

Pottery Storage Vessels in Antiquity: Formation and Use – The *Dolia* Model –

أواني التخزين الفخارية في الفترة القديمة بين التشكيل والاستعمال – الدُوليا (*Dolia*) نموذجاً -

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Abstract:

The large-sized ceramic jars known as *dolia* were considered among the most important containers used during the Roman period, due to their close association with the era's lifestyle, which heavily relied on the storage of provisions and supplies, including various types of food, liquids, and even military ammunition. The *dolium* was also used in the preparation and fermentation of wine. As such, people of that time employed the *dolium* to meet their essential daily needs.

From this perspective, the present article seeks to explore *dolia* pottery both as a utilitarian artifact employed by humans in antiquity and as a distinctive ceramic form, examining its manufacturing techniques and shaping processes. We aim to define the term *dolium* and investigate the mastery behind its production, particularly given the challenges posed by its considerable size, which makes its shaping significantly more complex than that of small or medium-sized ceramic vessels.

The article further examines the chronological development of this craft across different historical periods and regions known for their engagement in the manufacture of such large-scale pottery. Special attention is given to the innovative methods used in the fabrication and formation of *dolia*.

Our study employs an inductive methodological approach, combining the analysis of collected data with explanatory texts. The primary objective is to shed light on this ancient craft, recognizing it as a specialized artisanal activity practiced by humans in earlier civilizations.

Keywords: Pottery, vessels, jars, *dolia*, shaping.

ملخص:

اعتبرت الجرار الفخارية الكبيرة الحجم من نوع الدُوليوم من بين أهم الأواني المستعملة في الفترة الرومانية لاقتراحها بنمط الحياة آنذاك، والذي ارتكز على جمع المؤونة والذخيرة من طعام بأنواعه وسوائل وحتى الذخيرة الحربية، كما استعملت في تحضير الخمور وتنبيذها، لذلك وظف الإنسان الدُوليا في تلك الفترة لتلبية حاجياته اليومية الأساسية. من هذا المنطلق حاولنا في هذا المقال التطرق الى الدُوليا الفخارية باعتبارها وسيلة لجأ اليها الانسان في الفترة القديمة وباعتبارها

نمط فريد من الأواني من حيث الصناعة وطريقة التشكيل، محاولين التطرق الى تعريف مصطلح الدُوليا والبحث عن السر وراء التحكم في تقنيات صنعها بالرغم من حجمها الكبير الذي يجعل من امكانية تشكيلها أمرا صعبا مقارنة بالأواني الفخارية الصغيرة والمتوسطة الحجم، كما سنتطرق في هذا المقال الى مراحل تطور هذه الصناعة عبر الفترات الزمنية والمناطق التاريخية التي اهتمت

بصناعة هذا النوع من الأواني الفخارية، مبينين بعد ذلك الطرق المبتكرة لصناعتها وتشكيلها. اعتمدنا في مقالنا على المنهجية الاستقرائية مع تحليل المعلومات المجموعة وتقديمها على شكل نصوص توضيحية، الغرض منها أساسا

هو التعريف بهذه الصناعة القديمة باعتبارها نشاطا حرفيا زاوله الانسان في الفترات القديمة.
الكلمات المفتاحية: الفخار، الأواني، الجزائر، الدُوليا، تشكيل.

Introduction:

Since Antiquity, humans have been known for the diversity of their livelihoods, leading to the development of crafts and industries that made use of natural resources in daily life. Pottery represents a pinnacle of ancient innovation. After crafting stone tools for a long time, the urgent need and natural conditions drove humans to discover clay and shape pottery, leading them into a new era of life. Consequently, pottery has become one of the most prevalent artefacts found at archaeological sites, prompting specialists to delve into this industry and seek to understand the methods and techniques involved in shaping clay into pottery.

Notably, specialists have primarily focused on small pottery vessels, overlooking larger ones like *dolia* storage jars, despite their widespread use during the Roman period. In this article, we aim to restore the significance of these vessels, which were used to preserve provisions such as liquids and grains, and explore the reasons why humans resorted to this industry, as well as the secrets to mastering its production techniques.

Our aim is to attribute to these vessels the historical and artistic value they deserve, in light of the scientific neglect we have observed. Most studies have focused on small and medium-sized pottery vessels adorned with artistic and aesthetic decorations, while neglecting storage jars and the functional aspect of these archaeological remains.

Regarding the research methodology, we have defined the following general issue for this topic:

- What is the archaeological significance of pottery storage vessels as material evidence of ancient human life?

Several sub-questions pertaining to the main issue can be included, such as:

- What are storage vessels known as *dolia* pottery?
- What is the history of *dolia* pottery in terms of production and use?

In order to address this issue, we will employ the inductive method, gathering as much information and sources as possible despite their scarcity, and attempting to analyse and utilise this information in the article. Our aim is to achieve satisfactory results in terms of fulfilling the objectives of the study.

The topic is divided into two parts from a methodological perspective: the first part is historical in nature and has enabled us to arrive at a precise definition of the term *dolia*, clarifying its origin as a storage and provision vessel, as well as

the reasons for its use and its originators. In the same context, we address the areas in which it was used in Antiquity, particularly in Europe, considering the latter to be the origin of this type of jar. We also examine the history of its use and manufacture, noting the stages of its development in terms of its shape in particular and how it reached its largest size in Roman civilisation.

Next, we move on to the second part of the article, which discusses the common uses of *dolia*, including storage, fermentation and burial in some locations. We also discuss the methods of shaping and manufacturing these jars and the reasons behind their large size. We also discuss the methods used in Antiquity to repair fractures and cracks in this type of pottery jar.

1.. Definition of storage vessels of the type *dolia*:

The term *dolium* has been used since Antiquity by Latin agricultural engineers, who also used the terms 'bin' and 'barrel' for the same purpose.

The *dolium* is considered a large pottery vessel intended for preservation in ancient societies. In Spain, it was known as the 'horcas', and in Italy it was called *dolia* (the plural of *dolium*) in Latin (Carrato, 2013, 1174).

These large jars with thick walls and a shape reminiscent of strawberries were produced by potters in central Italy and were referred to as *doliarŭ* (Birch, 1873, 532) .

Dolium appeared in two forms: a large pottery jar, sometimes made of stone or metal, and a cylindrical wooden barrel. The pottery versions are the oldest and were most common in Antiquity, in both Roman and Greek cultures. They are mentioned in Homeric literature as containers for storing wine (Daremborg & saglio, 1877- 1919, 332).

Dolia pottery was installed in many homes throughout central Italy to store wine and oil produced or consumed on site. They exceeded 1.2 metres in length, had a body diameter ranging from 0.6 to 1.2 metres, a small pointed base and thick walls ranging from 2.5 to 5 centimetres (Cheung, 2021, 69). This size allowed for storage capacities ranging from several hundred to over two thousand litres of liquid. Due to their narrow bases and large, strawberry-shaped bodies, these *dolia* required stability, which was achieved by burying at least part of them in the ground, providing a cooler environment than the air, especially in hot regions (schenck , 2016, 40).



Image 01: Buried *dolia*

Image 02: *dolia* above ground

2.. History of *dolia*:

Research conducted by the archaeologist Arthur Evans in the city of Knossos in Crete indicated that he discovered several types of large jar containing olive oil in the Palace of Knossos; some of these jars were taller than a man (Estella , 1961, 53-54).

These large, thick-walled jars were unknown to southern civilisations from the end of the Bronze Age until the Iron Age. The introduction of this type of vessel to southern Gaul is usually attributed to the Greeks. Due to their rarity, *dolia* jars serve as an indicator of usage at archaeological sites. Local production began in the sixth century BCE, developing rapidly as populations increasingly settled and agricultural production increased. In the absence of similar vessels in their heritage, southern communities embraced *dolia* to meet their long-term storage needs (Michel, 1993, 402).

3.. Development of *dolia*:

Dolia evolved in different styles depending on the region (Languedoc Oriental, Provence and Languedoc Occidental), though they were rarer in Catalonia, where storage pits were used instead (Michel, 1993, 402).

Initially, *dolia* were similar in size to the largest pottery vessels (urnes) in the mid-sixth century (image 1). They then acquired a more distinctive shape (images 2–3) and gradually increased in capacity (images 4–5). The influence of Italian models can be seen in samples from the first century (Image 06), while the period between the first and second centuries saw the emergence of small models without necks (Images 07–08). During the Roman Empire period, more adaptive models with an inward lip became prevalent (Michel, 1993, 402).

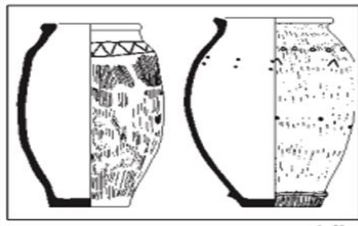


Figure 03



Figure 02

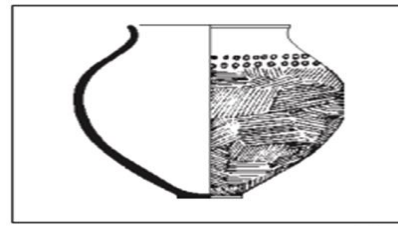


Figure 01

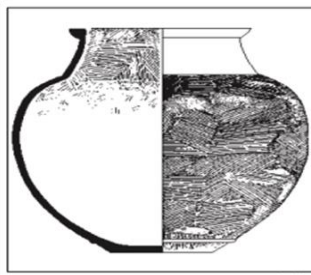


Figure 06

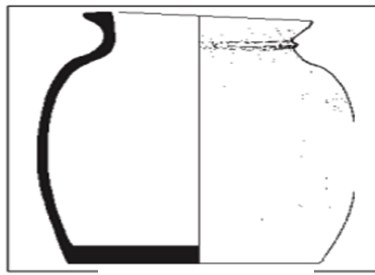


Figure 05

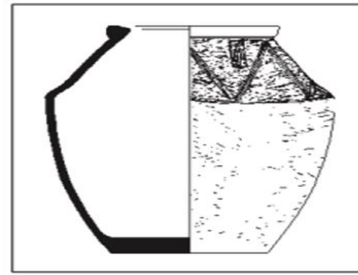
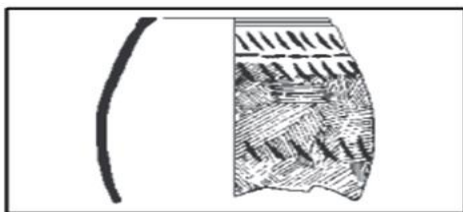


Figure 04



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. Specifically, the largest quantities were produced locally in Provence and Eastern Languedoc using techniques similar to those employed in traditional non-turned pottery. However, there were also more distinctive products with limited regional distribution. Examples include jars produced in Béziers around the fifth century, a category of *dolia* with an Iberian character in the Narbonne-Béziers area between the fifth and third centuries, and those that appeared later in the first century BCE and were characterised by a bevelled lip (see Image 08) (Michel, 1993, 402).

Additionally, some *dolia* from the late Roman Empire or Republic of Italian origin (which may bear Greek markings) were used for maritime transport and were possibly reused in the regions to which they were transported (Michel, 1993, 402).

4.. Uses of *dolia*:

The researchers Homer and Hesiod considered *dolia* to be vessels for ageing wine. However, archaeological evidence from a later era to which Homer referred can be used to confirm the uses of *dolia*. Intricate forms from the early periods of Hellenic civilisation were discovered during these excavations. During his

excavations at Troy, scholar Heinrich Schliemann noted the discovery of massive vessels buried in the ground, standing at 1.72 metres in height. It has not been confirmed whether these vessels were used for storing wheat or wine, or if they served as savings vessels. It is estimated that there were more than 600 of these large vessels, most of which were covered with a schist and lime lid (see Image 09) (Darembert & Saglio, 1877- 1919, 332).

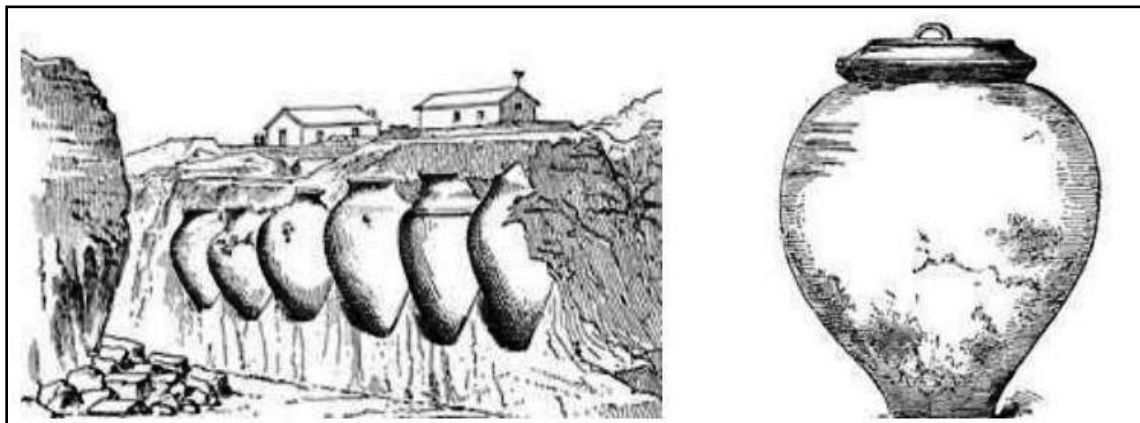


Figure 09: The shape of the *dolia* discovered at Troy (source: (Darembert & Saglio, 1877- 1919, p. 332).

It is reasonable to conclude that the *dolia* were primarily used for storing grains in the pre-Roman era. However, it is now accepted that some of these jars were used for wine production from the late Iron Age onwards. This is confirmed during the Roman period by the existence of winemaking facilities within houses containing barrels adjacent to cellars with many *dolia* (Michel, 1993, 402). In this context, *dolia* were often buried in soil or sand up to the level of the opening to isolate them from the air during wine production for proper fermentation. The base of the *dolia* in this case is pointed to facilitate insertion into the ground and provide stability (Darembert & Saglio, 1877- 1919, 332).

Some sources also mention that *dolia* were used for storing wine, oil, grains and salted meat. They were also used for funerary purposes, for example in graves where bodies were buried (see Image 10). However, they were not used for artistic purposes as much as for their practical objectives of transport and storage (Birch, 1873, 532).

Many medium-sized *dolia* were also used for transporting materials aboard ships (see Image 11) (Hesnard & Carre , 1988, 14).



Figure 10: The Use of *dolia* for Funerary Purposes. Source: (Birch, 1873, p. 532)

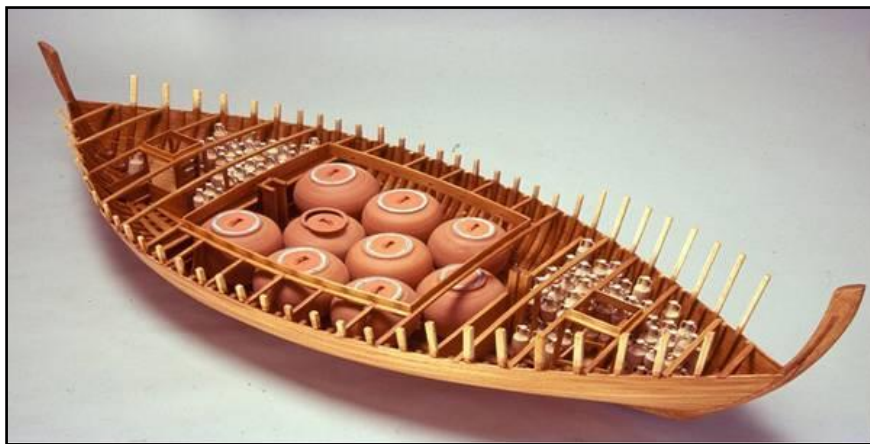


Figure11:Arrangement of *dolia* on ships, source (Hesnard & Carre , 1988, p. 133)

5.. Manufacturing of *dolia*:

The techniques employed in shaping this type of vessel (*dolia*) have long remained obscure to specialists in this field. These techniques differ from those used for other pottery (Carrato, 2013, 1183-1184) and it is difficult to accept that vessels of this size were produced by turning. Despite the craftsmanship involved, the theory that these vessels were made in separate pieces, with each part fired in a specific kiln, is hard to accept.

Some have suggested that the base of the *dolia* was made separately and then joined to the other parts using lead fittings. The massive *dolia* were also encircled with lead to support their weight (Birch, 1873, 532).

The theoretical conception of the *dolia* manufacturing process is based on observations of ancient *dolia* vessels in regions such as Spain and Crete, as well as experience in producing large pots. The technique used to manufacture the *dolia* is believed to be the clay rope technique, as studies have revealed fingerprints on several parts of these vessels, particularly on the body and rim.



Image 03: Clay Rope Shaping Technique Image 04: Fingerprint marks from
the interior
(source: researcher).

5.1.. Selection of Soil (La Terre):

The difficulty in producing pottery vessels of considerable size lies in avoiding cracks and flaws resulting from shrinkage during drying, which can worsen during firing. It is advisable to use non-fertile clay (Chamottée), which contains fragments of pottery.

A sample of *dolia* made from soil mixed with pottery debris (Chamottée) was found in Manosque, with varying thicknesses of pottery debris; some pieces exceed 10 cm. However, this method is not without flaws, as the more the clay is mixed with debris, the more brittle the pieces become, making them prone to breaking upon impact after firing. Here, the importance of having a balance in the size of debris particles becomes evident (Hesnard & Carre ,1988, 171).

5.2.. The Shape (La Forme):

It is clear that vessels of this size cannot be handled during manufacturing, so they are shaped by being placed upright. The process occurs in two stages:

A. Shaping the Lower Half:

The shaping begins from a flat base upward to the largest diameter of the body (approximately half). It is formed externally with solid additives that stabilize the clay, allowing for normal drying. This piece is later separated from the ground (Hesnard & Carre ,1988, 171).



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Images 05–07: Method of Shaping the Lower Part of the Jar

(Source: Researcher)

B. Shaping the upper half:

Shaping starts from the largest diameter and continues up to the neck. The piece is separated as soon as the clay holds together. The clay rope technique (Colombins) or clay sheets (Les Plaques) are used for this shaping process (Hesnard & Carre ,1988, 171).

The upper and lower halves are then bonded together using barbotine.



(Source: Researcher).

5.3.. Drying and shrinking (séchage et retrait):

Drying naturally takes a long time. Initially, it occurs in the shade, depending on the ambient temperature and humidity. A damp cloth is placed on the surface of the structure to minimise the occurrence of cracks and fissures. The clay takes between 15 days and a month to dry, depending on the season. After this, evaporation takes place (Hesnard & Carre ,1988, 171).



Image 10: *dolia* drying in the shade (Source: researcher).

5.4.. Firing (cuisson):

The kilns used for firing pottery that have been excavated are of a known type, unlike those used for firing *dolia*. Excavations have revealed circular kilns with a single side chamber, which often feature a central column or intersecting transverse arches. This type of kiln was commonly used in Baetica and Lusitania. In the Tarragona region and the Ebro Valley, rectangular kilns with single, double or triple openings were employed for firing amphorae, building materials and large *dolia* (Carrato, 2013, 1185-1186). In some areas, the kiln was built around the *dolia* using bricks, and the firing process took a long time due to the pottery's thickness. *dolia* are properly fired at moderate temperatures (Hesnard & Carre , 1988, 172).

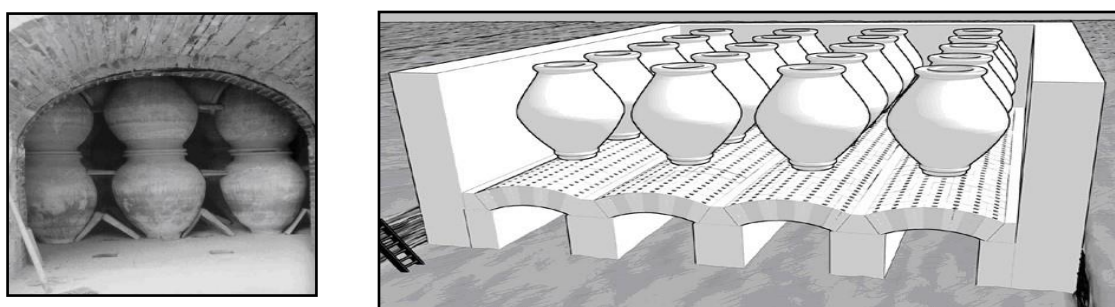


Image 11: Arrangement of *dolia* for firing source: (Carrato, 2013, pp. 1198–1200)

5.5.. Repair using lead:

Despite all the care given to the shaping process, cracks may appear during drying, primarily at the joints between the coils and sheets, or even at the points where the upper and lower parts are bonded. These cracks can significantly affect the durability of *dolia*, especially if they are buried in the ground. Therefore, after firing, the potter repairs these surfaces using melted lead (Hesnard & Carre , 1988, 171).



Image 12: Method of Repairing with Lead (Source: Researcher).

5.6.. Internal Lining Repair:

Dolia were used for liquids; therefore, they were lined with wax or treated with pitch or plaster from the inside to reduce permeability (Birch, 1873, 532).



Image 13: Images of Internal Lining with Plaster (Source: Researcher)

Conclusion:

Understanding ancient human life requires us to study both material and immaterial remnants, as the latter were essential to the daily lives of ancient humans.

Our role today is not limited to studying valuable or aesthetically expressive material remains alone, since ancient human life was characterised by periods of both poverty and wealth, as well as luxury and simplicity. Humans were accordingly creative at certain times and simple at others, devoting their time and energy to making life easier without the burden of decoration and ostentation. This resulted in ordinary remnants and simple crafts, to which we must pay attention regardless of their value.

In this study, we delved into a craft that has not received its fair share of modern research: a craft practised by humans in Antiquity for the everyday use of its products, far removed from aesthetics and artistic embellishments. We aimed to decipher and clarify the mystery surrounding the craft of producing large-sized *dolia*-type pottery jars, addressing its essence and history while illustrating its evolution. We discussed the key techniques used to shape them and how they differ from other types of pottery.

This serves to give historical value to this type of pottery, which has not been extensively researched compared to smaller aesthetic vessels, and relies on a number of foreign references. This type of vessel was found in abundance during the Roman period compared to other civilisations. Based on the outlined issues

and the information provided, we have succeeded to some extent in this endeavour. However, we found that this topic remains open for future research and expansion.

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