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First archaeozoological evidence for *haimation*, the 'invisible' *garum*

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Abstract

The fish remains are described that were found at the bottom of an Early Roman ceramic jar from Aila Aqaba, Jordan. The bones, representing the gill apparatuses of at least 33 medium-sized tunas (*Auxis*; Scombridae) and a single individual of a lizardfish (*Trachinocephalus myops*; Synodontidae), are believed to correspond to *haimation*. This highly prized fish sauce, documented previously only from ancient textual evidence, was typically made from the gills and the entrails of tunnids to which salt was added. The sauce was not imported from the Mediterranean or the Black Sea, but made from local Red Sea fish as shown by the zoogeographical distribution of the lizardfish that is considered as stomach content of the tunas. Because the fish bones were found in a locally produced jar and because the calculated volume of the *haimation* that the bones represent corresponds more or less to the volume of the jar, it is concluded that this high-quality *garum* was produced in this container at Aila itself.
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1. Introduction

The aim of this paper is to describe an assemblage of fish remains found at the bottom of an Early Roman ceramic jar from Aqaba, Jordan, that is believed to represent a special type of salted fish product, thus far undocumented by bone finds. Several overviews have been published that summarize the evidence available for the large scale production and commerce of salted fish and fish sauces in the Mediterranean and adjacent areas during the Roman period (e.g., Curtis, 1991; Etienne and Mayet, 2002). Emphasis is usually on the study of architectural remains of salting installations, amphorae and their *tituli picti*, texts from the classical writers and other written sources. As a result of the more systematic use of adequate recovery methods in the field and thanks to the availability, during the last few decennia, of better osteological reference collections needed for the identification, the number of fish bone assemblages representing salted fish products reported in the literature is constantly growing. The analysis of fish remains, found in salting vats, amphora bottoms, or sometimes without a precise context, yield complementary information that can be confronted with data from more classical sources. Fish bones permit the documenting of fish species used, their sizes and in some cases the type of product (*salsamentum* or fish sauce) can also be inferred (Desse-Berset and Desse, 2000). This can be particularly useful since amphorae mostly lack a *titulus*, and their supposed content has often been established on the basis of the type of shape. When botanical remains are preserved, the herbs that were added to flavour the product can also be identified (Hamilton-Dyer, 2001; Van Neer et al., 2006) and this information can in turn be compared to recipes known from classical texts. In some cases the organic remains can help to elucidate problems encountered during the analysis of *tituli picti*. For instance, Curtis (1991: 8), (footnote 12) disagrees with a previous identification of the label CICER/HAL[LEX] as a mixture of chick peas and *allec* (Remark, 1912), and supposes it indicates that

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the same amphora had first been used for peas and subsequently for fish sauce, or vice versa. However, the botanical and insect remains found among the bones of a salted fish product from an Early Roman context at Quseir al-Qadim show that the contents were a mixture of salted fish and legumes (Van Neer et al., 2006).

There are, however, also a number of drawbacks inherent to archaeozoological analyses since certain types of fish products are *a priori* almost invisible using traditional bone studies. *Salsamenta* can be attested when made from entire fish or from chunks (von den Driesch, 1980: 152) still containing bones. The classical writers, however, also mention various types of salted fish products which must have contained no or almost no fish bone. Such products made from large fish (mainly tunnids) include *tetragona*, *trigona*, *cubia*, and *melandrya* (Curtis, 1991: 6–7; Etienne and Mayet, 2002: 38). Among the fish sauces, *allec* has the best chances of being documented by bone finds because it still contains numerous bones whereas *garum*, *liquamen*, and *muria* were salty liquids that were fairly clear, if strained (Curtis, 1991: 14). Archaeozoological evidence for fish sauces indeed thus far only consists of *allec* finds (Van Neer and Ervynck, 2004: 208). Attempts are being made to try and trace fish lipids or their degraded products by residue analyses of pottery sherds, but studies have been hampered by the polyunsaturated nature of fish fat and the resulting chemical instability and leaching effects (Brown and Heron, 2004). However, even when extraction methods and definition of diagnostic markers for fish appear in the future (cf. Hansel et al., 2004), it is unlikely that it would be possible by residue analyses to make a distinction between the various fish products.

2. Provenance of the fish bone finds

The evidence reported here derives from ancient Aila (modern Aqaba) on the Red Sea coast of Jordan (Fig. 1). The site was excavated between 1994 and 2003 (Parker, 2003, with earlier references). Aila, a coastal oasis, was a port at the nexus of several land and sea routes connecting the Mediterranean world with the Red Sea and Indian Ocean littoral. Various excavation areas yielded a continuous stratigraphic sequence through the Nabataean, Roman, Byzantine and Early Islamic periods (late 1st century BC to 10th century AD).

One major focus of excavation was Area M, lying about 450 m from the modern shoreline. The location of the ancient coastline has clearly changed over time and it seems possible that Area M when occupied (i.e. 1st to 4th centuries AD) lay closer to the coast than at present. Area M exposed a large portion of a domestic complex which experienced five major phases of occupation over this period, before its final abandonment in the early 4th century and reuse as a cemetery later in the same century (Parker, 2003: 321–24; Retzleff, 2003). The first two phases of occupation in Area M date to the Nabataean/Early Roman period in the 1st century AD. Only limited evidence of the earliest phase was recovered. The second phase of occupation in the late 1st century witnessed construction of a domestic complex, built largely in mudbrick. The

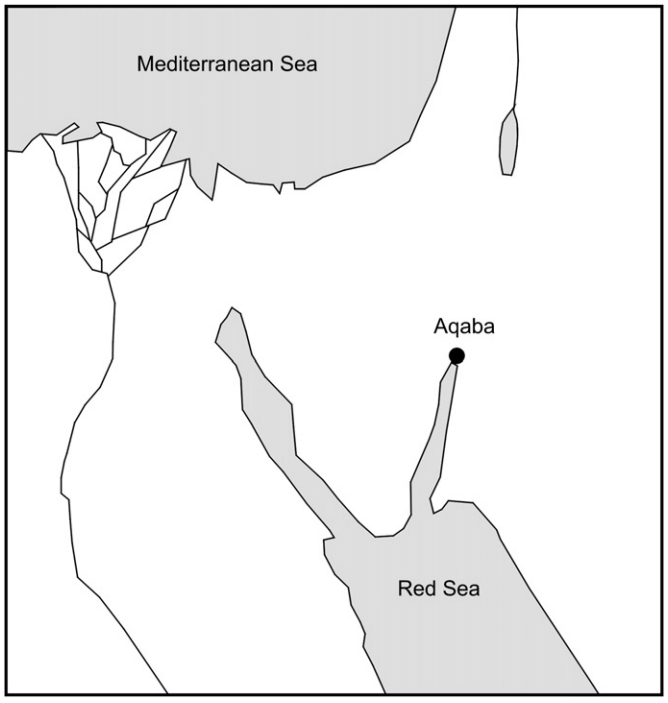


Fig. 1. Location of Aqaba.

complex was abandoned about the turn of the 2nd century, an event possibly connected with the Roman annexation of Nabataea in AD 106. This event may have witnessed more violence and discontinuity of occupation than once thought (Parker, in press). The Area M complex was soon reoccupied later in the 2nd century, with reuse of some existing walls but also with much new construction, largely in stone with some mudbrick. This reoccupation again appears to have been domestic in nature and begins the first of three Late Roman phases from the mid- to late 2nd through early 4th centuries. The final abandonment again seems to have been deliberate and peaceful. The abandoned complex was reused later in the 4th century as a cemetery that included about a dozen intrusive burials, the last discernable evidence of occupation until the 20th century.

The domestic complex of the second phase (late 1st century) consisted of several separate structures, none fully exposed by excavation (Fig. 2). The structures were constructed of mudbrick walls with floors of beaten earth. Most included clay-lined ovens built against the outside faces of walls in external courtyards. In the southwestern sector of trench M.4 excavation exposed one corner of an apparent interior space. Within the corner of this room was a beaten earth floor (locus M.4:44). Imbedded in the floor was a partially preserved Early Roman jar of local ware, excavated as locus M.4:45 on May 27, 1998. Only the lower portion of the jar was preserved; it was filled with earth and hundreds of fish bones (Fig. 3). The jar was subsequently covered by a fill layer deposited at the beginning of the 2nd century reoccupation of the complex (Retzleff, in press). The date of this context is based both on stratigraphic and artefactual evidence. Although originally dated to the third occupational phase in the early 2nd century

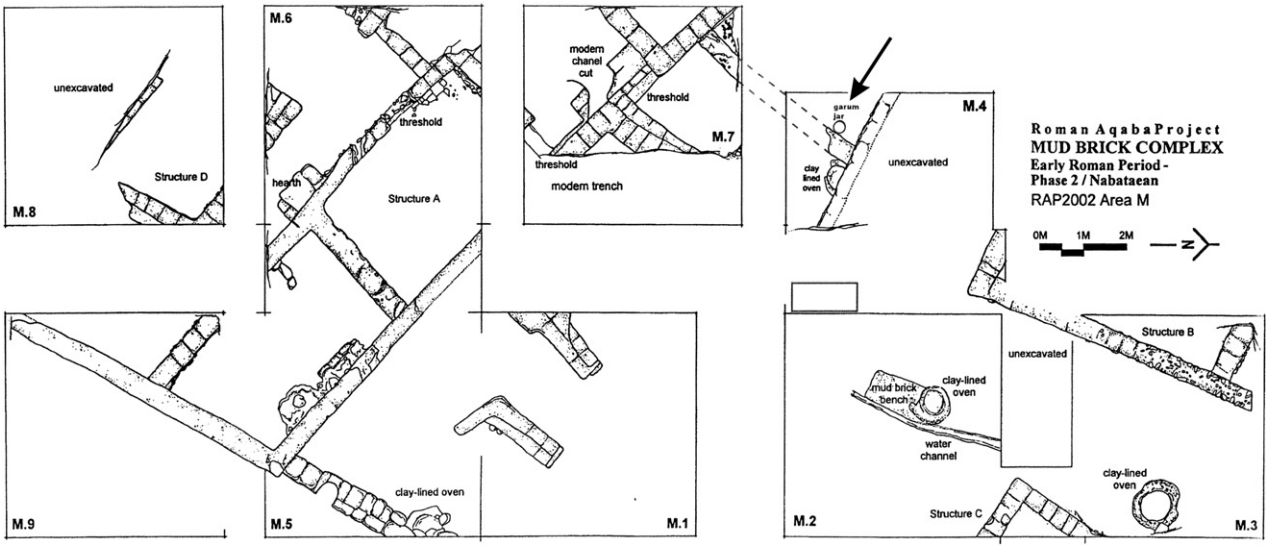


Fig. 2. Plan of the Early Roman/Nabatean domestic complex in Phase 2 (late 1st century AD). The jar with fish bones lay in a corner of a room in Trench M.4 (indicated with an arrow).

(Retzleff, 2003: 55), it now seems clear that the floor and associated jar actually date to the second phase in the late 1st century. The associated local coarse ware pottery dates to the 1st and 2nd centuries. More closely datable were a few sherds of Nabataean painted fine ware of the mid-1st century (Dekorphase 3a, ca. AD 20–70). The fill layer under the phase 2 floor yielded a closely datable sherd of Eastern Sigillata A (ESA) dated to ca. AD 40–70 (Hayes Form 48), providing a *terminus post quem* for the laying of the floor above (Hayes, 1985: 36).

The ceramic vessel is a typical 'ribbed-neck jar' of local ware, the most common type of storage vessel at Aila between the 1st and 3rd centuries AD (Fig. 4; for other published examples, see Dolinka, 2003: 128: #20–#21; Retzleff, 2003: 59, figure 15; 18–19). The vessel displays the characteristic ribbed globular body and ring base. It once included a ribbed neck and twin vertical loop handles that extended from the upper shoulder to the rim. The estimated capacity of the preserved portion of the jar is ca. 8.5 litres; the original capacity of the jar when complete was ca. 9.8 litres.



Fig. 3. The Early Roman jar *in situ*.

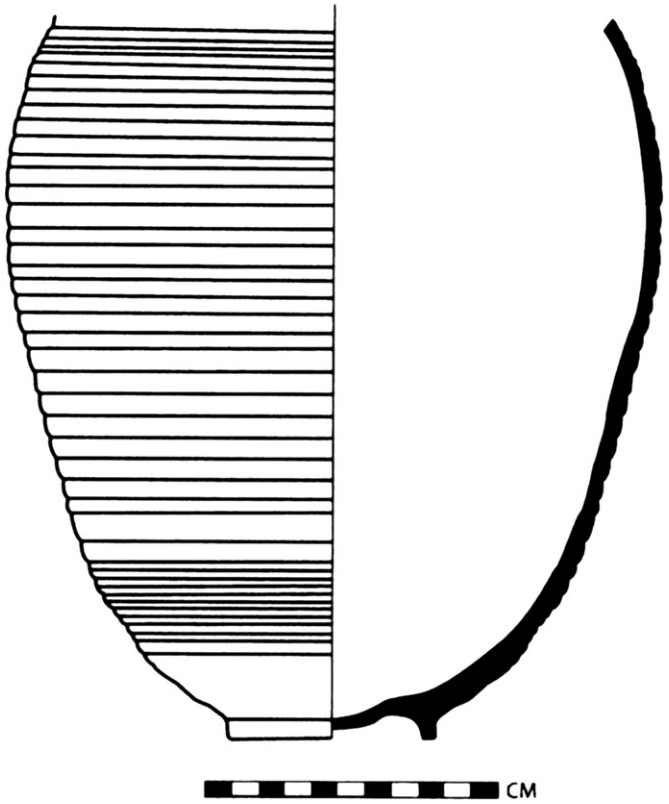


Fig. 4. Drawing of the 'ribbed-neck jar' of local ware.

3. Description of the fish remains

With the exception of four bones, all the fish remains recovered from the bottom of the jar are branchial elements. Comparison with the reference collection of modern fish skeletons, housed at the Royal Belgian Institute of Natural Sciences, showed that they belong to scombrids. The most diagnostic elements permitting this identification are the pharyngobranchial III and IV. Their general shape and, especially, the form of the toothplate (Fig. 5), are only found in the genus *Auxis*. The second pharyngobranchial bears no teeth and this also excludes an identification as *Thunnus*, *Euthynnus* or *Sarda*. Within the genus *Auxis* two species are distinguished, the frigate tuna (*Auxis thazard*) and the bullet tuna (*Auxis rochei*) (Collette and Nauen, 1983; Collette and Aadland, 1996), although many authors (e.g., Fraser-Brunner, 1950) believe that there is only a single worldwide species to be designated as *Auxis thazard* and in which *Auxis rochei* is included. The modern skeletal material at our disposal does not allow verifying if osteological differences exist between both forms on the level of individual bone elements, but a more accurate identification would not be relevant to the discussion regarding the provenance of the fish. Indeed, both forms are cosmopolitan in warm waters and occur, amongst others, in the Mediterranean, the Red Sea, including the Gulf of Aqaba, and the Indian Ocean. Direct comparison of the Aqaba fish bone material with modern *Auxis* specimens of known body length shows that the corresponding fish had a standard length (SL) of between 40 and 50 cm (standard length = length of the fish from the tip of the snout to the base of the caudal fin).

A detailed overview of the skeletal elements from these scombrids is given in Table 1. Left and right elements of paired bones were recorded separately, and this allowed establishing the minimum number of elements (MNE, see Lyman, 1994: 102–104) that need to be accepted. The figure of 33 first hypobranchials corresponds at the same time with the minimum number of gill apparatuses included in the assemblage.

The four non-scombrid remains are a dentary, a parasphenoid, a frontal and a hyomandibular, belonging to the family of the Synodontidae (lizardfish). All the bones seem to be from a single individual measuring between 15 and 20 cm SL. The general morphology of the bones shows some similarities with *Synodus* and *Saurida*, but only with *Trachinocephalus myops* a perfect match has been found. Especially the anatomical details of the dentary seem to exclude any other taxon. While Cressey and Wapples (1984) mention several species of *Saurida* in the Red Sea, they report *Trachinocephalus myops* only south of Mozambique, and from the Persian Gulf farther east. Goren and Dor (1994), however, mention the latter species also as an inhabitant of the Red Sea.

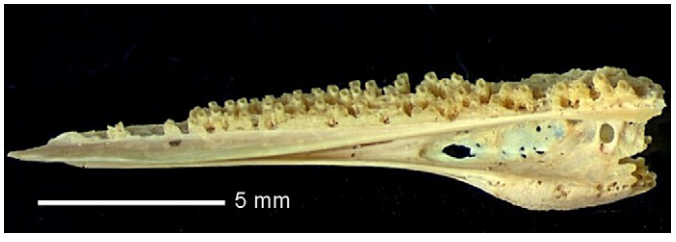


Fig. 5. A pharyngobranchial III of *Auxis* from the Early Roman jar.

Table 1
Overview of the *Auxis* skeletal elements

Paired elements	MNE			Fragments
	Right	Left	Unknown	
Pharyngobranchial I	–	–	3	–
Pharyngobranchial II	22	8	–	–
Pharyngobranchial III	23	20	–	–
Pharyngobranchial IV	15	19	–	3
Epibranchial I	20	25	–	–
Epibranchial II	30	26	–	–
Epibranchial III	26	28	–	–
Epibranchial IV	23	15	–	–
Ceratobranchial I	–	–	–	–
Ceratobranchial II	–	–	–	–
Ceratobranchial III	20	26	–	–
Ceratobranchial IV	25	20	–	–
Ceratobranchial V	–	–	–	57
Unidentified ceratobranchial	–	–	–	109
Hypobranchial I	24	33	–	–
Hypobranchial II	24	20	–	–
Hypobranchial III	20	29	–	–
Gillraker	–	–	71	–

Unpaired elements	MNE
Basibranchial I	7
Basibranchial II	21
Basibranchial III	8
Basihyal	1

	Fragments
Unidentified branchial remains	668

Minimum number of elements (MNE) was established and in cases where this was not possible fragment counts are given.

4. Discussion

4.1. Identification of the product

The fact that almost exclusively elements of the gill apparatus of a tuna species are represented obviously suggests that these finds were a product designated as *haimation* by classical authors. According to the author of the *Geoponica* this is the best *garum* typically made from the intestines of tunny along with the gills, juice and blood (Curtis, 1991: 13). The amount of bone within such a product was relatively small and possibly this was the reason why the fish sauce found at Aila was apparently not filtered, a lucky fact which ultimately also allowed its identification. The bones of the other, smaller fish, no doubt represent stomach content.

It is not clear in which recipient the production of the haimation happened. The product found at Aila could either have been obtained by fermentation of the ingredients in the ceramic jar in which the bones were found or, alternatively, it may have been produced in another recipient or installation from where it was subsequently transferred into the jar. The latter scenario seems less plausible since it can be expected

that, when transferring the liquid into another container, care would have been taken to decant it in such a way that impurities would not flow simultaneously into the final container. A small experiment was carried out, inspired by the one of Desse-Berset (1993). After the analysis of a Dressel VII amphora, recovered from a shipwreck near Sud-Perduto, that revealed the presence of *salsamenta*, she was able to fill a replica of the amphora with 25 Spanish mackerels of the same size as in the archaeological context. This amount was comparable to the MNI of 26 established by the bone analysis.

From the osteological analysis it appears that a minimum of 33 tuna gill apparatuses were present from fish measuring between 40 and 50 cm SL. A gill apparatus and the guts of a scombrid (*Sarda sarda*) measuring 51 cm SL and weighing 2.2 kg, obtained from a fish monger, had a weight of 200 g and a volume of about 200 cm^3. This means that the volume of the fish tissue of 33 individuals would be about 6.6 litre (200 ml × 33). The amount of salt that would normally be added is difficult to estimate. According to the *Geoponica* "sufficient salt" was sprinkled on. The fish-to-salt ratio recommended for fish sauce production elsewhere by the same author would correspond to 8:1 (Curtis, 1991: 13). If it is accepted that this is also the proportion used in *haimation* production, about 0.8 litre of salt would have been used, and the total volume corresponding to the bone finds from Aila Aqaba would therefore be about 7.4 litres, which is very close to the estimated volume of 9.8 litres of the ceramic jar. This means that the bone contents of the jar are preserved more or less in their entirety and that if some taphonomic loss occurred, this must have been minimal. These findings also suggest that the production of the *haimation* was in the jar itself.

4.2. Provenance of the product

The jar and its contents were clearly in use during the last years of the Nabataean kingdom, then a client state firmly under indirect Roman control. The fact that the *garum* was found in a ceramic container of local origin could mean that the sauce itself was also a local product. It seems unlikely that the sauce was imported in another container and decanted into the local jar because, in that case, one would expect fewer bones and thus a greater discrepancy between the actual volume of the jar and the calculated volume of the product represented by the bones. Ancient texts make no mention of the Nabateans engaged in *garum* production but do stress their luxurious lifestyle. This is supported archaeologically at Aila by a wide range of imported goods recovered in significant quantities, not to mention the luxury products attested in documentary sources that have not survived in the archaeological record, such as frankincense and myrrh (Retzleff, 2003: 56–62).

The geographical distribution of the *Auxis* from which the *haimation* was made gives no clue as to the area where it was produced. Theoretically, it could have come from one of the large production centres documented in the Western Mediterranean, or from another centre less well known, but supposed to have been present in, for instance, the Black Sea area (Højte, 2005). However, the presence of a single individual of lizardfish belonging to a species that does not occur in the Mediterranean or the Black Sea allows to narrow down the area where the product was manufactured to the Red Sea (or theoretically also an area farther east).

Thus far, no evidence has been found in the whole Red Sea area for possible salting installations. Small scale, even domestic manufacture of salted fish products, has been supposed for areas for which no archaeological or written evidence is available for salteries (e.g., Drexhage, 1993 for Egypt). Along the Red Sea coast, fish sauces were produced made from local clupeiforms as shown by finds from a Late Roman amphora and some other contexts at Berenike (Van Neer and Ervynck, 1998, 1999), and early Roman (mid 1st to late 2nd century AD) Quseir al-Qadim (Van Neer et al., 2006). In Petra, a late 4th–early 5th pilgrims flask was found containing thousands of small clupeiform bones (Studer, 1994), and also at Jabal Hārūn in the Byzantine monastery, about 5 km southwest of Petra, some isolated small bones of this taxon were found in sieved sediment dated to the Late Byzantine–Early Umayyad periods (late 6th–7th centuries AD) (Frösén et al., 2002).

Typical for *haimation* is that large numbers of tuna-like fish are needed which seems to imply that open water fisheries needed to be well developed. Small scale, domestic manufacture therefore seems unlikely. Thus far, the fish bones from other Roman contexts at Aila Aqaba have not yet been analysed, but a first quick scan of the material from Area M, dated between the 1st and 4th centuries AD, shows that the necessary amounts of large fish would certainly have been locally available to allow production of *garum* and other salted products. Open water taxa such as scombrids, carangids, sailfish are well represented, indicating that offshore fishing was practiced to a large extent.

Another indication that fisheries were probably well developed in the Gulf of Aqaba during Roman and early Byzantine times is given by the large amount of fish bones discovered at, amongst others, two forts of the Arabian frontier (el-Lejjūn and Da'janiya) east and southeast of the Dead Sea (Toplyn, 2006: 497, 505), and several Roman forts in the northern Negev (e.g. Lernau, 1986) and Jabal Hārūn (Frösén et al., 2002). The majority mentioned from the last site consists of parrotfish, as usual on inland sites, but scombrids represent 6% of the fish bone assemblage also showing that open-sea fishing in the Gulf of Aqaba must have been regularly practised.

5. Concluding remarks

This find of the highest quality *garum* from antiquity in what otherwise appears to be a rather humble domestic complex on the northern outskirts of Nabataean Aila raises intriguing questions about the occupants of the Area M complex in the 1st century AD. Although their homes look rather ordinary for the region in this period, the inhabitants apparently had regular access to a variety of imported goods, including wine from various Mediterranean production centres, glass vessels and window glass from Phoenicia, and terra sigillata

from Syria (Jones, 2000; Retzleff, 2003: 56–62; Parker, 2007).

Although ancient texts rightly stress the role of Aila in international commerce, the current excavations have also revealed evidence about several local industries, including pottery and metal-working, about which the textual sources are silent (Parker, 1998: 388–91). Although we await more study of the entire collection of fish bones recovered from the site, it now seems probable that production of high quality *garum* may be added to the known industries of Aila's economy.

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