Mechanical Engineering in Ancient Egypt, Part XXXIII: Stone Statues Industry (Predynastic to Old Kingdom)

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Abstract
The objective of this paper is to investigate the development of mechanical engineering in ancient Egypt through the production of stone statues. This study covers the design and manufacturing of stone statues from the Predynastic Period (Naqada II) to the end of the Old Kingdom showing the type and characteristics of each statue. The decoration, inscriptions and beauty aspects of each statue were highlighted.

Keywords – Mechanical engineering history, stone statues, Predynastic to Old Kingdom Periods.

I. INTRODUCTION
Ancient Egyptians pioneered and mastered cutting and shaping stone for building their tombs, temples, pyramids and manufacturing products including different sized stone statues. The stone statues of the ancient Egyptians fill now almost all the National and International Museums around the World. Some of the National Museums in Europe called themselves ‘The Egyptian Museum’ such as the Egyptian Museum at Turin of Italy and the Egyptian Museum at Berlin. Such museums house a lot of stone statues of the ancient Egyptians.

Aldred (1950) wrote a book about the Middle Kingdom art in ancient Egypt. She presented the alabaster statue of Chancellor Mesehti from Late First Intermediate Period, limestone statue of Steward Merl from the 11th Dynasty, sandstone statue of King Menthu-Hetep from the 11th Dynasty, limestone statue of King Senusret I from Early 12th Dynasty, limestone head of King Mentuhetep II, red granite statue of King Amen-em-het I from Early 12th Dynasty, basalt turso of King Senusret I, black granite statue of Lady Sennuy from Early 12th Dynasty, dark grey granite statue of King Senusret I, dark granite statue of Steward of Lower Egypt Khti from Middle 12th Dynasty, black basalt statue of Ameny from Late 12th Dynasty, dark granite statue of Treasurer Hetep from Middle 12th Dynasty, limestone statue of Treasurer St-Hator from Middle 12th Dynasty, black and grey granite statue of King Senusret II from Middle 12th Dynasty, red granite statue of King Sebek-hetep III from the 13th Dynasty, black granite statue of Herald of Thebes Sebek-en-sau-ef from the 13th Dynasty and dark granite statue of Sebek-hetep VIII from 13th Dynasty [1].

Steindorff (1951) studied and analysed a royal head from ancient Egypt carved from diorite and belonged to the 6th Dynasty [2]. Smith (1960) Smith (1960) wrote a book about ancient Egypt as represented in the Museum of Fine Arts at Boston. Among his presentations a head of a Prince from the Old Kingdom and a head for his wife, a head for Treasurer Nofer from the 4th Dynasty, painted limestone bust of Prince Ankh-haf of the 4th Dynasty alabaster face of King Khafre from the 4th Dynasty, group statue of King Mankaure and his Queen, alabaster statue of King Mankaure, Statue of Khuners son of Mankaure as a scribe and other statues from the 5th and 12th Dynasties [3]. Andelkovic and Fischer (1975) discussed the objects hold in the fisted hands of male ancient Egyptians statues. He presented the case of Msi and Snnw pair statue and statue of Mm-Sibw and his wife [4].

Roth (2002) in her study about servant statues in Old Kingdom serdabs presented some statues for a serving statue from Giza mastaba 2088, double serving statue for two women from the same mastaba and an inscribed serving statue from tomb of Nikaouthater and her husband at Giza [5]. Teeter (2003) wrote a book about treasures from the collection of the Oriental Institute of the University of Chicago. She presented selections from the Early Dynastic, Old Kingdom, First Intermediate Period, Middle Kingdom, New Kingdom, Third Intermediate Period, Late Period and Ptolemaic and Roman Periods. Among her presentations: a granite statue from 4th/5th Dynasties, statue for Nu-cau-inpu and his wife from the Old Kingdom, two statues for a male and female harpist from the Old Kingdom and Statue of Men-Khafet-Ka and his wife from the 5th Dynasty [6]. Bard (2007) wrote a book about the archaeology of ancient Egypt starting from the Predynastic Period up to Greco-Roman Period. Among her presentations was the statue of Rahotep and Nefert from the 4th Dynasty, statue of King Mankaure and his Queen from the 4th Dynasty, limestone bust of Prince Ankh-haf from the 4th Dynasty and statue of King Mentuhotep

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II from the 11th Dynasty [7]. Tassie (2008) in her Ph.D. study about social and ritual contextualisation of ancient Egypt hair and hairstyles presented a statue for Lady Meretites, the Overseer of the hairdressing and her son Khenu and the statue of Ty from the 5th Dynasty, statue of Redjit from the 2nd Dynasty, limestone head of a King from Early Dynastic, limestone statue of Nesa and Sepa from the 3rd Dynasty and statue of Netjerikhet in the step pyramid comple from the 3rd [8].

Lancie (2010) in a research article about ancient Egyptian religion and art presented a diorite statue for King Khafre and his Queen from the 4th Dynasty [9]. Brooklyn Museum (2011) in an article about Egyptian treasures from the Brooklyn Museum presented the limestone statue of the Granary Irukapth from the 5th Dynasty [10]. Flentye (2015) established the interrelationships between 4th Dynasty royal and non-royal statuary from the Giza Necropolis. The author discussed how royal statuary influenced the elite programs in the Western and Eastern cemeteries at Giza [11]. Wikipedia (2016) wrote an article about block statue emerged in the Middle Kingdom of ancient Egypt and continued to be produced up to the Late Period. As examples they presented block statues of official Senwosret from the 12th Dynasty [12].

II. PREDYNASTIC PERIOD

The predynastic period is that before the First Dynasty of ancient Egypt, i.e. before 3100 BC [13]. There are two examples of stone statues during this period:

- The first example is a limestone figurine from Naqada II (3500-3200 BC) in display in the British Museum shown in Fig.1 [14]. Most probably this is a statue for a woman with cut hair as clear in the zoomed view in Fig.1.

- The second example is a basalt statue from Naqada II (3250 BC) in display in the Ashmolean Museum at Oxford and shown in Fig.2 [15]. The statue has an overall height of 390 mm and is carved from basalt and shows the man standing. The statue shows the man standing, cutting his hair and wearing a veil of a triangular shape on his neck and down to his waist. The elements of the face are carved professionally even it is a hard rock, but Egyptians could carve it more than 5260 years ago.

- The third example is a limestone figurine for a seated woman from Late Naqada II (3450-3300 BC) in display in the Metropolitan Museum of Art at NY and shown in Fig.3 [16]. It has a 198 mm height and was decorated by woman hair and some paintings on her body. The proportions of the body are not logical and face elements were not professionally carved.

III. EARLY DYNASTIC PERIOD

The Early Dynastic Period of ancient Egypt covers the 1st and 2nd Dynasties over a time span from 3100 to 2686 BC [17]. We have four examples of stone statues defining the development of stone statues in ancient Egypt during its first and second
Dynasties:
- The first example is a small lapis lazuli statue carved during the 1st Dynasty (2900 BC) and shown in Fig.4 [18]. There is a confusion about the gender of this statue. Is it a man or a woman? The zoomed image in Fig.4 illustrates this confusion. The head says it is a man wearing a decorated cap, while the bust says it is for a woman. He/she is putting his/her right hand on the left hand on the chest as Muslims do in their prayer.

- The second example is a statue for King Khasekhmwy, the last King of the 2nd Dynasty (died 2686 BC) in display in the Ashmolean Museum at Oxford and shown in Fig.5 [19]. The King is wearing a cloak and the White Crown of Upper Egypt. This may be the first time for a King appearing with the White Crown.

- The third example from this period is a granite statue for Priest Redjit from the 2nd Dynasty in display in the Egyptian Museum at Cairo and shown in Fig.6 [20]. The designer showed the Priest putting his two palms on his knees. He is wearing a Khat headdress, This may be the first time the ancient Egyptians used the hard rock granite to produced some of their statues.

IV. OLD KINGDOM

The Old Kingdom of ancient Egypt covers from the 3rd Dynasty to the 6th Dynasty over the time span from 2686 to 2181 BC [21]. We have good examples of stone statues produced during this period detailed as follows:

3rd Dynasty:
- Fig.7 shows a limestone statue for King Djoser, first King of the 3rd Dynasty (2670 BC) in display in the Egyptian Museum at Cairo[22]. The King is wearing a full-dress and a Nemes headdress. He is setting and putting his right hand on his chest and his left hand on his left leg. The carver showd the King with a thin long beard as clear in the zoomed image in Fig.7.

- The second example is from near the End of the 3rd Dynasty and the Early 4th Dynasty. It is a lime stone for Prince Rahotep and his wife Nofret in display in the Egyptian Museum at Cairo[23]. The Prince had a small hair, moustache and small beard. He is wearing a short white Schenti and a necklace. His wife Nofret was shown with her normal hair with a colored diadem on it, wearing a long Tunic and a colored pectoral. Both statues shows the details of the face in a very accurate manner as it is taken by a digital camera of nowadays.
Fig. 7 Limestone statue of King Djoser [22].

Fig. 8 Limestone statue of Rahotep & Nofret [23].

4th Dynasty:
- The first example from the 4th Dynasty is a limestone statue for a seated scribe found in Saqqara of Egypt, in display in the Louvre Museum and shown in Fig.5 [24]. It shows the scribe wearing a short Schenti, putting his two hands on his legs in a position ready for writing. The zoomed image of the scribe shows him with his normal short hair and a serious facial pose.

Fig. 9 Limestone scribe statue from the 4th Dynasty [24].

- The second example is a limestone group statue for Priest Neferherenptah (2589-2566 BC) and his family in display in the Egyptian Museum at Cairo and shown in Fig.10 [25]. The statue designer showed the Priest striding, his wife setting and his children setting. The priest and his son are wearing a Khat headdress, short Schenti and a pectoral. His wife and daughter are wearing a long Tunic, and the wife is also wearing a pectoral. The limestone was painted by a number of colors including brown, yellow and black.

Fig. 10 Limestone statue of Neferherenptah from the 4th Dynasty [25].

- The third example from the 4th Dynasty is a pair limestone statue for Memi and Sabu (2570-2465 BC) from the 4th Dynasty in display in the Metropolitan Museum of Art and shown in Fig.11 [26]. Memi is wearing a short Schenti and a Khat headdress while his wife Sabu is wearing a long Tunic and has a normal hair. The statue shows them in a sentimental position with her right hand holding his waist.

Fig. 11 Limestone statue of Memi and Sabu from the 4th Dynasty [26].
- The fourth example is a red-quartzite head for King Djedefre, the 3rd King of the 4th Dynasty (2566-2558 BC) in display in the Louvre Museum and shown in Fig.12 [27]. The quartzite is a hard and tough stone [28]. Even though, the ancient Egyptians from more than 4560 years could carve it with the King face details shown in Fig.12 and even his Nemes headdress which has a complex shape and a lot of curved surfaces.

- The fifth example is a diorite statue for King Khafre, the 4th King of the 4th Dynasty in display in the Egyptian Museum at Cairo and shown in Fig.13 [29]. The designer shows the King setting on a chair wearing a short Schenti and a Nemes headdress and putting his hands on his legs. The statue overall height is 1.675 m. The ancient Egyptians could carve it from diorite even though diorite is an extremely hard stone and difficult to carve [30].

- The sixth example is a limestone statue for Prince Ankhhaat, Vizier and Overseer of Works for King Khafre (2558-2532 BC) in display in the Museum of Fine Arts at Boston and shown in Fig.14 [31]. The Prince is shown necked with his hair cut. The limestone is painted to simulate the body of the Prince.

- The seventh example is a green-schist statue for King Mankaure, the 6th King of the 4th Dynasty (2548-2532 BC) with Hator and Cyropolite in display in the Egyptian Museum at Cairo and shown in Fig.16 [32]. The King is wearing a short Schenti and the White Crown of Upper Egypt. Hator and Cyropolite are wearing a long Tunic and their crowns.

- The eighth example is an alabaster statue for King Menkaure, the 6th King of the 4th Dynasty (2532-2503 BC) in display in the Museum of Fine Art at Boston and shown in Fig.17 [33]. The overall height of the statue...
is 2.53 m. The carver showed the King setting, wearing a short Schenti, a Nemes headdress, his two hands are on his legs and holding an object in his right hand. The face shows the King as a serious man with thin long beard.

Fig.17 Alabaster statue of King Mankaure from the 4th Dynasty [33].

- The last example from the 4th Dynasty is again for King Menkaure and his Queen. The statue is carved from the hard stone 'greywacke' in display in the Museum of Fine Arts and shown in Fig.18 [34]. It has an overall height of 1.3843 m. The statue shows the King wearing a short Schenti with front tail and belt, wearing the Nemes headdress and having a thing long beard. His wife is wearing a long Tunic, holding the King waist by her right hand and putting her left hand on his left hand in a very indicative sympathetic position.

Fig.18 Greywacke statue of King Mankaure and his Queen from the 4th Dynasty [33].

- The first example of stone statues produced in the 5th Dynasty of ancient Egypt is for King Userkaf, the founder of the 5th Dynasty (2494-2487 BC) in display in the Egyptian Museum at Cairo and shown in Fig.19 [34]. It is carved from the hard stone greywacke and then polished. The King is wearing the modius crown.

Fig.19 Greywacke statue of King Userkaf from the 5th Dynasty [34].

- The second example is a limestone statue for a Scribe (2491-2345 BC) located in the Egyptian Museum at Cairo and shown in Fig.20 [35]. The statue shows the Scribe setting and wearing a short Schenti, Khat headdress, pectoral and holding the writing paper on his legs. The statue was carved in a very professional way showing the details of the Scribe face and his headdress as if it was taken by a digital camera not carved. They were the ancient Egyptian artists.

Fig.20 Limestone statue of a Scribe from the 5th Dynasty [35].

- The third example is a Gneiss statue for King Sahure, the 2nd King of the 5th Dynasty in display in the Metropolitan Museum of Art and shown in Fig.21 [36]. The King is setting, putting his hands on his legs, wearing a Schenti and holding an object in
his right hand. He has a thin long beard wearing a decorated Nemes headdress. Even though gneiss is one of the hardest stones, the Egyptian artist could carve it and produce the utmost quality and accuracy shown in Fig.21.

- The fourth example is a limestone statue for a Musician from the 5th Dynasty (2477 BC) in display in the Museum of Fine Arts at Boston and shown in Fig.22 [37]. The carver showed them playing music and wearing a short Schenti and a small cap headdress. Their pose of the face depicts the emotion of the musician when playing music.

- The fifth example is a limestone pair statue of Ptahkhenuwy and his wife (2465-2323 BC) in display in the Museum of Fine Arts at Boston and shown in Fig.23 [38]. The statue shows Ptahkhenuwy and his wife standing in a very sympathetic position. He is wearing a short Schenti , Khat headdress and a pectoral. His wife is wearing a long Tunic, pectoral and bracelet.

- The sixth example is a limestone group statue of Penmeru (2465-2323 BC) in display in the Museum of Fine Arts at Boston and shown in Fig.24 [39]. The statue shows Penmeru (in the middle) and in the right side wearing a short Schentim a Khat headdress and (may be) holding an object in his hands. His wife is shown in a sympathetic position putting her right hand around her husband waiste and her left hand extended vertically. She is wearing a long Tunic with her normal hair. The statue shows their children (boy and girl) standing beside their legs. The frame in which the statues are located is inscribed inside a band-frame.

- The seventh example is a limestone statue Nykara and his family from Late 5th Dynasty.
(2455-2350 BC) in display in the Brooklyn Museum at NY and shown in Fig.25 [40]. The designer showed Nykara setting on a chair, his wife standing at his left and his daughter standing at his right side. He is wearing a short Schenti and a decorated Khat headdress. His wife is wearing a long Tunic and a decorated headdress as clear from the view of her head shown in Fig.25 [41]. His daughter is completely necked.

- The eighth example is a limestone pair statue of Nenkheftka and his wife (2350 BC) in display in the Walters Art Museum at Baltimore and shown in Fig.26 [42]. The carver showed Nenkheftka wearing a decorated Schenti with a belt and a decorated Khat headdress as cleared in the zoomed view in the same figure. His wife is wearing a long Tunic and a headdress as clear in her zoomed image. The overall height is 545 mm [43].

- The first example is a limestone pair statue for Raherka (Inspector of Scribes) and his wife (2350 BC) very close to the beginning of the 6th Dynasty in display in the Louvre Museum and shown in Fig.27 [43]. The designer showed Raherka wearing a short decorated Schenti with belt, a Khat headdress and holding a cylindrical bar in each palm. His wife is wearing a long Tunic with her normal hair and in a very sympathetic position with her husband (holding his waist with her right and left hands and her body is almost 50 % behind his body.

- The second example is a granite statue for King Teti, the founder of the 6th Dynasty (2345-2333 BC) in display in the Egyptian Museum at Cairo and shown in Fig.28 [44]. The designer showed the King standing, wearing a short Schenti with belt and a front tail and the White Crown of Upper Egypt. He presented carefully the strong body of the King.

- The third example is an alabaster statue for King Pepi I, the 3rd King of the 6th Dynasty (2331-2287 BC) in display in the Brooklyn Museum and shown in Fig.29 [45]. The designer showed the King setting on a tall-back chair with Horus standing on the the top edge of the chair. The King is putting his hands on his chest, holding two objects in his palms and wearing the White Crown of Upper Egypt.
- The fifth example is a kneeling statue from the reign of King Pepi II, the 5th King of the 6th Dynasty (2278-2184 BC) in display in the Metropolitan Museum of Art and shown in Fig.31 [47]. He is wearing a short Schenti and a Khat headdress and looking sharply to the future history of Egypt.

- The sixth example is a limestone statue for a servant grinding corn (2200 BC) in display in the Kunsthistorsches Museum at Vienna, Austria and shown in Fig.32 [48]. This one of the difficult statues to carve because of the too many details due to the position taken by the servant. However, because limestone is a soft stone it was easy for the ancient Egyptian carver to generate it with its too many details.

- The seventh example is limestone statue for Nefer-hekepes in display in the Pelizaeus Museum at Hildesheim, Germany and shown in Fig.33 [49]. The designer showed her wearing a white sleeveless Tunic with a long V-cut on her chest, a pectoral and a headdress as clear in the zoomed image in Fig.33.
Fig.33 Statue of Nefer-Hetepes from the 6th Dynasty [49]
- The eighth example is for Scribe Path-Shepse from the 6th Dynasty shown in Fig.34 [50]. He is taking the standard position of Scribes, wearing a short Schenti and a Khat headdress with serious pose as clear from his zoomed view. A lot of data are missing, definitely because its un-legal existence in some hands through artifacts robbery.

Fig.34 Statue of Path-Shepse from the 6th Dynasty [50]

V. CONCLUSION
- This paper investigated the evolution of Mechanical engineering in ancient Egypt during the Predynastic to Old Kingdom periods through the design and production of stone statues.
- Ancient Egyptians produced limestone and basalt statues since the age of Naqada II.
- The stone statues of the ancient Egyptians showed their men wearing short Schentis, their woman wearing long Tunics and their children necked.
- Wonderful stone statues showing the amazing know-how of this industry using hard stones were a characteristic of the Egyptian Civilization during the Old Kingdom.

REFERENCES


