Naukratis: Greeks in Egypt

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http://www.britishmuseum.org/naukratis

Tools and weapons

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1. Introduction

Weapons and tools were a major area of interest for Petrie, the discoverer of Naukratis.¹ His interest was perhaps sparked when in 1884–5 he discovered large quantities of iron tools and slag at Naukratis, within what he believed to be an industrial metal working area within stratigraphically early layers Petrie dated to the 6th century BC.² This led him to argue that this was proof of iron manufacture at Naukratis and evidence ‘that this was a great centre of the iron trade, if not indeed the principal source of manufactured iron to the Greeks of the sixth century’.³ Whilst subsequent discoveries have revealed iron tools in Egypt from earlier periods (for example the 666BC Assyrian workshop at Thebes),⁴ that some dating may be revised, and that some of this collection have since been lost or lost their provenance (see below), the Naukratis assemblage still represents a significant group of Late Period to Roman weapons and tools.

Other finds groups covered in other Naukratis chapters represent overwhelmingly religious and ritual practices and beliefs (figurines, lamps, inscriptions, temple architecture) or the trade that took place in Naukratis (pottery, figurines). Tools and weapons overwhelmingly, but not exclusively, represent the secular activities undertaken as part of peoples’ vocations or in their (limited) spare time. Nevertheless it is difficult to separate secular from religious activities in these communities as we will see; many apparently functional objects, such as arrow-heads, can also be used within a religious context.

Tools and weapons comprise many aspects of the daily life of the inhabitants of Naukratis. They provide us with the picture of an active and productive port city that was at times a centre of innovation, which contained a diverse population where various skills, crafts and technologies were used. However, the objects discussed here do not lend themselves to a general conclusion, but are instead treated below as the following self-contained groups: weapons and armour; missiles; tools; kiln furniture; games and maritime artefacts. Whilst this chapter comprises a disparate group of objects that do not always enable comprehensive interpretation, certain artefact groups that often receive limited attention, such as the fishing and sailing equipment, have here been singled out for wider comment and analysis. It is fitting that this chapter closes with a detailed discussion of the maritime artefacts, considering the primary role of Naukratis as a port.

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¹ Petrie 1917. All images are © Trustees of the British Museum, unless otherwise indicated.
² Petrie 1886, 39. Levels 320–330 corresponds to the Scarab Factory (ibid., 39, 87–9), dated c. 600–570 BC and associated with 6th-century BC pottery (ibid., 20–3). Although some of the objects were excavated and their levels measured by Petrie, others were sold to him and the early context assumed on the basis of reports by the finders: ‘they were always described to me by the Arab finders as coming from the low strata of the town’ (ibid., 39), which probably introduced contamination to this otherwise early group.
³ Petrie 1886, 39, pl. XI.
⁴ Petrie 1917.
2. Weapons and armour

With the exception of missiles, only a very small number of weapons were found at Naukratis, and no certain examples of armour can be confirmed as coming from there. Many ‘weapons’ may instead represent tools (such as ‘lances’, spears, axes and knives), whilst others were found in sanctuaries suggesting that they were used as votives in a ritual context. For this reason there is little evidence of mercenary or military activity at Naukratis. This is in stark contrast with Tell Dafana, where armour and weapons were found in relative abundance. However, many objects from Naukratis and Tell Dafana were conflated, confused, or lost their provenance. This probably occurred before distribution by the Egypt Exploration Fund and then again subsequently within Petrie’s private collection (currently in the Petrie Museum), when Petrie worked on his ‘Tools and Weapons’ monograph in 1916.

A single Corinthian bronze helmet (Fig. 2) within the collection of the Royal Museum of Art and History, Brussels, acquired in Egypt for 115 French francs, was given a Naukratis provenance. The helmet is broken with the right side and top missing. Hammered details are visible around the edge consisting of single dots, incised palmette and lotus decoration on the forehead and hammered eyebrows. Close parallels include a Western Greek Corinthian bronze helmet found in Puglia dated to c. 510 BC, and numerous examples dedicated in Olympia in c. 600–550 BC. If this object was indeed found in Egypt, Naukratis is a possible origin, although not the only one as foreign mercenary garrisons in Egyptian forts have also produced Greek material of this period and a later Chalcidian type helmet was discovered in Thonis-Heracleion.

Some tools that were presumably used as weapons comprise a sword (Fig. 1), eight blade fragments (presumably daggers or knives, Fig. 3), six socketed spear-heads (Fig. 4), and three axes (Fig. 5). One of the ‘knife’ fragments was found within the floor deposit from the temple of Aphrodite (Context Φ1), laid down during the 6th century BC, and covered by subsequent construction in c. 500 BC. Other blade fragments from the first season at Naukratis were recorded in Museum registers as coming

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5. Leclère and Spencer 2014, 46.
8. Walters 1899, no. 2838; British Museum, 1865.0722.1.
10. For example Tell Dafana (Leclère and Spencer 2014, pls 25 and 26 for weapons and armour) and Tell el-Herr (Marchi 2014, 111–12).
12. Petrie 1886, pl. XI.1 is not located. Possibly one of the iron blade fragments within the Egyptian Museum, Cairo (JE26773.2 or JE26773.1) as Petrie records in a letter entitled ‘Articles retained at Bulaq’ (Cairo), dated 8/6/1885, an object described as ‘1 shard of iron sword’ (letter retained in the EES archive reference PMA/WFP1/D/1/1.1).
13. Egyptian Museum, Cairo, JE26773.2; JE26773.1; Petrie 1886, 39, pl. XI.7; Museum of Fine Arts, Boston, 86.352; Eg.Inv.1349; Redpath Museum, Montreal, 2527.02; 2527.01; Bolton Museum, 1886.31.73.a.
14. Petrie 1886, 39, pl. XI.1, pl. XI.27; Petrie Museum, London, UC59877a; Redpath Museum, Montreal, 2525a; Fitzwilliam Museum, Cambridge, GR.73.1887; Ashmolean Museum, Oxford, AN1886.529; AN1886.527; AN1886.531.
17. Egyptian Museum, Cairo, JE26773.2; JE26773.1.
from the ‘first Greek period’. Presumably this is a reference to Petrie’s 6th century BC Naukratis Town contexts where many iron tools were found, such as one of the axes\(^\text{18}\) and other tools discussed below. Fragments of worked bone handles, which probably came from knives, were found in the sanctuary of Apollo.\(^\text{19}\)

The axes found are all of socketed types (Fig. 5). Petrie interpreted the iron work at Naukratis as being locally produced in the 6th century BC and socketed axes specifically as a technology imported into Egypt in c. 600 BC, as one example was found in a 6th-century context at Naukratis.\(^\text{20}\) However, socketed axes are a very long-lived form that continued to be used in Egypt well into the Roman Period.\(^\text{21}\) Collectively, it is unlikely that any of these objects, apart from the sword, represent weapons of war, as the most likely explanation for their presence at Naukratis is as tools relating to everyday practices, crafts and ritual activity. However, some of the tools may have been dedicated only after (a secondary use) a period of use as a weapon.

3. Missiles

The largest single group of weapons found at Naukratis is a group of 88 arrow-heads. To this group of missiles we can add three sling bullets (assuming the poorly preserved spear head fragments were not from throwing spears). It is possible that an unknown proportion of these arrow-heads were never fired in battle, with a number of examples reportedly being found in the Sanctuary of Apollo. Instead, some of these may represent votives, a practice well documented from other Greek sanctuaries.\(^\text{22}\) Despite their use, or secondary use, as votives, they were all usable and represent the full range and variety of forms developed over the period that Naukratis was inhabited.

These varied forms belong to a number of different cultural and military innovations that took place during the 7th century BC to the 1st century AD in response to changing battlefield conditions. The arrow-heads can be divided into five broadly chronological groups: firstly traditional Egyptian leaf-shaped tanged arrow-heads that were rapidly replaced during the Saite period by the second group, leaf-shaped socketed types of East Greek design and a local Saite variant. Thirdly; the introduction of the well-known ‘Scythian’ type, a trefoil (triangular) section socketed arrow-head that became particularly important during the 6th century BC, extending into the Hellenistic period with several variants and innovations over this long period. A fourth group was found in smaller numbers, but is broadly contemporary to the ‘Scythian’ type. It is a heavy double-bladed, tanged form of Greek origin that was introduced at the end of the 6th century BC and used well into the Hellenistic period. The fifth group represents a major technical innovation during the Roman period, with the introduction of

\(^{18}\) Petrie 1886, 39, pl. XI.25.
\(^{19}\) Bristol Museum and Art Gallery, H1374; British Museum, 1965,0930.961.
\(^{20}\) Petrie 1886, 39, pl. XI; Petrie 1917, pl. IX, O. 19.
\(^{21}\) Petrie 1917, 11, pl. IX, O. 20; pl. XIII, O. 31–2.
\(^{22}\) Baitinger 2001.
tanged and barbed trefoil iron arrow-heads. However, these Roman arrow-heads were very rare at Naukratis.

3.1 Leaf-shaped tanged arrow-heads

Leaf-shaped (oblanceolate) tanged arrow-heads (Fig. 6) belong to a 7th century BC Egyptian form known from Tell Dafana and from Ashkelon, Israel, which developed out of New Kingdom types. It is an Egyptian form not found in Greece, or the Middle East. These are exceptionally rare at Naukratis, as this type was in the process of being replaced by innovations in arrow-head design adopted in the Eastern Mediterranean during the 7th and 6th centuries BC, resulting in the large scale adoption of Scythian forms from the 6th century BC.

3.2 Leaf-shaped socketed arrow-heads

Oval leaf-shaped, socketed (Fig. 7) and barbed (Fig. 8) arrow-heads originated in Anatolia and the Ionian cities of western Turkey and were in use in the Greek world during the second half of the 7th to the early 5th centuries BC, although the examples from Naukratis probably date between the late 7th and the mid-6th centuries BC. They come in two variants, either without, or occasionally with a barb or spur. Parallels from the mid-7th to 5th centuries BC have been found at Olympia, the battle field of Marathon (490 BC), and the Egyptian forts (and associated settlements) at Tell Dafana, Tell el-Kedwa and Tell el-Herr.

Egyptian tapering leaf-shaped, long-socketed arrow-heads (Fig. 9) with a mid-rib are well known from Saite late 7th- and 6th-century BC contexts in Egypt. The socket attachment and mid-rib appear to have been influenced by the Anatolian or Ionian forms discussed above, although the form of the blade is longer than these East Greek ‘imports’. Petrie describes this type as distinctive of the 26th dynasty in Egypt and not before, possibly being introduced from Asia.
3.3 Trefoil arrow-heads

Three-bladed (winged) trefoil (triangular) section, socketed arrow-heads are commonly known as ‘Scythian’ or ‘tribolate’ types. Socketed trilobate arrow-head types are common in the Middle East from the 7th century BC and subsequently in Greece and Egypt. Long shaft socket types (Fig. 10) are dated to the period between c. 600 BC and 480 or c. 458 BC. They were used by the Achaemenid Persians and Greeks, with parallels known for example, from Haliesis, Nemea, Delphi, Athens, Lindos, Samos, Smyrna and Dura-Europos. They have also been found in Egypt, notably the fort at Tell Dafana. The long shaft socket type is less common in the 5th century BC, and absent at Marathon (490 BC), by which time it had been replaced by shaft-less short socket pyramidal type.

The shaft-less short socket pyramidal types (Fig. 11) are known from Classical Olympia, tentatively dated to the 5th and early 4th centuries BC. This type is cited as evidence by Snodgrass of Persian archers at the battles of Marathon (490 BC) and Thermopylae (480 BC) and was subsequently adopted in Greece. Parallels are known from Egyptian border posts at Tell Dafana, Tell el-Herr and Tell el-Kedwa. This short...
type is abandoned during the course of the 4th century BC in favour of larger, longer and heavier arrow-heads.

Shaft-less short socket diamond-headed types (Figs 12–13) were developed by the Achaemenid Persians before 500 BC, and later adopted to become the most common form used in Greece during the 5th century BC. There are parallels from Marathon (490BC) and Olympia. There are also good parallels from Tell Dafana, Tell el-Kedwa and Tell el-Herr. This type was possibly still in circulation at the beginning of the Hellenistic period, although longer and heavier types became increasingly popular over the course of the 4th century BC.

Shaft-less short socketed long head types (Fig. 14) appear in the 5th century BC, but became increasingly popular over the course of the 4th century BC in Egypt, where parallels are known from garrisons at Aswan, Tell Dafana, Tell el-Herr and Tell el-Kedwa. The majority of examples of this variant can be dated to the (late) Achaemenid and early Hellenistic period.

Socketed ‘Scythian’ (trilobate) variants were the most common arrow-heads found at Naukratis, which is unsurprising considering that this was the preferred arrow-head technology used during the latter Saite period through to the early Ptolemaic period. These arrow-heads are well known votive offerings at Greek sanctuaries and are common finds at battle fields, garrison towns and forts of this period. The origin and provenance of such arrow-heads is a matter of ongoing debate, although they could have easily been produced in a number of places, including garrison towns, using recycled copper-alloy.

3.4 Heavy barbed and tanged arrow-heads

Heavy barbed and tanged arrow-heads with a diamond section, mid-ridge and a central burr are sometimes called ‘Cretan’ (Fig. 15). The Archaic form developed from Late Bronze Age Mycenaean and Minoan arrow-heads and continued to be used through the Classical and into the Hellenistic period. The variants represented at Naukratis were used between 525 BC and 30 BC. Their use is associated with the composite

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54 Baitinger 2001, 124, pl. 10 nos 309–11, Dreilöfige Tüllenfeilespitzen type IIb4; Snodgrass 1964, 153 socketed Form 3B3.
56 Erdmann 1973, 35 Form CI1, dated to 7th or 6th to 4th centuries BC; Oren 1984, 25, fig. 26.7 dated to late 7th to 6th centuries BC.
57 Marchi 2014, 111 fig. 150c.
58 Snodgrass 1964, 153 shaft-less three-edged socketed Form 3B3; Erdmann 1973, 35 Form CI3.
59 British Museum, EA42174.
60 Common in 4th century BC levels at Aswan (Wolfgang Muller 2013 pers. comm.).
62 Marchi 2014, 111 fig. 150e–f.
63 Oren 1984, 25, fig. 26.5.
64 Baitinger 2001.
66 British Museum, 1888,0601.6.a; 1886,0401.1736; 1886,0401.1735; 1935,0823.80; 1935,0823.78; EA27514; Bristol Museum and Art Gallery, Bristol, H2008.3; H2008.1; Baitinger 2001, 58; Dompfleispitzen types 1A4 and 1A5, pl.2 nos 34–5; Snodgrass 1964, 145–7, ‘Cretan’ form 1C2; 1967, 81, fig. 35; Erdmann 1973, 35 Form B1.
3.5 Roman iron trefoil arrow-heads

A small group of iron Roman arrow-heads have been found at Naukratis. Although often fragmentary and corroded, the arrows are barbed with a triangular section and a tang (Fig. 16). These iron arrow-heads were found by Petrie in 1886, one of which was found at his level 320, which he dated 6th century BC. However, this context seems likely to have been contaminated as iron tanged and barbed trilobate arrow-head are commonly dated to the Roman period, specifically to 30 BC—AD 250. The corroded remains of a single putative iron fire arrow could also be of early Roman date.

3.6 Arrow-heads in context

Many Archaic arrow-heads were supposedly found within temple of Apollo contexts. As the majority of the arrow-heads were found during Petrie’s first season, when excavations concentrated on sanctuary deposits, this is a likely provenance for many of the arrow-heads. In his *Naukratis I* publication, Petrie mentions four arrow-heads from the town settlement, but these are all ‘Roman’ iron types discussed above. The remainder could have come from the sanctuary of Apollo or the Great Temenos in 1884–5. A small group of Scythian type arrow-heads (produced c. 550–350 BC) are recorded as having been found in the cemetery during the second season. However, they are presumably residual as the majority of graves and grave finds are dated c. 350–250 BC or later.

The temporal distribution of arrow-heads at Naukratis shows a distinct concentration during the 27th dynasty. In contemporary Classical Greece arrow-head dedications were a popular form of votive dedicatory practice. It is also possible that there was an armed community at Naukratis or that visitors based in Egyptian garrisons dedicated these objects.

67 Baitinger suggests this type was developed from Mycenaean forms that continued to be used into the Hellenistic period (Baitinger 2001, 98, Dornpfeispitzen types 1A4 and 1A5, nos 31–2, 38–40).
68 Ibid.
69 Snodgrass 1964, 145–7, boss and barb tanged ‘Cretan’ type Form 1C2; 1967, 81, fig. 35; Erdmann 1973, 35 Form B1, 1200, 7th to 1st centuries BC.
70 British Museum 1920, 0214.38; 1920.0214.37; 1866.1228.46. From Thonis-Heracleion (Goddio and Fabre 2008, 337 no. 314, dated 6th to 4th century BC) Tell Dafana (Leclère and Spencer 2014, pl. 25 no. 23917) and Tell el-Herr (Marchi 2014, 111 fig. 150 and k).
71 Petrie Museum, London, UC59869c; Museum of Fine Arts, Boston, Eg.Inv.1276; Eg.Inv.1298; Ashmolean Museum, Oxford, AN1888.190.
72 Petrie 1886, 39, pl. XI.2, 3, 4.
73 Snodgrass 1967.
74 Fitzwilliam Museum, Cambridge GR.75.1887.
75 One group is recorded in the British Museum as coming from the sanctuary of Apollo, although the source of this information is unclear. There is no indication in the original register, catalogue or publications that this came from the sanctuary of Apollo.
76 Petrie 1886, 39, pl. XI.2, 3, 4. One was found at ‘level 320’, and all are supposedly of 6th century BC date. However, these seem to be Roman types discussed above.
77 Petrie is silent on the context of discovery. He does not record it within his publications, section drawings or notes.
78 Recorded in the Museum of Fine Arts (Boston) registers for 88.753 and 88.754. These belong to Baitinger (2001, fig. 472), Dreiflügelige Tüllenpfeilspitzen type IID3.
3.7 Sling shots

Three Ptolemaic sling bullets were found at Naukratis (Fig. 17). Oval and pointed at each end, they were all hand-made from micaceous brown Nile silt presumably at Naukratis, perhaps because pebbles were not always available. Petrie argued that the sling was essentially a Levantine weapon, as no sling bullets are known in Egypt, except one of Khabbashi and those made in Greek (Hellenistic) times. The example from Memphis bears Seleucid emblems (anchor, trident, thunderbolt and star) and was possibly left by the Syrian army of Antiochos IV who besieged the city in 171 BC.

4. Tools

4.1 Iron tools from the Late Period workshop

A large group of iron tools, iron slag and iron ore was both acquired from locals and excavated by Petrie in ‘the low strata’ of the north-eastern part of Naukratis town (Figs 18–20). Although there were only two or three cases [objects or groups of objects], where the exact level could be measured, Petrie was confident that these largely came from this deep level. Petrie dated this level and the iron tools found there to the 6th century BC and cited these finds as proof that the ‘iron was actually smelted and manufactured on the spot’ which was that Naukratis in his mind ‘was a great centre of the iron trade, if not indeed the principal source of manufactured iron to the Greeks of the sixth century’. However, the iron tools could have come from a range of contexts, including possibly a workshop repairing, sharpening or reworking old iron tools. There is currently no certain evidence that smelting took place at Naukratis, so Petrie’s claims that Naukratis was a major Greek iron manufacturing centre cannot be supported by the evidence available to date. From Petrie’s documentation we know he discovered: 28 flat chisels/wedges; 6 pointed chisels; 5 socketed wood chisels; 4 tanged chisels; 2 cells; 1 axe; 2 hoes; 1 fragmentary sword; 6 knives; 2 sickles; 6 tanged borers; 2 socketed borers; 1 small gouge; 1 double-handed pick; 1 ‘plumbers’ scraper (?); 6 bodkins; 2 lance-heads (1 of 4th-century BC date); 4 arrow-heads, 1 large pig of iron; and 1 poker, in the shape of a hand. Many of these tools remain in the collections of the British Museum, Ashmolean Museum, Fitzwilliam Museum, Egyptian Museum (Cairo) and the Petrie Museum, although not all can be located and many have probably disintegrated or been de-accessioned, because of their poor state of preservation.

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81 Petrie 1909c, pl. XXVI, 10.
82 Petrie 1917, 36.
84 Petrie 1886, 39, pl. XI.
85 Petrie subsequently confused some objects excavated in Naukratis in 1884–5 (Petrie 1886, 39; pl. XI, no. 23), later re-publishing them erroneously as 6th century BC Dafana pieces (Petrie 1917, 43, pl. XIII, no B. 19). See Petrie Museum, London UC59876 group.
86 Note some of these are probably Roman period forms, see above. However, rare Persian Period Iron arrow-heads (of a different form) are known in Egypt (Marchi 2014, 111 fig. 150–I). The poor preservation of iron arrow-heads can make distinguishing between Persian and Roman forms difficult.
87 Petrie claims the Keeper of the Greek and Roman collections ‘Mr Newton said they were ugly things and he did not want them, so they were thrown away’ (Petrie 1932, 59).
large collection, discovered during Petrie’s first season at Naukratis, only a small number of iron tools can be added from subsequent seasons.

4.2 Carpentry, farming and stonemason’s tools

A relatively small number of tools were used for working wood, and may have been used to maintain the ships and boats that frequented Naukratis, such as axes, possibly adzes (Fig. 21), chisels, borers and gouges. These include an iron saw from the second season at Naukratis, with the remains of a wooden handle, fixed with two nails (Fig. 22). There are close parallels from Thebes where Petrie suggests that ‘the iron and steel saws begin at least as early as 666 BC’. He continues by describing the saws: ‘in the Theban group of the Assyrian armourer were three saws; one double edged and narrow, probably a framed saw, S27; the other two blades have a decided rake in the teeth, and both of them were pull-saws (S28)’. The pull saw S28 is particularly close to the Naukratis example, although the blunt end of saw S27 is also similar.

The Naukratis assemblage includes rarely preserved farm tools. These include sickles (Figs 23–4) and hoes of both Late Period and Roman dates. Fragments of two simple iron sickles made from a single piece of iron riveted to a handle published by Petrie from ‘6th century BC contexts at Naukratis’. Later Roman variants are also known. Roman variants have a separate blade (Fig. 24). According to Petrie on this variant: ‘the body is of iron with a groove along the whole length; in that groove a strip of steel with teeth is inserted, and can be renewed as often as needful’. This form of sickle curiously seems never to have spread beyond Egypt.

Other possible farm tools include hoes (although the heads could possibly be interpreted as from an iron mattock or adze, Fig. 22), with two examples found within Petrie’s supposed 6th century BC contexts. Another example from Naukratis has numerous complete or fragmentary Roman parallels found at Memphis.

The Naukratis assemblage is dominated by chisels and iron ‘wedges’ that may have been used for stone working (Figs 19–20). Some of the limestone and marble architecture of Naukratis was probably finished.
there. Parallels from Memphis for some of these chisels and wedges have been dated to the Roman period, whilst other unprovenanced wedges are undated. As these were found within a ‘6th century’ context and also have Roman parallels, they seem to retain the same form for the duration of the life of the settlement.

4.3 Keys

Eleven keys (Figs 25, 27, 28) and two fragments of lock (Fig. 26) have been found at Naukratis. A single copper-alloy lever-lock key of fine workmanship (Fig. 25) would have opened an advanced lever-lock mechanism, such as a padlock. This has Roman period parallels from Egypt, which are also found across the Roman Empire, including Britain. A number of simpler Roman iron keys were found at Naukratis. Roman parallels are known from Egypt, including the Fayum. These are L-shaped lift or slide keys, used to open a simple tumbler lock (Fig. 28). They are not unique to Egypt, being used in the Roman period and found across the Roman Empire, including Britain, where they were used since the late Iron Age. The Roman context for one key (which was part of a ring, Fig. 27) is recorded by Petrie in his journal: ‘An excellent key ring in iron was found near the site of the silver objects [south western area of the town, near the river front]; it was apparently to be worn, having a raised bezel on it, I do not remember seeing such before. By pottery also found there I see the lot is all about the 1st or 2nd century AD. Such key finger rings are associated with small jewel caskets and boxes from the 1st century AD to the 4th century AD.

96 Petrie Museum, London, UC47701; UC47740.
98 Ashmolean Museum, Oxford, AN1888.189; Museum of Fine Arts, Boston, 86.355; 86.354; 86.353; British Museum EA27606; Fitzwilliam Museum, Cambridge GR.72.1887; Redpath Museum, Montreal 2522a–c; Petrie Museum UC59869d.
99 Museum of Fine Arts, Boston 88.768, 86.318.
100 Petrie 1895, 94–5.
101 Ashmolean Museum, Oxford, AN1888.189; Boston 86.355, 86.354, 86.353; British Museum EA 1885, 1101.82; Fitzwilliam Museum GR.72.1887; Redpath Museum, Montreal 2522a–c; Petrie Museum, London, UC59869d.
102 Petrie Museum, London, UC71705; UC63742; UC63769-77; Petrie 1917, 60, pl. LXXVI, W.200; 59–60, W.168.
103 Manning 1985, 94–93.
104 British Museum EA27606; Petrie 1886, 39, pl. XX.
105 Petrie Journal 1884–5, 165–6, which has a sketch of the key.
106 Cool 2016, 48. A narrow cylindrical bone hinge from such an earlier casket (Museum of Fine Arts, Boston, 86.224) was found at Naukratis, and can be dated, based on its form, to the 2nd or 1st century BC (Cool 2016, 172–8).
4.4 Metal and composite utensils and vessels

A diverse range of eating utensils and vessels made of metal (usually copper-alloy) and composite materials was found at Naukratis. It included spoons and fragments of three-pronged iron forks, a ladle and even a wine strainer fragment (Fig. 29). Also fragments of 18 bronze vessels were found, comprising bowls and dishes, fragments of and decorated attachments for hydria and jugs, including lids and miniatures. A single lead bottle was found in the cemetery.

Three ceramic ink-wells, dated c. 400–200 BC and c. 250–50 BC, are known from Naukratis, the latter of which were is made in the style of (and probably in the same workshops as) contemporary Ptolemaic lamps found at Naukratis (Fig. 30).

The fragment of a high quality bronze eight-spoked wheel with an iron axle with a circular plate of bronze over the hub was found by Petrie (Fig. 31). Previously interpreted as a fragment of a toy, this was possibly from a 7th-century BC wheeled stand. The wheeled terracotta figures found at Naukratis, commonly interpreted as toys (as well as doll with moving limbs), were found within sanctuary deposits and so this may also be considered a votive offering.

109 A model with shell decoration: Museum of Fine Arts, Boston 86.350; see also World Museum, Liverpool, 9,9,86.123 and Roman bone or ivory spoon (Museum of Fine Arts, Boston 86.219; for parallels from Pompeii see Cool 2016, 169–72).
110 British Museum 1888, 0601.698; 1886, 0401.1748.
111 Egyptian Museum, Cairo JE33540.
112 British Museum EA27604. For Persian period parallel see British Museum, ME108714.
113 Copper alloy dish or bowl: Boston Eg.Inv.198; 86.314; 86.306; British Museum, 1886, 0401.1748.
114 Copper alloy handle fragments (Museum of Fine Arts, Boston, 86.319; 86.329; Bolton Museum 1886.31.66.b) and silvered handles (Exeter Museum 5/1946/704). Late Hellenistic copper-alloy jug fragments include foot attachments (Boston 86.320, dated c. 100 BC–AD 50; Cool 2016, 158; Feugère and Rolley 1991, 40, Fig 18) and handle attachments (Boston 86.346; Bolton 1886.31.74.e, dated c. 200–1 BC; Feugère and Rolley 1991, 26, fig. 3). Other fragments are too fragmentary to identify or date securely (Museum of Fine Arts, Boston, 86.321; 86.35).
115 Museum of Fine Arts, Boston, 86.343; Bolton Museum, 1886.31.73.q.
116 Miniature copper-alloy jugs were probably votive offerings (Museum of Fine Arts, Boston 86.313; British Museum, EA27603; 1886, 0401.1707).
117 British Museum, 1888, 0601.727.
119 Two similar ‘ink-wells’ of the same form known from Naukratis (Fitzwilliam GR.219.1899; Cairo E33565). Each display different decoration styles, but both styles are commonly found on Ptolemaic mould-made lamps (Mlynarczyk 1997, 54–7, Type G, Figs 65-6), dated either to the late 2nd to 1st, or the late 3rd to 2nd centuries BC. Close parallel are also known from Alexandria, dated to the 2nd century BC (Bailey 2008, no. 3672).
120 Museum of Fine Arts, Boston, 86.244.
121 Italian 9th to 7th century BC parallels (Macnamara 1968, 283, pls 29, 93, 97, 98). This type has Bronze Age precedents from the Levant and Cyprus.
4.5 Stone, bone and composite tools

A number of stone tools were found in Naukratis mainly comprising burnishers and polishers, whetstones/ knife-sharpener, hammers, pounders, quern stones and grinders. A range of flint and bone blades, points and burins were also found at Naukratis. Evidence for complicated bow drills consists of two stone handles for drills that may be complemented by four putative terracotta grip fragments that bear inscriptions dated to the 2nd century BC.

4.6 Loom-weights and spindle-whorls

Fifteen loom-weights (Fig. 32) and eight spindle-whorls (Fig. 33) are known from Naukratis. Loom-weights were found in both ‘Greek’ pyramidal and traditional Egyptian disk forms (Fig. 32). The Greek loom-weights were made of Corinthian, East Greek and local Nile silt fabrics, suggesting that Greek women were resident at Naukratis, bringing looms from Greece and East Greece, but also making (or repairing) them locally. An archaic East Greek loom-weight with a gem stamp has parallels from the 7th to early 4th centuries BC. The ‘Greek’ style pyramidal loom-weight becomes popular across Egypt during the Ptolemaic period, and

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122 Stone burnishers: Ashmolean Museum, Oxford, AN1886.537; AN1896-1909-E.3813; Redpath Museum, Montreal 2485; World Museum, Liverpool, 9,9,86,22; Bolton Museum 1886.31.54.e; 1886.31.54.d. Stone polisher: Redpath Museum, Montreal 91.03.25; 2480b; 2480a; 2497.1; 2483; 2482; 2479.03; 2479.01.
123 British Museum 1886, 401,1726. this object was later re-used as a jewellery mould. Ashmolean Museum, Oxford, AN1896-1909-E.3663; Redpath Museum, Montreal 2478; 2472; 2473; 2471; Museum of Fine Arts, Boston 11.45921 E inv. 2940; 86.185. Chautauqua Institution no number.
124 British Museum, 1888, 37,24; Redpath Museum, Montreal, 2502.
125 British Museum, 2496.01-08; possibly Museum of Fine Arts, Boston, 86.218; RES.86.3; Bolton Museum 1886.31.55.a.
126 British Museum 2496.01-08; Museum of Fine Arts, Boston, 86.218; RES.86.3; Bolton Museum 1886.31.55.a.
127 British Museum 1909, 1201; Redpath Museum, Montreal, 2484.01.
128 British Museum 1910, 0222,255–B; Bailey 2008, nos 3695–8. Parallels from Memphis have been interpreted as grips for pump drills (Anthes and Bakry 1959, 48, pl. 30, nos 222–3; contra Johnston 2015, 16–18 in chapter on ceramic inscriptions), who prefers their identification as kiln furniture, see below.
129 Stone spindle-whorls: Ashmolean Museum, Oxford, AN1886.537; AN1896-1909-E.3813; Redpath Museum, Montreal 2485; World Museum, Liverpool, 9,9,86,22; Bolton Museum 1886.31.54.e; 1886.31.54.d. Stone polisher: Redpath Museum, Montreal 91.03.25; 2480b; 2480a; 2497.1; 2483; 2482; 2479.03; 2479.01.
131 Stone spindle-whorls: Redpath Museum, Montreal, 2479.02; World Museum, Liverpool, 9,9,86,127.a; Chautauqua Institution (unregistered); Bristol Museum and Art Gallery, Bristol, H1113. Ivory spindle-whorl: Bristol Museum and Art Gallery, Bristol, H1373. Terracotta conical spindle-whorl: Museum of Fine Arts, Boston, 86.484; 86.483. Terracotta lentoid spindle-whorl: Nottingham, Castle Museum NCM 1888-37; Chautauqua Institution (unregistered).
133 British Museum, 1886, 401,1575 (Bailey 2008, no. 3699). The following Pyramidal terracotta loom-weights are probably also East Greek: Museum of Fine Arts, Boston, 86.481; McLean Museum and Art Gallery, Greenock, 1987.460.
134 British Museum, 1886, 401,1575. Parallels from Eretria have been dated to the 7th or 6th centuries BC (Martin Pruvot et al. 2010, 243, no. 229). A pyramidal loom-weight from Atalante in Thessaly with a similarly shaped gem impression is dated c. 450–350 BC (Raselli-Nydegger 1996, pl. 48, no. 48). The fabric resembles that of South Ionian amphorae found at Naukratis and is clearly not made of local Nile silt (contra Bailey 2008, no.3699).
135 Pyramidal loom-weights have been found in the c. 330–250 BC Chatby cemetery in Alexandria, (Brecia 1912, 91, fig. 56), a c.150–100 BC context in Karnak (Lauffray 1995, 309, fig. 4:1159) and within Ptolemaic levels at Edfu (Michalowski et al. 1938, pl. 40,12).

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it is this shorter, later variant that may be represented by some of the locally made examples.\textsuperscript{136}

Some forms of weight are known to have been used on both looms and fishing nets. However, these are more frequently drilled round-cut (disk shaped) sherds, or hand-made fired terracotta disks with holes pierced before firing (discussed below). The spindle-whorls come in a variety of materials and forms including local terracotta or stone conical style (Fig. 33); local terracotta rings in a lentoid shape; carved rings of stone or ivory; or simple pierced stones (which could be equally fishing weights).

4.7 Cosmetic and surgical implements

A number of cosmetic or medical instruments were found at Naukratis. These include one stone and two bronze kohl sticks (Fig.34) used to apply eye makeup, but of an unknown date or context.\textsuperscript{137} Other objects for adornment comprise an iron strigil found within an early Ptolemaic grave,\textsuperscript{138} as well as mirrors. In addition fragments of combs, including a late Period bone comb,\textsuperscript{139} and bone hair pins were found at Naukratis.\textsuperscript{140}

Two surgical probes (Fig.35), were from graves in the cemetery, and can be dated through associated finds to c. 350–250 BC.\textsuperscript{141} There is also a glazed composition object interpreted as a pill maker.\textsuperscript{142}

4.8 Metal fixings

Numerous metal fixings were found at Naukratis. Most common are copper (Fig. 36)\textsuperscript{143} and iron nails or tacks\textsuperscript{144} and staples.\textsuperscript{145} Lead clamps used to join stone architecture were also discovered.\textsuperscript{146} Components from more complicated artefacts include hinges,\textsuperscript{147} fragmentary links or rings from chains,\textsuperscript{148} and a variety of copper wire,\textsuperscript{149} as well as various scraps of folded metal including lead and copper sheeting.\textsuperscript{150}

\textsuperscript{136} Castle Museum Nottingham, NCM 1888-38.
\textsuperscript{137} Copper alloy: Museum of Fine Arts, Boston 86.305; 86.241. Hematite stone: Redpath Museum, Montreal 2521.
\textsuperscript{138} Museum of Fine Arts, Boston, 88.750a-b.
\textsuperscript{139} Museum of Fine Arts, Boston, 88.1049.
\textsuperscript{140} Museum of Fine Arts, Boston, 88.1048; possibly 86.218; RES.86.3. See forthcoming chapter on Jewellery and mirrors.
\textsuperscript{141} British Museum, 1888,0601.9/1975,1106.23; Gardner 1888, 28, pl. XVI, no. 17; Museum of Fine Arts, Boston, 88.766.
\textsuperscript{142} British Museum, 1909,1201.13. Alternatively this was used in glass bead production.
\textsuperscript{143} British Museum, 2011, 5009.23; 1886, 0401,1745; Egyptian Museum, Cairo, JE26850.4; JE26850.3; JE26850.2; JE26850.1; Museum of Fine Arts, Boston, 88.757; 88.756; 86.237; 86.240; 86.238; 86.236; 86.235; Bolton Museum, 1886.31.73.p; 1886.31.73.o; 1886.31.73.n;
Bristol Museum and Art Gallery, Bristol, H2205.07; H2205.04; H2205.04; H2205.04; H2205.04;
\textsuperscript{144} Redpath Museum, Montreal, 2523b; 2523a; 2523.04; 2523.02; Petrie Museum, London
UC54639a; UC59869b; UC59869a; UC54643c; UC54643e; UC54643f; UC54643d;
UC54643c; Museum of Fine Arts, Boston, 88.771; Eg.Inv.2944; Eg.Inv.2954; 88.758;
Ashmolean Museum, Oxford, AN1886.523; AN1886.522; AN1886.521; Bolton Museum
1886.31.74.c; 1886.31.74.b.
\textsuperscript{145} Copper alloy: Museum of Fine Arts, Boston, M.1519; 86.324; 86.323; Bristol Museum and Art Gallery, Bristol, H2005.2; H2005.1; H2205.01. Iron: Petrie Museum, London UC54643e; Bolton Museum 86.375.
\textsuperscript{146} Museum of Fine Arts, Boston Eg.Inv.241.
\textsuperscript{147} Museum of Fine Arts, Boston, 86.333; 88.762a; Egyptian Museum, Cairo JE26848.
\textsuperscript{148} Bristol Museum and Art Gallery, Bristol, H2005.03; Petrie Museum, London UC54644d;
Museum of Fine Arts, Boston, 88.769; British Museum 1886, 0401,1744.
\textsuperscript{149} Copper alloy rod: Museum of Fine Arts, Boston, 86.349; 86.341; 86.340; Bolton Museum
1886.31.73.j; 1886.31.73.g; 1886.31.73.a; 1886.31.74.d; 1886.31.73.v. Iron rod: Museum of Fine Arts, Boston, Eg.Inv.1333.
\textsuperscript{150} Bolton Museum 1886.31.73.k.
5. Kiln furniture

Nine circular or oval pot stands, possibly used as kiln-supports or as kiln furniture (Fig. 37) were collected by the excavators at Naukratis. They were retained because of the Greek inscriptions they carry. They come in two forms, oval hand-made forms and larger circular wheel-thrown forms.

Smaller oval variants (Fig. 38) were originally published by Bailey. This group is similar to objects (one of which is inscribed) from a mid-2nd century BC pottery workshop at Athribis. Four parallels (with inscriptions) come from the fill above the early Ptolemaic Ibrahimieh Necropolis at Alexandria. Comparisons can be made with Byzantine kiln furniture from African red-slipped ware workshops at El Mahrine in Tunisia. Bailey and Johnson suggest they are kiln furniture. Parallels from Memphis, however, have been interpreted as grips for pump drills.

The larger circular wheel-thrown examples with inscriptions have parallels from Ptolemaic contexts from the American fieldwork at Naukratis, where they were interpreted as pot-stands or kiln furniture, and numerous uninscribed examples were found during the excavations and survey of Naukratis.

6. Games

Evidence for games comes from two major artefact groups: game-pieces and dice. Game-pieces, or counters were predominantly of glass, terracotta and stone (Figs 39–40), although Egyptian blue, copper alloy (Fig. 41) and lead are also known from Naukratis. They can be flat counters, or intricate octagonal pointed cones or simpler cones such as the examples made of Egyptian blue, limestone and terracotta (Figs 39–

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Footnotes:

153 Where they were published as weights (Myśliwiec 1994a, 38, fig. 6; Myśliwiec 1996, pl. VIII, 4).
154 Breccia 1907, 55 and 69–70, pl. II,1; Breccia 1934, no. 453, inscribed ‘CEPHNOC’; Volbach 1946–7, pl. III.
155 Mackensen 1998, 438, fig. 5; see also British Museum, 1979,0814.2.
156 Anthes and Bakry 1959, 48, pl. 30, nos 222–3.
157 Pietri et al. 1886, pl. XXXIV, 661, 638, 646, 648 and 644; British Museum, 1910,0222.233, 241, 243 and probably 239; Schlotzhauer and Villing 2006, 65, figs 43 and 44.
158 Leonard 2001, pl. 3.21; 192, fig. 3.6; pl. 3.32. A reappraisal of their context (by the present author) confirms one was found in late Ptolemaic levels (c.150–30 BC) and another was with residual (late) Ptolemaic pottery within an early Roman context of c. 30BC – AD 100.
159 Uninscribed pot-stands of mid- to late-Ptolemaic date (Coulson 1996, nos 1639, 1542, 1539; Leonard 2001, fig. 2.51.13; fig. 2.51.1-13; Egyptian Museum, Cairo, JE97807; Leonard 2001, pl. 3.31-2).
160 Redpath Museum, Montreal, 2509.01, 2509.02, 2509.03, 2509.04, 2509.05, 2509.06, 2509.07, 2509.08, 2509.09, 2509.10; Museum of Fine Arts, Boston, G.959; British Museum 1886.0401.1712.
162 World Museum, Liverpool, 9.9.86.119.
A group of glass counters or inlays was found in Naukratis (Fig. 41), of types which are well known from Roman contexts. They were produced by melting scraps of recycled glass. The type of glass is then a useful indicator of the date of the ‘gaming pieces’. The Naukratis pieces are transparent clear and coloured monochrome glass (as opposed to decorated or polychrome glass), which was increasingly popular during the Roman period, especially during the 1st and 2nd centuries AD.\textsuperscript{166} However, their interpretation as gaming counters has recently been convincingly contested. They may rather be accounting aids, acting as tallies, or used as decorative elements in furniture, architecture, jewellery or metal vessels.\textsuperscript{167} They were registered together as part of Redpath Museum’s collection in Montreal alongside a series of contemporary unfinished glass beads and jewellery moulds,\textsuperscript{170} suggesting that this may have been part of a Roman jewellery and metal vessel industry at Naukratis.\textsuperscript{171}

Dice were predominantly of six-sided (cubic) types made of limestone with drilled pips (sometimes filled with lead, Fig. 43),\textsuperscript{172} although examples made of faience (Fig. 44),\textsuperscript{173} ivory (Fig. 45),\textsuperscript{174} marble,\textsuperscript{175} pumice\textsuperscript{176} and terracotta\textsuperscript{177} are known. Most are of solid materials, with bone and limestone well attested; there are parallels from the 7th century BC, but they are particularly popular in the Roman period (the period to which most of the ‘game-counters’ from Naukratis can be dated).\textsuperscript{178} A single 14-sided truncated cubic glass (or less likely rock crystal) bead (as confirmed by the drilled hole), is a well-known Roman period bead type (Fig. 46).\textsuperscript{179} The identification of this as a rare rock crystal pentagondodekahedra (with 12 pentagon-shaped faces) dice can now be excluded.\textsuperscript{180}

166 British Museum, 1886.0401.1709.
167 British Museum, EA27614.
169 Ibid.
170 Beads: Redpath Museum, Montreal, 2490.03, 2490.6, 2490.8, 2490.9, 2490.10, 2490.13, 2490.19–22, 2508, 2514. Inlays or ‘gaming-pieces’: Redpath Museum, Montreal, 2509.01–10. Moulds for jewellery or metal vessels: Redpath Museum, Montreal, 2495, 2474.1–3; see also Museum of Fine Arts, Boston, 86.670; Nottingham Castle Museum, NCM 1888–57; British Museum, 1888,0601.158, 1888,0401.1726.
171 See forthcoming chapter on Jewellery and mirrors.
172 British Museum 1886.0401.1721; 1886.0401.1719; Redpath Museum, Montreal, 2490.02; Egyptian Museum, Cairo, JE26832.2; JE26832.1; Ashmolean Museum, Oxford, AN1896–1908-E.3744; McLean Museum and Art Gallery, Greenock, 1987.442; Bristol Museum and Art Gallery, Bristol, H1127; Philadelphia, University of Pennsylvania Museum of Archaeology and Anthropology, 16875; 16876.
173 British Museum, 1886.0401.1720.
174 British Museum, 1900.0214.19.
175 Redpath Museum, Montreal, 2490.01.
176 Museum of Fine Arts, Boston, 86.657.
177 Museum of Fine Arts, Boston, 86.656; World Museum, Liverpool, 9.9,86.24.
179 See forthcoming chapter on Jewellery and mirrors.
180 Smith 1908, 196.
7. Maritime artefacts

The maritime activities undertaken at the thriving harbour of Naukratis are represented by a variety of artefacts found during the various excavations undertaken at the site. These include fishing hooks and weights, ballast stones, fragments of lead hull sheathing, copper hull tacks and brail rings. Not all these objects have their original context recorded, although general descriptions within publication and notebooks confirm that these materials were predominantly found in the northern portion of the western most strip of Naukratis, either on the river front, or in adjacent houses and warehouses during Petrie’s and Hogarth’s excavations within this area. During the first season undertaken in 1884–5 Petrie stated: ‘on digging at the border of the town, about west of the temenos of Apollo, we reached a thick bed of black mud, foul-smelling and offensive. This was probably some old dock or pond by the side of the ancient canal [now confirmed as the river bank], filled up with sewage and refuse.’\(^1\) Hogarth also excavated this western strip during his 1898–9 excavations, to the west of the Apollo, Hera and Aphrodite sanctuaries.\(^2\) His 1903 excavation within the village of Rashwan to the north-west, near the ancient cemetery, ‘penetrated the same muddy sand… both this mound and that on which the hamlet south (Abu Mishfa) of it stands seem to me to be remains of the same old canal or river embankment.’\(^3\) The British Museum’s geophysical survey since 2012, auger drilling since 2013 and excavations in 2015–16 can now confirm that this area was a river bank and the centre of merchant activity on the Canopic river front of Naukratis during the 6th to 4th centuries BC.

7.1 Fishing lines with hooks

A group of 30 iron and three bronze fishing hooks (Figs 47–8) were found alongside numerous folded lead casting net sinksers within a chamber near the river front of Naukratis at the south end of the town. Petrie records the context of discovery, erroneously calling the structure in which they were found an (early) Ptolemaic house alongside his contemporary ‘Ptolemaic cache of bronzes.’\(^4\) Fourteen large barbed iron fishing hooks fitting his

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\(^1\) He goes on to say ‘Further pitting along this part may perhaps show us some old bed of the stream’ (Petrie 1886, 10).

\(^2\) From 46–49 we sank sixteen pits and trenches. Generally we came on early sherds at from 1 to 20 inches only below the actual surface: at 15 to 20 inches further down we were in hard mud entirely empty of antiquities. The general surface in this region is well below the cultivation level, but just west and south of 48–9 rise high mounds with a straight cut face. In these could be seen a line of chips resting on sand at 5 feet above our average surface, and above it a layer of Roman remains, burnt bricks and about 3 feet thick. The 5 feet of sand under the chips seemed to be absolutely empty of sherds. Except some early sherds we found nothing significant in all this region. Two inscribed fragments (one to Hera), found at the edge of the hollow near 46, were in the surface rubbish and probably stragglers from further east’ (Hogarth et al. 1899, 40, on trench numbers 46 to 49).

\(^3\) Hogarth et al. 1903, 122–3. Hogarth argued the river was to the east of Naukratis but must have separated Abu Mishfa from Rashwan, which we now know not to be the case (Pennington and Thomas 2016).

\(^4\) ‘Two or three iron fish hooks in good state were found in one Ptolemaic chamber, when we were digging for bronzes; these explain a lot of lead pieces which are therefore probably net sinksers. … In the Ptolemaic house by the bronze find we get a quantity of iron fish hooks, 13 perfect, 17 slightly broken, and many pieces beside three bronze ones. These show that the canal here must have been more important, and that they caught big fish’ (Petrie Journal 1884–5, 165, 174; see Petrie 1886, 39).
description remain in museum collections around the world.\(^{185}\) The dates of
the two contemporary chambers excavated by Petrie\(^{186}\) have since been
corrected. The cache of bronzes was deposited c. 420–390 BC, by 350 BC
at the latest.\(^{187}\) The house in which the fishing equipment was found
yielded a bronze seal with the name of an official in Aramaic that can be
dated to the 5th century BC.\(^{188}\) A later date is suggested here for the
fishing equipment c. 425–300 BC, because although nothing in either
building can be securely dated to the Ptolemaic Period, the so-called
‘Ptolemaic house’ could have been used until a later period than the cache.
Although the majority of the hooks came from this context, a single iron
fishing hook of this type was also found in the cemetery, where the majority
of graves are dated c. 330-250 BC (although some are dated earlier).\(^{189}\)

Large barbed copper alloy fish-hooks (Fig. 47) probably also came from
the town, although the context is not recorded and they likely cover a broad
range of dates.\(^{190}\) The Naukratis examples are unusually large, when
compared to those from marine multiple hooked fishing lines, which are
usually only 2cm long.\(^{191}\) Their size suggests the Naukratis fish-hooks
came from single (baited) large hooked fishing lines, and not from multi-
hooked lines.

In addition to hooks, a small number of lead sinkers used as fishing line
weights were found at Naukratis (Fig. 49).\(^{192}\) However, the majority of
fishing line weights were probably never collected as there is often nothing
specifically diagnostic (or collectable) about ancient fishing line weights.
Some of the forms of loom weight discussed above, for example the
pyramidal type, are also known to have been used on fishing nets, or lines.
It is possible that some circular objects were used as reels for fishing lines,
although this is not certain.\(^{193}\)

Fishing hooks were commonly made of copper alloy in antiquity, being the
most easily recognized and frequently identified fishing equipment.\(^{194}\)
Bronze hooks were common in the Mediterranean from the Bronze Age,\(^{195}\)
and the standard copper alloy fish-hook form was introduced to Spain in
the 8th century BC (and the Red Sea by the 3rd century BC).\(^{196}\) the type

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185 Redpath Museum, Montreal, 2518.01; 2518.02; Museum of Fine Arts, Boston, 86.356;
Fitzwilliam Museum, Cambridge, E.14a-c.1885; World Museum, Liverpool, 9.9.86.126.b;
9.9.86.126.a; Ashmolean Museum, Oxford, AN1886.533, AN1886.532; Bolton Museum
1886.31.75.1-d).
186 Petrie 1886, 39, marked ‘Ptolemaic building’ on pl. XLI
187 British Museum, 1885,1101.70; Masson-Berghoff 2015, 73.
188 Villing 2013, 75, fig. 1; Masson-Berghoff 2015, 71.
189 Museum of Fine Arts, Boston, 88.767a-d.
190 British Museum, 1888,0601.7; Bolton 1886.31.73.m; Cairo JE26772.1-2; Redpath
Museum, Montreal, 2519a; Ashmolean Museum, Oxford, AN1886.535. Fragments and
uncertain pieces: Redpath Museum, Montreal, 2519c-d.
191 Thomas 2010; 2011; Copeland 2011.
192 Museum of Fine Arts, Boston RES.88.38; Ashmolean Museum, Oxford AN1950.373;
dubious example Redpath Museum, Montreal, 2476.
193 Nottingham Castle Museum, NCM 1888-96.
196 Hooks found at Aila (Parker 2006), Berenike (Hense 2007), Abu Sha’ar and Myos Hormos
(Thomas 2010; 2011). They were also found inland at Mons Claudianus (Maxfield 2001, 416).
They were probably made in the metal-working areas of these ports (Parker 2006; Thomas
2010, 151).
was almost exclusively used (unchanged) until the 7th century AD. Fish-hooks have often been found on shipwrecks as part of the sailors’ kit.

Traditional fish-hooks have four main variables that determine performance and function:

- Attachment (eye, grooved, flattened spade end or fitting).
- Material (copper alloy, iron, wood, shell or bone).
- The form of the shank and bend which ultimately determine the size and the width of the gap between the shank and the point.
- The point (barbed or un-barbed variants).

The Naukratis fish-hooks were barbed, of medium size, and had an end fitting or flattened spade for attaching the line. They were almost all iron. The presence or absence of barbs depended upon the preference of the user. Barbed hooks retain fish on the line more securely, but take longer to unhook. Also barbed hooks foul more easily, which could waste valuable time if fishing over a particularly prolific shoal of fish when this mishap occurs. Smaller hooks have been found in groups (but not in Naukratis), even corroded together, suggesting that they were used on the multiple hooked lines described by Oppian. Larger hooks, such as those from Naukratis would have been baited for larger fish species, but would not have been large enough for catching adult tuna, shark or swordfish. They could have been used as a trolling line, dragged behind a ship while underway, or merely baited and hung over the side when at anchor, or from a raft or boat when fishing on the Canopic branch of the Nile.

### 7.2 Fishing casting nets

A group of eleven lead fishing net weights can be identified from a larger group that was found within a ‘Ptolemaic house’ excavated by Petrie, and found alongside the iron fish hooks discussed above. A number of fragments of net weights have probably come from this deposit (dated c. 425–300 BC) are also known. There are parallels from other areas of Naukratis, but they do not seem to be contemporary. Net-weights were made for a range of net types. The most commonly represented at Naukratis were casting nets.

197 Bernal Casasola 2010, 87–8.
199 There are a range of non-traditional forms, such as multiple hooks, chain hooks discussed in detail by Bernal Casasola (2010, 86–95) and gorges or ‘straight hooks’ (Bernal Casasola 2010, 88; Thomas 2010, 151).
200 Bernal Casasola’s (2010, 87–91) classification distinguishes between very small (<25mm), small (24–40mm), medium (40–80mm) and large (>80mm) fish-hooks. At the Roman Red Sea ports two sizes were recognized, small copper alloy hooks 10–20mm and medium iron 30–60mm hooks.
201 Beech 2004, 67.
202 Thomas 2010; 2011, M0311, M0025; Copeland 2011.
204 Modern tuna, sharks and swordfish fishing hooks are c. 60mm long and over 3mm thick and made of high tensile stainless steel.
207 World Museum, Liverpool, 9.9.86.82; British Museum, 2011,5009.25.a; Bolton Museum, 1886.31.77.a; 1886.31.77.b; 1886.31.77.c, possibly also Museum of Fine Arts, Boston, 86.334; Petrie Museum, London, UC54639b; UC54639c probably all came from this context.
208 Museum of Fine Arts, Boston, 88.775; 88.774.
The net weights were made from small folded or rolled rectangular lead sheets. They are folded or rolled over twine to prevent fouling the net. The fold was made by hand and finally crimped tight by hand, teeth or tool. Both closed and open forms were found. Open examples have pressure-lines and cracks where they have been opened up numerous times, suggesting these may have been spares and not attached to the net. The weights could have been easily made by recycling and melting down spare lead left by ship maintenance, such as off-cuts of lead hull sheathing, perhaps explaining the scraps found at Naukratis, discussed below.\textsuperscript{210}

Folded lead casting net weights are the most commonly identified type of net weights, being easily recognized and frequent within the archaeological record.\textsuperscript{211} Comparanda are well known from coastal settlements,\textsuperscript{212} first attested in the Late Bronze Age\textsuperscript{213} and abundant from the Archaic period onwards in Greece.\textsuperscript{214} Turkey and the Levant.\textsuperscript{215} Egypt and Spain.\textsuperscript{216} Net weights have been found offshore and on Bronze Age and Archaic period shipwrecks,\textsuperscript{217} with groups from complete nets being found on Hellenistic, Roman and Byzantine shipwrecks.\textsuperscript{218} One group found on the Serçe Limani Byzantine wreck was interpreted as the remains of three 40m-long fishing drag nets.\textsuperscript{219}

The long and crimped rectangular fishing weights found at Naukratis (Fig. 50) are distinct from contemporary square Phoenician (and some later types).\textsuperscript{220} These were ideal and commonly used for casting net weights.\textsuperscript{221} However, similar weights were also used until recently on drag nets.\textsuperscript{222} It is possible to distinguish casting and drag net weights based on weight, balance, distribution and wear. Dragnet weights are generally heavier. Trawl nets found on Cala Olvera are significantly larger and heavier and possess wear distinctive of trawling on sandy beds.\textsuperscript{223}

\textsuperscript{209} Galili, Rosen and Sharvit 2002, 183, fig. 2, Type L.2.3; Bernal 2010, 86, 112–6, fig.1, Type PLIX2. See Tzahou-Alexandrini and Spathan 1987, 73, no.18.

\textsuperscript{210} Thomas 2010; 2011; lead sheeting offcuts were stored with fishing equipment at Myos Hormos. See also weights and scraps found on the Kyrenia ship (Thomas forthcoming, notes on Pb8, Pb10).


\textsuperscript{213} Iakovidis 1969, 451–5, 460, pl135b, Tomb 131, c.1165–1100BC; 1980, 96; Davy 1962, 658–9, 668, fig. 26. However, the method of casting nets is attested since the Neolithic (Cleyet-Merle 1990, 147). Nets are depicted on Mycenaean Theban pottery (Sakellarakis 1974, 390, fig.30). See also 18th and 19th-dynasty examples from Gurob, Egypt (Petrie 1890, 34, pl. XVIII, 1b).

\textsuperscript{214} Powell 1996, 118–20; Mazarakis 2002; Alfaro 2010, 77.

\textsuperscript{215} Found in late 7th century BC Ashkelon (Aja 2011, 544–5) and common in Roman and Byzantine contexts (Galili, Rosen and Sharvit 2002, 187).

\textsuperscript{216} Such as Emporias, Baelo Claudia and Tossal de la Cala (Castanyer 2006, 21; Bernal 2009, 202-3; Bernal and Torremocha 2010, 119). Quseir al Qadim (Thomas 2010, 146–7, fig. 6, M0302).

\textsuperscript{217} Late Bronze Age, Uluburun (Bass 1987, 721; Pulak 1988, 33–3); Cape Gelidonya (Bass 1987, 131–2, fig.139); Archaic period Isles of Giglio (Bound 1991, 26–7; Beltrame 2010, 236, fig.7).

\textsuperscript{218} Roman, Mainz (Witteyer 1982, 139–42, 28 weights); Byzantine, Dor (Galili and Rosen 2008, 69–70, 153 weights); Yassi Ada (Kuniholm 1982, 303–7; Katzev 1982, 262, 280–1, 16 weights where a netting needle was also found); Serçe Limani (Piercy and Bass 2004, 42; Beltrame 2010, 239).

\textsuperscript{219} Piercy and Bass 2004, 42; Beltrame 2010, 239.

\textsuperscript{220} Found in 4th century BC Cadiz (Arevalo, Bernal and Torremocha 2004, 200, 138; Bernal 2010, 113) and also in late antique contexts where they are frequently decorated (Kuniholm 1982; Galili, Rosen and Sharvit 2002, 188–90; Galili and Rosen 2008).

\textsuperscript{221} Bernal 2010, 114.

\textsuperscript{222} In the Balearic Islands (Alfaro 2010, 79).

\textsuperscript{223} Alfaro and Costa 2008; Alfaro 2010, 79.
nets can be worn along the bottom, where they rub against the sandy bottom of the chosen environment. Casting nets have to be evenly spaced and equally balanced around the lead-line (the outer circumference of the net) to enable a balanced cast. Drag nets generally use many more weights than are used on casting nets.

Casting nets were valuable and could be worthy votive objects, for example those dedicated to Poseidon at his sanctuary on Kalaureia, and have also been recorded in an epigram by Leonidas of Tarentum. They were also found as burial gifts in Late Bronze Age graves in Gaza. Perati and in the cemetery in Brauron. Most of the examples from Naukratis were associated with an Egyptian sanctuary votive cache dated 420–390 BC, suggesting that these could have been votive offerings too.

Nets were made using a netting needle. One bronze netting needle was found within an early Ptolemaic grave at Naukratis (Fig. 51). It is broadly contemporary with the majority of the casting net weights and iron fishing hooks discussed above. Netting needles of this ‘Mediterranean type’ are attested in contemporary La Albufereta, Spain, and were used to create the ‘knotted netting’ required for casting nets as well as other objects (drag nets and net bags).

7.3 Fishing: drag nets

A second form of fishing net weight was made of terracotta, with six examples known from Naukratis (Fig. 52). It is in the form of a roughly semi-circular thick disc with two holes. Some were hand-made, others were wheel-made before being cut in half and pierced before firing. All examples from Naukratis were made of local micaceous orange-brown organic Nile silt, typical of coarseware pottery of the Late Period and early Ptolemaic periods. This form of net weight had been used in Egypt since the New Kingdom, in both Egypt and Egyptian colonies in Sudan. The examples from Naukratis probably date from c. 630–330 BC, although Bailey prefers the broader date of 630–30 BC and caution is advised as

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224 Alfaro 2010, 77.
225 Anthologia Palatina, 6.13.
226 Petrie 1933, 6, no.35.
227 Iakovidis 1969, 455.
229 This equipment was found with a cache of (mostly bronze) Egyptian temple votives, but is not definitely part of the cache. Petrie stated, ‘In one… chamber, when we were digging for bronzes [the cache of Egyptian temple votives]… a lot of lead… net sinkers… iron fish hooks, 13 perfect, 17 slightly broken, and many pieces beside three bronze ones (Petrie 1884–5 Journal 165, 174; see also Petrie 1886, 39, pl. XLI, marked erroneously ‘Ptolemaic building’). The lead net weights and fishing hooks have now been distributed to numerous museums worldwide (World Museum, Liverpool, 9,9,86.82; British Museum, 2011.5009.25.a; Bolton Museum, 1886.31.77.a; 1886.31.77.b; 1886.31.77.c; probably Museum of Fine Arts, Boston 86.334; Petrie Museum, London, UC54639b; UC54639c, see also Museum of Fine Arts, Boston, 88.775; 88.874). Iron fish hooks (Redpath Museum, Montreal, 2518.01; 2518.02; Museum of Fine Arts, Boston 86.356; Fitzwilliam Museum, Cambridge, E.14a-c.1885; World Museum, Liverpool, 9,9,86.126.b; 9,9,86.126.a; Ashmolean Museum, Oxford, AN1886.533; AN1886.532; Bolton Museum, 1886.31.75.1-d; Egyptian Museum, Cairo, JE26772.1–2) and copper alloy fish-hooks (British Museum, 1869.0601.7; Bolton Museum, 1886.31.73.m; Redpath Museum, Montreal, 2518a; Ashmolean Museum, Oxford, AN1886.535). The Naukratis examples are of a medium to large size (c. 4–5cm long).
223 British Museum, 1888.0601.10; Gardner 1888, pl. XVI, 17.
223 Alfaro 2010, 62–3, fig.2.
223 Bailey 2008, no.3700, British Museum, 1886.0401.1573; Ashmolean Museum, Oxford, AN1886.519; Redpath Museum, Montreal 2475; Museum of Fine Arts, Boston, RES.87.226; Chautauqua Institution, unregistered; Museum of Fine Arts, Boston, RES.87.235 (lost).
none are from known contexts. It is unlikely they were used on casting nets, as they are large and cumbersome (and would snag the casting net when thrown), but instead on a drag net or some form of net trap. The curved bottom seems designed to protect from snagging on the sea or river bottom and, on the four examples assessed, there were signs of wear suggesting they were dragged along a sandy river or sea bed, a distinctive feature of drag net weights.233

7.4 Fishing practice and economy

The fishing equipment from Naukratis comes from all periods of the settlement’s occupation. However, the majority of the material discovered dates to the period 425–250 BC. Naukratis relied upon a range of different net and line techniques that could be undertaken in the shallow waters of the floodplain (with casting nets and traps) and in deeper waters (using baited hooks). Excavations in 2015 and 2016 along the river front revealed contexts ranging from c. 550–30 BC, with particularly rich c. 420–330 BC deposits that contained a diverse faunal assemblage of which 13.8% came from a mixed fishing regime. Although of secondary importance (after animal husbandry) the faunal remains of fish included those caught in shallow water and floodplains (clarias catfish and the tilapia), along with deep-water fish such as the Nile Perch and synodontis catfish. This was complemented by the collection of molluscs (10%).234 As Petrie correctly asserted following his fishing equipment discovery in 1884, ‘these show that the canal [sic] here must have been more important, and that they caught big fish’.235

We should not assume that all objects relating to fishing found at Naukratis were used locally; it is possible that some objects belonged to merchants visiting Naukratis. For example, the 4th century BC merchant vessel, the Kyrenia Ship, although primarily a merchant ship, was, like others,236 also involved in fishing that provided an additional revenue stream for the owner and crew. The fishing equipment on the Kyrenia ship consists of 301 lead net weights from two casting nets, two fishing hooks, a wooden fishing line reel, large stone line weights and a lead weight.237

Recent research has revealed that fishing was a major industry in the ancient Black Sea, Mediterranean238 and the Red Sea,239 countering previous ‘primitivist’ perspectives, influenced in part by Greek or Roman authors’ description of these industries as primitive.240 The identification and analysis of fishing equipment complemented by epigraphy, papyri, ostraka, dipinti and ancient literature as well as iconographic depictions

234 Bertini 2016, pers.comm.
237 Thomas forthcoming, Pb1, Cu15, Cu26, W46, S6, S7, S10, (possibly) S9 and Pb7 respectively.
239 Thomas 2010; 2011; Blue et al. 2011.
240 For example Agatharchides on the Erythraean Sea, 32–40; Strabo Geography, 16.4.5-20; Pliny Naturalis Historia, 6.176 (on fishing in the Red Sea) and uncritically accepted as such by some authors (Gallant 1985).
and archaeofaunal evidence, have greatly increased our knowledge. This encompasses the fish targeted, the environment fished and the methods used, helping us to gauge their efficacy. Modern ethnographic accounts furnish useful comparative material. Fishing and its role can be divided into three areas: fishing, processing and marketing, and its social significance.\(^{241}\) Whilst the humble fisherman (\(\textit{piscator}, \textit{pisicapus}, \textit{άλιεύς}, \textit{ἰχθυοθηρίας}, \textit{ἰχθυεθηρίηρ}, \textit{ἰχθυβόλος}, \textit{θάλασσαργος}\))\(^{242}\) was generally perceived in Greek and Roman society as low in status, sometimes of a different ethnic group\(^{243}\) or even a slave, the high demand for fish and fish products meant that organized fishing associations could become affluent.\(^{244}\) Additional resources were required to maximize profitability, as fresh fish could not always be marketed immediately. Sometimes fish was processed by salting, drying, pickling, smoking or converting into sauces, processes which would require specialized installations, ingredients and skills.\(^{245}\)

Fishing was undertaken on different scales: recreational, subsistence, small and large commercial ventures. It was done from the shore, from fishing boats – rarely preserved\(^{246}\) or identified\(^{247}\) – or from sailing ships. A fishing boat was known as \(\textit{epactron},\) or more often by general terms such as \(\textit{lemnus}, \textit{lenunculus}, \textit{horia}, \textit{cydarum/kydros}, \textit{ratis} \) or \(\textit{schedia},\)\(^{248}\) and some had specially constructed fish tanks, known as \(\textit{navis vivarium},\) \(\textit{σκάφος} \) or \(\textit{έγγεννοι}.\)\(^{249}\) Small oared craft called \(\textit{ἐπκωμιότατον} \) operated on the Red Sea,\(^{250}\) where \(\textit{schediae} \) (small boats or rafts) were most commonly used.\(^{251}\) The small and variable group of known specialist fishing boats (small craft under 10m), include examples from Portus Claudius,\(^{252}\) lake Kinneret,\(^{253}\) Herculaneum,\(^{254}\) Toulon,\(^{255}\) Pisa,\(^{256}\) Naples\(^{257}\) and Marseille.\(^{258}\) However, the economic role of fishing on cargo ships is often underplayed, because the equipment is not always correctly identified.\(^{259}\)

### 7.5 Ship maintenance: ballast

Four groups of artefacts are preserved from the old excavations that can now be identified as objects used to maintain or operate sea-going ships. These comprise ballast stones, lead hull sheathing, hull sheeting tacks and brail rings from the sail. The first group comprises five water worn stones

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\(^{241}\) Thomas 2010; see Bekker-Nielsen and Bernal 2010.
\(^{242}\) Casson 1971, 392, see also Ayodeji 2004, 64.
\(^{244}\) Bekker-Nielsen 2010.
\(^{245}\) Trakadas 2005; Wilson 2006.
\(^{247}\) Beltrame 2010; Bernal 2010.
\(^{249}\) Ayodeji 2004, 64.
\(^{250}\) DiDoros Siculus Library of History, 3.40.1–9.
\(^{254}\) Steffy 1985; 1994; Bockius 2002.
\(^{255}\) Borreani et al. 1988; Brun 1999; Boetto 2009.
\(^{257}\) Boetto 2005; 2009.
\(^{259}\) Fifty-two of the 177 Roman period ships studied by Beltrame revealed fishing equipment (Beltrame 2002; 2010, 230; see Benoit 1961, 177–9; Biss 1987, 721; Santamaria 1975, 190; Joncheray 1975, 95–99, pl. 57, fig. 46; Charlin et al. 1978, 51).

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**Figure 53** Water worn ballast stone from Naukratis. Length 8.7cm. British Museum, 2011,5009.317

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found by Petrie at the river front in 1884.\textsuperscript{260} These are very similar to examples found during the recent 2015–16 excavations along the river front, which produced water-worn limestone and other stone fragments. They included stones, not from Egypt’s geology, which must have been brought into Naukratis as ballast. Petrie himself stated that ‘pottery, with oyster-shells on it… [and]… brick, similarly incrusted… [and a] stone covered with small barnacles; such could only have been brought up as ballast from the sea.’\textsuperscript{261}

7.6 Ship maintenance: hull

Naukratis was frequented by sea-going vessels, and these vessels required maintenance. Details on ship construction and how they were maintained is preserved in a range of artefacts made from wood, copper alloy, iron, pitch and lead. Further evidence for woodworking, wood treatment, anti-fouling and lead sheathing could be preserved in the tool assemblage already discussed, although many of the tools used could equally have been used for other (non-maritime) carpentry, although the saws and adzes represented were necessary for the construction and maintenance of Greek (and Phoenician) hull-first technique ship construction (but are not necessary for other ship and boat construction methods).

Good quality wood planks were probably a rare commodity at Naukratis, as no indigenous Egyptian tree could provide the long straight pieces required for sea-going vessels. This made the commodity exceptionally expensive.\textsuperscript{262} For this reason wood, even offcuts, would be recycled or burnt as fuel. Wood is rarely preserved in the archaeological record. The anaerobic conditions of the silted riverbank of Naukratis (excavated in 2015–6) revealed fragments of mortice and tenion joined ship planking. This suggests ship maintenance was undertaken in the vicinity.

All wooden hulls require constant maintenance to protect the wood from rotting, joints from leaking, and to prevent marine borers from penetrating the wood. Greco-Roman ships from the Hellenistic period to the 3rd century AD were sealed with pine pitch or bitumen,\textsuperscript{263} and often sheathed with lead sheets, attached by broad-headed copper tacks, for protection against boring molluscs such as teredo navalis.\textsuperscript{264}

‘Fouling’ is the growth of various shellfish and seaweed on the hull of the boat, which reduces efficiency when travelling through the water and can weaken the hull itself, and so the removal of this growth would have been an important occupation of crews. Marine barnacles were recognized by Petrie, who found them on the riverfront and retained some examples for future study.\textsuperscript{265}

\textsuperscript{260}British Museum, 2011,5009.315–18, and possibly 2011,5009.320.

\textsuperscript{261}Petrie 1886, 10.

\textsuperscript{262}Lewis 1983, 141.

\textsuperscript{263}Meiggs 1982, 467. Waterproofing was made from a composite of resin or pitch mixed with hardening agents, fibre or material and/or wax as well as pigments (Hocker 1995, 199; Colombini et al. 2003, 659). This was applied to the outside, to protect from borers, rot and fouling and inside to protect from rot caused by bilge water and can be found in boats of the classical Mediterranean (Parker 1992, 199; Hocker 1995, 199).

\textsuperscript{264}Parker 1992; Hocker 1995; Steinmayer and Maclntosh Turfa 1996.

\textsuperscript{265}Petrie 1886, 10; Museum of Fine Arts, Boston 86.937.
Lead hull sheathing is a technology commonly associated with Greek and Roman ships in the Mediterranean and the Red Sea from the 5th century BC to the 2nd century AD. It involved large sheets 1–2mm thick being laid over the pitch waterproofing and held in place by copper tacks in a characteristic ‘quincunx’ pattern. Lead hull sheathing fitting this description, c. 2mm thick with impressions left by the heads of sheathing tacks and pierced by their square shafts, have been found in Naukratis (Fig. 54), together with large flat headed (with grips) hull sheathing tacks with square sectioned shanks that were used to affix the sheeting (Fig. 55). They were usually made from a copper alloy, possibly because the ancient seafarers knew that copper nails poisoned barnacles preventing fouling on the hull. Two iron example were also found at Naukratis. They have heads 16–33mm diameter with grips on the inside. The shafts are square in section and 21–53mm long. One example still has trapped on the inside of the tack head traces of lead and organic residues, possibly pitch (Fig. 55).

As many of these pieces were found during Petrie’s first season of excavation, they were probably found by the river front, as discussed by Petrie. However, it is also possible that some represent the hoarding of metal for recycling for some other purpose, such as the making of fishing equipment.

The perceived benefits of lead sheathing are various and debated. Complete sheathing could prolong the life of a seriously deteriorated hull, possibly by protecting the pitch sealant from wear or detritus, by forming a barrier against fouling and marine borers, by sealing joints and seams, by increasing rigidity, preventing sagging, by patching areas of damage or rot and perhaps by ballasting. However, the ballasting and improved rigidity benefits were probably negligible and the protection against borers is the most likely motive. By the 3rd century AD lead sheathing was abandoned across the Mediterranean, possibly because of cost (specifically growing labour costs) and because it was replaced by driven or clamp seamed caulking, imported from northern Europe. Although lead is a by-product of silver smelting (and as a result relatively cheap in antiquity), lead was imported into Egypt, because Egyptian lead ores were primarily used for cosmetics and so there was still a transport cost implication for this useful commodity.

266 Parker 1992, 199.
267 Hocker 1995, 197.
268 Examples include folded scraps stored for re-use, in one case possibly modified into a bowl (Museum of Fine Arts, Boston, RES.88.35). Another is a lead strip with a square shank tack impression at one end (British Museum, 2011.5009.25). Unfortunately many have subsequently been lost, such as three deaccessioned examples in the Museum of Fine Arts, Boston, RES.88.37; RES.88.36; RES.86.39.
269 Parker Museum, London UC54643g; UC54643b. Iron examples were also found in Roman contexts at Myos Hormos on the Red Sea (Thomas 2011). The design is a slightly different form to those commonly used in the Roman period, known from Myos Hormos, so an earlier, Hellenistic or Late Classical date seems possible.
270 Ashmolean Museum, Oxford, AN1886.535; Museum of Fine Arts, Boston 88.764, 86.239.
271 Petrie Museum, London UC54643g; UC54643b. Iron examples were also found in Roman contexts at Myos Hormos on the Red Sea (Thomas 2011).
272 British Museum, 1886.0401.1733. The organic residues could not be confirmed as pitch through lipid analysis as the results were not conclusive, perhaps due to conservation undertaken in the 1880s.
273 Hocker 1995, 197.
7.7 Ship maintenance: sail

Rare evidence for Greek style sails comes in the form of two brail rings of horn (Figs 56–7) from Naukratis. These would have originally been attached to a sail as a fairlead for the brail lines used to adjust the sail. The two examples from Naukratis were excavated in 1903 by Hogarth and may have been discovered in the Hellenion, although this is not certain as he also undertook excavations in other parts of the town, including the river front. Therefore they may have been found where ship maintenance was carried out on the river front, or been stored within a merchant’s house in Naukratis. Both examples are complete, but for the significant wear around their attachment to the sail. It is not certain whether the rings were drilled when first created (as is often, but not always, the case for brail ring attachments), although wear suggests that they were used until the attached part was worn thin (or, with one example, completely worn through) by the friction of attachment to the sail cloth and rope.

Brail rings of horn are well known from the Ptolemaic and Roman Red Sea ports of Egypt, where they are the most numerous class of maritime artefact from Myos Hormos. The Naukratis examples have a similar construction to the Red Sea ones, having a rectangular cross section, unlike the more rounded wooden examples. It is impossible to compare attachments as the Naukratis examples are severely worn. Brail rings were also made from lead, copper alloy, wood and stone, with parallels from Archaic to Byzantine period shipwrecks in the Mediterranean.

Brail rings provide direct evidence for the size of brailing lines and by extension the sail and ship size. The rings had to have a uniform size to prevent the sail and brail lines tangling when furled. Comparative material from the large Myos Hormos data set (from various ships) varies from 27–90mm in diameter, providing some impression of the range of sizes used in antiquity. Examples from the Kyrenia ship, a c.15 m long single-masted ship, were from two sets, a large group of 59–67mm diameter and a small group of 65–72mm. Two large (c. 40 m long) Republican Roman wrecks, known as the Grand-Congloué wrecks, had lead brail rings of two sizes, one c. 80mm, the second 90–120mm. The Naukratis examples are 78–82mm in diameter, therefore are larger than those from the early (and small) Hellenistic Kyrenia ship and the majority from Red Sea ships, while comparable with those found on the Grand-Congloué wrecks. The Naukratis examples probably came from a relatively large sail, which was not commonly used during the Roman period (or later), due to sail

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278 Blue et al. 2011, fig. 14, 13–14; Whitewright 2007, 282–92. 169 brail rings comprising 118 of cattle horn and 51 of wood were found. These include an example attached to sail cloth and webbing (Handley 2003, 57, T331, which shows brails were spaced 0.81m apart). See also Wild and Wild 2001, 214 and Rouge 1987.
279 Parker 1992. Cavalàire (Charlin et al. 1978, 57–60), Grand Congloué (Benol 1961, 178–9, pl. 30), Grand Ribaud D (Hesnard et al. 1988, 105–26), Kyrenia (Swiny forthcoming), Straton’s Tower (Fitzgerald 1994, 169). Dor (Kingsley and Raveh 1996, 55 and pl. 49). 280 Large brail rings were required to guide the large diameter rope used as brailing lines to operate the large sails required for larger ships (Whitewright in Blue et al. 2011).
281 131 and 40 pieces respectively (Swiny et al. forthcoming).
282 Benol 1961, 178. The wreck site includes the remains from two shipwrecks mixed together during excavation (Parker 1992, 200–201), they are wrecks of c. 210–180 BC (cargo comprising over 430 amphora and over 7000 other vessels) and a 110–80 BC wreck (cargo of 1200–1500 amphorae).
innovations in the 1st and 2nd centuries AD that introduced multi-masted ships with multiple smaller sails (with smaller brail rings).283

Although it is not possible to date the context in which the brail rings were found, an Archaic or Classical Greek date is most likely, based upon the other material collected by Hogarth and the areas in which he was excavating.284 If so, these would be the oldest known examples of horn brail rings. Parallels are rare because horn brail rings usually float away as flotsam, or rot on the seabed.

Ship maintenance undertaken at Naukratis was necessary to keep the merchant fleet visiting Naukratis suitable for Mediterranean seafaring. This involved the use of various skills, tools, materials and installations available in Naukratis. Ship maintenance at Naukratis was concentrated on the riverfront adjacent to the Greek sanctuaries in the north western part of the ancient port.285 This area was apparently also the location of ballast dumping. It was in effect just a hard working surface on the riverbank of the Canopic branch of the Nile. Maintenance was probably undertaken by the skilled crew of the ships. Help, materials and tools may have been provided (at a price), by other communities resident, at least seasonally, at Naukratis. Various maritime artisans, skilled workers, shipyard hands and caulkers may have lived permanently in Naukratis. The wide variety of skills, trades and technologies represented by the tools and weapons are testament to the wealth, diversity and ingenuity of the population of Naukratis who facilitated trade within Egypt’s primary Mediterranean port from the late 7th to the late 4th century BC.

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283 Two-masted or ships with an artemon from the 2nd century AD (Casson 1971, figs 142 and 169; Deloche 1996, 223–4; McGrail 2001, 253–5) could have used smaller rings.
284 Hogarth could only have excavated the area of the Late Period river front, because the Hellenistic and Roman river front remains concealed beneath 5 m of earth in fields some 80 m to the west of the excavation area.
285 As confirmed by the British Museum excavations of 2015–6 and the reconstructed provenances of artefacts excavated by Petrie and Hogarth.