

WORTH OF THEIR SALT...

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Anthropologists have collected numerous stores of myths from all over the world. Those of ancient Greeks have a special flavour: they reflect the search of an intelligible order, the need of knowing which connection Man has with the environment. For example, the myth of Aphrodite is closely related to her birth in a divine milieu, Pontos, the salted waves on which life depends.

In the myths developed by their speculative intellect and exegetical imagination, Greeks of the early ages were tempted to go beyond their mortal limits. Myths are of different kinds, echoing their various origins. They contribute to by-pass human limitation and to get in touch with Nature without any anxiety about all kinds of termination. Concerning the myth of Aphrodite, fertility and beauty are associated in a divinity born from salt. See Aphrodite, Sex and salt – from butterfly to man (*Nephrology Dialysis Transplant*). This substance mediates between diet and sensuality. Referring to such myths, Hesiod (8th century BC) develops his *Theogony* to deal with the genesis and the continuation of the world: in this case, thanks to salt and sexuality. Empedocles elevates the myth to a pure concept, Love.

CAUSES AND EVENTS OF A MERE SUBSTANCE

Gone with the win. Remains salt, a precious gift of the sea and the sun according to Pythagoras (6th century BC) and Hippocrates (460-377). The former focussed on the importance of the sun in salt production. 'Concerning salt, he would have said, it should be brought to table to remind us of what is right, for salt preserves whatever food it finds, thanks to its origin, sun and sea'. This was echoed by Plutarchus (50-125) later on. 'Unless salt is used for cooking, there is practically nothing which is palatable. Added to foodstuffs, it enriches their flavour as a basic seasoning' (*Symposiakon*, V, 10). Salt is a medium to season the diet. Fish and meat require its preservative power for quality and security of food. Exchange consolidation preludes with added value products, which means better profit.

Salt encourages sheep, cattle and draught animals to pasture. Aristotle (384-322) stated that sheep are in a better condition by keeping their hydro-mineral balance under control. 'The animals that drink saline water can copulate earlier. Salt must be given to them before they give birth' and during lactation. Supply of milk is much more copious for salt makes a flock healthier and fatter when mixed with their food. It improves taste and texture in both cheese and meat.

One of the characters participating in Plutarch's *Symposiakon* (V, 10) draws his commensals' attention to the fact that 'Salt encourages remarkably generation'. He insisted on its generative propensity by giving various examples. Even if Aristotle and Plutarch fail to explain the reason why, observation leads them to evaluate how important is salt appetite (this drive is innate in animals) due to the danger of sodium deficiency when the response is of a restrictive nature.

Athens is a paradigm of the political and environmental forces which could liberate individuals from traditional constraints and initiate economic and cultural welfare.

Trade is built on open economies, and open economies can benefit from a positive environmental language far from any theoretical systematisation. Thus, institutional background was not to interfere with free trade at that time. The men in charge with the cities were not engaged to shape the forces driving economic activities. Flexibility based on fair competition was aimed at optimizing profit in Athens, Byzantium, and other places, irrespective of any programme designed to 'renewing our commitment to the prosperity,

deepening our engagement with rising economic power, and embodying the global potential for progress". Such an emphatic wording would have been turned into ridicule. It is not so easy to compare ancient economies with modern ones. Trade was a vital component in the Athenian economy. The basis for the trading supremacy of the city was laid by Themistocles (525-460) in the early fifth Century with the establishment of an active port. Another momentum resulted from the public works initiated by Pericles (495-429). Other economic activities rested mainly on craft skills like high standard painted pottery (Kerameikos). A final source of wealth was silver mining (Laurion). Salt was available elsewhere, and the sites where to get it were fully identified, as evidenced by Strabo (58 BC-25) in his *Geography*.

The Greeks were active merchants, and owing to the mountain barriers making movement by land difficult, chiefly maritime merchants. Trusting themselves to their ships, they disseminated along the coasts. In this way, they came in contact with the Barbarians of the north, offering weapons, ornaments, pottery and cloth in return for wheat, salt, fish and other raw products. They also engaged to stimulate settling on the islands of the Egean, estuaries running in the Black Sea, and lands lying in a crescent around the eastern Mediterranean basin, even in the Far West; and in sharing experience of how to exploit available resources within an ever increasing geographic area.

Between two wars, years of patient cooperation and research were used by Greek cities to improve the economic order thanks to globalising trade opportunities. In as much as salt was widely available along the explored shores, the chance was to get it integrated into the large scale curing and preservation operations of fish and meat. This was a matter of fact: in Greek colonies, these raw materials were manufactured at the cheapest price. Τάριχοι were exported in relation to the increasing need of food products in line with demographic development. Should marine and salt-based activities had not been properly organised, flourishing centres around the Black Sea would never have brought the right answer to the need of quality food.

Salt is rather remarkably well distributed all over the world thanks to solar evaporation on sea shore or around salt lakes (Tatta), and to dry or solution mining (rock salt from underground deposits). Ancient civilisations appear to have had access to one or another of these sources according to ancient scholars. As regards salt production, the major development was an increasing exploitation of the sea while the widely available resource was associated to fishing activities. The lagoons of the Egean, and Black Sea were paving the way to trade centres close to existing, and sometimes natural salt works, aimed at taricoy supply according to Herodotus (484-420), and Strabo as well.

However the lawyers were not so much interested in salt as such as shown by Isocrate's (436-328) comments about a substance which does not deserve any panegyric, for it is cheap and common. No monopoly was installed although modern unreliable allegations sometimes prevail. According to Athenaeus (c.AD 200), Lysimachos failed to tax pan salt from Tragasae. The related salt springs have dried up as soon as he had decided to regulate the price of this indispensable commodity... See his *Deipnosophistae* (73d). Moreover its supply as such or as salted fish was not socially contributing to high reputation. Fishmongers (τάριχευτές) were of low condition. See Theophraste's (372-287) *Characters*. Comedians teased them traditionally (foul individuals when they went into politics).

Aristotle who wrote a great deal was basically a collector of facts, anxious to state some points better than his predecessors about the nature of things. Περί δὲ τῆς αλμυροτητος αὐτῆς λεκτέον... 'It is now time to deal with salinity'. Various observations in relation to the saltishness of the sea and of certain spring waters are showing that he retains real interest in areas such as environment and the evolution of the world. 'The same parts of the Earth are not perpetually wetlands or dry areas. Changes are taking place, indeed... Today, the sea submerges a part of former continental estates, and to-morrow it will emerge again'. See his *Meteorologics*.

Where salt is to be harvested further to solar evaporation, or produced from salted water surging from the earth, it is obvious that it meets both Man requirements and nature conservation. It is perceived a typical case which combines the renewable character of the resource and the sustainable development of a production aimed at answering the demand. Sea salt has both internal coherence and topical interest.

Logic is the servant of knowledge provided it does not lead a logician to advance from evident facts to unprofitable conclusion. The sophism called 'sorite' (σωρος) constitutes an example of such an intellectual entanglement. Whereas piling up salt grains, how to know the very moment when the pile is in being? Chrysippe's (280-205) answer is that there is no answer.

A civilised life is impossible far from the sea, its salt and other delicacies. Homer (9th century BC) made laugh at those who had never seen the sea. He suspected them to be uncouth people. Ten centuries later, in his description of Greece, Pausanias (2nd century) observed this was not so unusual. Nowadays, certain public health theorists (terrorists) would like to ignore salt. The food industry's energetic response to the apparent sodium and hypertension relationship shows that the debate cannot remain one-sided whereas hypertension is a multifaceted risk factor; like the ancient Greeks, they are worth of their salt...

A CASE STUDY OF ANTHROPOLOGICAL ACTION: FISH SALTING IN THE MEDITERRANEAN ECOSYSTEM

One aspect of fish in ancient diet as staple food relates to its nutrition status: high in protein, vitamin, and calcium. This status is affected by two negative factors i.e.

- High energy input required to produce suitable quantities
- Inability to get fresh fish preserved unless salt is available to.

This constraint can be partly overcome by salting fish catches or converting them into fish sauce.

The economics of fishing activities deserve special attention from an environmental point of view. On the one hand, the production capacity depends on proximity of the sea, knowledge of stocks (pelagic species), human adaptation to natural cycles, and efficiency of fishing gears. On the other hand, salt resources widely determine the appropriate location and extension of processing sites.

Early fishing is supposed to take place within the oikoj economy under the conditions of which fish catches and salt harvesting are aimed at meeting limited food requirements. Fishing on a larger scale is attested later on, in relation to Greek colonisation on the Northern and Eastern Pontus Euxin littoral, the protection of corn and fish routes being a major determinant of the Athenian public policy throughout the classical period. Immediate salting extends the life of fish and the range of fish trade ensured for the benefit of Greek cities. In democratic Athens, fish appears as 'a conspicuous social divider'. See Garnsey. Ordinary people can buy salted fish unlike fresh fish and garoj (fish sauce) bought by tiny citizens. The duality makes the difference. Comedians use it for developing acrimonious political caricature in line with the persistence of social inequality. In the Roman period, fermented and salted fish products are produced in quantity, especially in Baetica, and later on in African provinces, to be extensively transported, provided their added value, to supply urban consumer. Thus, large salt works are established in favourable places in terms of trade based on fish or leather. Besides salted fish, specialities like garum are developed for which a growing demand is observed. The early-imperial gastronome, M. Gavius Apicius, gives fascinating glimpses of Roman haute cuisine. See his *De re coquinaria*. Petronius (1st century) describes the banquet dressed up by Trimalchio's cook. Among seasonings, he mentions luxurious 'garum piperatum' (*Satiricon*, XXXVI). Nevertheless, adherence to garum is not so general. Seneca is far from vindicating this famous fish sauce which he defines as 'overpriced guts of rotten fish' (*Epistulae*, 95). Moreover, the diet of the majority is rather frugal as attested by Horace's *Satirae* II, 2

... cum sale panis
Latrantem stomachum bene leniet...
Jejunus raro stomachus vulgaria temnit.

Salting is presumably carried on in the earliest time by the Phoenicians who first (?) identify suitable sites as regards salt and fish on the Northern coast of Africa and the Western coast of Hispania. Alternative hypothesis suggests that the Phoenicians are those who introduce their fish preservation techniques westwards when developing colonies in these areas of the Mediterranean littoral. Anyway, the art of preserving fish in different ways makes rapid progress.

Traditionally, fresh fish is preserved in a manner similar to that used for hams as described by Cato (c.234-149) in *De agricultura* (CLXX-salsura pernarum) and by Columelle (1st century) in *De re rustica* (XII, 55-de salsura facienda). Layers of fish are alternated with layers of salt for a couple of days, and then, stored in ceramic or wooden containers. Fish is not only laid in salt (dry salting) or in brine but also pickled with odoriferous herbs, even converted into garum and its substitutes. Preserved fish products with salt are to be segregated as follows.

- Tarichos or salsamentum: whole fish or cuts are duly salted for further transportation and trade. Both words are also valid for meat preservation. They relate to dry salting.
- Garos or garum : fish sauce obtained by fermentation in presence of salt
- Allec or allex: residual deposit from garum manufacture
- Liquamen: another word for garum
- Muria: brine, and by extension fish sauce obtained by brining

In the first century BC, Manilius (*Astronomica*, IV, 5, 660) and Pliny the Elder (*Hist. Nat.* XXXI, 93) describe garum as a fluid matter extracted from the entrails of fishes having undergone fermentation. The latter throws some light about garum success story and its major production centres. 'The Greeks, in former times, prepared garum from the fish called garos by them. The best one, made from scomber, comes from Carthago Spartaria, and is famous under 'garum sociorum' designation... The fishermen of Mauretania, and Baetica, prepare it from mackerel, fresh from the ocean, alone fit for this purpose. The garum from Clazomene, Pompei, and Leptis is also highly praised. Muria from Antipolis and Thurii also deserve appreciation'. Fish sauce is in great demand in all classes of the society more especially when originating from the Turdetan area which competes successfully with fish products from Pontus Euxinus according to Strabo (*Geographia*, III, 2, 6).

In the early Roman Empire, the major production centers can be listed as follows:

- Lusitania : Troia, Salacia
- Baetica: Carthago Nova, Baelo, Sexi
- Mauretania: Lixus, Cotta
- Gallia: Antipolis
- Italia: Cosa, Pompei
- Africa: Neapolis
- Dalmatia:
- Pontus Euxinus: Chersonessos, Tiryake
- Egypt: Pelusium
- Judea: Tiberias.

See Appendix A.

The most detailed garum description dates from the *Geoponica* (20: 46), a ten-century compilation attributed to Cassianus Bassus who compiled earlier literature on agriculture, fishing and related matters. It is generally considered with special interest for specifying the ratio of 'two sextarii' salt for 'one modius fish' i.e. 1:8. See Appendix B.

Table 1: Salted fish capacity and salt requirements

Selected sites	Fish processing capacity (m ³)	Sources	Minimum salt requirements (ratio 1:4) t	Maximum salt requirements (ratio 2:3) t
Lixus	1.013	AT	1.500	4.000
Chersonesos	1.000 (?)	n.r.		
Troia	606	RE	900	2.400
Sexi	474	RE	390	1.000
Baelo Claudia	263	RE	300	800
Cotta	258	AT	300	800
Tiritake	204	RE	300	800
Neapolis	149	RE	200	580
Myrmeki	116	RE	170	450
Sania e Torres	80	AT	120	310
QDM-Olhao	56	RE	80	220
TFG-Setubal	47	RE	70	200

AT = published by Athena Trakadas

RE-FM = published by Robert Etienne and Françoise Mayet

n.r. = not reliable (volume alleged between 1.000 and 2.000 m³)

Appendix B

Geoponica 20.46:1-6 (translation found in Curtis, Robert I., *Garum and Salsamenta*; E.J. Brill, 1991, 12-13)

1. The so-called liquamen is made in this manner: the intestines of fish are thrown into a vessel and salted. Small fish, either the best smelt, or small mullets, or sprats, or wolfish, or whatever is deemed to be small, are all salted together and, shaken frequently, are fermented in the sun.

2. After it has been reduced in the heat, garum is obtained from it in this way: a large, strong basket is placed into the vessel of the aforementioned fish, and the garum streams into the basket. In this way, the so-called liquamen is strained through the basket when it is taken up. The remaining refuse is alex.

3. The Bythinians prepare it in this manner: it is best if you take small or large sprats, but if not, wolfish, or horse-mackerel, or mackerel, or even alica, and a mixture of all, and throw these into a baker's kneading trough, in which they are accustomed to knead meal. Tossing into the modius of fish two Italian sextarii of salt, mix up thoroughly in order to strengthen it with salt. After leaving it alone for one night throw it into a vessel and place it without a lid in the sun for two or three months, agitating it with a shaft at intervals. Next take it, cover it, and store it away.

4. Some add to one sextarius of fish, two sextarii of old wine.

5. Next, if you wish to use the garum immediately, that is to say not ferment it in the sun, but to boil it, you do it this way. When the brine has been tested, so that an egg having been thrown in floats (if it sinks, it is not sufficiently salty), and throwing the fish into the brine in a newly-made earthenware pot and adding in some oregano, you place it on a sufficient fire until it is boiled, that is until it begins to reduce a little. Some throw in boiled down must. Next, throwing the cooled liquid into a filter you toss it a second and third time through the filter until it turns out clear. After having covered it, store it away.

6. The best garum, the so-called haimation, is made in this way: the intestines of tuna along with the gills, juice and blood are taken and sufficient salt is sprinkled on. After having left it alone in the vessel for two month at most, pierce the vessel and is withdrawn the garum.

Quantification of the available vat capacity for salting in use at particular periods could allow a general sketch of the growth and shrinkage of the fish-salting industry during the Roman and late Roman periods. The technology of salting vats can be traced back to the 5th c. BC, when small Punic vats are known from the bay of Cadiz. However, the

construction of 'factories' with batteries of concrete vats is clearly a Roman phenomenon, reflecting a veritable fish-processing industry. The intensity of exploitation suggested by the processing structures is echoed in the reduced size of fish specimens during the Roman period. The spreading of built vats and tanks is linked to the development of empire-wide Roman food markets. This being said, nobody knows anything with regard to the regularity and the seasonality of fish processing.

However, the combined capacity of the salting vats and processing tanks identified thanks to archaeological is different from a site to another. In some of them, there is substantial information for restoring the different phases of capacity development, and for evaluating the evolving profile of the related facilities. Estimates can be drawn up as regards salt requirements. The data depends on the salt/fish ratio. Albeit their validity remains widely disputable, especially due to the large span and the absence of chronological reference, these data could be useful to facilitate a quantitative approach of salt requirements in a given area. It would make it clear that non-cooking requirements (fish and meat processing, skin dressing, animal feeding) are significant to an extent that has not been previously suspected. Capacity figures are useful in gauging the relative importance of a given site. They determine the conditions under which salt harvesting (or mining) should be adjusted to meet the global demand.

Besides, amphorae seem to offer a better means to explore the volume of fish products transported in fluid form like garum, liquamen and muria. Tituli picti and stamps placed on their containers contribute to a qualitative evaluation of the related trade thanks to entered details such as:

- Designation of the product
- Quality
- Origin
- Age
- Name of the producer.

Amphorae are not the exclusive packaging means of fish. Unless it is processed in brine, salt-fish i.e. tarichos or salsamentum is stored and transported in baskets, bundles or barrels. Although the significance of amphorae remains undisputed as an archaeological source of information for certain commodities (vine, oil, fish sauce and garum), focusing on this one category of containers would obfuscate the exact amplitude of fish trade over centuries.

Amidst the questions that need to be tackled: Are all cisterns to be identified in relation to fish salting? The identification of tanks for fish processing is another perplexing aspect of this very activity, together with the casual presence of furnaces alleged to improve fish impregnation process or even to get salt evaporated in pans prior to its utilization. Hypocaust does not relate to salted fish cooking. Neither breeding ponds correspond to large scale salting ponds. Fish breeding in artificial ponds (cetariae) could be another developing activity provided it being remunerative proportionally to the demand for fresh fish from urbanized population. Therefore the matter deserves a pinch of reservation.

Last but not least, the scanty archaeological material prevailing for certain Mediterranean or Black Sea areas should not be immediately interpreted as the sign of marginal fishing activities on certain coastlines. Distinctive criteria are used to identify fish processing tanks and vats:

- Coastal location
- Close to salt and water resources
- Constructed in the ground
- Free of vault
- Waterproof
- Reinforced to withstand the weight of salted fish

The sites vary in size, from a few vats to full batteries of fish tanks, taking generally fish migratory routes into account. Although the development of solar salt works does widely contribute to stabilizing the coastline, its displacement, eutectic variations, earth quakes,

silting, and erosion contribute to radical changes and prevent fruitful excavations where they have taken place...

More attention should be devoted to trends operating at different time scales, and out of phase from region to region. The emergence of diversified responses to both internal political pressures, and changing styles in interregional relationship is echoed in improved food preservation based on salt production and food cooking with greater care. In the ancient Mediterranean civilization, it is not so easy to analyze the dynamics driven by the population growth and human ability to optimize natural supply. An authoritative survey of interpretative factors should focus on food salting and its flexibility in procuring sufficient volume of quality food and maintaining a balance between the resources concerned, salt being operated as a regulator. In other words, food preservation based on sodium chloride appears as a commitment to the elimination of malnutrition, exactly as salt fortification with micronutrients today. See *Guidelines for food fortification* edited by both WHO and FAO, 2006. Those participating in universal salt iodization are also worth of their salt.

BIBLIOGRAPHY

- Apicius, *De Re Coquinaria*
Aristotle, *Meteorologics ; Hist. Anim.*
Athenaeus, *Deipnesophistae*
Cato, *De Agricultura*
Columelle, *De Re Rustica*
Manilius, *Astronomica*
Pliny the Elder, *Hist. Nat.*
Plutarch, *Symposiakon (Table Talks)*
Strabo, *Geography*
Theophrastus, *Characters*
Allen L., de Benoist B., Dary O., Hurrell R. 2006. *Guidelines for food fortification*, WHO/FAO, (341 pages)
Bekker-Nielsen T. Ed., 2005. *Ancient fishing and fish processing in the Black Sea region*, (222 pages)
Blazquez-Martinez J.M., 2006. La pesca en la Antigüedad y sus factores economicos – *Historia de la pesca en el ambito del Estrecho* (Proceedings of the International Conference, Cadiz, 2004).
Curtis R.I., 1991. *Garum and salsamenta* – Production and commerce in material medica, (226 pages)
Desse- Berset N., Desse J., 2000. *Salsamenta, garum et autres préparations de poisson MEFRA* : 73-97
Etienne R., Mayet F., Tavares da Silva C., 2000. *Chronologie des usines de salaisons de Lusitanie*, MEFRA : 99-117
Etienne R., Mayet F., 2002. *Salaisons et sauces de poisson hispaniques*, (274 pages)
Garnsey P., 1999. *Food and Society in Classical Antiquity*.
Gary J. 2003. Can archaeology uncover eschatology? *Archaeologia*.
Hesnard A. 1998. Le sel des plages : Cotta et Tahadart, Maroc, *MEFRA* : 167-192
Moinier B.M., Drüeke T.B., 2008. Aphrodite, Sex and Salt – From butterfly to man, *Nephrol Dial Transplant*: 2154-2161
Pesavento Mattioli St., 2001. Anfore I problem e prospettive di ricerca – *Bonifiche e drenaggi con anfore in epoca romana*.
Pons Pujol L., 2006. *L'importation de l'huile de Bétique en Tingitane et l'exportation des salaisons de Tingitane (I-IIIe siècle PC)*, *Cahiers Glotz* : 61-77
Sternberg M., 2000. Données sur les produits fabriqués dans une officine de Neapolis (Nabeul, Tunisie), *MEFRA* : 135-153
Trakadas A.L., 2004. Ancient marine resource exploitation in the Western Mediterranean : the contribution of the fish-salting industry of Mauretania Tingitana, HMPA / Mediterranean Workshop / Barcelona.

- Trakadas A.L., 2006. North African fisheries from late Antiquity to Middle Ages: a brief overview, HMPA / Mediterranean-Black Sea Workshop / Chioggia.
- Wilkins J., 1995. Fish as a source of food in Antiquity – *Food in Antiquity*.
- *** Oxford Roman Economy Project – Quantification of fish-salting infrastructure capacity in the Roman world, <http://oxrep.class.ox.ac.uk>
- *** Oxford Roman Economy Project – Fish-breeding, fish-salting and *garum* production in the Roman world (Bibliographies), <http://oxrep.class.ox.ac.uk>