

Mechanical Engineering in Ancient Egypt, Part XIV: Stone Vessels (Middle Kingdom to Third Intermediate Period)

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Abstract:

The paper investigates the development of the stone vessels industry in Ancient Egypt during the periods from the Middle Kingdom to Third Intermediate Period. The paper presents samples of the stone vessels during those periods and tries to analyze each sample showing its characteristics and location if known. The design of each stone vessel is outlined and the decoration (if any) is investigated. The development aspects of the stone vessels industry is investigated highlighting the innovations of the designs and their manufacturing. The maximum development of stone vessels in the 18th dynasty is outlined with example models from the rein of Pharaoh Tutankhamun.

Keywords — Mechanical engineering history, Ancient Egypt, stone vessels, Middle Kingdom to 3rd Intermediate Period.

I. INTRODUCTION

Stone vessels are one of the amazing industries in ancient Egypt. They could master completely all types of rocks available in Egypt such as schist and granite. They had the mechanical engineering technology to produce awkward products not only in their times, but even in present days with the highly sophisticated machinery available.

Engelbach (1915) presented the excavations at Riqqeh starting in December 1912 and Memphis started in 1913. He presented the stone vases found in graves related to 12th and 18th dynasties [1]. Lilyquist (1995) documented shapes, materials and inscriptions for stone vessels from royal tombs from 15th to mid-18th dynasties. He proposed a catalogue arranged in two parts: medium to large jars and smaller containers [2]. Andrews and Van Dijk (2006, Editors) presented stone vessels from the Predynastic Periods, Early Dynastic Period, Old Kingdom, and New Kingdom. This was within the exhibition of the Egyptian collection of Arnold Meijer whose catalogue was written by an international team of specialists [3].

Bevan (2012) summarized the shapes, materials and decorative pre-occupation that characterise stone vessel traditions in different parts of the eastern Mediterranean during the Bronze and very early Iron Age [4]. Abdel-Kader and Mohammed (2013) presented a case study for the restoration

and conservation of Egyptian alabaster vessels in Atfiyah Museum Store. They found that the burial and exposure environment had a severe effect on the coherence of the Egyptian alabaster physical structure causing the collapsing and weakness of the alabaster [5]. Nielsen (2014) investigated the fabric and stylistic parallels of an ovoid bottle from the New Kingdom in the National Museums Liverpool. He suggested the function of the vessel on the basis of context, parallels and shape [6].

Prevalet and Morero (2015) declared that goldworking, stone vessels industry and the production of faience objects flourished mostly in Crete, Egypt and Levant. They showed that the growth of trade and contacts between the Aegean and the Orient during the second and first millennia BC supported the spread of ideas and finished objects [7]. Hassaan (2016) presented the techniques and technology used by ancient Egyptians to cut hard stones and produce very complex artifacts. He studied how the ancient Egyptians could produce flate stone surfaces with accuracy better than 0.005 mm and measure dimensions as small as 1.3 mm [8]. Hassaan (2016) investigated the development of mechanical engineering in ancient Egypt through its stone vessels industry. His study covered the time span from Predynastic to Old Kingdom Periods. He investigated the features and innovation of some of the available stone vessels from those periods [9].

II. MIDDLE KINGDOM

The Middle Kingdom comprised the 11th and 12th dynasties of ancient Egypt and extended from 2000 to 1700 BC [10]. Most of the models available belongs to the 12th wealthy dynasty. Here are samples of stone vessels manufactured during the Middle Kingdom:

- Fig.1 shows an alabaster jar manufactured during the Middle Kingdom of 210 mm height [11]. It has a wide mouth, no neck, round rim, curved shoulder, conical body, medium flat base and two small handles at the shoulder. The decoration is natural through the alabaster stone itself and the outer surface is polished



Fig.1 Alabaster jar from the Middle Kingdom [11].

- The ancient Egyptians used limestone in producing some of their vessels as shown in Fig.2 which is located in Petrie Museum of UK[12].



Fig.2 Limestone vase from the Middle Kingdom [12].

- A different stone vessel model from the 12th dynasty is a 47 mm height Kohl pot manufactured from breccia and shown in Fig.3 [13]. It has a small mouth, round flared rim, short neck, rounded shoulder, semi-ovoid body, flat flared base and natural breccia colours with surface polishing.
- A wonderful stone vessel for cosmetic applications was manufactured from obsidian in the rein of King Amenemhat III, 1918-1884 BC of the 12th dynasty located in the Cleveland Museum of Art is shown in Fig.4 [14]. It has a wide mouth, flared round flanged rim, convex body and flat flared base. What is new in this design is inlaying the rim and base with gold sheet for the first time in the Egyptian stone vessels history. Gold handles we used before in the second dynasty [9].



Fig.3 Breccia Kohl pot from the 12th dynasty [13].



Fig.4 Obsidian cosmetic vessel from the 12th dynasty [14].

- Another high quality royal Kohl pot manufactured from obsidian belonging to princess Sithathoryunet from the 12th Dynasty, reign of King Senwosret II is shown in Fig.5 [15]. It has a wide mouth, flat flared flanged

rim, round shoulder, convex body, medium flat base and flat lid. The lid, rim and base are shielded by gold sheets in a neat and accurate manner.



Fig.5 Obsidian Kohl pot of Sithathoryunet [15].

- Another cosmetic pot manufactured from an anhydrite stone during the 12th dynasty is shown in Fig.6 [16]. It has a wide mouth, flared round rim, convex body, flared flat base flat round lid with round rim. It has one colour and the surface is polished.



Fig.6 Anhydrite cosmetic pot from the 12th dynasty [16].

- Another model of Kohl vessels manufactured from anhydrite is shown in Fig.7 [17]. It has a wide mouth, flanged rim, concave body, medium flat base and a three-stages unique lid. The first and last stage of the lid are flat while the medium one is concave. The surface is highly polished.



Fig.7 Anhydrite cosmetic vessel from the 12th dynasty [17].

III. NEW KINGDOM

The New Kingdom covers the 18th through 20th dynasties over the time span 1570 – 1069 BC [18]. This period of the Egyptian history had strong Pharaohs, strong economic and wide territories of the Egyptian Empire. Therefore, we are expected to see the reflection of this political situation on the technology of stone vessels production. Most of the models of stone vessels available relate to the 18th dynasty. This is logical because it was the most wealthy dynasty during this period.

- Fig.8 shows a 383 mm height canopic jar manufactured from alabaster and belongs to the elder daughter of Pharaoh Akhenaten of the 18th dynasty [19]. The jar has medium mouth, round shoulder, conical body, medium flat base. It has a lid taking the shape of the deceased.



Fig.8 Alabaster canopic jar of Akhenaten daughter [19].

- Another model of canopic jars was manufactured from lime stone and highly decorated is shown in Fig.9 [20]. It has a wide mouth, an ovoid body, a small flat base and an accurately produced lid having the shape of Anubis. It is clear that they have painted the lime stone with a light brown colour while the lid is painted by a dark brown. A part of the body is divided into a number of vertical bands in which ancient Egypt text is written using the hieroglyphic script.



Fig.9 Limestone canopic jar from the 18th dynasty [20].

- Another application of stone vessels is an alabaster vessel having a 454 mm diameter and 331 mm height manufactured during the 18th dynasty is shown in Fig.10 [21]. It has a mouth of the body diameter, round rim, cylindrical body flanged at the middle and a flat base of the body diameter. There is an internal recess facing the external flange.



Fig.10 454 mm alabaster vessel from the 18th dynasty [21].

- Another model from the 18th dynasty is a calcite jug from the rein of Pharaoh Thutmose III is shown in Fig.11 [22]. The jug has a good mechanical design and production. It starts with a medium mouth with a flared round rim, a long cylindrical neck, ovoid body, medium flared flat base and a single large handle. The applied technology is high because of the complexity of the design and the good finishing of the product.

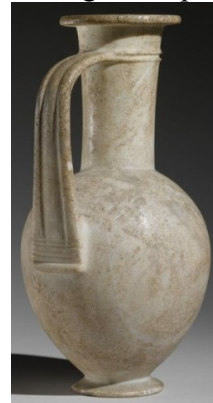


Fig.11 Calcite jug from the 18th dynasty [22].

- A different calcite model from the same rein of Pharaoh Thutmose III is located in the Metropolitan Museum of Art of NY and shown in Fig.12 [23]. It has a medium mouth, flanged flared round rim, cylindrical long neck, ovoid body, small flat base and a flad disc lid. The lid and rim are decorated by a gold band and the surfaces are highly polished.



Fig.12 Calcite bottle from the 18th dynasty [23].

- Another design of tall jars practiced in the 18th dynasty is manufactured from the

Egyptian alabaster and shown in Fig.13 [24]. It has a medium mouth, round rim, long concave neck, ovoid body and big flat base. It is decorated by high polishing and 3 bands on the neck from Egyptian faience.



Fig.13 Alabaster tall jar from dynasty 18 [24].

Another model belongs to Pharaoh Thutmose III of the 18th dynasty which is an Anhydrite jar having wide mouth and neck located in the Metropolitan Museum of Art and shown in Fig.14 [25]. The rim is round and inlaid by gold sheet, the neck is wide and has a medium length, the body is ovoid, the base is flat at the end of cylindrical foot.



Fig.14 Anhydrite jar from the 18th dynasty [25].

- Another model of a stone vase from the rein of Pharaoh Amenhotep III (about 1400 BC) of the 18th dynasty is displayed in Petrie Museum and shown in Fig.15 [26]. It is manufactured from grey steatite [27]. It has wide mouth, flanged round rim, medium length neck, ovoid body, small flat base, two vertical medium handles at the vase shoulder. The vase was highly polished and had one black colour.



Fig.15 Steatite vase from dynasty 18 [26,27].

- Another model of stone vessels of the 18th dynasty is again from the rein of Pharaoh Thutmose III found in his three foreign wives tomb and located in the Metropolitan Museum of Art is shown in Fig.16 [28]. It is manufactured from travertine, its lid from limestone, its height is 235 mm, its maximum diameter is 175 mm and its lid is 57 mm diameter [28]. It has small mouth, flanged round rim, short neck, round shoulder, conical body and medium flat base. The shoulder is inscribed by the Pharaoh cartouche.



Fig.16 Travertine jar from the 18th dynasty [28].

- Another application of the alabaster stone is a goblet manufactured during the rein of Pharaoh Thutmose III and set in the tomb of his three foreign wives. It is displayed in the Metropolitan Museum of Art of NY and shown in Fig.17 [29]. It has a flared rim, concave body, convex transition to the base neck, concave base neck and a medium flat base. The rim is decorated by a gold ring, the body is highly polished and the body is inscribed by the Pharaoh cartouche.



Fig.17 Alabaster goblet from the 18th dynasty [29].

- Before we move to the rein of Pharaoh Tutankhamun, we take one more model from the rein of his father Pharaoh Akhenaten. It is a travertine perfume bottle located in the Metropolitan Museum of Art and shown in Fig.18 [30]. It has a small mouth, short neck, ovoid body, concave base-neck and a large flat base. The body is designed to simulate a closing flower with decorated base at the base-neck. It has a large flange lid with concave holding stem. It is decorated by a figure of a princess holding the bottle body and inlaid with carnelian, obsidian, gold and colored glass. The princess figure is zoomed in Fig.18.



Fig.18 Travertine perfume bottle from the 18th dynasty [30].

- Now we present some stone vessels for the wealthy young Pharaoh Tutankhamun. Fig.19 shows a wonderful and highly appreciated mechanical design of an alabaster vase of Pharaoh Tut located in the Egyptian Museum of Cairo [31]. It has a medium mouth, flared round rim, long neck, ovoid body, conical base-neck and a large flat base. The neck carries the head of Hathor, the body is inscribed by two beasts pertaining to God, the conical base is inscribed by the Pharaoh protocol. The base is supported by two symbols of 'ankh' one from each side of the conical base neck. The top part including the neck and body is supported by smoothly changing curved strands bounding plant flowers. All this complex structure was carved from a single piece of alabaster stone [31]. This is a marvellous mechanical engineering work. If one draws a vertical centreline for the vase, he will find that it is exactly symmetric as if it was cut using a modern CNC machine !!.



Fig.19 Alabaster vase of Tutankhamun [31].

- Another high quality stone vessel from the tomb of Pharaoh Tut is an alabaster vase of a unique design as shown in Fig.20 [32]. It has a narrow mouth, flared flanged rim, very long neck, conical body, large flat base. The vase has a complex design since it is consisted of two parts cemented to each other [33]. The name of the Pharaoh and his wife is inscribed

on a large portion of the vase body. The structure around the neck and body consists of lily and papyrus stems with smooth curved profiles. Each side is hold by a girl wearing a crown from lily and papyrus clusters [33]. The sides of the structure represent a symbol for the unification of Upper and Lower Egypt. The base is an alabaster table supporting the alabaster vase. It is decorated by two vultures wearing the Atef Crown and holding the cartouche of the Young Pharaoh Tut. It is a wonderful piece of fantastic design and production from an Egyptian rock with the 14th century BC Egyptian Mechanical Technology.



Fig.20 Pharaoh Tut alabaster vase [32,33].

- Now we move to the next dynasty, the 19th dynasty. We have two models to present from this dynasty: The first is an alabaster Kohl pot produced during the 19th dynasty about 1200 BC and shown in Fig.21 [34]. It has a small mouth, small neck, flared-flanged-round rim, ovoid body and a flat flanged base. It has a disc round lid.
- Another model from the 19th dynasty is an alabaster jar from rein of Pharaoh Merneptah [35]. It has a wide mouth, round rim, cylindrical neck half the jar length, ovoid

body and a flat base with round flange. It has two big handles between the neck and shoulder. The finishing is not good.



Fig.21 Alabaster Kohl pot from the 19th dynasty [34].



Fig.22 Alabaster jar from the 19th dynasty [35].

- Now, we present some models with undefined dynasty , but referred to the New Kingdom. Such models are sold by tomb-robberies inside Egypt. Fig.23 shows a stone kohl vessel taking the shape of a fish and belongs to the New Kingdom (18th – 20th dynasties) [36]. The mouth is small and inclined making about 30 degrees with the horizontal direction. The body is decorated by the fish peel , the tail and the fins with multi colours. The base is a flatted bottom fin of the fish.



Fig.23 Kohl vessel from 18th t 20th dynasties [36].

- This is the last model from the New Kingdom (18th – 20th dynasties) which is a highly polished obsidian black jar shown in Fig.24 [37]. It has an 117 mm height, medium mouth, flared round rim, short neck, round shoulder, conical body, concave base ending with a large flat base. The dimensions and manufacturing technique are perfect reflecting the high mechanical technology level of the ancient Egyptians in the New Kingdom.



Fig.24 Obsidian jar from 18th-20th dynasties [37].

IV. THIRD INTERMEDIATE PERIOD

This period includes the ancient Egypt Dynasties from the 21st to the 25th and extends over the time span from 1070 to 664 BC [38]. During this period, the Egyptian state became to weaken and divide between Upper and Lower Egypt. We will see through the models of stone vessels if this political situation affects the stone vessels industry or not.

- Fig.25 shows a travertine canopic jar for king Nesibanebdjedet from the 21st dynasty displayed in the Metropolitan Museum of Art [39]. It has a wide mouth, round rim, ovoid body large flat base. The body is inscribed by the Pharaoh data.



Fig.25 Canopic jar from the 21st dynasty [39].

- Fig.26 shows an alabaster jar from the third intermediate period [40]. It has a wide mouth, flared round rim, medium cylindrical rim, ovoid body, round base and two medium handles at the jar shoulder.



Fig.26 Alabaster jar from 3rd Intermediate Period [40].

- Another model from this period is an obsidian vase manufactured during the 22nd – 23rd dynasties of the 3rd Intermediate Period and shown in Fig.27 [41]. It has a narrow mouth, flared round rim (gold shielded), no neck, parabolic body and small round base. The surface is highly polished.



Fig.27 Obsidian vase from 22nd-23rd dynasties [41].

V. CONCLUSIONS

- The development of the stone vessels industry practiced in the Predynastic Period continued during the succeeded periods of the ancient Egypt History. .
- Stone vessel models manufactured in the Middle Kingdom showed that they used limestone, alabaster, breccias, obsidian and anhydrite as raw materials.
- They designed and manufactured some of the Middle Kingdom stone vessels with lids.

- The lids has various designs and sometimes decorated by gold bands.
- They inlaid some of the Middle Kingdom stone vessels by gold ar rim and base.
 - The revolution of the stone vessels industry was completed in the 18th dynasty of the New Kingdom.
 - During the New Kingdom, the ancient Egyptians used limestone, alabaster, calcite, anhydrite, travertine and obsidian in manufacturing their stone vessels.
 - Wonderful designs took place in the 18th dynasty specially during the rein of the young Pharaoh Tutankhamun. .
 - During the 18th dynasty they could produce stone vessels with complex supporting structure from a single piece of stone and bearing number of important symbols in the ancient Egypt daily life.
 - They decorated some of the 18th dynasty stone vesels by girl-figures using other materials such as carnelian, gold and glass.
 - They inscribed some of the New Kingdom stone vessels by inscriptions displaying the Pharaoh personal data.
 - They decorated some of the New Kingdom stone vessels using gold and faience bands.
 - Excellent design and production of stone vessels continued up to the 20th dynasty of the New Kingdom.
 - In the Third Intermediate Period, they used alabaster, travertine and obsidian in producing their stone vessels.
 - They inscribed some of the 3rd Intermediate Period stone vessels, highly polished them and used gold-band decoration.

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