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Fish and Ships in the desert? The evidence for Trans-Saharan trade in fish products

Victoria Leitch

Fish and ships in the desert? These are perhaps two of the least likely things you would normally associate with the hot, dry, vast sandy stretches of Libya's Sahara. Camels, however, are known as 'ships of the desert', and are able to travel extensive distances across inhospitable desert, delivering people and goods, and often moving in large groups. These caravans stopped at oases for refreshment; which often became important entrepôts. Recent work by David Mattingly's archaeological team in Fazzan¹ has highlighted the relatively surprising quantity of Roman goods being imported to the Saharan zone, by both camels and donkeys, including oil and wine in transport amphorae, so why not fish? This question has not previously been investigated, so my aim in writing this paper was to examine the available evidence to ask to what extent we can talk of fish and ships in the desert. First I present an overview of the sites and desert trade, secondly I investigate the direct evidence for fish trade, thirdly I look at indirect evidence through containers, fourthly I examine demand for these products in the desert and then finally I look at where the fish products in the desert may originally have been produced. The concluding analyses interrogate the validity of the original question.

Although few sites away from the Libyan coast have been investigated, the excavations and surveys that have been carried out, published to varying degrees of detail, allow questions about fish trade to be raised. The sites include the Roman forts of Gheriat-al-Gharbia

and Bu Njem, the pre-desert Libyan valleys survey and settlement at Ghirza, and further south in Fazzan, the Garamantian stronghold in the Wadi-al-Ajal and its capital, Garama, as well as Aghram Nadharif, and the Wadi Tanezzuft Valley, near Ghat to the west.



Fig. 1. Camel train from Ghirza tomb (Brogen, Smith 1984, plate 110b).



Fig. 2. Map of sites in Libya mentioned in this study (imagery © ESRI; map by Dr Martin Sterry).

1. Mattingly *et al.* 2007a, 2008, 2009, 2010a, 2011.

1. Desert trade: an overview

Bu Njem

The fort at Bu Njem, situated along the river el-Kebir, 100 km from the coast and 300 km from Lepcis Magna was excavated between 1967 and 1980 by a French team.² Inscriptions date the building of the fort to 201, which was garrisoned by a detachment from the *Legio III Augusta* from Lambaesis. The camp was abandoned between 259 and 263.³ The pottery drawings in the publication are not identified or dated but include what looks like African Red Slip ware (ARS) A, D, C, Roman cooking wares from Tunisia, African lamps and mainly Tripolitanian amphorae, but also a number of late Africana amphorae from Tunisia, suggesting that occupation went on from after the abandonment of the fort and into the 5th century.⁴ The development of the settlement around the fort, recently surveyed but not yet published by Michael Mackensen's team, certainly suggests a non-military population involved in trade and that the fort became an important node in longer-distance trade systems.⁵ A number of ostraca found at Bu Njem and studied by Marichal refer to the arrival of Garamantes at Bu Njem with donkeys and barley.⁶ There are also references to ships and Lepcis Magna, confirming that trade went both north and south.⁷

Gheriat el Gharbia

The fort of Gheriat el Gharbia is currently being investigated by Michael Mackensen.⁸ It is known through inscriptions that it was built under Septimus Severus in AD201 and was probably garrisoned until at least AD238 and perhaps up to AD275, also by a detachment from the *Legio III Augusta*.⁹ The pottery includes ARS A, D and C, Tripolitanian sigillata and lamps, and amphorae mainly from Tripolitania but also from Tunisia and a small number of eastern imports, giving us clues about the direction of trade and suggesting that the area remained occupied after the garrison left until at least the 5th century.¹⁰

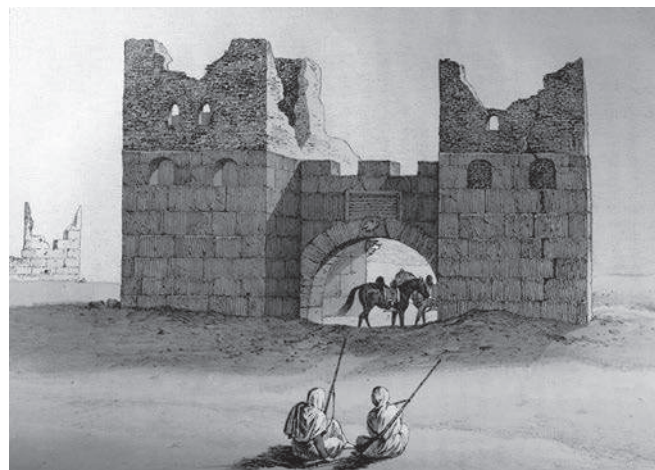


Fig. 3. North gate at Bu Njem (George Francis Lyon 1821).

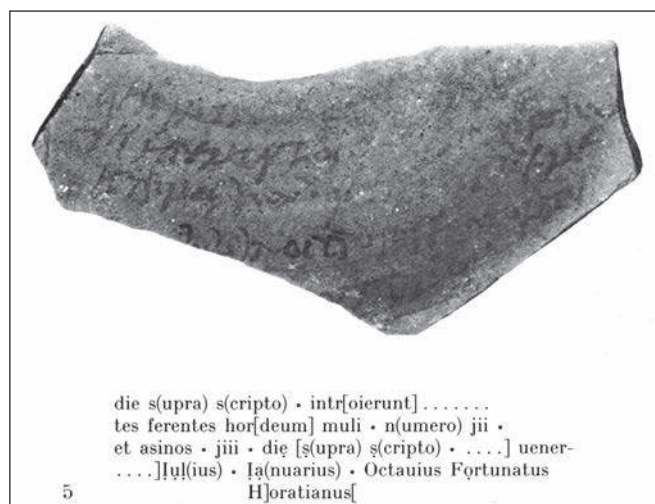


Fig. 4. Extract from ostrakon 74 at Bu Njem.

These two forts, situated near oases, represented the limits of Roman domination. On the one hand the soldiers were provisioned by the army for basic supplies but on the other the soldiers bought goods from merchants, creating new trade routes and demands that fed local production and longer distance trade. We see similar patterns in Egypt, where the consumption of salted fish was widespread and fairly cheap: in AD143 the *dipla* 12 litre amphora was sold for one drachma (P. Oxy. III 520). Also salted fish "temachia" were imported by the soldiers stationed in the forts of Eastern desert of Egypt, attested by ostraca at Mons Claudianus, Maximianon,¹¹ and Didymoi.¹² These Libyan fort sites thus could have acted as frontier markets, as well as centres for taxation and controlling trade going south.¹³

2. See Rebuffat *et al.* 1966-67, 1969-70, 1974-75, 1976-77.

3. Bu Njem 1969-70, p. 20.

4. Bu Njem 1969-70, p. 53-85.

5. Wilson 2012.

6. Marichal 1992, p. 111 and Ostrakon 72.

7. Marichal 1992, p. 104 and Ostraca 89, 97, 98, 104.

8. Mackensen 2010, 2011.

9. Mackensen 2010.

10. *Id.*, p. 398-413; 2011, p. 317-25.

11. Cuvigny 2003, O.Claud, 233 and O.Max 876.

12. Cuvigny 2012, p. 32.

13. eg Troussset 2003 on taxes at Zarái.

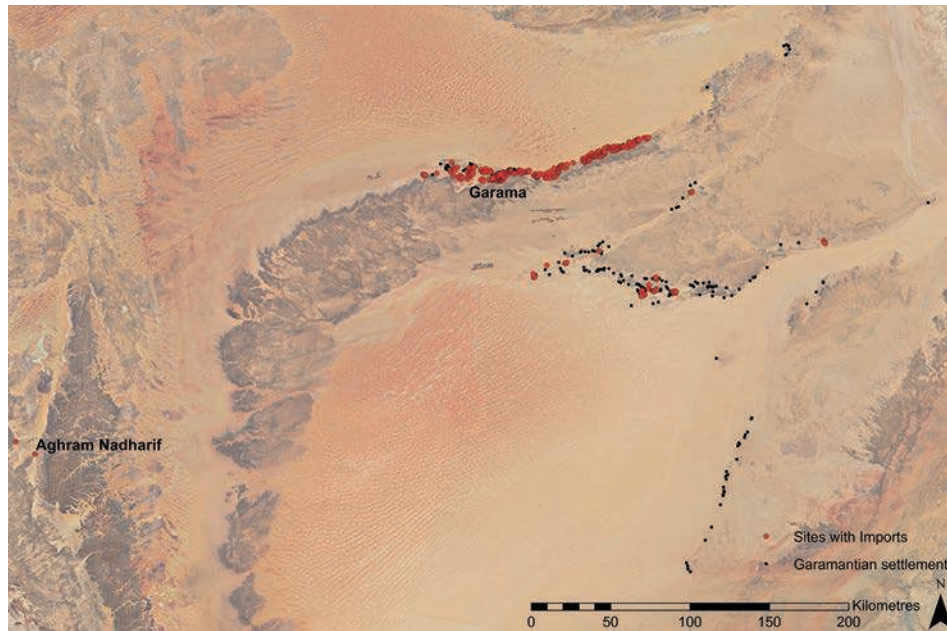


Fig. 5. Map of the Wadi-al-Ajal (imagery © ESRI; map by Dr Martin Sterry).

Ghirza

The settlement of Ghirza is in the pre-desert, a land characterised by alternating uplands and wadi basins. Ghirza is 250 km south east of Lepcis Magna and 130 km from the coast to the northeast. It is the largest settlement in the pre-desert and is characterised by farmhouse buildings dated from the mid 2nd to 5th century and mausolea, though it is thought to have existed before the Roman period.¹⁴ The arrival of the Romans at the forts meant that Ghirza and the pre-desert fell under Roman control, which greatly stimulated agriculture and trade, well into the late Roman period. The pottery includes some Italian Sigillata and then much later 4th to 6th century ARS and lots of Tripolitanian Red Slip ware (TRS). The lamps are African and Tripolitanian and date from the 2nd to 6th century.¹⁵ The amphorae were not recorded, but there are reliefs showing probable Tripolitanian amphorae.¹⁶ The indication is that settlement was more intense from the 4th century.

Libyan Valleys

Surveys carried out by the British ULV survey counted over 2500 sites, mainly farms connected with agriculture and the production of oil and wine.¹⁷ The

evidence demonstrates intensive farming and water management systems and the grand funerary mausolea are a testament to the wealth of this population, much of which may have come from agriculture and trade. As we see at Ghirza, the development of this area was probably initiated by the military presence and associated trade, which continued after the abandonment of the forts. The grain, oil and wine surpluses would have been sold to the forts and perhaps north to Lepcis Magna and Mediterranean markets. However, their main trade may have been local, for the increasing population in the Libyan Valleys. Andrew Wilson also argues that the Libyan Valley farms traded south with Fazzan.¹⁸ No amphorae workshops have been found in the area, but amphorae have, suggesting that they were brought in from elsewhere for bottling or more likely amphorae used for goods coming in from the north were reused. Other containers such as skins may also have been used (see below on Alternative Containers).

Wadi-al-Ajal

The Garamantes were a native Libyan civilisation with their stronghold in the Wadi-al-Ajal in Fazzan, centred around the capital at Garama. They seem to have been involved in trade from the 6th century BC to at least the 5th or 6th century AD (see **fig. 5** for distribution of sites and imported material in the Roman period).¹⁹ Their management of water resources meant they could

14. Brogan, Smith 1984, p. 34–35 and fig. 1 map.

15. *Id.*, p. 234–41 for pottery report.

16. *Id.*, plate 82a.

17. Farming the Desert 1996a, p. 111–158, and in particular plate 126b which depicts wine production.

18. Wilson 2012, p. 430–31.

19. Mattingly *et al.* 2010b, p. 523–30.

cultivate crops and their position as an oasis between the Roman forts and sub-Saharan Africa put them in a powerful strategic position, trading north and south. The Romans tried to control the area, and Cornelius Balbus from Cadiz, proconsul of Africa, led a campaign there in 20 or 19 BC, for which he received a triumph in Rome.²⁰ Although it is clear that he did not fully conquer Fazzan, his campaign may have initiated closer ties with the region, as part of Augustus's wish to expand and control the borders of the empire – with an eye on the potential for trade with sub-sahara regions. The knock-on effect of closer links between the Garamantes and the Romans was of course the importation of more Roman goods, which began in earnest in the late 1st century AD. Goods imported from the north included Italian and Gaulish finewares in the early Roman period, taken over by ARS in the 2nd century and an abundance of mainly Tripolitanian amphorae.²¹ In addition, there is a large quantity of glass,²² a pattern we also see in Oman in the 1st century²³ and the Axoumite kingdom in the 3rd to 6th centuries²⁴, where it was used for funerary purposes. Dates, new crops, alum, salt, natron, metal objects, beads, semi-precious stones and gold may have come from Fazzan itself or the sub-Sahara, and gave the Garamanians goods to trade with the Romans, alongside the main trade in slaves and perhaps exotic animals.²⁵

This brief overview demonstrates that there was a great deal of trade circulating between the coast, the Roman forts, the pre-desert settlements and Fazzan. These sites highlight the eastern routes, going from the coast via the Hamada el Hamra to the Roman forts and into the Wadi al-Ajal, the centre of the Garamantian territory. There is also a possible route going from Fazzan to Ghat and Ghadames, and then north to Sabratha or Jerba, however this route was somewhat longer and for the moment we do not have sufficient evidence from Ghadames to advance the question of trade at Ghadames and its connection with the other sites. In essence, the abundance of ARS, oil and wine amphorae, some of which came from coastal sites, would certainly suggest that salted fish and fish sauce could have been part of regular trade to the desert. The customs tariff from Zarai in Numidia dated to AD202, although some way from

the Libyan desert, provides evidence for the types of goods that were crossing the African frontier for onward travel south, and the list includes garum.²⁶

2. Direct evidence from fish remains

First of all, it is important to stress the major problems with collecting fish bones on excavations. Fish bones are extremely hard to spot for an average archaeologist, and the only way to find them is through wet sieving.²⁷ Inge Bodker Enghoff, during work on a medieval excavation in Denmark, demonstrated that unless careful sieving is systematically practised, the presence of fish will be grossly underrepresented.²⁸ Of course for fish sauce, the bones would have been sieved out, so no evidence would remain and the only way of detecting this would be through residue analysis of the amphorae. More hopeful are shellfish remains, which survive well.

Bu Njem

At Bu Njem no fish bones were found, probably for the reasons suggested, and it needs also to be considered that in the late 1960s and 70s when the excavations were carried out, detailed scientific analysis was not yet practised. However, the shellfish, *dolium galea*, common in the Mediterranean, was found in the building with niches; and in the principia, the shellfish *murex brandaris*, also common in the Mediterranean and used for making purple dye.²⁹ It is, however, highly unlikely that purple dye was made at Bu Njem, and far more likely that it was made on the coast, as demonstrated by Andrew Wilson's investigations at Roman Sabratha and Lepcis Magna, where he noted the presence of crushed murex shells.³⁰ Instead, murex were probably eaten at Bu Njem: a habit mentioned by ancient authors such as Ennius and Hicesius.³¹ Both these shellfish contexts date to the main period of military occupation in the early 3rd century.

Ghirza

At Ghirza oyster shells were found in a large building, but the specialist who looked at them thought they were probably dead when collected and so were not

20. Pliny NH V, 36; Mattingly 2001; Bernal, Arévalo 2011, p. 249; Desanges 1978, p. 189-195.

21. Dore *et al.* 2007; Mattingly *et al.* 2010b; Leone 2013.

22. Hoffman 2007; Cole, Hoffman 2007a, b; Hoffman 2010; Hoffman 2013.

23. Whitehouse 1998; 2000.

24. Morrison 1989; Harlow 2000.

25. Mattingly *et al.* 2007b, 2010b (in particular summary p. 526-530), 2013.

26. Troussset 2003, p. 263.

27. Ruth Pelling, pers com.

28. Bekker-Nielsen, Bernal 2007 p. 199.

29. Bu Njem 1969-70; 1976-77, p. 37-77.

30. Wilson 2002, p. 433-34.

31. Botte 2009, p. 60.

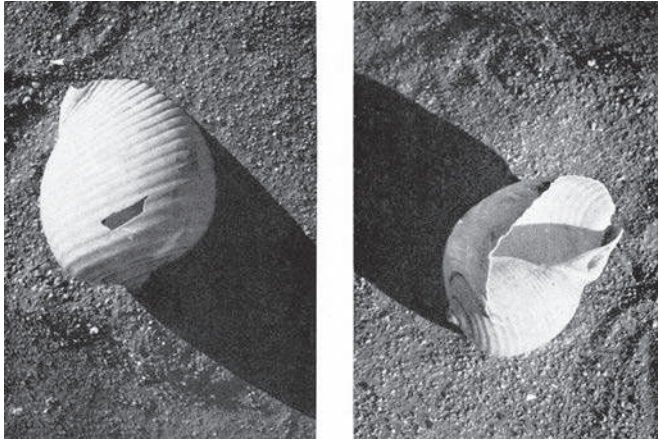


Fig. 6. Shellfish *dolium galea* found at Bu Njem (Rebuffat *et al.* 1970, plate XLI).

used for food, and it is instead suggested that they were used as a temper for the handmade pottery.³² However, it seems highly unlikely that merchants purchased and transported dead oysters, but instead it is more probable that they sold live oysters, a luxury item, to the wealthy owners of the building they were found in. We know, for example, that oysters were traded long distances, particularly in Gaul (see Bardot-Cambot, this volume). There are also a number of fish representations on the funereal monuments – some of these may have been symbolic, associated with the celestial ocean, and fish were also a good luck symbol³³. However, such an abundance of fish symbols also suggests an association with fish consumption at Ghirza.

Libyan Valleys

M. Van der Veen's examination of the botanical remains from the Libyan Valleys survey brought to light the vertebra of a sea fish *Sparus pagrus pagrus*, couch's sea bream, in a midden at site Kh01001.³⁴ This fish is common off the shores of Libya today, mainly found in mud and gravelly ground in beds of vegetation in water up to 200 m deep. These fish can grow up to 75 cm and weigh 10 kg, but the bone found suggests a 25 cm length and a weight of 300 g. Similar remains have been found at Berenice, the Roman coastal city in modern day Benghazi in north eastern Libya.³⁵ Looking at the context of this find, site Kh01001 contained 1st to 5th

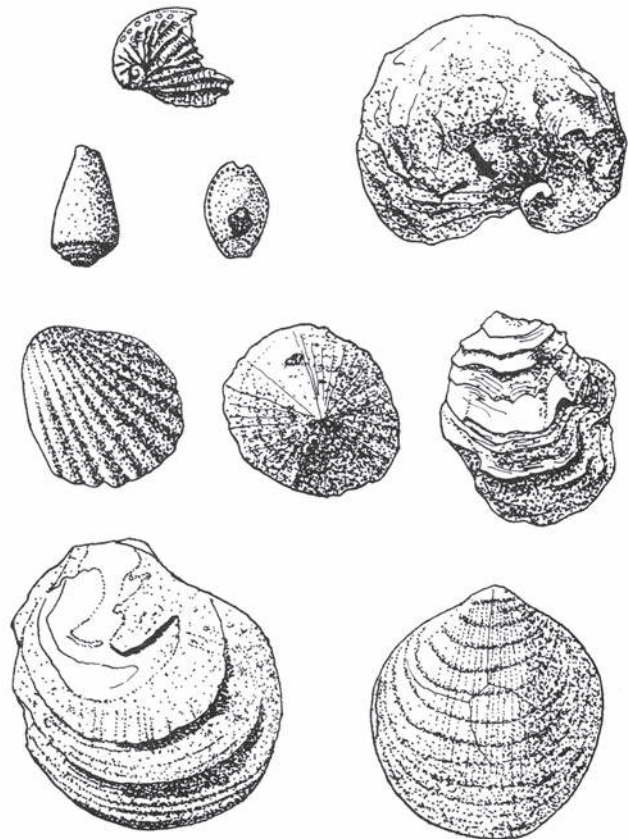


Fig. 7. Oysters found at Ghirza (Brogan and Smith 1984, fig. 94).

century Roman pottery, including ARS Hayes 6, 68, 87, 90, 104 and Tripolitanian II amphorae. This site was in close proximity to a large fortified farm with a Roman press, cistern and an extensive surrounding settlement. Another smaller farm nearby had Tripolitanian amphorae, including form II, and several late Roman amphorae such as Lepmminus II (probably for garum³⁶) and Keay 62 (Kh41, 2: 357, 359). So certainly fish was consumed in the pre-desert in the Roman period, although to what extent we do not know.

Garama, Wadi-al-Ajal

Excavations at the Garamantian capital of Garama revealed a fish vertebra found in botanical samples.³⁷ Ruth Pelling and Hannah Russ recently re-examined the bone.³⁸ Apparently the bone is a caudal vertebra from the Mugilidae fish family (mullets) suggesting a fish of

32. Brogan, Smith 1984, p. 94-95, 284, 290.

33. eg Brogan and Smith 1984, plates 109b, 119a, 121.

34. Farming the Desert 1996a, p. 253; Farming the Desert 1996b, p. 139.

35. Wheeler 1979, p. 25-6.

36. Bonifay 2004a, p. 82.

37. Pelling in Mattingly *et al.* 2001, p. 146.

38. Ruth Pelling, English Heritage, Hannah Russ, University of Sheffield.

approximately 30 cm in length. It compares favourably with the thinlip grey mullet (*Liza ramada*). However, there are other mullets in the *Liza* genus that it could potentially be - such as *Liza aurata* (golden grey mullet) or *Liza saliens* (leaping mullet), which being the same genus have similar vertebral morphology. All these mullets have a similar distribution – Mediterranean coasts and coasts on the NE Atlantic. We know that they were salted in antiquity.³⁹ All three species inhabit coastal waters and enter estuarine areas at times. The context in Garama is surprisingly early, being 2nd to 1st century BC, suggesting very early Roman trade, or referring back to the Punic trading phase in Fazzan – testified by many well-made punic coarseware bowls from the 3rd to 2nd century BC and early amphorae, including Greco-Italic types.⁴⁰ So, sparse as this evidence is, it is another hint at fish trade, from an early date, which could be interpreted as a sign that the Garamantes appreciated fish products even before the Roman period and therefore may well have sought such products when links with the Romans opened up.

The Wadi Tanezzuft Valley, near Ghat

As a final note, it is interesting that in the Wadi Tanezzuft Valley,⁴¹ near Ghat, to the very far west of the Garamantian territory, there were no fish remains, despite thorough archaeo-botanical collection. There are also very few Roman imports so this region seems to have remained outside the influence of Roman eating and drinking habits, of which fish was an important element.

3. Indirect evidence from amphorae

Investigations into the transportation of fish products suggest that amphorae were the most commonly used containers for salted fish and garum. The use of amphorae for shellfish is debated, as many amphorae with shellfish inside them have been found on shipwrecks and it is argued that the shellfish infiltrated the amphorae after the ship sunk. However, Emmanuel Botte points out that the ancient sources testify to the consumption and trade of shellfish and that an African Mau 11 found at Pompeii with an inscription MOL might be interpreted as MOLLIA, referring to shellfish – but this could have

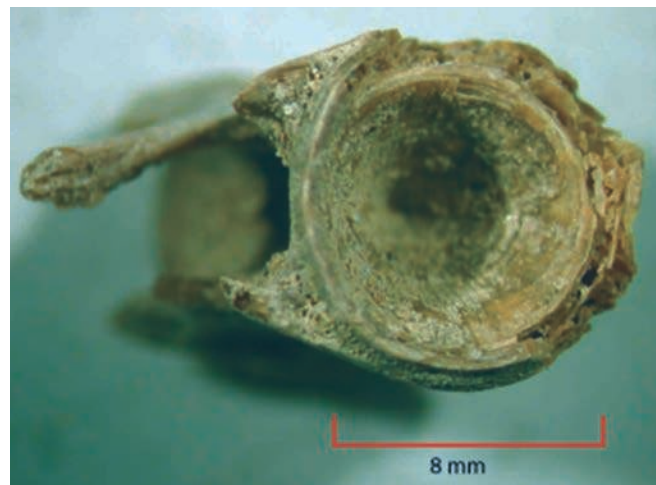


Fig. 8. Caudal vertebra from the Mugilidae fish family (Ruth Pelling)

been marked to signify a change of use.⁴² Also, shellfish do not grow in all environments, and so the environment of the shipwreck may indicate if the shellfish were brought in from elsewhere.

Tripolitania II and Africana IIA, C and D amphorae

Even if we know that salted fish were transported in amphorae, how do we know which types? The debate about the contents of certain types of amphora is ongoing and difficult to resolve,⁴³ particularly with re-use to consider and the new evidence that probably all amphorae were pitched.⁴⁴ For fish, pitch lining was appropriate, and certain African amphorae types show pitch more than others. For example the large Africana IIA (end 2nd to mid 3rd century) IIC (mid 3rd to 4th) and IID (mid 3rd to early 4th) are usually pitched and have generally been associated with wine or fish products,⁴⁵ such as an amphora containing shellfish found on the shipwrecks of Giglio Porto and Pampelonne.⁴⁶ At Fazzan, we have the much smaller Africana I, which was generally used for oil, but this form may have been selected and reused there due to its size, which was easier for desert transport, particularly if donkeys were used, and its contents may therefore have varied. For Tripolitanian amphorae, it is widely demonstrated that Tripolitania I and III have no apparent traces of pitch and so were for oil, as testified

39. Botte 2009, p. 25.

40. Dore *et al.* 2007, p. 336-341, 364-367.

41. Alhaique 2002.

42. Botte 2009, p. 38.

43. Bonifay 2004b, Garnier 2004; Garnier *et al.* 2011.

44. Garnier *et al.* 2011, especially p. 411-12 demonstrates that even Dressel 20 amphorae were pitched but the olive oil dissolved the pitch which then moves to the core is no longer visible.

45. Bonifay 2004a, p. 107-118.

46. Botte 2009, p. 38.

at Monte Testaccio,⁴⁷ but that Tripolitania II, dated to the early 1st to 5th century, were often pitched and used either for wine or fish products, and are an evolution of the punic Van der Werff 3 amphora.⁴⁸ However, typologies are modern inventions, so care must be taken in assuming that particular forms always corresponded to particular contents. In addition, there are potential problems with the identification of Tripolitania II amphorae as fish storage vessels. Firstly, the Van der Werff 3 from which it evolved is thought to have carried wine;⁴⁹ second, other than the workshops at Sabratha, we do not yet have proof for sizeable fish production workshops along the Libyan coast, and tanks recorded in survey may have been for wine storage; third, the Tripolitania II amphora in the Ghirza relief is in a banquetting context, so probably pointing to wine; and finally, tuna, the main fish used for salting, typically inhabit the western and central Mediterranean waters and some research suggests limited migration to the Libyan coast,⁵⁰ which could mean that fish salting was probably a minor industry in Libya, where other fish, such as mullet, were used, but on a much smaller scale. So perhaps the most we can say is that Tripolitania II were principally for wine, but we cannot exclude the possibility that they also carried fish products.

Amphorae production

Another way of tying particular amphora types to fish products is by looking at the close proximity of amphora production sites to fish installations, and noting the types produced. One recent example of this is the Lepcis Magna hinterland survey which covered 27 km west of Wadi Giabrun.⁵¹ Tanks and an amphora production site were found in very close to one another – samples from the amphorae production site have since been examined by Claudio Capelli who concluded that they were definitely from the kiln site, and the forms are predominantly Tripolitania II.⁵² But the tanks may have been for wine storage. In addition, a survey undertaken by Chris Preece at Janzour, 18 km west of Tripoli found rock-cut channels and a rectangular basin, which could be for fish salting, though this is unlikely if there was a

channel link to the vat, in which case it would have been for fish breeding, which would more likely have been just to serve a villa. There were at least five kilns nearby but only four pottery sherds were published including a Tripolitania I amphora, so this does not yet provide us with any convincing evidence for a fish factory and associated amphora production.⁵³

To sum up, there are problems with the typological association of certain amphora types with fish products from the Libyan coast, but the Tripolitania II seems the most likely, and in addition, the Sahara seems to have *Africana* IIA amphorae which are thought to have contained fish.

Amphorae from Bu Njem

At Bu Njem 125 amphorae were recorded. Of these, 82 are Tripolitanian, including 19 Tripolitania II forms and 4 Tripolitania II/III (the designation II/III is because forms II and III have similar rims but different handles, and when the handles are missing it can be difficult to definitively categorise them).⁵⁴ There are also 22 *Africana* forms, of which 20 are *Africana* IIA, which are a candidate for fish products.⁵⁵ Certainly the Tripolitania II and *Africana* IIA amphorae would have contained wine for the thirsty soldiers and those in the settlement, but we can hypothesise that some of them may have contained fish products.

Amphorae from Gheriat al Gharbia

At Gheriat al Gharbia survey and excavation revealed that more than 50% of the amphorae were Tripolitanian. The table published by Mackensen does not distinguish between Tripolitania II and III but the illustrations demonstrate that there were several Tripolitania II variants suggesting that their presence was not insignificant. There is also an illustration of an *Africana* IIA.⁵⁶

Amphorae from Ghirza

Although the amphorae from Ghirza were not studied or published, there are reliefs showing probable

47. eg Revilla Calvo, 2007.

48. Bonifay 2004a, p. 89–90 for summary of evidence.

49. Bonifay 2004a, p. 89.

50. Fromentin, Lopuszanski 2013. This requires more indepth investigation to clarify.

51. Directed by Luisa Musso and the University of Roma Tre, see Schorle, Leitch 2012 for preliminary findings.

52. Capelli, Leitch 2011.

53. Preece 2011.

54. Bu Njem 1969-70, p. 99-105: Tripolitanian II: nos A9-12, 34, 42, 49, 51-6, 58, 60, 64, 65, 73, 80; Tripolitanian II/III: A19, 22, 38, 41.

55. Bu Njem 1969-70, p. 103 fig. 21: *Africana* IIA nos 99-119.

56. Mackensen 2010, p. 412–413.



Fig. 9. Ghirza relief with amphora (Brogan, Smith 1984, plate 82a).

Tripolitanian II amphorae. One is a banqueting context: there is a seated man playing the citar, and next to this a camel loaded with four amphorae, and between them a man carrying a large amphora, the shape of which resembles a Tripolitania II. The other stone show camels and amphora (not photographed).⁵⁷ Certainly the banqueting relief suggests wine amphorae, and throws into question the use of Tripolitania II for fish, but we cannot yet discount the possibility that this amphora type was also used for fish.

Amphorae from the Libyan Valleys

The Libyan Valleys report published only a very small amount of amphorae, with the majority of the body sherds being categorised as unidentified coarse-wares – David Mattingly, who was on the original survey team, confirmed that there were in fact very few amphorae remains on the ground, and even fewer diagnostic sherds. The published amphorae include mainly Tripolitania I and III, but there are a few examples of Tripolitania II, nos 4, 6, 7, which appear on several sites.⁵⁸ Some of these Tripolitania II amphorae were found in a press building where they were reused for

storing wine or oil.⁵⁹ Others may originally have carried fish from the coast, though there is no proof for this yet.

Amphorae from the Wadi-al-Ajal

Amphorae from survey and excavation, carried out in the 1960s and as part of David Mattingly's Fazzan Project in the early 2000s have been published in *The Archaeology of Fazzan 2*. The amphora report written by the late John Dore groups Tripolitania II and III amphorae together, due to their fragmented nature, his mid Roman Fazzan type 21. Some of these can certainly be classed as Tripolitania II.⁶⁰ Additional material includes amphorae from the museum storeroom, which were photographed and recorded by John Dore, and the pottery from David Mattingly's most recent Desert Migrations Project.⁶¹ A preliminary analysis, however, indicates that there is a whole range of Tripolitania amphorae that do not fit into any previously known categories (such as the Tripolitanian I, II, III series) and for which the contents remain a complete mystery. Amongst these are a small early Roman form (Dore's Fazzan type 13) with a wide mouth, which could conceivably have

57. With thanks to Andrew Lawrence, University of Bern, for the photo and suggestion, see also p. 205 n.21.

58. *Farming the Desert* 1996b, p. 355-361.

59. This site was published as an oil press, but see Brun 2004, p. 186 for an argument that it was probably for wine, like many other presses in the region.

60. Dore 2007, fig. 41.13.

61. Leitch, current research as part of David Mattingly's Trans-Saharan Project, University of Leicester.

been made for transporting salted fish. However, until work resumes in Fazzan and residue analysis carried out, this question remains unanswered. In addition, it is worth considering whether or not the amphroid flagons, which seem to have Tripolitanian fabrics, and which would certainly have carried something for their journey across the desert, may have contained wine or indeed fish sauce.

Amphorae from Aghram Nadharif

The fortified citadel of Aghram Nadharif, investigated by an Italian mission, represents an interesting contrast to Garama. Although still within the Garamantian kingdom and linked to caravan routes, it was on the southern fringes and there are in fact very few Roman imports, and the report does not mention fish remains. It should be noted, however, that a number of Tripolitanian amphorae are mentioned, including form II,⁶² hinting at perhaps the limited infiltration of fish products.

4. Alternative containers

Two possible alternatives to amphorae known in the Roman world for transporting goods, liquid and solid, are skins and barrels. The first point to consider is whether or not these materials are suitable for fish products. Elise Marlière and Josep Torres Costa looked at the use of these alternative materials in Africa.⁶³ Skins were used principally for water, milk, oil and wine. Obviously they would not be suitable for more bulky salted fish, but we know that they were sometimes pitched or coated in butter to make them impermeable, so why not use them for garum? In the area of Oued el Gattar in the high step lands of central Tunisia olive oil was produced alongside ARS pottery but not amphorae, making it certain that skins were used, corroborated by a Hayes 55C plate of second half of the 4th century depicting camels carrying skins, which were of course much lighter.⁶⁴ The use of barrels is attested in Africa, such as on a mosaic from Carthage, from the second half of the 1st century,⁶⁵ and of course wood was far more abundant in Tunisia during the Roman period. Emmanuel Botte points out that the shape of barrels made more economical use of space for packing salted fish, and in 2nd-century Italy we know

that barrels were used for fish.⁶⁶ Also, a barrel found at Fos-sur-Mer near Marseille dated to the end of the 1st century contained sardines.⁶⁷ So, although we have no direct evidence from Libya for the use of skins or barrels for carrying fish products, this is a possibility that we should bear in mind.

5. Demand for Roman goods in the Desert

The evidence for fish trade in the desert is certainly not in abundance, but alongside the arguments concerning amphora types used for fish, the possibility seems more real. An additional factor to consider is the impact of the appearance of Roman goods that may have stimulated demand for these new products such as olive oil, wine and possibly fish, as well objects such as finewares or glass. For the garrisons at the frontier forts, it is certain that they would have imported goods such as oil, wine and fish, and since we know they traded with the Garamantes it is highly probably that fish made it south along with oil and wine. However, garum, particular to the Roman cuisine, may not have suited Saharan cooking habits or even been particularly popular. We know from the mixture of local and Roman goods found in Garamantian graves⁶⁸ that they were not identifying fully with the Roman way of life, and for instance continued to use particular handmade casseroles that were unlike the African forms so ubiquitous at Mediterranean Roman sites. Another possibility is that Roman merchants were living in Fazzan and ordered these goods (a similar question arises for the Roman amphora found at Arikamedu, in the Bay of Bengal⁶⁹) but we have no evidence to support a Roman population and the quantity of Roman amphorae suggests that they were used by the wider population.

6. Where did the fish come from?

Evidence along the Libyan coast for fish production is slowly increasing thanks to new survey work. Perhaps the best known examples are from Sabratha. Andrew Wilson's summary and his own personal observations show that there were numerous groups of vats over a metre wide and deep, lined with waterproof mortar

62. Felici 2006, p. 245.

63. Marlière, Torres-Costa 2007.

64. *Id.*, p. 91, fig. 4.

65. *Id.*, p. 95, fig. 7a.

66. Botte 2009, p. 166-168.

67. *Id.*, p. 167.

68. E.g. Mattingly *et al.* 2010b, p. 222-298, burial catalogue for Saniat bin Huwaydi and Desert Migrations work by the Trans-Sahara Project.

69. Tchernia 2011, p. 138-39.



Fig. 10. Wide-mouthed Fazzan type 13 amphora and amphroid flagons from Tripolitania found in Fazzan (Photos by John Dore, Toby Savage).

and similar to fish salting vats in Salakta.⁷⁰ Associated smaller vats may have been used for making garum, liquamen or hallec. There are at least 18 workshops, and probably more, dating from the 1st to 2nd century, signalling highly organised urban fish production. Andrew Wilson attempted to calculate the volume of production which even when deliberately minimised indicates a surplus, and he suggests that those living on the coast probably ate fresh rather than salted fish, so assumed the salted products were mainly for export. However, salted fish was another type of dish, so the locals probably did buy this in addition to fresh fish, particularly as fresh fish are seasonal, so salted fish would have been eaten in between seasons. This factory at Sabratha is also much smaller than other known factories that exported their products, such as Lixus, Cotta, Troia or Salakta. An additional problem with associating Sabratha with large-scale export of fish products is that no amphora production site has yet been discovered. That said, Nina Keay's pottery report indicates an increase in the number of local/regional amphora forms in the early imperial period, with Tripolitanian types representing 47% of the amphora total from the first half of the 1st century to the 3rd century.⁷¹ David Peacock studied the fabrics and concluded that the Tripolitanian types formed a textually homogenous group, perhaps pointing to a common origin in the Sabratha area.⁷²

In addition to Sabratha, there are the two recent surveys already mentioned at Lepcis Magna and Janzur near Tripoli. The Lepcis Magna survey revealed a landscape of villas, many associated with olive or wine presses, and also a rock-cut square pool which may have been used for keeping live fish. One villa had associated tanks and nearby many Tripolitanian amphora sherds.⁷³ However, it must be recognised that villa production was often just for local markets, and the tanks could have been for wine, likewise the amphorae.

At Janzur the rock-cut channels suggest fish-traps or pens, though these were probable for live fish for local consumption. West of Janzur, Preece also found a large rectangular basin adjacent to the sea, which could have

been for fish, and to the east at the regatta complex a series of pools bordered by a barrier of rock with sluices cut into it, as seen also at Apollonia for keeping fish.⁷⁴ But this is not a clear indication for fish salting factories and export trade. Mohamed Hesein's survey work in Cyrenaica also opens up the possibility of fish production sites, though it is unlikely that these products were exported in the direction of Fazzan.⁷⁵

So the evidence to support the theory for large-scale fish production along the Libyan coast is as yet lacking. It would seem more sensible to suggest that fish products were relatively rare, and luxurious, in Libya, and certainly in the desert.

Conclusions and future directions of research

The research undertaken for this paper would suggest that the title 'Fish and Ships in the Desert' has some validity, though the volume of fish trade is a question that remains unanswered. Direct evidence from fish and shellfish remains in the Libyan Valleys, at Bu Njem and in the Wadi-al-Ajal prove that fish were transported there. Indirect evidence from amphora types which probably carried fish products found at Gheriat-el-Gharbia, Bu Njem, the Libyan Valleys and in the Wadi-al-Ajal suggest the presence of salted fish trade and garum, and perishable containers such as skins and barrels may also have been used. In addition, the fact that many other Roman goods were traded in the desert, such as oil, wine, pottery and glass suggest a demand for Roman goods and cultural objects, and that fish may have been another such item. To better answer this question, more surveys and excavations on the Libyan coast need to be carried out to establish first, whether we are looking at fish production or in fact storage tanks for wine or other products and second, the true scale of fish production. Finally, residue analyses of amphorae that may have carried fish need to be undertaken, especially on the Tripolitania II amphora that may well have been exclusively for wine.

70. Wilson 2007.

71. Keay 1989, p. 67-70

72. Peacock, Seager Smith 1989, p. 70; Keay 1989, p. 80.

73. Schorle, Leitch 2012.

74. Preece 2011.

75. See Mohamed Hesein's contribution in this volume.

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