A Study of the Loop Sistrum (Accession Number: 1994.4.26) at the University of Memphis

Rachel Joy Suddreth

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A STUDY OF THE LOOP SISTRUM (ACCESSION NUMBER: 1994.4.26) AT THE UNIVERSITY OF MEMPHIS

by

Rachel Suddreth

A Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of

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Major: Art History

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For
Lucas and Sheppard
ACKNOWLEDGEMENTS

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ABSTRACT

The object of this study is a loop sistrum (Accession Number: 1994.4.26) in the Egyptian Collection of the Institute of Egyptian Art and Archaeology, a musical instrument used in cultic practice from the New Kingdom to the Roman Period (1539 BCE - 646 CE).

During the Summer of 2016, 3-D imaging of the object revealed a lack of definition in the details of its manufacture. This observation, combined with the object’s undocumented provenience prior to its purchase by private collector, Glenn White, has called the authenticity of the instrument into question. To evaluate the object this thesis employs a stylistic comparison of the object to provenienced examples, an examination of the method of manufacture and corrosion products on the object and testing by means of portable Xray Fluorescence (pXRF). The combined results of these analyses lead the author to a conclusion that the instrument is authentic.
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Chapter One

Introduction

The Institute of Egyptian Art and Archaeology (hereafter, IEAA) has in its collection a bronze Hathor sistrum (acc. no. 1994.4.26).

1 The sistrum has been tentatively dated to the Late Period (ca. 722-332 BCE). The sistrum (fig. 1) is of a type called a “loop sistrum”. It consists of a metal loop that is pierced by three intact horizontal metal rods. The loop ends at a thin rectangular base surmounted by a seated cat figurine. The bottom of this base is connected to a double-sided Hathor image (frontal face) with a rearing uraeus in profile at the outer corner of each side of her broad collar. The cobra on the viewer’s right wears the double crown while the one on the viewer’s left wears the red crown of Lower Egypt. Beneath the face of Hathor is a broad collar. The Hathor head is attached to a thick lotus column-shaped handle ending in a three-ringed end-cap.

The Memphis sistrum does not have a documented provenience. A nearly identical sistrum was identified in a sales catalogue from a London auction house,

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1 Memphis, Art Museum at the University of Memphis, (acc. no.1994.4.26). I would like to thank Dr. Lorelei H. Corcoran, director of the Institute of Egyptian Art and Archaeology for permission to publish this object, and Dr. P. Podzorski, curator of the Egyptian Gallery at the Art Museum at the University of Memphis, for her assistance with the analysis of the object and for providing the images of the sistrum. When the sistrum was photographed for 3-D imaging by Dr. Joshua Roberson from May to June of 2016, IEAA director, Lorelei Corcoran noted a lack of definition to the details of the facial features of the Hathor mask that she considered inconsistent with an authentic artifact. The sistrum has been discussed previously in Melinda Hartwig and Stephen Harvey, Gods of Ancient Memphis (Memphis: University of Memphis, 2001); Flora Hesse, “The Iconography and Use of the Sistrum in the Pharaonic Period” (Master’s thesis, University of Memphis, 2007).

2 The designation “Late Period” as used in this thesis, references the period that begins with Dynasty 25 (ca. 722 BCE) and ends with the conquest of Egypt by Alexander the Great in 332 BCE, which began the Ptolemaic period. The dates in this work follow Erik Hornung, Rolf Krauss, and David Warburton, Ancient Egyptian Chronology (Leiden: Brill, 2006), 490-495.
Bonhams (fig. 2). The close similarity between the two examples brings into question the nature and origin of the both sistra. It is possible that these objects were once part of a pair of sistra that were created together and then separated once discovered. This would be a very rare occurrence as these would then be only the second surviving example of a pair of loop sistra to be identified since the discovery of the pair from the tomb of Tutankhamun (fig. 3). Another possibility is that one or both of these instruments were created by forgers in order to be sold as original pieces as noted by Saura-Ziegelmeyer. 

The objective of this thesis is to evaluate this sistrum in order to determine its authenticity. The first step toward this goal will be to determine the stylistic authenticity of the piece. First, comparing the stylistic details of additional sistra in other collections will provide a set of external criteria for comparison with the Memphis sistrum. Secondly, metalwork and manufacture techniques will be discussed in order to establish common and expected traits of ancient bronze works, in order to discern any potentially

3 Arnaud Saura-Ziegelmeyer, a Belgian musicologist studying ancient Egyptian sistra, identified this sistra in the auction catalog of Joanna van Lande, Antiquities:Wednesday 25 April 2012 at 11am, New Bond Street, London (London: Bonham’s, 2012), Lot 131. Saura-Ziegelmeyer subsequently contacted the IEAA to inquire about sistra in the IEAA collection. Communication from IEAA object files. In his brief discussion of the two objects, Saura-Ziegelmeyer notes what he considered to be the exactly similar dimensions of the two objects is suspicious for the pre-industrial era and could suggest that one or both objects are inauthentic. A. Saura-Ziegelmeyer, Le sistre isiaque dans le monde gréco-roman: analyse d’un objet cultuel polysémique. Typologie, Perceptions, Significations (Université Toulouse II Jean Jaurès, Toulouse, 2017), 148-149. I would like to thank Dr. Saura-Ziegelmeyer for his kindness in sharing with me chapters of his dissertation, Le sistre isiaque dans le monde gréco-roman: analyse d’un objet cultuel polysémique. Typologie, Perceptions, Significations, and for sending me his article, “Inside and Outside the Tomb: The Isiac Sistrum as Testimony of Worshippers’ Beliefs,” Musical Instruments as Votive Gifts in the Ancient World, in Angela Bellia and Sheramy Bundrick (Rome: Institute Editorialie Poligrafici Internazionali, 2018), 71-80.

4 Sistra commonly appear in pairs in representation, however, the pair found in Tutankhamun’s tomb are the only surviving pair to be recovered. C.G. 69317, J.E. 62009, 62010, see Manniche, Musical Instruments from the Tomb of Tutankhamun, Tutankhamun’s Tomb Series VI, ed. J.R. Harris (Oxford: Griffith Institute, 1976), 5-6.

5 Saura-Ziegelmeyer, Le sistre isiaque dans le monde gréco-roman, 148-149.
suspicious deviance in the Memphis sistrum. Finally, the results of the analysis of the sistrum using portable Xray Fluorescence (pXRF) technology will be discussed.

My investigation will begin with a description of the Memphis loop sistrum and a brief introduction to the problems facing the authentication of the artifact. This will be followed by a brief discussion of the historical origins and use of sistra in Egyptian history. Next, I will evaluate the stylistic authenticity of the object established in prior scholarly literature, by reviewing the historic origins, iconography, and artistic representation of the loop sistrum from their first appearance in the New Kingdom (ca. 1539-1077 BCE) through their stylistic and functional evolution during the Roman period (30 BCE - 646 CE).

Due to the inability of the author to visit every museum containing relevant sistrum examples for comparison, those used in this work were identified from two catalogues of musical instruments and museum websites including the British Museum, the Musée du Louvre in Paris, and the Petrie Museum of Archaeology at University College London.6 Forty-three sistrum were used in this research (Table 1) and were chosen based on their ability to represent the stylistic norms or manufacturing techniques of each time period.7

The research will also focus on the methods of metalwork fabrication, in order to

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7 Christian Ziegler, *Catalogue des instruments*, 36-37. The majority of sistrum, unfortunately, are unprovenanced and under-published in research. As such, these instruments are difficult to accurately date, and are often given approximate dates based on stylistic properties. My research understands this and follows the approximate dates given by the objects’ owner. It is my hope that this research will add to the knowledge of the specific stylistic variations in loop sistrum during the time periods discussed.
establish what characteristics we might expect in a genuinely ancient sistrum. Finally, the study will employ the use of portable X-ray Fluorescence (pXRF) to determine the specific elemental make-up of the sistrum, the results of which will indicate traces, if any, of modern manufacture. This combination of an art historical and chemical analysis will offer evidence to assist in the determination of whether or not the Memphis loop sistrum is in fact a forgery or authentic.\footnote{It should be noted that my use of the term forgery instead of fake is intentional. I am following Noah Charney who states that although in practice the two terms are used interchangeably a forgery is an entirely new copy created in the image of an existing object, whereas a fake is an existing object that has been altered in some way to increase its value. See Noah Charney, \textit{Art Crime: Terrorists, Tomb Raiders, Forgers and Thieves} (London: Palgrave Macmillan, 2016), xiv.}
Chapter Two

History and Description of the Object

The Memphis sistrum was purchased from an antiques shop in Los Angeles, California, on January 21, 1975, by a private collector and Air Force officer, Glenn White. In 1994, the sistrum and other Egyptian objects belonging to the estate of the collector were bequeathed to the Institute of Egyptian Art and Archaeology. The original sales receipt preserved with the object dates the instrument to Dynasty 26 (ca. 664 - 525 BCE).

Object Description

Through visual observation, the sistrum appears to be composed of bronze (a copper-alloy) and it measures approximately 28 cm in height, 3 cm in width with rods measuring at 10 cm in length (fig. 1). The handle is composed of a short, stocky column with a triple tie band base and a single tie band separating the column from the collar of the Hathoric image. The broad collar of each of the Hathor figures is a wide, undecorated, triangular shape. Atop each broad collar, separated by a small rounded neck, is the face of the goddess Hathor, which although badly damaged by corrosion can be identified by her signature curled-end wig, that is long and thin, and the barely visible yet distinctive bovine ears that typically appear on anthropomorphic images of the deity. The face of the goddess is round with large narrow eyes, a thick and round nose, and full lips. There is a rearing uraeus in profile on either side of the face. The uraeus on the viewer’s right wears the double crown, while the left wears the red crown of Lower Egypt. Resting atop the

1 An alloy is a metallic compound composed of one or more ores. The alloy of copper and tin are considered a “true bronze” however, lead and arsenical coppers can also be considered as bronzes. See Jack Ogden, “Metals” in Ancient Egyptian Materials and Technology, in Paul T. Nicholson and Ian Shaw (Cambridge: Cambridge University Press, 2000), 151.
image of the goddess and the uraei is a rectangular platform, which serves as the base for the loop and a figure of a seated cat. The loop is pierced by three horizontal curved metal rods at varying heights. The sounding plates that were typically strung through these rods are unfortunately missing. The lack of information regarding the instrument’s condition and history before it was purchased in 1975, calls into question the object’s authenticity as a genuinely ancient artifact.

The date of the sistrum can also be important for verifying its authenticity. Hesse agrees with the date for the object that appears on the sales receipt for it, and dates the object to the Late Period of Egyptian history. She suggests that the ornate nature of the sistrum’s decorative pattern supports this assessment. Her proposed dating is supported also by Manniche who states that the addition of cats and the god Bes to loop sistra begins in the Late Period. Therefore, an examination of the historic development of loop sistra, as well as their iconography during the New Kingdom as the origin point of the loop sistrum, into the Amarna, Late, Ptolemaic (ca. 332-30 BCE ), and Roman Periods will prove necessary to assess the validity of this proposed date.

**The Bonhams’ Sistrum**

On April 25, 2012, a similar sistrum was sold by Bonhams, a London auction house (fig. 2). It measures approximately twenty-eight cm in height and three cm in width. The stated provenance of that object was that it had been in the possession of a

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private collector in Belgium during the 1970s, very near to the date of purchase of the Memphis sistru.
The similarity of these two objects could indicate that they were part of a set pair that were separated upon their discovery. Their similarities can be reconciled using an ancient casting technique which employed shaping the wax core of an object in a plaster mold. This ancient form of mass production would allow for multiple iterations of the same object being cast.\(^5\) Another possible explanation, however, is that one or both objects were forgeries from the same workshop that were artificially aged to create the rough patina visible on both objects. Although a thorough comparison of these two objects cannot be accomplished due to the lack of access to the Bonhams’ sistru, a side-by-side pictorial examination can still yield information concerning their possible connection.

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\(^5\) Ogden, “Metals,” 159.
Chapter Three

Historic Development of Sistra

Attested in use as early as the Old Kingdom (ca. 2543-2120 BCE), the sistrum was both an instrument and a votive object used primarily in cultic worship.

1 The most widely noted cult association was with the goddess Hathor. However, other deities were worshiped with the sistrum including Isis, Amun, and Min.2

In physical aspect, Hathor appears often as a woman wearing a crown composed of curved cow horns on either side of a sun disk (fig. 4).3 She can also be represented as fully bovine, or as a cat.4 Hathor was associated with the instrument early on, both as the goddess of music, and her relationship with her fierce counterpart the lioness Sekhmet for whom the people would play the sistrum, in order to appease her violent nature.5 Shaking sistra to the goddess developed from a ritual of the Old Kingdom, where papyrus stalks

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2 Hathor’s assimilation with the goddess Isis as early as the New Kingdom allowed Isis to become associated with the arched sistrum which would later become her most recognizable attribute during the Greco-Roman periods. Francesco Tirdritti, Isis, The Egyptian Goddess Who Conquered Rome (London: Thames & Hudson, 1997) 16-18. The worship of multiple deities with the sistrum is attested by its use in the cults of Amun and Isis as evidenced by the title of the owner of the sistrum of Henetawy as the Chantress of Isis and Amun, as well as, the inscription on the outside of the loop that references the god Amun-Ra and the goddesses Isis. Christian Ziegler, Catalogue des instruments de musique égyptiens (Paris: Musée du Louvre, 1979), 57; For translation of the loop’s text see Ziegler, Catalogue des instruments, 55-56; Roberts, Hathor Rising, 95-96, pl. 104.


4 Bleeker, Hathor and Thoth, 22,30-34; Hornung, Conceptions of God in Ancient Egypt, 110-113; Pinch, Votive Offerings to Hathor, 160-183,190-197.

5 Bleeker, Hathor and Thoth, 60; Roberts, Hathor Rising, 14, 57.
were pulled from the swamps and shaken, creating a rattling sound that was deemed pleasing. A scene in the tomb of Merysankh demonstrates this ritual (fig. 5). The terms sistrum/sistra are associated with the Egyptian word sḫm, “power”, because these objects are thought to be related to power or magic, and could imbue the bearer with the attributes of the goddess depicted or protect them from harm. In representation, these instruments were most commonly depicted in identical pairs.

The Naos Sistrum

The earliest sistrum were votive and symbolic in nature. This type of sistrum is known as the naos sistrum, because it consisted of a tall, rectangular, elaborately decorated structure which was meant to evoke the naos or inner chamber of the temple that was the sanctuary of the gods. Sistra were attributes of priestesses as well as royal women and men shown in ritual acts of offering to deities. The first representation of a royal woman holding a naos sistrum appears in the Middle Kingdom temple of Medinet Maadi. Its long handle was attached to the base of the naos, and often surmounted by a double-sided Hathor face (fig. 6). These sistra are typically composed of Egyptian faience, but other

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6 Manniche, Music and Musicians, 63.

7 Dunham and Simpson, Merysankh III: The Mastaba of Queen Merysankh III (Boston: Museum of Fine Arts, 1974) fig. 7; Vivienne Callender, In Hathor’s Image I: the Wives and Mothers of Egyptian Kings from Dynasties I-VI (Prague: Charles University, 2011), fig. 53.


10 Paris, Musée du Louvre, (acc. no. 4314), illustrated in Ziegler, Catalogue des instruments, fig. 41.
examples are documented in wood, Egyptian alabaster, and stone. The naos structure could sometimes be made into a functional instrument through the addition of a laddered series of horizontally placed wires with disks strung through the naos structure, for the purpose of creating a rattling sound when shaken.

The Loop Sistrum

The second type of sistrum, appearing in representation and physical form during the New Kingdom, is known as the “loop” or “arched sistrum”. This particular type of sistrum commonly features an arched metal loop atop a rectangular base, resting on the head of a Hathor mask that was connected at the bottom to a thin columned handle. Metal rods transverse the loop with small disks that when shaken, just as with the naos sistrum, crash together, creating the desired sound of the instrument. The loop sistrum, however, is meant almost exclusively as a musical instrument as the metal is a less fragile and more acoustically pleasing than the faience naos sistrum. The loop sistrum was the instrument of choice for priestesses and royal women, as the sound was seen as a propitiation to the gods.

Hathoric Association with Cats in Representation

The presence of the cat figure is one of Hesse’s main arguments for dating the Memphis sistrum to the Late Period. Its use in loop sistra decoration is supposed to

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12 Anderson, Musical Instruments, 40; Pinch, Votive Offerings to Hathor, 138.


14 Hesse, “Iconography and Use,” 7.
have begun only at this point, subsequent to the collapse of the New Kingdom and the political formation of the Third Intermediate Period (ca.1076-723 BCE).\textsuperscript{15} To evaluate this idea, it is necessary to consider what symbolic connection or significance the cat held within the cult of Hathor, and when this connection arose.

Hathor’s connection to felines arises from the polyvalence of her nature in Egyptian mythology.\textsuperscript{16} She takes on a variety of forms and functions throughout Egyptian history, e.g., human, tree, cow, and lioness forms. In Egyptian religious literature, she functioned as the goddess of the sky, love, music, the dead, and a royal goddess related closely to kingship.\textsuperscript{17} She also played the vital role as the sun’s eye.\textsuperscript{18} Hathor’s lioness form, Sekhmet, appears as the wrathful destroyer goddess, who must be lured back into her more gentle and nurturing form by becoming inebriated.\textsuperscript{19} However, while Sekhmet was depicted in a variety of forms, the cat does not appear to be among them. Hathor’s connection to the smaller feline is found during the Middle Kingdom (ca.1980-1760 B.C.), when her fierce lioness form, Sekhmet, becomes the counterpart to the more gentle cat goddess, Bastet.\textsuperscript{20} Bastet’s connection to Hathor was later expanded by the numerous

\textsuperscript{15} Manniche, Music and Musicians, 63.

\textsuperscript{16} For information on the multiple aspects of Hathor see Erik Hornung, Conceptions of God in Ancient Egypt:The One and the Many (Ithaca: Cornell University Press, 1982), 110-113; Geraldine Pinch, Votive Offerings to Hathor (Oxford: Griffith Institute, 1993), 192, 196; Bleeker, Hathor and Thoth, 102.

\textsuperscript{17} Bleeker, Hathor and Thoth, 102.

\textsuperscript{18} Te Velde argues that any lioness goddess assuming this role is also consequently associated with cats. Hermann Te Velde, “The Cat as Sacred Animal of the Goddess Mut,” in Studies in Egyptian Religion Dedicated to Professor Jan Zandee, ed. Van Voss, M. Heerma, D.J. Hoens, G. Mussies, D. Van Der Plas and H. Te Velde (Leiden: EJ Brill, 1982),127-137.

\textsuperscript{19} Pinch, Votive Offerings to Hathor, 192.

\textsuperscript{20} Ibid., 192-193.
Late Period bronze figures of the goddess Bastet, or possibly Hathor, holding both emblems of Hathoric worship, the loop sistrum and the menat necklace, which was also used as a complement to the sistrum (fig. 7). While she is depicted in various forms, Hathor in a full cat image is not known until early Dynasty 18 (ca. 1539-1292 BCE), where she appears on small faience plaques from the temple of Tuthmose III at Serabit el-Khadim (fig. 8). The cat aspect of the goddess is also found at Hatshepsut’s mortuary complex at Deir el-Bahari in the form of faience cat figurines leading Pinch to suggest that this form could have been interchangeable with Hathor’s more familiar bovine aspect as early as Dynasty 18.

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23 Cat figurines from both Deir el-Bahari and Serabit el-Khadim range in date from Dynasty 18 to the Ramesside Period (ca. 1292-1077 BCE). Pinch, Votive Offerings to Hathor, 196.
Chapter Four

Representation of the Loop Sistrum in Art and Object

Changes in loop sistra iconography and representation are evident over the course of Egyptian history. It appears that most often, the loop sistrum is depicted in its simplest form in artistic representation. The objects themselves, however, can range from simple to elaborate. Each era of time seems to have added its own unique influence to the physical appearance of the loop sistrum. Table 2 contains a summary of the variations in the stylistic features of loop sistra from the New Kingdom to the Roman period, which will be discussed in detail in the following sections.

New Kingdom: Representation in Art

Representations of loop sistra in the art of the early New Kingdom appear most commonly with a Hathor face on a papyrus-columned handle. Often, the rods piercing the loop might also be molded into serpents. Depictions of loop sistra from the wall paintings in the New Kingdom tombs of Paheri and Rekhmire appear to be shown in their most easily recognizable form, conforming to a principle of Ancient Egyptian art known as aspective.¹ In these examples, the loop sistra appear with slim unadorned handles topped by a wigless Hathor head identifiable only by the bovine ears that span the entire width of the base of the loop. The loop itself is bare of any adornments and transversed by rods which have been molded into serpents.

¹ According to Brunner-Traut, aspective is the representation of objects in their most recognizable aspect. This can mean the representation is more conceptual rather than realistic, and often combines perspectives in order to show the most important features of the figure or object depicted. Heinrich Schäfer, and Emma Brunner-Traut. 1974. Principles of Egyptian Art (Oxford: Clarendon Press, 1974). 422.; For the tomb Rekhmire see Philippe Virey, Le tombeau de Rekhmara, prefect de Thebes sous la XVIIIe dynastie, Tome 5, Fascicule 1 (Paris:E.Leroux,1889), Pl. XL; For the tomb of Paheri see Edouard Naville, Hayter Lewis, Tylor, and F. Griffith, Almas el Medineh (Heracleopolis Magna): with chapters on Mendes, the nome of Thoth, and Leontopolis (London: Egypt Exploration Fund, 1894), Pl. VIII.
The Dynasty 19 (ca. 1292-1191 BCE) statue of the priestess of Hathor, Enehey, in the Walter’s Art Museum (acc. no. 22.106), shows the priestess seated with her left hand holding an arched sistrum to her chest as a symbol of her profession (fig. 9).\(^2\) The sistrum she holds lacks any elaborate decoration. The loop of the sistrum is short and transversed by three straight rods that do not appear to extend through the sides of the arch. This loop is attached directly to the top of a wigless Hathor mask with bovine ears extending past the base of the loop. The cylindrical handle is connected directly below the mask without decorative tie bands or knobs.

However simple New Kingdom sistra may have appeared in representation, their physical counterparts could have been more elaborate and highly decorative than previously suggested by Manniche.\(^3\) A set of Hathoric column capitals from Bubastis either dated to Dynasty 12 or Dynasty 18, present a bi-frontal image of Hathor with a wide face, bovine ears, and curled wig (fig. 10).\(^4\) Atop the image rests a frieze of uraei crowned with sun disks, and lateral uraei sit on either side of the Hathoric image facing forward like the goddess. These capitals could have served as the inspiration for more elaborately decorated examples of sistras handles of the later New Kingdom.


\(^3\) Manniche, *Music and Musicians*, 63.

\(^4\) Naville argues that the columns could be dated to the 12th dynasty, however, also gives evidence for a date of the 18th dynasty suggesting that the column style was a favorite of kings in this period and giving numerous parallels such as the columns at the Hathor chapel at Deir el-Bahari. Edouard Naville, *Bubastis (1887-1889)* (London: Egypt Exploration Fund, 1891), 11-14, pl. IX.
Amarna Period (ca. 1353-1336 BCE)

A significant change in loop sistrum iconography and representation occurs during the Amarna Period, at the end of Dynasty 18 (ca. 1353-1336 BCE). During the reign of Akhenaten, the traditional cult of Hathor, along with a majority of the Egyptian pantheon, was rejected in favor of the elevation of a new interpretation of the Aten cult which had been worshiped in harmony with the original pantheon of Egypt since the Middle Kingdom.\(^5\) This new form of worship focused solely on the Aten sun god as the creator god and father of the king, alongside the living divinity of the royal family. Akhenaten’s father Amenhotep III also initiated an increased solarization of the role of kingship during his reign.\(^6\) He elevated himself and his family to the status of living divinities who embodied the gods on earth. His wife, Queen Tiye, embraced the regalia and power of Hathor, and as such assimilated herself with the goddess.\(^7\) This shift in religious focus necessitated an iconographic revision of the loop sistrum that enables the objects from this period to conform to the conventions of Akhenaten’s reforms. In the early years of his rule (years 1-5), before Akhenaten moved his royal court to Amarna in Thebes, representations of the loop sistrum were still depicted in relief art with Hathor on

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\(^7\) Aldred, *Akhenaten*, 150, 162, 306.
the columned handle. Representations of loop sistra after the move to Amarna, become devoid of any image bearing reference to the Hathor cult, and the double-sided face is replaced by a papyrus umbel. Just as the iconography changed to suit the new religion, so too did the symbolism of the sistrum. This shift in religion changed the status and function of royal women. Sistra in the Amarna period became a ritual object signifying the queen’s divinity and equality in both political and religious status to the king himself. The instrument was now exclusively reserved for use by the royal women whose new embodiment of the goddess, Hathor, and her divinity replaced the need for Hathoric emblems in this particular time period.

Surviving versions of sistra from the Amarna Period are limited to a pair of loop sistra with gilded wooden handles from the tomb of Tutankhamun (fig. 3). The gilded wooden handles are long and beveled into a hexagonal shape. The base is a large rectangular block of gilded wood which is attached to a plain unadorned loop with three rods shaped like snakes with three square metal disks on each rod. This pair reflects the Amarna stylistic changes evident in representational art of the period, described above, which removed symbolic association to the goddess Hathor.

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10 Although they often appear in pairs in representation, the loop sistra of Tutankhamun are the only surviving material evidence that the objects were originally created in pairs. C.G. 69317, J.E. 62009, 62010, see Manniche, Musical Instruments from the Tomb of Tutankhamun, Tutankhamun’s Tomb Series VI, ed. J.R. Harris (Oxford: Griffith Institute, 1976), 5-6.
New Kingdom: Objects

A loop sistrum handle in the Petrie Museum of Archaeology, London, (acc. no. UC30383) dated approximately to the New Kingdom (ca. 1539-1077 BCE) provides a glimpse into the decorative pattern that could have been used during the period despite the loop of this particular object having been lost (fig. 11).\(^{11}\) The surviving base of the loop features a large-eared, seated cat figurine at its center. The base sits atop a cornice of uraei which appear to be crowned with sun disks. This thick rectangular cornice rests on the etched, thick, curled wig of a Hathor head, whose small rounded face shows bovine ears extending to the edge of its wig. Lateral uraei sit on both sides of the Hathor head. The bottom of the Hathor head is connected directly to a four-banded broad collar with etched, beaded design. This collar is attached to the shaft of the handle with four tie bands. The handle is short and rather stocky, and ends with a knob-like end-cap. The presence of a cat figurine within the base of the loop of this sistrum, although dated approximately, calls into question Hesse’s Late Period dating of the Memphis sistrum based solely on the criterion of cat figurines.\(^{12}\)

Late Period: Representation in Art

The rulers of the Late Period (ca. 722-332 BCE) sought to legitimize their reign by reaching back to the stylistic and thematic images of both the Old and Middle

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\(^{11}\) As mentioned previously, the majority of sistra are unprovenienced and thus assigned an approximate date based on several factors including style, patination, and date of acquisition. Until more research is done on the dating of these objects, I will rely on the dates given through the expertise of the museums in which these instruments are located.

Kingdoms. This period is considered a revival of Egyptian art.\textsuperscript{13} Incorporating the styles of the Old and Middle Kingdoms in their art is a technique known as archaizing that would send a specific message to the Egyptian people about the legitimacy of their rulers. Figures rendered in the Late Period artistic style exhibit a rounded and often fleshy or chubby appearance.\textsuperscript{14} Similarly, the loop sistra of this period are thick and round in shape, this is most notably seen in the Hathor head whose face and chin are round with chubby cheeks. They also include a thick curled wig and wide bovine ears. Representations in the Late Period from the additions to the Temple of Amun at Bubastis by Osorkon II continue to show looped sistra in aspective form. The handle is plain, long, and thin. Connected to the top of the handle is a wigless Hathor mask. A basic, curved loop is connected to the base that sits above the mask (fig. 12).\textsuperscript{15} The loop itself is also shorter and more rounded than the high arching representations from previous dynasties.

**Late Period: Objects**

Although they incorporated much of the older styles of Egyptian art, the Late Period kings also sought to remake and innovate art. The arched sistrum of Henettawy (acc. no. E11201) dated to Dynasty 26 (ca. 664-525 BCE) is a testament to the skill and


\textsuperscript{14} For information on Late period style art see Peter Der Manuelian, *Living in the Past:Studies in Archaism of the Egyptian Twenty-Sixth Dynasty* (London: Kegan Paul, 1994), 1-5, 387; Edna Russman, *The Representation of the King in the XXVth Dynasty* 22-23.

craftsmanship of this time period (fig. 13).\textsuperscript{16} The arch is tall with decorative etchings on the outward facing panels that depict the goddesses Isis and Mut playing the sistrum for the god Amun. The loop has piercings on each side where the now missing rods would have been placed. The base of the loop is a large rectangular band of uraei, each of which is crowned with a sun disk. Atop the base inside the loop sits a small statuette of the goddess Hathor wearing her traditional horned sun-disk crown.\textsuperscript{17} The bottom of the base is a stylized form of architectural border casing, otherwise known as a covetto cornice, which is often found in the architecture of Egyptian temples and tombs, and curves atop the head of a Hathor mask.\textsuperscript{18} The mask has long bovine ears and a triangular face that is surmounted by a detail, etched, curled wig. There are two lateral uraei facing outward in profile, each wears the white crown, connected by two push-fit dowels to the sides of the Hathor face. The face sits on a broad collar etched with four bands. The bottom of the collar is connected to a short, thick cylindrical handle, with two wide bands. The handle is etched with a \textit{rishi}, or feather pattern. An inscription runs vertically in a band from the bottom of the tie bands to the base cap, which is also etched with a decorative pattern.\textsuperscript{19}

\begin{itemize}
\item \textsuperscript{16} I have included the sistrum of Henettawy with the Late Period as its approximate dating is between Dynasty 21 (ca.1076-944 BCE) and Dynasty 26 (ca. 664-525 BCE). Ziegler notes that the date is ranged this way because of the popularity of the name Henettawy during Dynasty 21, but the style of the instrument places it more firmly in Dynasty 26 thus my inclusion of it in the Late Period. Paris, Musée du Louvre, (acc. no. E11201), see Ziegler, \textit{Catalogue des instruments}, 36-37, 55.
\item \textsuperscript{17} This could also, given the context, be an image of Isis who is shown wearing the traditional Hathoric crown. Jean Capart, \textit{Abydos: Le Temple de Seti Ier} (Brussels: Musées Royaux, 1912), 47, 55.
\item \textsuperscript{18} For an example of the uraei cornice in architecture see Edouard Naville, \textit{The Shrine of Hathor and the Southern Hall of Offerings} (London: Egypt Exploration Fund, 1901), pl. XCVI.
\item \textsuperscript{19} For the translation of the texts on the loop and handle see Ziegler, \textit{Catalogue des instruments}, 55.
\end{itemize}
A broken Late Period (ca. 722-332 BCE) sistrum loop in the British Museum (acc. no. 36310), like that of Henettawy, is incised with elaborate decorations on its exterior surface (fig. 14).\(^{20}\) The very top of the curve shows a Hathor head flanked by two lateral uraei while the mirrored images on each side of the loop show a vulture beneath the Hathor head’s uraei. At the base on each side is a standing female figure, with upraised arms wearing a papyrus thicket headdress, possibly representing Lower Egypt. The loop has three snake-shaped rods, that terminate at one end of the loop with curled heads each crowned with a sun disk. The base is a narrow rectangle or band of uraei that sit above an overlarge, triangular, wigless Hathor head with long bovine ears that extend out beyond the base and the loop. Lateral uraei are attached to the sides of the cornice base above the ears of the Hathor head. The handle begins underneath the chin of the mask with five thin tie bands, and is long, thin, and has a plain end-cap.

Another example (ca. 722-332 BCE) from the British Museum (acc. no. 38172), exhibits a similar decorative pattern, with the addition of a poorly preserved cat figurine in the base of the loop as well as a different engraving on the outside of the loop (fig. 15).\(^{21}\) The engraving on the top curve of the loop of this example shows an elaborately decorated Hathor head flanked by lateral uraei, each with lion head, crowned with a sun disk crown. As on the previous sistrum, (fig. 14) the mirrored images on each side of the loop’s exterior show a vulture with the šn symbol in its claws, flying above an udjat eye.

\(^{20}\) London, British Museum, (acc. no. 36310), see Anderson, *Musical Instruments*, 51; For more examples of this type of Late Period sistrum see: Baltimore, Walter’s Art Museum, (acc. no. 54.1207); London, Petrie Museum of Archaeology UCL, (acc. no. UC35791); New York, Metropolitan Museum of Art, (acc. no. 68.44).

and a winged sun disk. Beneath the wings, the feline headed goddess, Bastet, is seated in a naos structure. Below the goddess stands a thin female figure holding a loop sistrum in each hand. The female adorant on the left side of the loop wears a papyrus thicket headdress, symbolizing Lower Egypt, while the one on the right wears a lotus blossom headdress, as the symbol of Upper Egypt. These designs appear to have been drawn from the representations of loop sistra in art, as well as actual loop sistra from previous dynasties, which were then imitated by the Late Period rulers.

An entirely different series of Late Period sistra appear to be modeled more closely on the Hathor-headed sistra of the New Kingdom. A representative of this type, that can stand for the corpus, can be found in the Musée du Louvre (acc. no. AF6858) (fig. 16). The instrument (ca. 722-332 BCE) is missing the majority of its loop, which at one time sat on a rectangular frieze base of uncrowned uraei. At the base of the loop sits a mostly intact feline figurine that is missing its right ear. The base rests on the thick, short, curled wig of a triangular-faced Hathor head. Long, bovine ears extend to the outer edge of the wig that is also engraved with a diamond-shaped pattern. Lateral uraei flank the sides of the wig: the serpent on the viewer’s left is adorned with the double crown while the serpent on the viewer’s right wears the white crown. The chubby, triangular mask is

22 The word šn meaning ‘that which the sun encircles’ in Middle Egyptian. Hannig, Ägyptisches Worterbuch, 2468.

23 Text in front of the goddess identifies her as Bastet. For translation of the text see Anderson, Musical Instruments, 41.

24 Paris, Musée du Louvre, (acc. no. AF6858), see Ziegler, Les instruments de musique, 58; For more examples see: London, Petrie Museum UCL, (acc. no. UC35792); Boston, Museum of Fine Arts, (acc. no. 1970.572); London, British Museum, (acc. no. 6357), (acc. no. 63573), (acc. no. 65254); Paris, Musée du Louvre, (acc. no. N 4269, E 681), (acc. no. N 4269, E 678), (acc. no. N 4269, E 679), (acc. no. N 4270), (acc. no. AF 6859), (acc. no. AF 682), (acc. no. E 21428).
neckless and is connected directly to a seven-banded broad collar which is also etched with a bead pattern. This collar is connected to a plain yet stocky handle that ends in a flat-capped bottom. Both styles of loop sistra discussed in this chapter, illustrate the archaizing methods of the Late Period in their reuse of New Kingdom styles and representations.

**Ptolemaic Dynasty: Representation in Art**

The Ptolemaic Period saw the rise of the cult of Isis.²⁵ Isis was syncretized with several Egyptian and Greek goddesses during this time including Hathor and Aphrodite. As a result, Isis came to be associated with the attributes of these other deities, including the sistrum that was typically an attribute of Hathor.²⁶ Ptolemaic queens were associated with Isis as well and could have been a further source of inspiration for the representations of the goddess in art.²⁷

Isiac sistra begin to appear in Alexandria with marked differences from the traditional Egyptian instrument. Sistra in this time begin to be cast in a one-piece mold and decrease in overall size.²⁸ Stylistically, sistra might be embellished also with a Bes

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²⁶ A. Saura-Ziegelmeyer, “Inside and Outside the Tomb: The Isiac Sistrum as Testimony of Worshippers’ Beliefs,” in Angela Bellia and Sheramy Bundrick, *Musical Instruments as Votive Gifts in the Ancient World* (Rome: Institute Editorialie Poligrafici Internazionali, 2018), 71. I thank the author for sharing this article with me.


²⁸ Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 72.
figure on the handle of the instrument, as well as animal figurines including cats, birds, and in some instances dogs. Isiac sistra outside of Egypt lose the image of Hathor, whose image becomes increasingly more schematic until it is either transitioned into an image of Isis or omitted completely (fig. 17). Schematic renderings in mold made artifacts are more common in the Ptolemaic and later Roman periods. Uraei on non-Egyptian Isiac sistra can also be crowned with an atef or feathered crown as well as floral motifs, as opposed to the traditional white or red crowns.

Ptolemaic representations in relief continue to present the sistrum in its simplest form, similar to the representations of the New Kingdom. On the Ptolemaic funerary stela of Pakhaas (ca. 2nd-1st c. BCE) in the Brooklyn Museum (acc. no. 71.37.2), the wife of the deceased stands behind his chair and shakes a loop sistrum for his pleasure (fig.18). The high arching loop is pierced with straight, horizontal rods, and is fit to the slim handle by means of a narrow unadorned base. The handle ends at a flared end-cap. This schematic rendering of the loop sistrum favors their less detailed physical counterparts.

29 Ibid., 72-73.

30 Ibid., 72-73; This is an example of a Ptolemaic sistrum where the image of Hathor (possibly Isis) lacks the traditional bovine ears. The transition of Hathor to Isis in Ptolemaic sistra is described in Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 73. Berlin, Ägyptisches Museum und Papyrussammlung, acc. no. ÄM9710, illustrated in Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 79, fig. 2e. I thank the author for sharing this article with me.


32 Ibid., 73.

33 Brooklyn, Brooklyn Museum, acc. no. 71.37.2, illustrated in Richard Fazzini and Robert Bianchi, Cleopatra’s Egypt: Age of the Ptolemies (Brooklyn: Brooklyn Museum, 1988), 323, pl. XXXII.
Ptolemaic Dynasty: Objects

The Hellenization of the cult of Isis is evident in a new type of sistrum that began to occur in the Ptolemaic Greek style. Isiac sistra begin to appear in Alexandria with marked differences from the traditional Egyptian instrument. Sistra in this time begin to be cast in a one-piece mold and decrease in overall size.34 Stylistically, sistrum might be embellished also with a Bes figure on the handle of the instrument, as well as animal figurines including cats, birds, and in some instances dogs.35 Isiac sistra outside of Egypt lose the image of Hathor, whose image becomes increasingly more schematic until it is either transitioned into an image of Isis or omitted completely (fig. 17).36 Schematic renderings in mold made artifacts are more common in the Ptolemaic and later Roman periods.37 Uraei on non-Egyptian Isiac sistra can also be crowned with an atef or feathered crown as well as floral motifs, as opposed to the traditional white or red crowns.38

A looped sistrum at the British Museum (acc. no. 64558) presents several aspects consistent with a dating to the later Ptolemaic Period. This arched sistrum is approximately twenty-two cm in height and four cm in width (fig. 19).39 The loop is slightly bent with only a portion of one rod preserved. Two metal disks remain attached

34 Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 72.
35 Ibid., 72-73.
36 Ibid., 72-73; This is an example of a Ptolemaic sistrum where the image of Hathor (possibly Isis) lacks the traditional bovine ears. The transition of Hathor to Isis in Ptolemaic sistra is described in Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 73. Berlin, Ägyptisches Museum und Papyrussammlung, acc. no. AM9710, illustrated in Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 79, fig. 2e. I thank the author for sharing this article with me.
38 Ibid., 73.
39 London, British Museum, (acc. no. 64558), see Anderson, Musical Instruments, 53.
to the interior of the loop. At the base of the loop sits a small cat figure on a thin, undecorated platform, which separates the loop and the double Hathor-headed handle. The inclusion of this plain base is a deviation from both the New Kingdom as well as the Late Period styles. The uraei frieze appears to have dropped out of use during the Ptolemaic era and was replaced by a simple unadorned rectangular base. The Hathor image has a short rounded and curled wig and definitively bovine ears. The face is a longer more ovoid shape than round. It sits atop a broad collar that lacks incised decoration. Curving outward from both sides of the mask are double-plume crowned uraei. A short, stubby, round columned handle extends from the base of the collar and ends in what Anderson describes as a “knob”.\textsuperscript{40} A noticeable difference, however, is the smaller more compact appearance of the Hathor mask. The lateral uraei are situated very snuggly against the figure’s face. This object is possibly an example of an earlier Ptolemaic sistrum created outside of Egypt due to its rather schematic rendering of the anthropomorphic Hathor image and the feather crowned uraei.\textsuperscript{41}

Later Ptolemaic sistra, like the one found in the Ägyptisches Museum in Berlin (acc. no. ÄM9710), can be complex in ornamentation, and demonstrate more localized Greek influence (fig. 17).\textsuperscript{42} This particular example was found in Sparta and is dated to the Greco-Roman period. On the top of the thick loop lies a recumbent cat figurine. At the bottom of the loop on each side of the loop is a recumbent cow crowned with a sun

\textsuperscript{40}Anderson, \textit{Musical Instruments}, 44, fig. 74.

\textsuperscript{41}Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 72-73.

\textsuperscript{42}Berlin, Ägyptisches Museum und Papyrussammlung, (acc. no. ÄM9710), illustrated in Saura-Ziegelmeyer, “Inside and Outside the Tomb,” 79, fig. 2e.
disk, possibly representing Hathor, facing one another. Standing atop each cow’s back is the figure of a young nude boy, possibly Harpocrates, on the viewer’s right and Pataikos on the left. Another animal, possibly a bird, is seated on the inside of the base of the loop. Beneath the base is the image of a round-faced woman with short, curled, and stylized hair. The woman’s ears are not visible, and she does not wear a wide collar. This could be an image of Hathor transitioning into Isis. The lateral uraei at each side of the female image wear a feather-plumed crown. Beneath the image of the face is a square block with a lion mask in the center, which rests atop an image of the god Bes. This image of Bes stands atop two recumbent lions whose plinths make up the flat end-cap of the handle. The integration of varying styles in the ornamentation of this object, like the inclusion of the Bes figure, the numerous animal figures, and the possible Hathor-Isis figure in the center of the handle, demonstrates the great variability of sistra in the later Ptolemaic period.

**Roman Period: Representation in Art**

During the Roman Period of Egyptian history, the cultic symbolism of the sistrum changed. The new Greek immigrants in Egypt, under the Ptolemys’ influence, had adopted Isis into their pantheon and associated her with a new Greco-Egyptian god called Sarapis. The earliest known adoption of Isis into Roman religion occurs in the second

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century BCE at Delos where a group of Romans had settled. From Delos the Isiac cult would spread to Italy where Isis became a significant part of the Roman pantheon. Since her assimilation with Hathor in the Ptolemaic period, Isis had become associated with the loop sistrum. This association creates a new form of sistrum beginning in the Ptolemaic Period and persisting through the Roman age. The Isiac sistrum represented with Isis in this period is generally devoid of Hathoric imagery and is plainly decorated. The appearance of the Isiac sistrum does not, however, diminish the use of the Hathoric sistrum.

Representations of loop sistra in art during the Roman period are found on the coinage of the era. On a provincial coin from Lydia, Isis is shown standing, holding a situla in her left hand and an arched sistrum in her right. Isis later appears on imperial coinage during the reign of Hadrian (98-117 AD), and then disappears once again only to reappear during the reign of Commodus (161-169 AD). The image of Isis with the sistrum is also found on a carved carnelian intaglio (2nd half of the 1st c. BCE) in the Ashmolean Museum (acc. no. AN2009.1015) (fig. 20). On this jewel, Isis is placed on the viewer’s left facing the god Sarapis. A loop sistrum is depicted between Isis and the god.


Sistra depicted with the goddess Isis on both coinage and relief have a thin, unadorned handle with a rounded end-cap and a round ball mount between the top of the handle and the base of the loop. The loop and base are depicted as one solid cast piece with a flat base that curves upwards to create the loop. Two horizontal rods pierce the loop and the loop is shown with a sphere mounted to the exterior edge of the loop.

**Roman Period: Objects**

Although the cultic association of sistra changes to favor Isis, Hathor faces on sistra do not disappear from Roman loop sistrum iconography. Hathoric loop sistra of the Roman Period are often elaborately decorated instruments. The loop becomes long and thin often with decorative etchings on the outward facing surfaces. Cat figurines are a prominent addition and, although common inside the loop, are found recumbent or seated on the top of the loop. An example of this type of object (ca. 30 BCE-646 CE) is in the British Museum (acc. no.30735) (fig. 21). The thin loop is pierced by three horizontal straight rods of progressively shorter length from top to bottom. A small recumbent cat figurine with a smaller bird figurine seated beside it, are located on the exterior top of the loop. A small cat figurine is seated inside the base of the loop that is connected to the curled wig of a Hathor head. A lateral uraeus, on the viewer’s right, wears the red crown while the left one wears a double crown, and sits at either side of the image. The handle is a thin column with a palm leaf capital, which extends below the broad collar of the Hathor head, and has six ring bands along its length. The handle ends with a flat end-cap.

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A loop sistrum (ca. before the 1st c. BCE) from the Temple of Isis in Rome, now in the Musée du Louvre (acc. no. E8076), illustrates the continuation of Ptolemaic themes within Roman society (fig. 22). This particular sistrum has a thick loop pierced by three rods that are curled backward on each end. The loop is surmounted by a sun disk on top of a papyrus umbel. The bottom of the loop is flanked on both sides by cat figurines that are seated on pedestals above the base of the loop. The base itself is connected to a thin rectangular platform. Beneath the platform is a Hathor-headed figure with a short, curled wig and small, rounded, bovine ears. A lateral uraeus appears on either side of the Hathoric image and is connected at the back of the head to the base, extending down into the broad U-shaped collar of the Hathor head. Beneath the Hathor face is a lotus blossom that separates the image of Hathor and the images below. These images are of two different gods who mirror each other on the opposing sides of the sistrum. The first deity, Bes, stands with his left arm propped against his hip while his right arm is raised. On the opposite appears Isis who is distinguished by her plumed crown. In a mirror image of Bes, Isis has her right arm propped against her right hip, while she raises her left arm. Both deities stand atop a lotus blossom that ends with a short stalk. This sistrum is significant as it demonstrates the adaptation of the Hathoric loop sistrum within Roman religion outside of Egypt and proves the continued use of the Hathoric imagery into the first century BCE.

51 Paris, Musée du Louvre, (acc. no. E8076), see Ziegler, Les instruments de musique, 58; For more examples see: Baltimore, Walter’s Art Museum, (acc. no. 54.493); Berlin, Ägyptisches Museum und Papyrussammlung, (acc. no. AM 9710); Paris, Musée du Louvre, (acc. no. N 4269,E682), (acc. no. E 11158), (acc. no. AF6862), (acc. no. E 7982); London, British Museum, (acc. no. 6365).
Many Isiac sistra of the first century BCE, however, omit the images of gods altogether. These instruments also appear to be more similar to their representations in art than those observed in earlier periods. Another first century BCE sistrum from the collection of the Musée du Louvre (acc. no. E8077) is a near replica of those found on imperial Roman coinage and intaglios depicting Isis with the loop sistrum (fig. 23). The notable exception is the addition of a recumbent cat figurine on the top of the loop. The loop itself is thick with three long rods with curved ends. The handle, connected directly to the base of the loop, begins with a wide band that continues down into a thick column that widens and becomes more rounded as it reaches the end. Another wide band separates the handle and the end-cap which is a wide, concave discus. Sistra of this type have varying handle decorations and end-caps.

**Conclusions: Stylistic Analysis**

Based solely on an art historical analysis, it is possible to establish common stylistic criteria that might favor one period over another. Table 2 contains a summary of the previously noted variations in the stylistic features of loop sistra from the New Kingdom to the Roman period that will be useful for the analysis of the Memphis sistrum. For this purpose, similarities and differences of style from each period will be discussed in comparison with the Memphis sistrum.

Beginning with the loop of the Memphis sistrum, it is plain and unadorned like examples from both the New Kingdom and Late Period. The rods transversing the loop are not modeled into serpents but are curved on both ends in opposite directions like

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52 Paris, Musée du Louvre, (acc. no. E 8077), illustrated in Ziegler, *Les instruments de musique*, 61; For other examples see: London, British Museum, (acc. no. 1814,0704.777), (acc. no. 1756,0101.541), (acc. no. 1926,0406.15); London, Petrie Museum UCL, (acc. no. UC30382).
those found on examples from the Late Period. Next, we must discuss the presence of the feline figurine within the loop. Rather than being firmly diagnostic of a Late Period date, the presence of the cat figurine, which has been attested by one example of questionable date, instead implies that the instrument could have come from any period of time from the New Kingdom up to the Roman Period. The Memphis sistrum lacks the decorative pattern associated with the later Ptolemaic and Roman loop sistra discussed above. For example, those sistra that still depict the goddess Hathor could also have a figure of the god Bes inserted into the handle of the sistrum below her image. Even those without this second divine image could have a thin, highly decorated handle, whereas the Memphis sistrum has a short and stocky, unadorned handle. On the other hand, the schematic rendering of the Hathoric features might be viewed as consistent with a Greco-Roman date.

The next indicator to be analyzed is the uraei frieze. The uraei frieze base that appears in both the (possible) New Kingdom and in the Late Period examples, seems to have fallen out of use during the Roman and Ptolemaic periods, being replaced by a thin, rectangular, unadorned base. The Memphis sistrum’s lack of a uraei frieze could be indicative of a Ptolemaic or Roman date of manufacture. The lateral uraei crowned with the double or red crown could also indicate an earlier Ptolemaic date considering that later examples tended to omit these traditional Egyptian crowns in favor of a double plume or floral motif.

The features of the Hathor head suggest certain differences worth noting. The wig of the Memphis Hathor head is long, thin and undecorated, the face is ovoid and long, and the ears are thin. This is a remarkable difference from the majority of the sistra
analyzed here whose wigs are thick and short with chubby triangular or rounded faces. A long thin wig and face, which appears rather unlike any other sistra noted here, is most similar to certain Late Period and Roman examples.\textsuperscript{53} The image is also rather schematic and apparently lacking in any defined detail work as is present on the majority of sistra. The nose is overlarge and oddly shaped, the wig lacks any incised details like the crossed pattern seen on the bands of other examples, and the broad collar lacks any decorative detail work.

An unusual addition is what appears to be a small squared neck between the chin of the Hathor head and the broad collar. This addition, has only been noted on one other Late Period sistrum (fig. 24).\textsuperscript{54} The lateral uraei, that are connected from the back of their heads to the sides of the base extending down into the broad collar are widely set apart from the wig itself are a feature found on some Roman era sistra (fig. 25).\textsuperscript{55}

Just below the Hathor head is the broad collar that is represented in a wide triangular shape. This shape is in contrast with those from the New Kingdom and Late Period that appear more U-shaped and are more rounded and semi-circular. The Ptolemaic representations, however, appear to be more triangular in shape. Extending below the collar is the short, thick handle that is devoid of any engraved decoration. The handle has a tie band at the top as well as three bands at the bottom above the end cap. This style of handle is seen in both the Late and Ptolemaic Periods.

\textsuperscript{53} Examples include: London, British Museum, (acc. no. 30735), (acc. no. 6365), (acc. no. 63573), (acc. no. 65254); Paris, Musée du Louvre, (acc. no. E 11201), (acc. no. N 4270), (acc. no. AF 682), (acc. no. E 21428), (acc. no. E 7982).


\textsuperscript{55} London, British Museum, (acc. no. 38175), see in Anderson, \textit{Musical Instruments}, 49.
The evidence from those sistra that have been approximately dated based on style can be helpful in assigning a possible date for the Memphis sistrum. Overall, the Memphis sistrum adheres most closely to the style of the Ptolemaic and Roman eras. The schematic Hathor image, lack of uraei cornice base, double and red crowned lateral uraei, and Ptolemaic style broad collar suggest a general range from the Ptolemaic to the Roman Period.
Chapter Five  
Metal Work in Ancient Egypt

Metal Production and Smelting

The use of copper and copper ores is attested as early as the Predynastic (ca. 4000 BCE) where evidence of smelting, the process by which small amounts of pure copper are extracted to remove the metal from the ore, is evidenced by tools from the Sinai site of Timna.¹ Smelting of metal was accomplished through the use of furnaces that were heated by large bellows or blow pipes.² The use of bellows in smelting is represented in the tomb of Rekhmire (fig. 26).³ As metallurgical technology advanced, bellows were replaced by larger furnaces and pot bellows which allowed for higher temperatures.⁴ Once melted, the liquid metal could then be poured into a mold and shaped to the desired specifications or beaten and shaped by hammering the cooling metal.

Copper alone was brittle and soft, thus it became advantageous to improve the metal through the addition of other substances.⁵ This process of changing the physical properties of the metal through the addition of other ores is known as alloying. During the

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smelting process, varying amounts of other materials or ores would be added to the copper and melted together to create the alloy. The introduction of these other materials to the copper base created a harder and stronger metal. 6

**Metal Compounds**

The composition of different metal compounds can be an indicator of the age of an object. Throughout Egyptian history certain metal compounds were more popular in use than others, leading to a notable presence of certain alloys and a lack of others. Understanding the percentages of certain alloys preferred in specific time periods could help to discern a more accurate date for the Memphis sistrum. The identification of anomalies or modern materials in its manufacture would classify the instrument as a fake. Following Hill’s timeline of usage, the following sections will discuss the common metal compounds in use during specific periods of Egyptian history. 7 Table 3 offers comprehensive data for the percentages of the metal compounds discussed, throughout the relevant time periods in Egyptian history.

**Copper-Arsenic Alloys**

Mixing copper with arsenic is attested in use as early as the Old Kingdom and is the main alloy in use from this time period through the New Kingdom. 8 The use of this

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7 Marsha Hill, *Royal Bronze Statuary from Ancient Egypt* (Leiden: Brill, 2004), 2. Hill briefly outlines the chronology of use of copper alloys beginning in the Middle Kingdom with pure copper and moving through to copper-arsenic, copper-tin, and ending in the Roman period with copper-lead. This section will use this timeline to discuss the historic use of each alloy.

compound in metalwork falls out of favor until the New Kingdom, specifically in the Amarna period due to the popularity of arsenic-based pigments in this period.\(^9\)

The addition of arsenic to copper made for a harder more durable metal than copper alone making this compound more efficient. Coloration could perhaps be another purpose for the addition of arsenic as the mixture produces a silver sheen that would have been desirable to the Egyptians.\(^10\) However, it is believed that the addition of arsenic in copper alloys might have been unintentional and perhaps due to a naturally occurring presence of arsenic in the copper, copper alloys containing less than 1% arsenic are considered unintentional.\(^11\) After the New Kingdom it is uncommon to see compounds containing levels of arsenic higher than 1%.\(^12\) Copper-arsenic alloys are not common in use again until the Late Period when cat figurines appear with levels of arsenic up to 4%.\(^13\)

**Copper-Tin Alloys**

Copper-tin mixtures become popular after the decline of the use of arsenic at the end of the New Kingdom.\(^14\) Although the use of tin in metal working was seen as early as the 2nd Dynasty, it was relatively uncommon during subsequent periods. The increased use of tin after the New Kingdom is attributed to an increase in availability, when exports

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\(^10\) Ogden, “Metals,” 153.

\(^11\) Ibid., 153.

\(^12\) Ibid., 153.

\(^13\) Ibid., 153.

\(^14\) Ibid., 153-54.
of tin and copper came primarily from Cyprus due to an increase in mining production.\textsuperscript{15} It is possible that its popularity was also enhanced due to the hardening properties it provided for the cast metal as well as the increased fluidity of the molten metal that made the casting process more efficient and allowed for an increase in production scale.\textsuperscript{16} Bronzes containing tin could also be mixed with small amounts of gold or silver to produce what are called “black bronzes.” This particular coloration was popular during Dynasty 18 and the later New Kingdom.\textsuperscript{17} Egyptian bronzes of this period contain anywhere from 10-16\% tin.\textsuperscript{18} A decrease in use occurs during the Late Period where tin levels decrease to between 2\% and 10\%.\textsuperscript{19} The highest levels recorded, upwards of 20\%, generally appear during the Ptolemaic and Roman Periods when mass production of metal objects was a booming industry.\textsuperscript{20}


\textsuperscript{16} Ogden, “Metals,” 153.

\textsuperscript{17} Hill and Schorsch, “A Bronze Statuette,” 12.

\textsuperscript{18} Ogden, “Metals,” 154.

\textsuperscript{19} Aurélia Masson-Berghoff, Ernst Pernicka, Duncan Hook, Andrew Meek, “(Re)sources: Origins of Metals in Late Period Egypt,” Journal of Archaeological Science: Reports, 21, (2018), 327.

Copper-Lead Alloys

Although copper mixed with lead was rare before the Middle Kingdom, it was in wide use from the late New Kingdom onwards. Nevertheless, a small amount of lead-bronze alloy objects have been dated to the Middle and New Kingdoms.

Levels of more than 2% lead are uncommon before the New Kingdom, however, levels below 5% are considered to be unintentional additions from lead rich copper deposits. In the Ptolemaic period, lead levels have been found to range from 20-30%. Lead in a mixture of copper increases the fluidity of the molten metal as well as decreases both the melting temperature and the porosity of the compound. It has also been found to increase the object’s resistance to corrosion. Lead itself was relatively easy to come by and cheap, as it occurs as a byproduct of silver production. Copper-lead alloys became the metal compound used for most bronze statuary from the Late Period on to the

22 Hill, Gifts for the Gods, 191.
24 Ibid., 155; Gravett, A Critical Analysis of Selected Egyptian Bronze, 39.
Roman Age. This is due in part to the relative abundance and lower price of lead as opposed to tin.  

**Copper-Zinc Alloys**

The intentional smelting of copper and zinc forms an alloy known as brass or gunmetal. Copper-alloys from the Eastern Desert containing 1% to 2% zinc from impurities in copper are found throughout Dynastic times. Intentional use of zinc as an alloying agent can be seen as early as the Late Ptolemaic Period, but is not commonplace until the later Roman Age. Copper-zinc alloys in the Roman Period can contain up to 30% zinc, while pre-Roman use is restricted to approximately 1%.

**The Lost Wax Technique**

The majority of bronze works were cast in wax molds. A technique, known as the lost wax technique, was used as early as the Old Kingdom. The lost wax technique employed a wax model of the object to be cast, that was then covered in clay to create an impression of the object. The clay and wax were then heated in order to allow the wax core to liquify and melt out of the mold. Liquid metal was then poured into the remaining


29 Ogden, “Metals,” 155.

30 Ibid., 155.


cavity and allowed to cool. Once hardened, the clay mold would be broken away from the now complete object. This process created small solid cast objects.\textsuperscript{35} Larger objects cast in a similar manner were often created in multiple pieces that would be left hollow in order to decrease the amount of metal used as well as the weight of the object. To hollow cast a work, a core of sand mixed with other organic materials e.g. sand or straw to improve plasticity was molded to the desired form and covered in a thin coating of beeswax.\textsuperscript{36} The same process of creating the mold would then be carried out. Once the wax was melted out of the mold, the liquid metal would fill the space that it had occupied between the core and the mold. The mold and the core could then be broken away leaving the hollow cast object. The separate pieces of the object could then be fitted together using rivets. Multiple identical wax components could be quickly cast through the use of plaster molds that easily shaped the wax core to be cast.\textsuperscript{37} The relative ease and speed of this technique allowed for the mass production of nearly identical bronzes during the Late, Ptolemaic, and Roman Periods. This method of ancient mass production could account for the similarities between the Memphis and Bonhams’ sistra and could indicate the two were cast as part of a larger set.

\textsuperscript{35} Ibid., 221.
\textsuperscript{36} Ibid., 221.
\textsuperscript{37} Ogden, “Metals,” 159.
Chapter Six

Analysis of the Memphis Sistrum

What is Expected

Objects cast in a one-piece mold using the lost wax method should exhibit no signs of hammer marks meant to shape the metal, however, tool marks from chisels could be found on objects using this method. The decorations on thin metal, or hollow-cast, sistra were etched into the wax which would leave an impression on the liquid metal. Details could be chased or reworked with fine tools post casting.\(^1\) This would be done in order to minimize the damage done to the exterior surfaces of thin metal cast objects. Other identifiable marks would be left from the rivets that connected one piece to another if a multi-piece mold was used.

The manufacturing process should leave other signs on authentic sistra. Push fit dowel pieces should be noticeable behind the lateral uraei that attach them to the sides of the Hathor image on objects that were made with multi-piece molds. Iron core supports would indicate a date after the Third Intermediate Period, as iron for this purpose was not used until that time.\(^2\) Furthermore, a profusion of supports is also an indicator of a modern manufacture as it has been observed that modern replicas tend to have more core supports than their original inspirations.\(^3\) It should also be noted that the majority of


\(^3\) Ogden, “Metals,” 159.
Ptolemaic and Roman sistra were cast in one piece, while in Late Period examples the loop was made separately from the handle and fitted with push-fit pieces.\(^4\)

**Corrosion**

The metal of the Memphis sistrum is significantly corroded. An examination of the type of corrosion and its possible sources could help to identify environmental and material factors in the creation of the artifact.

“Bronze disease” or corrosion, is the interaction of bronzes containing chlorides and the air or moisture of the artifact’s surrounding environment.\(^5\) The main cause of this interaction is the presence of cuprous chloride (CuCl). Depending on soil contaminants and the surrounding environment, these chlorides can react differently and produce corrosion products that vary in color and texture. Two categories of corrosion in tin-copper (true bronze) alloys have been identified.\(^6\) The first type is caused by an interaction between the surrounding soil and the artifact itself. This interaction causes a dissolving of the copper from the tin alloy. The exposed tin then oxidizes and creates a layer over the separated copper underneath. The second interaction forms due to a higher rate of separation, caused by higher relative humidity, between the copper and the tin alloy.\(^7\) This interaction causes three distinct layers of corrosion to form. The outermost


\(^7\) Scott, “A Review of Some Chemical Problems and the Role of Relative Humidity,” 202-204.
layer is composed of a copper carbonate or malachite. This compound is greenish in color and generally flaky or crystal-like in texture. Malachite develops on objects buried in soil that is most often deficiently aerated, and where carbon dioxide and water are abundant. As a corrosion product, malachite is difficult to replicate through unnatural processes, and thus can be an indicator of authenticity. Beneath the malachite forms a layer of reddish-brown oxidized copper. The inner-most layer is generally found to contain high levels of the remaining tin which separated from the copper during the corrosion process. This type of bronze disease forms a protective layer around the object that can spare it further damage. The chemistry of the soil that an object is buried in can also have an impact on the object. As corrosion occurs, the affected layer can absorb elements of the surrounding soil that will in turn change the structure and chemical makeup of the resulting product. In acidic soil, the oxidization of copper creates unstable and destructive chlorides known as atacamite or paratacamite. This form of corrosive product must be treated quickly in order to preserve the object from further destruction. Lead, however, can have an entirely different reaction to the corrosion process. The presence of lead in a compound, as well as large levels of tin, stabilizes the metal and increases the resistance to corrosion in both humid and dry conditions.

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Bronzes can also be corroded artificially through the use of specific techniques. Intentional or artificial corrosion has been scientifically induced by scholars such as Robotti et. al., in order to study the reliability of certain scientific techniques.\textsuperscript{12} Or like Constantinides et. al, to understand the effects of corrosion on different materials.\textsuperscript{13}

There is, however, another purpose for the artificial corrosion of bronze that must be considered. An increase in interest in the ancient world, spurred by untrained collectors, has increased the demand for “ancient” bronze works. This demand has often been met by fakes and forgeries alike that have been meticulously crafted to increase their value. Artificial corrosion is one way for forgers to elevate the appearance of authenticity of a piece in order to increase its value. As such, it is necessary to discuss the ways in which a forger could accelerate or artificially create ancient corrosion patterns and determine how to distinguish these from original patinas.

A common method of artificial corrosion is the use of hydrochloric acid. Such patinas present a uniform, soft and crumbly product that will contain chloride.\textsuperscript{14} Another method of faking an original patina simply uses ground malachite applied to the area with an adhesive, or green and blue paints to create the desired appearance.\textsuperscript{15} Exposing the object to the elements, such as rain or wind, for an extended length of time creates a

\textsuperscript{12} Robotti et. al, “Reliability of X-Ray Fluorescence,” 41-49.


\textsuperscript{15} Giumlia-Mair and Lucchini, “Surface analyses,” 407.
quick patina that will appear uneven or streaky.\textsuperscript{16} A dark brownish or black layer beneath the corrosion layer can indicate a fake patina, and often presents with white or blue speckles on the corroded portions.\textsuperscript{17} Fake patinas can also be manufactured through various chemical treatments that can leave traces of unused alloys, such as lead or zinc, in the corrosion layer.\textsuperscript{18} Soil debris can also be intentionally added to the patina in order to create a more authentic appearance.\textsuperscript{19} Soil analyses however are able to detect the differences between the added soil and the corrosion layer itself.\textsuperscript{20} These methods are easily discernible from a true patina, and can be distinguished further due to their lack of penetration into the metal itself.

\textbf{Methodology}

The techniques of analysis employed by this study of the Memphis sistrum are, of necessity, non-destructive. The first is a general observational analysis of the exterior of the artifact. Detailed photographs of the object from the condition report done by Dr. Patricia Podzorski in 2014 were used in order to determine the presence of any tool-marks, joins, or rivets. Close observation of the artifact yielded information regarding the manufacture techniques used to create the piece. The sistrum was then compared to images of its alleged doppelgänger from London in order to determine their connection as well as any similarities that might be considered abnormal.

\textsuperscript{16} Ibid., 407.
\textsuperscript{17} Ibid., 407.
\textsuperscript{18} Robbiola and Portier, “A global approach,” 8-9.
\textsuperscript{19} Ibid., 8-9.
\textsuperscript{20} Ibid., 8-9.
The second technique is the use of portable X-ray Fluorescence (pXRF). This technique involves scanning portions of an artifact using high energy X-ray waves that are then analyzed based on the energy and intensity emitted by the X-ray light reflected back from specific elements. The energy and intensity of a reflected wave is then identified as a specific element. The elements identified are either major or trace peaks in the composition. While this technique is limited in its ability to produce exact percentages of the elemental make-up of the object, its purpose for this study is to identify the presence of certain elements within the metal of the sistrum. The presence or absence of certain elements can help determine the alloy used, the make-up of the corrosion product, and other contaminants on the object.

I tested the sistrum on March 1, 2019 with the help of Dr. Ryan Parish and Dr. Patricia Podzorski, using a Bruker Tracer V portable XRF that was operated at 15 kV (kilovolts) and 35 uA (microamps) for the light elements and 45 kV and 35 uA for the heavy elements. The spectra were collected for 120 seconds each. The testing was conducted on multiple uncleaned, unpolished, and corroded surfaces on the object. The Tracer is internally calibrated to identify trace element compositions within scanned objects, however, at the time the sampling was done the Tracer had not yet been calibrated to any specific materials. Therefore, it was not possible at this time to obtain exact parts per


22 Ibid., 43.

23 I would like to thank Dr. Ryan Parish from the University of Memphis Earth Sciences Department, and IEAA curator, Dr. Patricia Podzorski for their assistance with the testing of the sistrum.
million (ppm) counts for elements that were detected. As such, only the presence of elements will be discussed in the results.

While this method is generally accurate for analyzing the elements present in ancient bronzes, bronze disease has the potential to alter the testing results.\textsuperscript{24} Bronze disease can change the elemental composition of an object and as such must be considered when analyzing the compounds. Different compounds within bronze react to oxidization uniquely. The presence of lead and high levels of tin in a compound stabilizes the object’s oxidization and creates an indissoluble layer of corrosion on the surface of the object while those without these metals oxidize to form crystalline salts on the surface which can be safely removed from the object.\textsuperscript{25} The results of the analysis of objects containing lead or tin show an increase in the amounts of these metals which possibly are inaccurate for the initial manufacture of the product. Furthermore, as evidenced by Mantovani et. al, analyses of the corrosion product and the metal underneath can be helpful in the discovery of an unnatural patina.\textsuperscript{26} Their conclusion was based on the higher amount of copper found in the metal beneath the corrosion layers. The natural separation of copper and alloy during the corrosion process draws the copper from the metal and creates a copper rich outer layer, leaving the alloy beneath. Robotti et. al.’s experiment, testing the reliability of XRF with regard to corrosion, concluded that


\textsuperscript{26} Luciana Mantovani, Mario Tribaudino, Grazia Facchinetti, “A mineralogical approach to the authentication of an archaeological artifact: Real ancient bronze from Roman Age or fake?” \textit{Journal of Cultural Heritage}, 21, (2016), 879.
analyses using this method should test several varying points on the object in order to
determine the differences between the original metallic compound and the corrosion
products.27

XRF analysis of the Memphis sistrum should be considered only preliminary for
the analysis of the metal, as it can only determine presence or absence of elements, but it
is helpful for determining the source of the bronze disease products. This method of
analysis allowed the elemental components of the artifact to be identified. In addition,
examination of the corrosion product with X-ray fluorescence can provide valuable
information about the components of the product and the environment and circumstances
that influenced its formation.28

**Results and Discussion**

This section of the study will focus on the results of the visual and elemental
analyses of the Memphis sistrum. It will begin with an in-depth description of the
physical attributes of manufacture and technique, if any, that are visible on the object. A
second analysis will be conducted comparing the Memphis sistrum to the Bonhams’
object in order to determine similarities and possible connections. The second portion
will report the findings of the pXRF analysis, and then discuss their possible significance
in detail.

**Method of Manufacture**

Much can be learned about the manufacturing process of the Memphis sistrum
through simple observation. For example, upon inspection it is clear that the instrument


28 This technique is used in Ghoneim, “An Egyptian Partially Gilded Bronze,” 133-45.
was cast as a single piece (aside from the rods) using a one-piece mold. Evidence of this can be seen in the construction of the loop and the uraei. The loop of the Memphis sistrum is uniform in shape and width and does not exhibit any signs of hammered tool marks such as is found on examples where the loop was cast separately from the handle and beaten to the desired shape (fig. 27 and fig. 28).29 The holes on the sides of the sistrum’s loop are also uniform in shape and placement, indicating that they were cut into the mold before casting (fig. 29 and fig. 30).30 Another indicator of this method is the lack of a push fit connection between the loop and the handle of the sistrum (fig. 31 and fig. 32).31 Sistra of the New Kingdom and Late Periods were cast in separate pieces where the loop was formed and then pushed into slots at the top of the handle base and secured. Ptolemaic and Roman sistra, to the contrary, were cast as solid pieces with handle and loop combined in one mold. This process is what created the uniformity in sistra loops of the later time periods, and also made for a more durable instrument.

The lateral uraei of the Hathor mask indicate also that a one-piece mold was used to manufacture this object. Like the loop, lateral uraei in New Kingdom through Late Period examples are most commonly modeled and then applied to the instrument via

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29 Figure 28 demonstrates the uniform quality of the Memphis loop, and reveals the lack of hammer marks, while Figure 29 is an example of a beaten and worked loop, Paris, Musée du Louvre, (acc. no. N 4269), illustrated in Anderson, Musical Instruments, 37.

30 Figure 30 shows the uniformity of the Memphis sistrum’s rod holes, while Figure 31 is an example of rod holes that would have been cut into the metal after shaping, Paris, Musée du Louvre, (acc. no. N 4272), seen in Ziegler, Les instruments de musique égyptiens, 57.

31 Figure 32 is an example of a push fitted loop from London, British Museum, (acc. no. 36310), illustrated in Anderson, Musical Instruments, 40. Figure 33 shows the Memphis sistrum’s loop as one solid piece with the handle.
push fit dowels (fig. 33).\textsuperscript{32} However, being cast in one piece as Ptolemaic and Roman sistra were, the lateral uraei were an original part of the mold and cast with the object at the time of its creation (fig. 34).\textsuperscript{33} The uraei of the Memphis sistrum exhibit no signs of external fittings, and appear as one solid piece with the handle of the instrument. These two seemingly small details suggest a Ptolemaic or Roman Period origin or perhaps the use of a Ptolemaic or Roman model by modern forgers.

Three marks on the surface of the instrument are, however, unusual for a one-piece mold. The first is visible on the tie band of the handle directly beneath the right edge of the collar (fig. 35). This mark appears as three rather deep, diagonal scratches. The second is found on the right-side corner of the collar directly beneath the uraeus (Fig 36). A mark on the left presents as two semi-circular divots, while the mark on the left is another diagonal scratch. The final mark is found on the collar of the mask on the obverse side of the sistrum (fig. 37). This long, diagonal scratch mark is shallow and does not penetrate the first layer of corrosion. Marks such as these most likely occurred during the discovery or transport of the object, or perhaps are tool marks from an ancient or modern source.

**Corrosion Pattern**

As discussed previously, the patina of an object can be instrumental in determining its authenticity. This section of the analysis of the Memphis sistrum will discuss the texture, color, and make-up of the corrosion product on the instrument. Basic

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\textsuperscript{32} An example of the sockets in the sides of the handle where the uraei would be fitted from London, British Museum, acc. no. 65254, illustrated in Anderson, *Musical Instruments*, 49, fig. 83b.

\textsuperscript{33} Figure 35 is a detail image of the Memphis uraei, illustrating their solidarity with the collar and base of the handle.
visual observation of the patina shows that the corrosion product is most likely the second type of interaction discussed previously, where the decuprification of the metal has caused three distinct layers of corrosion to form.

The outermost layer of the object is composed of a rough, greenish scale that covers roughly 95% of the instrument. The color varies from bright white to a dark green, and the crust has varying degrees of thickness throughout. There are no obvious signs of pitting, and there are no white-rimmed blue spots that would indicate an unnatural patina. The product is not streaky or runny, indicating that it was not left in the elements for a speedily faked corrosion layer. The corrosion is not uniform in placement or thickness, and it does not appear soft or crumbly in texture indicating that acids were not used to artificially create the patina. There remains however, the possibility that ground malachite, paint, and soil were applied to the object with an adhesive binder. Chemical analysis of the outer layer of the corrosion product will be necessary to determine the authenticity of the patina.

The second layer presents as a smooth reddish-brown color that is normal to find in this type of reaction. Aside from the marks mentioned previously, there does not appear to be any divots or pitting of the metal, indicating that the corrosion is non-damaging to the object. The coloring is consistent with the expected natural patination of a bronze artifact. As previously discussed, a dark brown or black coloration in this layer would be indicative of an artificial corrosion.

The innermost layer of the corrosion product is not visible to the eye. However, analysis with the pXRF provided useful information regarding the chemical make-up of the corrosion product beneath the surface layers. What can be expected from a natural
corrosion of a copper alloyed bronze is a higher concentration of copper on the surface layers as well as larger amounts of the alloyed element below.

**Comparison with the Bonhams’ Sistrum**

A final visual analysis can now be attempted in order to discern what connection the Memphis sistrum may have to that of the sistrum found in the Bonhams’ catalogue. From a formal analysis of the Bonhams' sistrum, it is clear that the two sistra are quite similar in appearance.

The Bonhams’ is approximately 28 cm in height from the top of the loop to the end-cap and 3 cm in width. The loop is unadorned and transversed by three metal rods. Still intact on the middle rung of the Bonhams’ sistrum is strung a metal disk. The base of the loop of the instrument is a thin, undecorated rectangular band on which sits a small, cat figurine. Below the base is a Hathor image with a rounded face, long narrow eyes, and a large rounded nose. Her eyes, however, slant slightly at a downward angle towards the viewer’s right. Her curved, bovine ears do not extend beyond her long, thin curled wig, but stop at the hairline. The wig of the Bonhams’ Hathor also exhibits a band or parted hairline that bisects the top of her wig. A square neck separates the figure’s head from the collar below. The broad collar is wide, undecorated, and triangular-shaped. The lateral uraeus on the viewer’s right wears the double crown while the uraeus on the viewer’s left wears the red crown of Lower Egypt. The uraei extend from each side of the collar to the bottom of the base. The collar rests on a single, wide tie-band connecting the upper half of the instrument to the handle. Its handle is short, thick, without decoration, and ends in a double tiered tie-band end-cap.
The method of manufacture used to create the Memphis sistrum was also implemented on the Bonhams’ piece. This instrument appears to have been cast in a one-piece mold as illustrated by the lack of push-fit pieces connecting both the loop and the uraei. The uniformly thick loop is connected directly to the base of the object with no signs of separation or joining points. The uraei pieces, also, were molded as integral pieces of the original work, as opposed to later additions.

While several of the basic design elements of the two sistra render them similar, several variations in detail prove, however, they are not exact copies (fig. 38). The wig of the Bonhams’ Hathor is bisected by a band that has been incised into the metal, this detail is not seen on the Memphis Hathor. The Memphis Hathor’s eyes also sit horizontally rather than at a slanting angle like that of the Bonhams’ image. In addition, the ears of the figures extend to different lengths. The Memphis Hathor’s ears stop just before the hairline of the wig, while the Bonhams’ touch the hairline. Another indicating factor are the handles of the two objects. The tie band beneath the Hathor head of the Bonhams’ sistrum is significantly wider and thicker than that of the Memphis sistrum. Their end-caps are also varied as the Bonhams’ has a two-tiered end-cap and the Memphis sistrum a three-tiered cap.

Another difference between the two sistra are their corrosion patterns. The Memphis sistrum has extensive bronze disease that spans the surface of the object. The damage has almost completely obscured the face and collar of the Hathor image. The Bonhams’ sistrum, however, has less corrosion product on the surface, and the reddish-brown color of the metal is more visible. The outer layer of corrosion is also minimal and does not appear to have affected the structure of the object. Inconsistency in the corrosion
patterns on the two objects suggests that the environments they were exposed to were different or that they received different care after being found. This could indicate an early separation of the objects before patination occurred.

In sum, although the two sistra are quite similar in manufacture and design, the objects exhibit important stylistic variations that prove they are not exact copies. Their similarities in dimension and style could be attributed to their manufacture. It is possible that these two objects were created by means of a similar plaster mold to shape their wax cores before casting.\(^\text{34}\) This technique of ancient mass production would ensure that both wax components were similar in detail and dimension with slight variation without being exact replicas. The more defined details of the Bonhams’ sistrum could suggest that after casting the object was incised and the details of the mold chased, while the Memphis sistrum was not. This method would account for the objects’ similarities which were considered by Saura-Ziegelmeyer to be suspicious for the pre-industrial era.\(^\text{35}\)

**pXRF Analysis**

The sistrum was scanned in four separate locations, the center of the top of the outside of the loop (fig. 39; Tables 4 and 5), the flat back of the cat figurine (fig. 40; Tables 6 and 7), the obverse face of the Hathor image (fig. 41; Tables 8 and 9), and the bottom of the end-cap (fig. 42; Tables 10 and 11). Each area was scanned twice, once to assess the light elements in the composition, and then again for the heavier elements. The datum collected from each location were consistent with one another and displayed no

\(^{34}\) Ogden, “Metals,” 159-60.

significant variation in the elements identified. As mentioned previously, the results of the scans yielded only an identification of the elemental composition, as the device was not yet calibrated to obtain exact parts per million (ppm) counts of the elements detected.

The assessment of both the heavy and light elements show the highest intensities to be copper (Cu), while the second highest, although significantly lesser in intensity, is zinc (Zn). Trace elements identified in the heavy spectra also included tin (Sn) and lead (Pb). This indicates that the metal is most likely a copper-zinc alloy or a quaternary bronze composed of copper, lead, zinc, and tin.\textsuperscript{36} The use of this particular type of metal would be consistent with a date in the late Ptolemaic or Roman Periods.

Impurities in the metal were identified through the trace amounts of nickel (Ni), iron (Fe), manganese (Mn), and arsenic (As).\textsuperscript{37} Nickel is a common impurity in copper alloys and occurs in higher levels in alloys containing zinc.\textsuperscript{38} Iron also can be an impurity that was unintentionally included during the smelting process, or a possible soil contaminant.\textsuperscript{39} Impurities in the metal can be indicative of the object’s authenticity as ancient metalworkers employed several methods of alloying, while modern forgers opt for purer more homogeneous metals.\textsuperscript{40} Other elements that represent authentic impurities


\textsuperscript{38} Ogden, “Metals,” 152.

\textsuperscript{39} Ghoneim, “An Egyptian Partially Gilded Bronze,” 145.

\textsuperscript{40} Mezzasalma et. al, “Ancient Coins and Their Modern Fakes,” 21.
in the metal including bismuth (Bi) and cobalt (Co) were identified in trace amounts (Table 12).\textsuperscript{41}

Soil contaminants were identified in trace amounts which can indicate soil type as well as corrosion product. The presence of trace amounts of calcium (Ca), chlorine (Cl), aluminum (Al), titanium (Ti), and iron (Fe), in the object demonstrate soil contaminants that, according to Ghoneim, suggest the object was buried in calcareous aerobic soil, like that of natron rich Egypt.\textsuperscript{42} Trace amounts of oxygen (O), potassium (K), and magnesium (Mg) were also identified, and can be considered soil contaminants (Table 13).\textsuperscript{43} Chlorine in the soil can also account for the corrosion product on the sistrum. Chlorine is the main cause of corrosion in copper-alloys and is almost always present in corroded artifacts.\textsuperscript{44} The reactive nature of chlorine along with other trace soil components such as oxygen, sodium (Na), carbon (C), and hydrogen (H) contribute to the corrosion product.\textsuperscript{45}

Based on the pXRF analysis, the metal is composed of a heterogenous copper-zinc alloy. Trace amounts of expected authentic impurities included bismuth, cobalt, arsenic, tin, and lead. Several elements identified, including iron, aluminum, calcium, chlorine, and titanium are consistent with natural soil contaminants from a sodium


\textsuperscript{42} Ghoneim, “An Egyptian Partially Gilded Bronze,” 140, 145.

\textsuperscript{43} Ibid., 141.

\textsuperscript{44} Ibid., 141; Norgaard, “Portable XRF on Prehistoric Bronze Artefacts,” 104.

\textsuperscript{45} Ghoneim, “An Egyptian Partially Gilded Bronze,” 135-137.
chloride rich environment. Soil contaminants like chlorine, oxygen, carbon, and hydrogen account for the corrosion product on the object.
Chapter Seven

Conclusion

Based on the evidence given in the preceding chapters, it is the author’s opinion that the Memphis sistrum is most likely an example of an authentic ancient sistrum. A brief review of the evidence that supports this theory will be presented here as the culmination of this research.

This research began with a stylistic comparison of the Memphis sistrum with a corpus of sistra that have been dated from the New Kingdom to the Roman era. This comparison suggested the Memphis sistrum to be consistent with several common stylistic patterns of a Ptolemaic or Roman sistrum. These features include the schematic Hathor image, lack of uraei frieze base, double and red-crowned lateral uraei paired at either side of a Hathor face, and Ptolemaic U-shaped style broad collar, all of which are consistent with a date of manufacture in the Ptolemaic or Roman Period. The instrument’s method of manufacture is also consistent with a Ptolemaic or Roman date. The Memphis sistrum was most likely cast in a one-piece mold as evidenced by the lack of push-fit slots for both the loop and the lateral uraei. One-piece molds were not popular in use until the Ptolemaic Period in Egypt.

The sistrum was then compared to a similar piece sold by the London auction house, Bonhams. The two instrument’s appearance and dimensions render them similar, however, not exact copies. The Bonhams’ Hathor image exhibits a slight slant to the eyes, an incised band bisecting her wig, and ears that extend to her hairline which are details that are not present in the Memphis sistrum. The tie-band at the top of the Bonhams’ handle is thicker and wider than that of the Memphis sistrum, and its end-cap
is double-tiered while the Memphis sistrum’s is three-tiered. Although the two might possibly have been produced in the same ancient workshop, the mass-produced instruments were not part of a pair. This method of mass production could also account for the similarities of the objects that Saura-Ziegelmeyer considered suspicious for authentic works from the pre-industrial era.\footnote{A. Saura-Ziegelmeyer, \textit{Le sistre istaigue dans le monde gréco-roman: analyse d’un objet cultuel polysémique. Typologie, Perceptions, Significations} (Université Toulouse II Jean Jaurès, Toulouse, 2017), 148-149.} It is nevertheless significant that two such similar objects survived.

Finally, analyses with pXRF indicated that the metal of which the Memphis sistrum is made is a copper-zinc alloy that was popular primarily after the 1st c. CE. The metal’s inclusion of natural impurities from other alloying metals like arsenic, tin, and lead, as well as soil contaminants including iron, magnesium, titanium, and aluminum are consistent with those found on authentic artifacts, contributing to the legitimacy of the instrument. Elements identified in trace amounts such as carbon, hydrogen, chlorine, and oxygen are also consistent with natural corrosion products.

In sum, the metal of the Memphis sistrum is a copper-zinc alloy with natural impurities that are consistent with expected soil contaminants and corrosion product of authentic ancient metalworks, the use of which would date the artifact to either the Late Ptolemaic or early Roman Period which corresponds also to the stylistic assessment and manufacture technique of the object. Based on the evidence provided here, it is the conclusion of the author that the Memphis sistrum is most likely an authentic artifact that can be dated approximately to the Late Ptolemaic or early Roman Period.
References


Table 1: Date, Accession Number, and Current Location of Sistra used (Chronological)

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<th>Current Location</th>
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<td>New Kingdom</td>
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<td>Museum of Egyptian Antiquities</td>
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<td>Dyn 26</td>
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<td></td>
<td>Loop</td>
<td>Base</td>
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<td>------------</td>
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<td><strong>New Kingdom</strong></td>
<td>N/A</td>
<td>Uncrowned Uraei Cornice</td>
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<tr>
<td></td>
<td></td>
<td>Cat Figurine</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Amarna Period</strong></td>
<td>Plain and</td>
<td>Thick Rectangular Block</td>
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<tr>
<td></td>
<td>Unadorned</td>
<td></td>
</tr>
<tr>
<td><strong>Late Period</strong></td>
<td>Decorative</td>
<td>Thin Rectangular Uraei Band</td>
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<td></td>
<td>Etched Designs</td>
<td>Cat Figurine</td>
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<td>1. Plain and</td>
<td>Undecorated, Rectangular, Cat Figurine possible</td>
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<td></td>
<td>Undecorated</td>
<td></td>
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<tr>
<td>Roman</td>
<td>Loop</td>
<td>Base</td>
</tr>
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<td>-------</td>
<td>------</td>
<td>------------</td>
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</table>
|       | Long, Thin, Etched Designs | Cat Figurine | Long, curled wig | 1. 6 tie bands, plain handle  
2. Thin, ring or twisted pattern, lotus blossom, Bes Image, Isis image column, rounded end | Flat    |

**Table 3:** Intentional Alloy compound percentages from the New Kingdom to the Roman Period

<table>
<thead>
<tr>
<th>Compound</th>
<th>New Kingdom</th>
<th>Late Period</th>
<th>Ptolemaic Period</th>
<th>Roman Period</th>
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<td>1-4%</td>
<td>&gt;1%</td>
<td>&gt;1%</td>
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<td>10-16%</td>
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<td>&lt;20%</td>
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<td>Copper-Zinc</td>
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<td>&gt;1%</td>
<td>&gt;1%</td>
<td>1-30%</td>
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**Table 4:** Loop Heavy Spectrum
Table 5: Loop Light Spectrum
Table 6: Cat Figure Heavy Spectrum
Table 7: Cat Figure Light Spectrum
Table 8: Hathor Image Heavy Spectrum
Table 9: Hathor Image Light Spectrum
Table 10: Bottom of Base Heavy Spectrum
Table 11: Bottom of Base Light Spectrum
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Callender, In Hathor’s Image I: the Wives and Mothers of Egyptian Kings from Dynasties I-VI,
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Edouard Naville, *Bubastis (1887-1889)*, (London: Egypt Exploration Fund, 1891), 11-14, pl. IX
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http://www.smb-digital.de/eMuseumPlus?service=direct/1/ResultLightboxView/result.t1.collection_lightbox.$TspTitleImageLink.link&sp=10&sp=Scollection&sp=SfieldValue&sp=0&sp=1&sp=3&sp=Slideshow_3x4&sp=0&sp=Sdetail&sp=0&sp=F&sp=T&sp=0
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_bw_IMLS.jpg
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London, British Museum, acc. no.30735  
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Left Side of Loop

**Figure 29**: Detail of the Rod Holes on the Memphis Sistrum
Memphis, AMUM, 1994.4.26
Photo: Dr. Patricia Podzorski
Figure 30: Detail of Rod Holes Cut After Forming
Paris, Musée du Louvre, acc. no. N 4272
Ziegler, *Les instruments de musique égyptiens*, 57, fig. 67
Figure 31: Detail of Push Fit Slots on Loop Sistrum Handle
London, British Museum, acc. no. 36310
Figure 32: Detail of Handle and Loop of the Memphis Sistrum
Memphis, AMUM, 1994.4.26
Photo: Dr. Patricia Podzorski
Figure 33: Line Drawing of Push Fit Socket for Lateral Uraei
London, British Museum, acc. no. 65254
Anderson, *Musical Instruments*, 49, fig. 83b
Figure 34: Detail of the Lateral Uraei of the Memphis Sistrum
Memphis, AMUM, 1994.4.26
Photo: Dr. Patricia Podzorski
Figure 35: Detail of Scratch Mark on Memphis Sistrum Handle
Memphis, AMUM, 1994.4.26
Photo: Dr. Patricia Podzorski
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Memphis, AMUM, 1994.4.26
Dr. Patricia Podzorski
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Memphis, AMUM, 1994.4.26
Photo: Dr. Patricia Podzorski
**Figure 38:** Side-by-Side of the Memphis and Bonhams’ Sistra  
Left Photo: Dr. Patricia Podzorski  
Right Photo: Dr. Arnaud Saura-Ziegelmeyer
Figure 39: Location of Spectrum Scan on Sistrum Loop
Photo Credit: Paige E. Brevick
Figure 40: Location of Spectrum Scan on Cat Figure Reverse
Photo Credit: Paige E. Brevik
**Figure 41:** Location of Spectrum Scan on Obverse Hathor Image  
Photo Credit: Paige E. Brevick
Figure 42: Location of Spectrum Scan on Base
Photo Credit: Dr. Patricia Podzorski