Commercial amphoras are large ceramic vessels that were used from 1500 BC to 500 AD to ship wine and other products throughout the Mediterranean. The most large-scale use was to serve the ancient Greek and Roman empires. Although their form is much different from our own packages, the shape and design were clearly the result of the same reasoning that we use to design successful packaging today. They were designed to be economical to produce and ship. The unusual shape, and especially the pointed base, facilitated handling, storage, transport and use in logistical systems that were very differently shaped from those that we use today. This paper investigates amphoras as a packaging system from a functional approach. It describes their protective physical properties, manufacturing process and industry structure, logistical and marketing advantages, and illustrates the value of such packaging artifacts in documenting the history of trade.

The lens of history reveals the flaw in the theory that marketing began in the USA in the early 20th century "as the Renaissance which followed upon the Dark Ages of the supposed production and sales eras." (Nevett & Nevett 1987) Evidence of marketing has been shown from as long ago and far away as classical Greece (Nevett & Nevett 1987) and Rome (Walle 1987).

Similarly, we no longer naively claim that consumer packaging began 100 years ago in America with the Uneeедa Biscuit box (Twede 1997). Curiosity about Nevett's reference to Greek commercial transport amphoras led to this paper. Its purpose is to explore the functions performed by this unique packaging system in trade and consumer use.

The paper presents the hypothesis that the ancient commercial amphora was not only a very well designed shipping container, but it may have been the first "consumer package" as well.

Amphoras are large ceramic jars that performed the same functions that we expect from packages today. In them, wine, oil and other processed food products were supplied to households and institutions. They were key to export trade. They served as "silent salesmen" to convey information about the contents' origin, type and grade. Many identified the merchant. The shape was an engineering masterpiece given the technology and materials of the time--designed to be strong and dimensioned to optimize handling and shipping efficiency. They even had tamper-evident closures to ensure "truth in packaging."

But their shape and material is not like any package that we use today (Figure 1). This package, for liquid which is a most difficult type of product to carry and ship, dominated trade for over 2000 years and was pointed on the bottom!


Doesn't it make you wonder why? This paper explores the reasons.

Although the "first consumer package" argument may be trivial, it gives a pretext for learning more about this very interesting package in its own marketing and logistical context. We know very little about ancient packaging because so little of it has survived. Amphoras are a notable exception because of their slowness to degrade. Many have been found throughout the Mediterranean, dating from about 1500 BC to 500 AD.

The paper is organized according to the packaging functions of protection, utility and communication (Lockhart 1997). The first section describes amphoras' technical packaging characteristics: materials, strength, manufacturing and filling processes. The second part discusses how the special shape facilitated logistics and use. The third section describes how the contents of amphoras were identified. The
fourth section provides a short digression on the archeological value of amphora discoveries for tracing the history of Mediterranean trade. The paper concludes by suggesting applications of amphora technology and concepts to contemporary packaging.

But first, it is useful to review the historical context and the role played by amphoras in the development of western civilization. Pottery transport jars originated in the eastern Mediterranean. Clay was an abundant natural resource and pottery-making was a well-developed technology. The idea of a two-handled transport jar was introduced during the 15th century BC by the Canaanites, on the Syrian-Lebanese coast.

The Canaanite jar's tapered bottom shape (Figure 2) was adapted for better stacking in ships, compared to earlier more rounded or flat-bottomed shapes, and coincided with an expansion of commerce in the late Bronze Age. The Canaanites traded with the Egyptians, and by the 14th century BC, the Egyptians had adopted a similar (but longer and slimmer) shape. The Canaanites' successors, the Phoenicians, distributed such jars—and the idea of the shape—throughout the Mediterranean. The Canaanite jars were smaller and plumper than the later Greek and Roman amphoras, and had handles on the sides of the jar, rather than at the neck.

(146 BC), the major developments in Greek amphora design had already taken place and the Romans had adopted the shape.

The Roman Empire's expansion increased the shipping of goods for military and trade, which required more packaging. Amphoras supplied the Empire, and were especially important for bringing wine, fish sauce and olive oil back to Rome. By the late Roman period, from 200-700 AD, amphoras from Rome's western Mediterranean provinces like Spain, Gaul (France) and North Africa dominated the Mediterranean.

Amphora use fell off around the time of the Arab conquests (mid-seventh century AD) which disrupted trade in the eastern Mediterranean, virtually ending Roman wine and oil shipments. After that, there is only evidence of shipping wine in skins and wooden casks (which were developed by the Romans). Although the amphora ceased to be the predominant container for liquids, the tradition can still be found today in some rural areas of the Mediterranean, particularly in North Africa and the Levant where similar jars are still used for water and oil.1

The first important study of amphoras was conducted over 100 years ago by Heinrich Dressel (1899), whose Corpus Inscriptionum Latinae recorded examples of painted inscriptions and shapes. Amphoras received little other interest until the 1950s development of underwater archaeology which discovered whole shipments aboard sunken ships. Since then, amphora study has developed as a way to document ancient trade patterns, and they have been classified and studied by archaeologists, historians, economists and ceramic petrologists. The most notable, and most cited, researcher was Virginia Grace (notable in the 1940-70's) who inspired the current generation of scholars.

This paper draws from published research and provides a new perspective on this elegant ancient packaging system. It seeks to share with contemporary packagers and marketing historians an appreciation for "those graceful fat-bellied earthenware jars the Greeks called amphorae" (Cousteau 1954, 4).

PACKAGING TECHNOLOGY

Amphoras (or amphorae) are ceramic jars which are characterized by their shape: a large oval body, narrow cylindrical neck, and two handles that rise almost to the level of the mouth. There are decorative vases in the amphora shape, but these are not the subject of this paper. Commercial amphoras were coarse clay undecorated jars with pointed bases. The word "amphora" comes from the Greek amphoreus meaning jar with two handles, which derives from amphi (on both sides) + phoreus (bearer).

Amphoras differ from other ceramic jars in that their fat bodies, ranging from egg to bottle shapes, were designed specifically for shipping a large quantity of liquid. They were primarily used for wine, olives and oils, processed fish sauce (guram), and some dry products like grain, nuts and salted fish.
MILESTONES IN MARKETING HISTORY

Amphoras were produced on a wheel in a multi-step process with intermittent drying to add rigidity. Some were produced as modular pieces and then joined. Sometimes the foot was added last. Tools were used to shape the clay after it had partially dried; sometimes the foot was shaped by paring with a knife. It is possible that standard capacities were achieved by standardizing the weight of raw clay before forming (Brown 1976).

Vandiver and Koehler (1985) and Brown (1976, citing Winter 1959) propose the following sequence. A large cylinder of clay was built up or thrown on a low level wheel and allowed to partially dry. The upper half was then worked into the shape of the lower half of the amphora, drawn as tight as possible, and the final (bottom) hole was blocked with a clay stopper. After another drying period, the vase was turned upright and supported by a clay, wood or metal chuck while the neck and rim were formed. The handles were attached last.

Vandiver and Koehler (1985) compare two styles of jars from Corinth and find that the earlier style is hand-formed from slabs or coils of clay on a slow wheel and the later (more high tech) style is wheel thrown, the body formed from a single lump of clay on a fast wheel.

Amphoras were, of course, breakable, and archaeological evidence of broken shards illustrates weak points and highlights attempts to overcome weakness. They had to be strong enough to support the weight of their contents and withstand the rigors of transportation, such as stresses from being tightly packed in ships and repeated handling. The heavy point on the bottom gave maximum strength against jolting impacts on hard floors.

But pointed toes wore down over years of reuse, and some show signs of having been repaired. Most impact fractures occurred on a flat area in the lower body, near the toe and at the widest part of the body. Rims, handles and joints broke off. Many potters intentionally increased a jar's strength and longevity by thickening the body wall near the base, by making the neck and rim thicker, by overlapping joints and by adding extra clay at point where the handles were attached (Vandiver & Koehler 1985).

A culture's least expensive materials are generally used for packaging, and amphoras were no exception. They were made from coarse clay with mineral and rock inclusions. The consistency approximates the naturally occurring mud from the places where the amphoras were made. Colors ranged from buff to terra cotta. Some were glazed.

The ability to use unrefined natural resources was an economic advantage in the production process. The coarse inclusions were helpful when making larger vessels because they would give the clay "tooth" and keep the walls standing during shaping and firing (Peacock & Williams 1986). This relationship of the material to the place of origin has enabled researchers in the field of ceramic petrology to examine an amphora's composition and relate it to the geology of its place of origin.
Un glazed ceramic pottery is porous, and so an impermeable lining was required for wine or other nonviscous liquids. Vandiver and Koehler (1985), comparing two kinds of Corinthian amphoras found that the earlier handformed style was made impermeable by adding potash and manipulating the firing cycle to promote a glass-like coating. The later style, which had the advantage of a faster wheelthrown production process, was permeable and required a resin lining. This is like the barrier coatings that are applied to modern plastic packaging materials to closer approximate the impermeability of glass.

Resin made from pine trees was most often used as the barrier lining for wine amphoras. It may have been applied while they were still warm from the kiln (Anthon 1850). Plutarch (Mor. 676a) claimed that the pine tree is sacred to Dionysos because of the use of pitch in lining wine jars. Cockle (1981) shows that an Egyptian potter in 234 AD agreed to line each amphora with 1.5 lbs of pitch. Koehler (1986) notes coatings 1-2 millimeters thick. The pine resin added a significant flavor to the contents, "an agreeable bouquet together with a certain degree of raciness or piquancy" (Anthon 1850, citing Pliny and Plutarch).

Amphoras made for other products may have employed different barrier layer or construction methods. Oil in an unlined porous jar could, over time, have a tendency to break down the ceramic structure. Therefore, the clay used for oil jars was extremely fine, in contrast to the coarse clay used for wine jars, and the walls of oil jars were very thick, so no lining was necessary (Will 2001b). Other commodities such as fish sauce and olives may have received different treatments (Koehler 1986).

As is the case with food and wine packages today, amphoras were expected to lengthen shelf life. Sweet unfermented grape juice was preserved for a year in amphoras that were coated inside and out with pitch and stored in cold fresh water or buried in wet sand. Wine was fermented in large ceramic dolias half buried in the ground. The finer wine was drawn off into amphoras, "many fanciful precautions being observed in transferring them from the larger to the smaller vessel." Aged wine was valued by the Romans more than Greeks; some southern Italian wines were said to require 20-25 years before they were drinkable (Anthon 1850). Aging was hastened by heat, and it was customary to expose filled amphoras to the sun or hot air from bath furnaces.

Amphora necks are narrow, as small as 12 cm. for some Greco-Italic forms (Will 1982), so that they can be securely closed, which is essential for preserving the product's shelf life. Some necks were reinforced by a heavy lip. Closure methods included a cylinder of cork or some other material like wood, a pine cone, a mixture of grass and mud forced into the neck and (like a modern crown cap) molded over the outside of the rim, or a terra cotta ceramic plug roughly cut to fit the opening. Stoppers, which changed over time and were within some time periods, were adapted to the shape of the neck and rim of jars and depended on the materials at hand.

The earliest Greco-Italic amphoras found with cork closures intact date from the third century BC, and in these the cork was flush with the rim. There has not been evidence to show at what point in the neck other Greek amphoras were closed, but there is a mark on some where a material might have been tied around the neck. Alternatively, some Greek amphoras were closed with an operculum or lid, sealed in a similar manner. Later Roman examples have been found plugged with cork at various points along the neck (Koehler 1986).

The cork was sealed with a simple mortar of sand or pozzolana (volcanic sand) and lime. This often bore a stamp, presumably identifying the merchant who bought the filled amphora (Paterson 1982).

There were several alternative arrangements of amphora supply. Some independent pottery works supplied a region. Some were located on the estates where wine and olive oil were made. There may have been cooperation where one estate made them for several neighbors. There is even evidence of trade in empty amphoras from one Aegean island to be filled on another.

But most were produced in coastal cities in order to minimize transport distance to the port and for fish processing operations. Amphoras, especially when filled, were heavy, and inland freight costs were high. Products like wine would have been carried to the port in skins and filled into amphoras there (Will 1992), an early example of how packaging postponement can reduce transport costs.

There was vertical integration as well as specialization. For example, members of the wealthy Sestii family in 100 AD located their amphora works on the same premises as their vineyard, winery and fish processing facility—in a single commercial complex, adjacent to the major Roman port of Cosa. Wine and fish were processed, packaged and shipped by the same organization that owned the vineyard, ships and controlled the harbor (Will 1987 and McCann 1988).

Pottery making was a specialized profession, and there were quality standards to which jars were made. This is illustrated in a 243 AD papyrus agreement by an Egyptian potter to lease an estate's pottery works and supervise the production of 15,300 jars per year in return for 4,800 drachmas. The lessee agreed to provide the facility and raw materials, and the potter agreed to supply the workers. There is the following performance and quality assurance guarantee:

I shall hand over the aforesaid jars on the drying floors of the said pottery from the winter manufacture, well fired and coated with pitch from the foot to the rims, not leaking and excluding anything that have been repaired or are blemished, each fourchoes jar holding up to the rim 20 Maximianous cyathae [about 20 liters] and at the end of the period I shall hand over the said pottery free from ash and shards (Cockle 1981).
For 2000 years the ceramic amphora form was a successful package. It was economical to make from an abundant natural resource and exploited the predominant technology with at least a somewhat competitive supply industry. Its shape facilitated filling and closing. As a package for liquids and food, its barrier properties could be tailored to meet specific needs. If this sounds familiar, it is because the same can be said of the technical aspects of every successful package.

**MARKETING AND LOGISTICS CONSIDERATIONS**

The amphora shape is strong and was very efficient for manufacturing and closing, but its most interesting benefit was its logistical efficiency. The ergonomically efficient design—size and shape—was intended for handling by one person, and the shape facilitated stowage in ships. This section describes how amphorae contributed to the efficiency of physical distribution operations, and explains the most important reasons for the pointed base.

The two opposing handles and the pointed knob on the base served as handholds for lifting and maneuvering the jars. The base also served as a pivot point. A flat base big enough for the jar to stand on would give no "purchase" for lifting (Grace 1961). The toe, "giving the jar the appearance of a one-legged ballerina," permitted the heavy container to be rolled around by one person, as it was guided and balanced by the handles (Will 1977). The handles and base were well-designed ergonomic handholds that provided a good grip which enabled a person to curl his/her fingers around them.

The shape made it easy to carry. The curve of the amphora body could be positioned in different ways to fit the human body. Illustrations from the time show the body of an amphora resting on the carrier's shoulder, the mouth pointing forward or backward, seeming to depend on its shape, weight, and whether it is empty or full (see Figure 3). The jar was steadied by holding the frontmost of the two handles or the base. A jar could be hugged to the person's body or carried in two hands; the two handles plus bottom knob insured a balanced handgrip. Ways of lifting, carrying and emptying jars remained much the same over time, although Greek amphorae seem to have been particularly easy for a single person to maneuver because of their tall handles and graspable toe (Koehler 1985).

In the case of heavier jars, two people could carry one by tying it to a pole. Vandiver and Koehler (1985) describe an especially heavy type of Corinthian amphora (Type A, up to 190 lbs) that was designed so that the lower edge of the rim was in line with the inner arch of the handle, permitting the jar to be tied at the top of the neck, with the rope supporting the load over the neck and handles. Once at a harbor, the jars were carried or lifted on board ships. In big Roman harbors, revolving cranes were used to unload ships (Casson 1971), although it is not clear how the jars were attached to the lifting mechanism, but it was probably by a hook or rope through the handles.

**FIGURE 3.** Roman mosaic of the second century AD in the Piazza delle Corporazioni at Ostia. A dockworker (called *omnaentarii* "putters on board") transfers an amphora from one boat to another. **SOURCE:** Will, 1977.

One of the most significant aspects of the amphora shape is its geometric advantage in shipping. The Mediterranean Sea provided the medium for Greek and Roman shipping and expansion, and amphorae were the right package to fit the ships.

Mediterranean shipwreck analysis shows that amphorae were by far the most common cargo type, over half of the ships found carried only amphorae (Parker 1984). A single ship would have carried a mixture of amphora types. An average Greek sailing ship in the 4th to 3rd centuries BC was capable of carrying approximately 3000 amphorae of 29 liter capacity (Whitbread 1995).

The amphora shape has a unique ability to interlock to prevent shifting and maximize cube utilization in the hold of a cargo ship. These two concerns—shifting and cube utilization—are still primary considerations for packaging professionals who aim to improve logistical efficiency (Twede & Parsons 1997).

Amphorae were designed so that they could be packed in layers in a pattern similar to the packing of spheres or eggs. The toes of subsequent layers nested in between the shapes below. The pointed base and proportional neck, combined with the rough surface, locked the amphorae into place when they were stacked. Such blocking and bracing is very important in transit, since a ship can be subjected to rough seas violent enough to shift, scramble, and even sink a poorly stowed load.
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One of the oldest known Greek shipwrecks (Kyrenia), with its cargo of over 400 amphoras, revealed the first row leaned against ribs of the hull as shown in Figure 4 (Katzev 1970 and 1972). Constanza (1954), exploring a different wreck, describes amphoras as being "stacked in rows along the deck." Dumas (1959) describes a wreck where the amphoras are "all leaning the same way, stacked one upon another."

![Image of a diver removing amphoras from a Greek shipwreck](image)

**FIGURE 4.** Diver removes amphoras from Greek (Kyrenia) shipwreck, showing position against the hull. **SOURCE:** Katzev, 1972.

In general, the toes of the first layer were secured in sand, pebbles, and/or brushwood dunnage. Once the first layer was in place, subsequent layers could be tightly braced by fitting the toes neatly into the spaces between the necks of underlying vessels (see Figure 5). It appears from the worn places on the shoulders of jars from the Kyrenia shipwreck, rubbed by the lower bodies of those above, that some were stowed nearly upright in the ship's hold (Koehler 1986).

![Image of an amphora stowage aboard ship](image)

**FIGURE 5.** Amphora Stowage Aboard Ship

Amphoras could be stowed up to five layers high, and perhaps as many as nine. In more than one shipwreck, the more slender jars were found placed above and between larger, fatter ones. In several cases, it can be seen that the hold was successively filled towards the center (Parker 1992 a and b).

Over time shapes varied and changed for various reasons, some of which may have been related to improving logistical productivity. Some scholars have noted a general trend to taller and narrower jars over time and speculate that it may have been aimed at improving the stowage factor (Whitbread 1995). Yet some other types tend to the opposite extreme, and other scholars conclude that the potters were more concerned with manufacturing technology, style, and local identity (Johnston 1984).

On land, amphoras could be stored in various positions. The lack of a firm flat resting surface seems at first a puzzling disadvantage. But hard flat floors were much less common than they are with us, and unlikely to be found in store-rooms or on shipboard, much less on sandy beaches or other similar bivouacs. The jars were embedded in sand or set in hollows made in an earth floor or among stones in the open or between thater in the curving hull of a ship (Grace 1947, 445).

When stoppered they could be stored lying down or even upside down. In shops, warehouses, ships and cellars, the jars were leaned against walls or bulwarks and supported by each other. They could also be stacked in tiers on specially made racks (Callender 1965).

There were many exchange arrangements for filled amphoras. In cities, wine and oil were sold in retail markets (Thompson 1971). There is evidence from Pompeii of a wine shop with several amphoras in stock, some closed and some, presumably partly full, held in stands. There are some scenes from a wine shop, painted on a Greek vase, that show the selling of full amphoras as well as the refilling of smaller amphoras and skins from larger containers (Immerwahr 1992).

The amphora, at least sometimes, affected the purchase decision, although there are clear exceptions. Many have been found in dumps near ports, which may indicate that the products were repackaged for further distribution inland. Under some Roman emperors, wine and grain were freely distributed (an interesting campaign promise) and in this case the package would have had no effect on the purchase decision. Of course, just as they do today, many Greek and Roman consumers and merchants took their own containers directly to the winery to be filled. But in most cases, the package had to speak for itself, as described in the third section of this paper.

Wine was not served directly from the amphora. Greeks and Romans always diluted their wine with water, more wine than water, and to drink it unmixed was considered to be a characteristic of barbarians. Most of the drinking was done after dinner, in the Greek symposium tradition, accompanied by philosophy, games, jugglers and/or dancing girls. An amphora would have been decanted into a large punchbowl-
like a vessel called a krater, where it was mixed with water and then ladled with a calyx into the guests' goblets.

The amphora shape was particularly well suited to decanting. The tip or knob served as a third handle, below the weight, needed when one inverts a heavy vessel to pour from it (Grace 1961). The weight was balanced between the pouer's hands (or the hands of two pourers), permitting careful control while decanting. Koehler (1986) notes that her experience with emptying large amphorae has shown that it is difficult to control the flow unless the jar is emptied in a single smooth, well-controlled motion. One might speculate that the pointed bottom and long neck also helped to trap sediment when decanting. This may be another explanation for the elongated Chian and Rhodian shapes, especially since these islands supplied the finest wines. Once partly decanted, jars were supported upright. The point could be buried in a hole in the ground, held in a stand made from wood or wicker, or secured in a base made from terra cotta.

Amphorae were strong enough—and valuable enough—packages to be reused. van Dornick (1989) provides the evidence of a mixture of jar types and origins on the same ship, including some originally assumed to be traveling in the "wrong" direction. He found similar graffiti forms scratched into the surface of the jars after firing, which may have indicated a change of contents or destination. Many show previous damage unrelated to the shipwreck, like handles missing and grooves cut into the inner rim which appear to have been caused by prying out a closure. Like today's reusable containers, amphorae were reused to maximize the owner's investment in this packaging asset.

Much earlier, amphorae were the object of the first recorded logistical system for managing reusable shipping containers. Herodotus reported that, after they had conquered Egypt in about 500 BC, the Persians supplied water to Syria in used wine amphorae:

Throughout the year, not only from all parts of Greece but from Phoenicia as well, wine is imported into Egypt in earthenware jars; yet one might say that not a single empty wine-jar is to be seen anywhere in the country. The obvious question is: what becomes of them? I will explain. The mayor of each place has orders to collect all the jars from his town and send them to Memphis, and the people of Memphis have to fill them with water and send them to this tract of desert in Syria. In this way every fresh jar of wine imported into Egypt, and there emptied of its content, finds its way into Syria to join the previous ones (Herodotus III.6, trans. De Selincourt in Meijer & Nijf 1992)

Like other reusable packages, empty amphorae were useful for many things besides their intended contents. They were used in burials, to symbolize the wine and oil that the deceased would need in the after-life. They were used as urinals in Pompeii where they were placed on street corners and then removed full of urine for use by the city's fullers in setting fabric dye. They were used to contain cremated human remains in France and England, and large ones with their necks removed were used as coffins for paupers in Rome. (Callender 1965). Broken amphorae were used as paving, landfill, roof tiles and in walls, while elongated styles with feet removed could be linked together to make drainpipe. The harbor walls and piers at the port of Cosa were largely built from cement and amphora fragments, a natural resource at the busy port. (Benoit 1958, Eiseman & Ridgway 1987, Will 1992).

As with all packaging systems, there were trade-offs between shipping, handling, structural efficiency and design. Affording more holding positions, the longer handles of the Greek types were probably more ergonomically efficient than the later smaller Roman handles, but they were also more likely to snap off. The Greek types were also designed more for style, with some sacrifice of efficiency. The later, torpedo-like Roman and African amphorae certainly carried the greatest capacity and were cube efficient, but consequently risked more loss in case of breakage.

One might hypothesize that the extent to which logistical factors affected amphora shape may have depended on the structure of the distribution channel, because this is certainly the case with modern logistical packaging (Tweedy 1988). The more vertically integrated the channel, the more likely that stowage efficiency on board ship and other logistical considerations would have been important design considerations.

For example, there is evidence of greater standardization in wares organized for the military (Pucci 1983). Roman organization must have also influenced the widespread use of the "Dressel 1" style throughout the late Republican period in Italy. And organization of the economy had some effect on reuse, as shown in the story of the Persians causing the systematic reuse of Egyptian jars; the Persians' control over the Egyptian mayors was an important factor in making that reusable packaging system work.

On the other hand, in more fragmented "merchant-adventurer" channels, based only on transactions, the focus of the potter would more likely have been to optimize production efficiency or some other product-oriented consideration like brand identification. This could be an interesting hypothesis for future research, especially when paired with Lawall's theory discussed in the next section about the relationship between markings and information systems.

For its time and place, the amphora shape was a successful design for shipping and handling. Ancient logistical systems were much less square than are modern ones, with our box-like sea containers, enclosed trailers, palletload handling and automatic storage/retrieval systems. It should come as no surprise that the ancient package form which succeeded for over 2000 years was not square either.
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PRODUCT IDENTIFICATION AND DIFFERENTIATION

There were many variations in amphora shapes and markings which provided information for transactions. But there was no standard identification system throughout their 2000 years and wide geographical span, and there was considerable disparity in the amount of commercial information provided on the packages.

Shapes and identifying markings changed over time and varied by region, producer and contents. Some very specifically advertised a certain producer, contents, date and price—and others are, as yet, indecipherable.

Just as wine, olive oil and Aunt Jemima Syrup are sold in easily identifiable packages today, there were characteristic amphora shapes for different products. For example, there was a trend in Roman vessels for olive oil jars to be more bulbous and for wine jars to be more columnar. Shape would have been a useful identification tool in a society where most people were illiterate, especially the slave who may be sent to fetch the wine. A given shape tended to remain much the same for the whole time it was produced, but then it was succeeded by a new series with a different form made from the same clay.

The Greek vases had more personality and regional variation than the Roman ones. The Greek shapes identified the region of their origin. For example, Figures 6 and 7 compare characteristic shapes over time for wine from two different Aegean islands: Chios and Kos. Chios produced the most famous of all Greek wines, and its amphora shape was distinctive and slender. This trademark shape was so important to the Chians that it appears on their coins (Figure 8). Koan wine was also admired, but was relatively inexpensive and sold in larger, more bulbous jars—the jug wine of its time.


The Roman shapes from about 30 BC on became more indicative of the contents than of the producing region. As evidence of the strong "brand" identification provided by shape, some Roman amphorae appear to imitate earlier shapes used elsewhere. For example, the Koan shape was used to identify later Roman amphorae that contained Koan-style wine, said by Cato to be made with sea water. (Grace 1961) After about 400 AD, the diversity of shapes decreased, superseded by a few standardized jug-like cylindrical shapes, as shown in Figure 9, produced by large (possibly officially sponsored) centers (Hayes 1997).

There were four kinds of markings: stamps in the clay, scratched graffiti, painted symbols and stamps over the closure. There was a wide variety of symbols used in different times and places. The earliest Greek jars did not carry stamps and are identified solely by shape. The most extensive and systematic use of stamps occurred in the fourth century BC and later.
MILESTONES IN MARKETING HISTORY

The non-explicit stamps contain only a single symbol—a name, letter, monogram or shape—and their meaning is not known, although many appear on well-known classes of amphoras. These non-explicit stamps may have been the trademarks of their age.

Some series of Greek amphoras are stamped with an image of an amphora itself, representing an earlier shape made by the same producers. Similar to today’s “New and Improved” starburst on redesigned packages, the stamp assured consumers that the product was the same as that sold in the earlier shape (Koehler 1982).

Stamps on handles have attracted much interest from archaeologists who seek to classify amphoras by origin and document the number at destination. Like all shipping containers, they were discarded far from where they were manufactured, and handles are usually the most recognizable pieces at a site where broken amphoras are found. They also aid in counting, since each amphora has either one or two stamps, depending on the series, it is easy to count how many jars may be in a pile of shards.

Painted inscriptions and scratched graffiti were the amphora’s real labels. Graffiti and dipini gave the most information about the contents and could also have been changed as the amphoras were reused.

Painted inscriptions, called dipini or tituli picti, must have been present on most amphoras. They have been found on jars in Pompeii, but otherwise they are rarely preserved. These were applied after the jar was fired, so the point at which a mark was applied is uncertain. Will (2001a) notes that in a large number of cases, Roman dipini refer to commodities stored in re-used amphoras. They do not, except in special cases, tell what was originally shipped in the jar. In contrast, graffiti, scratched into the surface could be applied before or after firing. They were more common on Greek jars, rare on Roman ones.

The markings are deliberate and systematic; marks from a particular time and place are consistent in type and placement. Although there is disagreement about the meanings, L. Wall (1995) argues that their systematic nature is itself a clue to their meaning as part of an organized exchange system associated with the producer, exporter or importer, and sometimes involving government standards.

For example, Spanish amphoras for olive oil (“Dressel 20”) destined for Rome have been shown to have four or five standard elements painted on them between the neck and shoulder; see Figure 11. The first has a value ranging between 79.5 and 107.5 and is probably the tare weight of the empty amphora. The second ranges between 178.5 and 219.5 and is gross (filled) weight. Third is the name of the navicularius or shipper. Fourth is a series of symbols: the mark of the officers controlling export, the type of product, an indication of the estate where the product originated and the name of the town where the control was carried out. The fifth may have been some specific ship loading or storage notation (Rodriguez-Almeida 1972, summarized by Peacock & Williams 1986).
As the information provided by shapes and markings, as elements of economic structures, differed from region to region or from decade to decade, economic behavior dependent on or limited by access to that information also must have varied." (Lawall 1995, 10)

Package communication is always part of a larger system. Like today’s automatic identification systems, amphora markings needed to be easily decoded to be matched against shipping and sales documents. And like the brand markings today, the symbol system was understood and appreciated by consumers in order to facilitate sales. This is a key reason why the amphora may be considered to have been the “first consumer package.”

**ARCHEOLOGICAL AND HISTORICAL SIGNIFICANCE OF AMPHORAS**

Today, amphoras play an important role in archeological and historical analysis. They bear direct witness to ancient marketing channels and have proven especially useful as origin/destination evidence of trade patterns in and around the Mediterranean, from Africa to England.

By their nature, packages hold a unique position in geographical commerce because they are discarded at their destination. Amphoras have been found in destination cities throughout the Greek and Roman empires. Others have been found afloat sunken shipwrecks, literally marking a transit route.

For many years, the primary emphasis in amphora study has been to classify the origin of amphoras found elsewhere. Researchers have been able to classify many amphora shapes, stamps, and materials. These discoveries provide evidence of trade routes and tonnage, and they help to date rafts and wrecks.

Amphora analysis has led to a better understanding of the economic, social and cultural needs satisfied by the products that they carried (e.g. Garlan 1983, Tobercaia 1983, Riley 1984). Amphoras have helped show the organization of the import trade for a region and pinpoint distribution centers where their products were transferred into skins or barrels for overland distribution. They show what regions produced surplus food and can indicate the preferences of consumers of an area for imports from a specific location.

For example, the Roman wine production and trade have been traced. Analysis of amphora discoveries in the Western Mediterranean prove Italy’s dominance as an exporter to the Western Mediterranean from 241 BC (the end of the first Punic War) to the time of Christ. The Sestii’s product from the port of Cosa can be traced west in five shipwrecks and other sites in central and southern France. Amphora finds mark the distribution route through France: from the south, up the Rhone valley and then across to the Rhine where amphoras were redistributed as far away as Britain. Will (2000) found that the wealthy Tamil kings of southern India...
imported wine from Rhodes, Knidos and Kos, and also favored an imitation-Koah wine produced in Pompeii.

During the first century AD, during the rise of the Roman Empire, amphora evidence shows that control of the amphora industry moved to the state, for the purpose of controlling imports to Italy. Production shifted to Spain and Gaul. The evidence later substantiates the increase in imports from North Africa (Will 1987, Paterson 1982, Will 1992).

CONCLUSION

It is clear that ancient amphoras served many of the same functions as contemporary consumer packages. They were economical to make, efficient to ship, and they communicated the nature of their contents. They were of a size that would be purchased by a household. They could even be said to have advertising campaigns, as shown by the Chian coins that featured the island's trademark amphora shape.

However, the role that amphoras played in the purchase decision is not clear. Neither is the degree of purchase motivation provided by the package. (It should be mentioned that these factors are not entirely clear for modern consumer packages either.) Ancient shops were not self-service, and the merchant probably assisted in purchase decisions (but this is true in many wine shops today as well). Furthermore, during some Roman periods, there was state-controlled and sometimes the free distribution of wine, grain and oil, in which case the package was probably not involved at all in the selection decision.

This is not a package for a 20th century supermarket, which is what is usually meant by the term "consumer package." But the designation is not well defined, and many packaging systems over time could be shown to satisfy the same requirements. Further research is recommended to learn more about other early packages and their roles in various human civilizations. Generalizations are bound to emerge.

What lessons from the amphora story can be applied to today's packaging design? The amphora concept encourages us to think outside the box—literally outside the box. Our logistical world seems made up entirely from square shapes, and there are good reasons for this based on current materials and standardized operations.

But a box is not necessarily the strongest shape; it is based on the technology of wood and paperboard. Boxes waste space because few are dimensioned precisely to fit a standardized conveyance, and most products are not, by nature, square, nor do they fill the box.

Our cylindrical-shaped can, based on metal sheets, is very strong, and the form is well-suited to liquids, but cans also do not have good cube utilization in shipping. Glass bottles can be formed into many shapes, but few shapes are strong enough to be commercial, and the same can be said for ceramics.

Plastic, however, is a very different kind of material. It is most like ceramic and glass, with a moldable state and a rigid state, but it is less likely to break. As history goes, plastic is still a new material, and most applications have been direct substitutes for other materials: plastic bottles, plastic cans and plastic boxes. One reason why plastic amphora shapes have not been created is that nobody remembers them well enough to try.

Plastic would be a good material for molding interlocking containers in shapes inspired by amphoras. For example, more and more plastic containers are incorporating profiles that permit them to be interlocked to prevent shifting in transit. At a recent industry conference, a manufacturer of plastic trays for soft drink bottles argued that the necks and bases of bottles should be redesigned to permit a better design which would include some degree of interlocking. The pointed foot may be impractical for most applications, however.

Amphoras remind one of the difference and relationship between interlocking, nesting and stacking. They emphasize the importance of cube utilization in shipping and the fact that most packages waste space. Better cube utilization can be a competitive advantage, as shown by the Swedish retailer, IKEA, which specializes in packing products to occupy the least amount of space. Another Swedish invention, the Tetrapak tetrahedron-shaped package, also has been designed to cleverly interlock despite its lack of squareness. Products like furniture and assembly parts can almost always be designed to nest rather than stack in shipment.

The amphora shape is strong and economical. There may be other applications for such an egg-shape in plastic packages. An example is the squeezable "Real Lemon" juice package. The idea that some may have been plugged on both ends to aid in emptying leads to the idea two openings in a rigid container. Such a closure system would help to empty sticky products or semi solids, or could be part of an anti-glugging feature.

The concept of balancing the container while pouring liquid can be applied to many heavy containers. For example, some detergent bottles are now providing handles that extend down most of one side, and one was recently introduced with two handles, one on top and one on the side. The amphora concept makes the point that perhaps the second handle should be near or on the bottom.

Of course, the graceful shape is still echoed in glass bottle designs for wine, beer and soft drinks. A small closure is still best for liquids and a long neck is best for cork closures. At least two bottles have trademarked a shape echoing the inward curve at the bottom: the classic Coca-Cola bottle and the bottle for Verdicchio Italian wine marketed by Fazi Battaglin.

Lawall's theories about the role of information on the package in the larger marketing system have been echoed in current discussions about radio frequency tagging of product. Whether the variable information is to reside in management information systems or in a reprogrammable tag is going to depend on the structure of the marketing channels. Better organized channels can depend on a system for centralizing information whereas less well organized channels may rely more on information being carried by the tags.
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Packaging history began when foragers began to gather food. Designing packaging forms according to functions probably goes back that far as well. The amphora solution that the Greeks developed to perform the packaging functions of protection, utility and communication shows a remarkable degree of sophistication and efficiency. Its performance level was high, which is proven by the fact that the amphora design succeeded for over 2000 years. One might wonder whether any of our contemporary packaging forms will live that long.

NOTES

1. It is interesting to note that as late as 1938, the Arab descendants of Phoenician sailors were still carrying amphorae on some of the same trade routes. Mallowan (1939) photographed shipment of empty amphorae from Algeria landed on a sandy beach in Syria where they were to be exchanged for donkey-loads of sheep dung.

2. For example, "gallon" is related to the Latin word for jug, and "pint" originally referred to a pinned mark on a container (Webster 1971). In the Middle Ages, wine was shipped in wooden casks, called "tuns; the derivative "ton" measure has, over time and various circumstances, indicated either weight or volume (Hale 1991).

3. In one of the earliest examples of non-liquid contents, a large ceramic pithos found aboard the oldest known shipwreck, a 14th century BC Egyptian ship, contained an assortment of pottery lamps, bowls and jugs. Smaller Canaanite amphorae found on the same wreck were filled with valuable terebinth resin chunks (Bass 1987).

4. It is interesting to note that the wheel was used for pottery before it was used for transportation. The ancient Sumerian (3500-3000 BC) first used a wheel for pottery, and later thought of flipping the potter's wheel on its side and adapting it for locomotion (DeBono 1974).

5. Eiseman and Ridgway (1987) describe jars found on the Portichello shipwreck with a clearly formed hole in the bottom, which may have been stoppered like the top (or a foot added last may have broken off). They hypothesize that the 2-opening design aided in emptying amphorae filled with salted fish.

6. It is interesting to note how wine traditions have exploited the migration of packaging flavors, like resin and oak, into wine. Greek winemakers today still add pine resin flavor to give the characteristic flavor to their Retsina, reminiscent of the time when their wine was shipped in pithscaled amphorae. And California winemakers have been known to add the oakly taste of a toasted barrel to wines processed in pristine and inert stainless steel.

7. For overland transport, the wine was filled into animal skins turned inside out, with the hairy inner surface covered with pitch.

8. Pozzolana is a finely pulverized volcanic mixture of cinders and clay. When lime was added, the mixture became an exceptionally consistent and cohesive concrete was not bettered as a mortar and binding material until the discovery of Portland cement. The Romans mixed the mortar with an aggregate of stone, brick and marble chips to make a strong, inexpensive, waterproof material used to build structures as diverse as harbors and domes, including that of the Pantheon (Grant 1969).

9. They were also "the main instruments of sanitation" in the milecastles and turrets of Hadrian's Wall and the wall around Chester in England, a logical use for an army's used packaging.

10. For example, are the Sestii amphorae from Cosa especially efficient? One might expect so, since they also owned the ships and controlled the distribution. In fact, we might expect that the Roman shapes were more efficient than the Greek ones, because the Romans had more control.

11. Today's metal can industry still distinguishes a special square olive oil can, named a "OO" can, from the slightly more rectangular shaped "F-style" can for insecticide (so named for the new defunct brand "Fit").

12. This is similar to how the European wine industry today still provides a regional identity by using different bottle shapes.

13. During the early period (525-480 BC) the Chian vessels were characterized by a bulging neck and had a system of markings, some painted and some incised, which were applied between the handles before firing. The marks were simple and consistent, circles and dotted circles, suggesting a system of communication.

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