iconographic evidence. The first type of cut, which I will call the 'overhand' or 'straight' cut, starts with my arm behind my right shoulder, and swings it down across my body from my right to my left, at a slight angle to the vertical. The second type of cut, which I will call the 'backhand' or 'cross' cut, begins with my arm behind my right shoulder, and swings it down across my body from left to right. The third type of cut, which I will call the 'stepping' overhand/straight cut, has the same arm

43 Verčík, *Die barbarischen Einflüsse*, 58.

44 Rover, "*Kopis vs Xiphos.*"

45 Thomas O. Rover, "*Kopis Demonstration 1*", (2016). Available at: <https://youtu.be/zAzTIKwr__Q>.

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motion as the straight cut, but starts with the left leg forward and adds a step forward with the right leg. Similarly, the fourth type of cut, which I will call the 'stepping' backhand/cross cut, takes the same arm motion as the cross cut while stepping forward with the right leg.

Without the shield, the cuts were universally very easy. The sword is hefty without becoming unwieldy, so no matter what cut I performed it was easy to recover and reset to the initial stance. The stepping cuts felt more powerful, unsurprisingly, but after each cut it did take a small amount of time to regain my initial stance.

Wielding the Kopis with a Shield

Fifth, I performed the same series of cuts while holding a correctly sized and weighted replica *aspis*.[46] Any analysis of hoplite combat with any weapon must factor in the constant presence of the enormous *aspis*. This large shield would dictate that a hoplite's swordfighting stance would be primarily defensive. To use the shield effectively to block, he would have had to stand with his left leg forward, slightly bent, and his right leg behind at a slight angle, his right shoulder behind his left, his left shoulder behind the *aspis* (Figure 14 here). No matter how open the formation or how fit the hoplite, holding this shield would have slowed[47] the hoplite's footwork,[48] and would have restricted his range of motion. To thrust farthest with the spear or sword, he would have had to take a step forward with his back leg. To strike hardest with an overhand blow of the sword, he would have had to take that same step forward with his back right leg.

I noticed a marked difference in the four cuts while holding the shield. The overhand cuts were much more difficult to perform, since the shield's size and defensive position in front of my body impeded the cut as it descended. Keeping the shield where it was positioned would drastically reduce the strike's efficacy and removing the shield from its initial position would expose the wielder to great risk. However, the backhand cuts were totally unaffected. The shield, though large, did not impede me. The backhand cuts are the more useful type

46 Measurements for *aspides* provided by Henry Blyth, "The Structure of a Hoplite Shield in the Museo Gregoriano Etrusco", *Bolletino dei Monumenti, Musei e Gallerie Pontificie* 3, (1982), 5–22.

47 For an analysis of an armoured hoplite's ability to move quickly, consult Donlan and Thompson, "The Charge at Marathon" and Donlan and Thompson, "The Charge at Marathon Again."

48 For a discussion of the importance of complex footwork on hoplite battlefields, consult Brian Cook, "Footwork in Ancient Greek Swordsmanship", *Metropolitan Museum Journal* 24 (1989), 57.

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FIGURE 14
Hoplite fighting stance with *kopis* (Author's photo).

by an enormous margin, since efficacy is not compromised for safety. The iconography also indicates that the backhand was widely used, depicting the starting position of the backhand cut more often than the overhand (Figures 6–10).

Human Flesh Analogues

Sixth, I used the replica *kopis* to cut and stab flesh analogues. The two main materials I employed were ballistics gel and *tameshigiri* mats. Ballistics gel is a gelatinous compound which, when mixed with water in a 10% solution by volume, resembles human soft tissue and is used by firearms manufacturers and law enforcement officials to test a bullet's effectiveness.[49] *Tameshigiri*, literally 'test-cutting', is a Japanese practice used for testing the cutting power of samurai swords, and is widely replicated today for the experimental archaeological testing of replica swords.[50] Rolled-up rice straw bundles called *tatami* are soaked in water for several hours until they resemble the density and resilience of human muscle tissue, albeit in a general sense, since they do not account for the varying densities of soft tissue and bone.

49 Martin L. Fackler, "Wound Ballistics", *Journal of the American Medical Association* 259, (1988), 2730.

50 Molloy, "Swords and Swordsmanship", 414.

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The *kopis* replica hacks extremely effectively. It was very easy to hit the target on the centre of percussion, and the sword chopped through the *tatami* and the gel so easily that it felt as if I were cutting foam (Figure 15 here).[51] Even when I hit the wooden dowel holding the *tatami* mat in place, the sword bit deeply into the wood, suggesting that if a hack with the *kopis* did not immediately amputate an arm, it would probably shatter either the ulna, the radius, or both, and would cause a compound fracture of the humerus. Every strike would have either maimed or killed an opponent outright.

The blade's forward curve, combined with its forward tilt caused by the tapering handle made it impossible to perform a slash correctly.[52] When I tried to slash, drawing the length of the blade along the target without trying to force my way through it, the curve and weight of the blade would force the tip of the blade forward, pushing through the target in a hacking motion. I could not slash, no matter how hard I tried. Slashing cuts are designed to find gaps in armour and inflict bleeding wounds that do not kill outright. Hoplites were too completely protected by the shield to allow slashing cuts to reach the gaps in their armour. Better to hammer at their armour, their shield, and their arms with a more robust hacking weapon than to dart around the shield, since even if one cannot shatter the shield, the force of repeated heavy blows on that arm would exhaust and potentially break the arm behind it.[53]

The blade's S-curve and handshake grip allowed me to stab effectively. The blade penetrated deeply and did not get stuck in the *tatami* (Figure 16 here). I was also able to pierce the gel 12-15cm deep, which is more than enough to puncture vital organs in the groin, the abdomen or the heart in the ribcage (Figure 17 here). While not as easy to perform as a hacking cut, a stab with this sword into an unprotected area would thus have been fatal more often than not.

Cutting a Spearshaft

The seventh and final test I performed was a strike against a spearshaft. I took an ash staff nine feet long (roughly one and a half times my height)[54] and planed it down to a comfortable diameter for holding so as to create a reasonable analogue for the size and material of an ancient Greek spear. Then,

51 Thomas O. Rover, "*Kopis Demonstration 2*" (2016). Available at: <https://youtu.be/S6q_p10SROo?>.

52 Rover, "*Kopis vs Xiphos*", 11min 30s.

53 An interesting note is that slashing weapons among infantry are favoured in military cultures emphasizing duels, such as the samurai of Japan, or in those featuring primarily mounted warriors, such as the Mongols.

54 Cartledge, "Hoplites and Heroes", 15; Herodotos 5.49.3.

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FIGURE 15 Results of test cuts on the tatami mats. (Author's photos).

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FIGURE 16 Results of a stab into a tatami mat. Right: the replica kopis embedded in the tatami (Author's photos).

FIGURE 17 Results of a stab into ballistics gel (Author's photo).

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I tried to hack through it.[55] I was able to slice partially through the wood, and the chop splintered the ash along its grain, breaking off the end of the spear. Presumably, ancient spear-makers would have tried to avoid ash staves with internal weaknesses as much as possible. What this indicates is that hoplites with *kopides* were likely able to batter through spear-shafts, but that it would have been difficult to cleave it in half in a single blow. The force of the blow, however, would likely have loosened the opponent's single-handed grip on the spear.

Conclusions

The key question remains, 'how was this sword used'? The results of my research and my experimental archaeological program of tests conclude firmly that the *kopis* was a hacking sword useful only in close-order combat, and therefore that hoplites fought in the traditionalists' close-order formation. The hoplite panoply, the spear, the *aspis*, and both swords would have been unsuitable and dangerous to their users in open-order combat, whereas each element of the hoplite's kit, particularly the *kopis*, provides a tangible benefit in close-order combat.

If hoplites fought in open-order, they would have engaged in one-on-one duels, or in duels of pairs or trios. Duelling is a highly complex form of combat, requiring practiced technique, precise timing, stamina, speed, complicated footwork, and a creativity to expand on all the practiced movements in a combat situation. Throughout history, duelling has been the realm of the elite – Homer's heroes are not all that different from Mediæval samurai or Renaissance French aristocrats in terms of their wealth and status relative to the foot-soldiers who comprised their armies. These nobles could afford the training to become accomplished duellists in battlefield settings. Hoplites, however, were mostly farmers. They were not professional soldiers; they were not wealthy enough for trainers; they had to provide their own arms and armour and pay for the upkeep, which further reduced their wealth; and their *poleis*, other than Sparta, did not have a formal program of military training.[56] Without the skills necessary to duel proficiently, hoplites facing each other one-on-one would have had to resort to brute force to overcome their opponent, or rely on

55 Rover, "*Kopis Demonstration 2*", 3min 8s.

56 Anderson, "Hoplite Weapons", 30; Nicholas Sekunda, "Greek Swords and Swordsmanship", *Osprey Journal of Military History* 3 (2001), 34–42, 35.

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strength of numbers. This is not Homeric combat, nor is it viable with hoplite arms and armour.

The hoplite panoply would have been far too hot and heavy to allow for long bouts of duelling in the sweltering Greek summer. As Donlan and Thompson demonstrated in their experiments in 1976, fit, well-nourished modern-day athletes could not run for any extended period of time while carrying even part of the panoply.[57] Open-order warfare would require jogging, sprinting, and bursts of intense activity for long periods of time over the course of a day. No amount of training can make such activity feasible for anyone wearing 15-22kg of bronze and linen armour and carrying a 7-8kg shield.[58] Close-order combat would not be nearly as taxing, as there would be no extended periods of running or sprinting. The heat and the constant injunctions to push forward would have assuredly sapped the hoplites' strength, but not as suddenly or as completely as open-order combat would.

The hoplites' main offensive weapon, the spear, was unsuitable for duelling. A spear is a difficult weapon to wield under the best of circumstances (i.e. when both hands are free to grasp it). Hoplites used only one hand to control this heavy, nine-foot long weapon. Duelling would have required complex parrying and binding,[59] which would have been extremely difficult to perform using only one wrist for such a heavy spear. It is suited for a powerful thrust and quick jabs, not intricate motions. A spear in a hoplite duel would be so unwieldy that it would be almost suicidal to use one. A hoplite using his sword would be able to deflect the spearman's spear thrusts, close the gap between the two men to negate the spear's longer reach, and use his shorter sword when the spearman could not use his longer spear. In close-order, powerful thrusts at the opposing line would have been the ideal attack to employ, since it would have kept the pressure on the opposing line without compromising the safety

57 Donlan and Thompson, "The Charge at Marathon", 340–342.

58 Calculations of the weight of ancient armour are inevitably based on reconstruction. Weights of individual panoplies could differ greatly even within the same army (Schwartz, *Reinstating the Hoplite*, 97). The heaviest estimates of 32kg have been argued persuasively against by Krentz (*The Battle of Marathon*, 43–50). The weights above were calculated from the following sources: Donlan and Thompson, "The Charge at Marathon", 339; Cartledge, "Hoplites and Heroes", 20; Blyth, "Structure", 5–6; Krentz, *Marathon*, 45–50; Lee, "The Classical Greek Battle Experience", in *The Oxford Handbook of Warfare in the Classical World* (New York, 2012), 149; Jarva, "Arms and Armor of the Greeks", 397; Kagan and Viggiano, "The Hoplite Debate", 24; Schwartz, *Reinstating the Hoplite*, 93–97; Schwartz, "Large Weapons, Small Greeks", 160.

59 'Binding' is a duelling term that refers to the act of using one's own offensive weapon to force the opponent's weapon out of the way while simultaneously preparing to attack.

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of the attackers. Also, in close order, there would have been no need for the complicated motions required in a duel due to the overlapping presence of each hoplite's neighbours.

The *aspis* is ineffective for duelling, regardless of the offensive weapon used in conjunction. Its weight and size are liabilities in a duel. Duelling shields in other cultures are small and have one handle instead of two, allowing the duellist to use his arm movements to deflect incoming attacks much more quickly than he could with an immense *aspis*. The *aspis* only protects the front of the wielder and cannot be repositioned in the manner of a one-handled shield. The *porpax-antilabê* system fastened the *aspis* to the arm, which allowed it to be carried on the shoulder to lessen the weight on the hoplite's arm, but only in one position. The *aspis* cannot move as quickly or to as many positions as a duelling shield because it was not designed to do so – it was designed to sit in one place and take an enormous amount of punishment.[60] This type of shield design only works when used in close-order combat.

Both types of hoplite sword are ineffective for duelling. In addition to the numerous disadvantages of the *aspis* in a duel, both the *xiphos* and the *kopis* offer few benefits in a duel as opposed to a close-order formation. Hoplite swords are short, requiring that the hoplite manoeuvre very close to his opponent to circumvent the *aspis.* Even though the *aspis*' size is a disadvantage in a duel, these swords are so short that they cannot effectively capitalise on the disadvantage inherent to such a large shield.

Having handled and tested this sword, I am convinced that the *kopis* was intended for one purpose: to be a terrifyingly effective hacking sword. The design of both its hilt and its blade increase the potency of a hack and make the hack easier to perform effectively. The taper of the hilt causes the hand to rotate forward, increasing the force of impact on the centre of percussion. The bump in the middle of the handle anchors the hand in place, making this one hand position the only viable way to hold the weapon. The point of balance of the blade shifts the weight toward the tip, focusing more force onto the centre of percussion. The centre of percussion is located at the point of maximal blade width, and the first point of contact in a hack. The reinforced back edge ridge of the blade resists bending or breaking, allowing the swordsman to hammer at his opponent with great strength. The result of this design is that the *kopis* can hack through human soft tissue and can lop off arms without much difficulty and is robust enough to shatter bone without chipping or bending. The design of the sword does not allow a swordsman to slash, and the forward-curving shape of the blade and the tapering hilt makes stabbing an awkward,

60 Blyth, "Structure", 5–8.

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if possible, motion. The *kopis* was designed only to hack, and it does so with devastating power and ease.[61]

I have proved that overhand cuts using the *kopis*, both standing and stepping, would endanger the hoplite unnecessarily, since in order to perform one strong enough to damage the opponent, he must remove his shield from the front of his body, leaving him open and vulnerable. Stepping to increase the power of the cuts was ineffective, since it provided only marginal offensive benefit, while discarding the advantages of the original defensive position.

My experiments demonstrated that the backhand cuts were very effective at hacking human flesh analogues and did not leave the attacker vulnerable to counterattack. Using the *kopis*, a hoplite could strike the head, shoulders, and right arms of opponents in front of him and reasonably expect that he could kill, maim, or otherwise disable his opponent. In addition, he would not compromise his safety by displacing his own shield, allowing him to use his weapon with confidence that doing so would not get him killed. The *kopis* was therefore designed so that it could perform this one type of attack: a backhand hack from behind the *aspis* at a target in front of him.

This one type of attack only makes sense in the context of close-order combat. Though the backhand cut allows him to keep the *aspis* out in front to protect his chest, his flanks are left exposed – a problem exacerbated if he were to step forward while cutting or if his opponents could circle around him. In open-order combat as envisioned by the revisionists, the hoplite would be dangerously vulnerable, even despite all his armour. He cannot move the *aspis* quickly enough to block blows on his right side, and indeed it is unlikely he could see opponents directly to his left or his right while wearing the Korinthian helmet. A weapon system that can only do one type of motion is useless in a duel in an open-order formation. Furthermore, one motion that leaves multiple points of vulnerability unguarded is suicidal in open-order. In close-order, however, the hoplite can fight opponents in front of him (the only he would likely encounter) without displacing his shield, and he can kill his opponent without causing any lateral movement that would interfere with either man on his sides. Moreover, with comrades on both sides of him carrying large *aspides* that protect him as well, he is not vulnerable on his flanks while performing a backhand cut. Thus, every element of the hoplite panoply from his armour to his sword could only reasonably have been effective in traditionalist close-order combat.

The *xiphos* was the more popular of the two types of Greek sword, despite not being optimised for hoplite combat. This is unsurprising, since its shape

61 Rover, "*Kopis vs Xiphos*"*;* Rover, "*Kopis Demonstration 2*".

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evolves directly from the pre-hoplite Early Iron Age Naue II *Griffzungenschwert*.[62] Yet, the *kopis* is devastatingly effective at hacking, the type of strike that would have been most useful in close-order combat. Hacks are simple, require little training to master effectively and indeed the *kopis*' design not only accentuates the power of a hack, it makes it very easy to perform correctly. The *xiphos* lacks the technical features necessary to compete with the *kopis* in this regard – its blade and hilt are not specialised for hacking. Though its straight blade would have given it an advantage over the *kopis* in terms of stabbing, the *kopis* is capable of performing a fatal stab without difficulty. The *kopis* is a better sword for close-order combat, and thus a better hoplite sword.

If the *kopis* was so much better than the xiphos, why use the *xiphos* at all? The answer is simple economics: the *xiphos* has a longer lifespan. Its two edges would mean that as one edge got nicked, dented, and worn down by sharpening, the hoplite could switch to the other side without a significant decrease in effectiveness. The *kopis*, with its single edge, and ability to bring more of the swordsman's force down on the centre of percussion on that single edge would have worn its blade down sooner than it would that of the *xiphos*. This is evident on the *falcatae* I examined, which all have major damage to the blade at the centres of percussion (Figures 2–5). These blades would have required frequent sharpening to have been made effective again. This constant repair would have been expensive and would have thrown the complex weighting out of alignment, reducing the *kopis'* efficacy even further. It is telling that when the longer Type 5 *kopis* is invented in the fourth century, Xenophon recommends that cavalrymen use *kopides* instead of *xiphê*.[63] Cavalrymen, already wealthy enough to care for horses, would assuredly have been wealthy enough to afford to replace their *kopides.*

If I were a hoplite in ancient Greece and could afford either, I would choose the *kopis* over the *xiphos*. The specialised design of its hilt and blade would have made it much more effective at hacking at arms, legs, and shoulders, and its robust form would have allowed the hoplite to batter through shields, chop through spear shafts, concuss opponents even through bronze helmets, and either cut through *linothôrakes* or shatter collarbones beneath any cuirass.[64] One can swing the *kopis* harder without fear of bending or breaking, and it could bring more of this force to bear on the centre of percussion. If I were

62 Snodgrass, *Arms and Armour*, 56.

63 Xenophon, *Peri Hippikês,* 12.11-12.

64 For a detailed analysis of the durability of linen armour, consult Gregory Aldrete, Scott Bartell, and Alicia Aldrete, *Reconstructing Ancient Linen Body Armor: Unraveling the Linothorax Mystery* (Baltimore MD, 2013).

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to fight in a duel, I would choose a longer, lighter weapon with the point of balance closer to the hilt. Also, as a hoplite I would not have had a great deal of formalised military training, and the *kopis* in close-order does not require any advanced technique. To use it correctly, one must perform a single type of strike while keeping the shield in front of him. The *kopis* is the perfect hoplite sword, and hoplite combat only works in close-order formation.

Suggestions for Future Scholarship

I think it would be valuable to test the *kopis* against other reconstructed ancient arms and armour. I believe it would be important recreate an *aspis* according to ancient methods, sheath it in bronze, raise a Korinthian helmet, make a *linothôrax*, and see what kind of damage the *kopis* can inflict on this equipment. Can it batter through a shield? What kinds of forces can it exert on the skull below the helmet? Is the *linothôrax* an effective defensive barrier for a hacking strike? These are some of the questions that remain unanswered.

There is still ground to explore within representational evidence of hoplite warfare. Cawkwell stated a potentially important observation in his analysis of black- and red-figure depictions of hoplites in combat: the vast majority of depictions of hoplite spears lack *saurôtêres*.[65] This could be due to the painters' decisions not to represent the less important end of the spear as accurately as possible, or it could reflect a general lack of *saurôtêres*. Lacking a *saurôtêr,* the spear's weight would shift toward the tip, making it lighter overall, though unbalanced. This has profound implications for how the hoplite would have used the weapon, and this question demands further examination. It would be fascinating as well to examine the differing depictions of *kopides* versus *xiphê* in the representational record. Were Greeks representing the swords performing different types of cuts? Were the depictions of swords being used indicative of how to evaluate of the warrior wielding them?

One important point to clear up is the term 'cut-and-thrust' sword. This term is used to describe swords from throughout the ancient period, but nowhere more often than the Naue II sword. This term is reductive. First, 'cut' elides the key differences that distinguish a slash from a hack, and in so doing would lump a Persian *shamshir* along with a *kopis* as identical in use, when in fact nothing could be farther from the truth. Second, all swords can both 'cut' and 'thrust,' with widely varying degrees of efficacy due to their shapes. A term I would suggest as a replacement for this outdated phrase would be 'all-purpose

65 Cawkwell, "Orthodoxy", 381.

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sword.' The aspects of the Naue II and the *xiphos* that 'cut-and-thrust' sought to highlight were their ability to triple as serviceable stabbers, slashers, and hackers without specializing in any one of the three blade strokes.

No study like this one has ever been devoted to the *xiphos* or any recreation of the *dory*. I believe that the value of experimentation and employing reproductions cannot be overstated. Little more can be said than has already been said, argued, disproved, proved and restated on the basis of surviving iconographic and literary sources, so all that remains for exploration is the experimental archaeological avenue. Recreations of *kopides*, *xiphê*, *dorata*, and *aspides* should be tested against one another to see how effective they all are in context. That being said, there has also never been a full lexicographic study of Greek warfare that examines all authors and deals with all evidence and portrayals of combat.

A thorough comparison of ancient Greek warfare and Celtiberian warfare is warranted as well. In what situations was the *falcata* used? Did the smaller, lighter shields of the Celtiberians allow the *falcata* to be used as a duelling sword or as a sword for open-order combat when in Greece, the *aspis* required it to work as a close-order hacking tool?

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