

Dana K. Senge

Buffalo State College

Analysis and Treatment of a Chinese Ceramic Mortuary Figure

Abstract: Chinese ceramic funerary figures are found in many museum and private collections. These figures are often discovered to be restored originals, forgeries or restored forgeries. The Buffalo Museum of Science owns a collection of these ceramic sculptures from ancient China, including the figure, *Guard on Horseback* (BMS CH296). Damage to this sculpture separated the body from the base exposing an earlier restoration. Access to the interior of the sculpture gave an opportunity to develop a greater understanding of its origin, its fabrication techniques, and its restoration.

Samples from the interior cavity of the sculpture were used for thermoluminescence authenticity dating and thin section analysis of the ceramic body. Fourier transform infrared spectroscopy (FTIR) was used to help describe the layers on the surface of the sculpture. Previous restoration materials were characterized and identified through ultraviolet radiation, X-radiography, microchemical and solubility tests, microscopy and X-ray spectroscopy (XRF). The principal objective of this paper is to present the results of these examination and analytical techniques, their influence on treatment decisions and the consequent conservation treatment of this sculpture.

1. INTRODUCTION

The Buffalo Museum of Science owns several ceramic tomb sculptures from ancient China dating from the Han (206 BCE – 220 CE) to the T'ang (618-906 CE) dynasties. In 1943, Museum President, Chauncey Hamlin, purchased sixteen of these sculptures, including *Guard on Horseback* (BMS CH296), from M. Meerkerk, an art dealer in New York City. At some point after exhibition in 1943, the figure was damaged, exposing evidence of prior restoration. In its broken state the sculpture has provided an opportunity to understand its history of manufacture, damage and subsequent repair.

The main issues addressed in conservation research relating to Chinese ceramic mortuary figures are authenticity, fabrication and previous restoration methods. Authenticity has been a major issue with these figures (Fleming 1970). Kiln sites containing the original ceramic or wooden molds for these figures were unearthed at a similar time as the burial sites containing the original sculptures. This led to the placement of replicas or forgeries, created hundreds of years after the original figures, onto the collectors market at the same time as the originals. Since these sculptures are made from the same molds, telling them apart stylistically is impossible. Authenticity is determined through analysis of the materials used to construct the figures and through the use of thermoluminescence dating of the ceramic body.



Figure 1. Damaged funerary figure: *Guard on Horseback*.

Variations of these figures occur for at least a thousand years in ancient China. The clay used to form the sculptures and the materials used to decorate the surface differ from region to region and from dynasty to dynasty. The aim of this paper is to discuss the examination and conservation of one mortuary figure: *Guard on Horseback*. This includes the examination of the construction of the cast figure and the application of the previous restoration materials, material analysis of the ceramic body, surface decoration and restoration materials and finally, the conservation treatment of this sculpture.

2. HISTORICAL BACKGROUND

Ceramic sculptures of humans, animals, buildings and modes of transportation were placed in tombs with the deceased for over a thousand years in ancient China (Baker 1993). These figures, known as *ming qi*, meaning “articles of the spirit”, replaced the practice of interring of live humans (servants or slaves) and animals with their deceased master. Changes to the structure of Chinese society from a slave to feudal system, between 1066-221 BCE, allowed the populace to resist the internment of live people and animals in the funerary ritual (Renbo 1987). During this time the use of representational figures of servants or slaves made from wood and ceramic

became popular. The practice of human sacrifice was outlawed in the late Eastern Zhou dynasty (770-221 BCE).

What was once a practice with religious significance became a representation of wealth and worldly status. The placement of ceramic or wood representational figures in the tomb expanded beyond the wealthy to the middle class. So much money was spent on these figures that a royal decree was issued to regulate the size and amount of figures with which a person of a certain rank could be buried (Baker 1993; Strahan 1988), however, these regulations were repeatedly disregarded (Fleming 1974). As prosperity declined in the ninth century A.D, so did large-scale use of these figures in burials (Fleming 1974).

3. EXAMINATION AND MATERIAL ANALYSIS

3.1 Attribution

The records of the Buffalo Museum of Science attribute *Guard on Horseback* to the Six Dynasties period (220-589 CE) of Chinese history. An article written by Dr. Alfred Salmony, Research Associate in Oriental Studies at the Buffalo Museum of Science in 1946, narrows the dates of attribution to the Northern Wei dynasty (386-535 CE).

The design and decoration of ceramic tomb figures changed from dynasty to dynasty as the influence of new cultures and religion affected the society. Stylistically this sculpture is similar to others attributed to the Northern Wei dynasty. Animal figures from this dynasty are often depicted with large bodies supported by slender legs, and with heads that are small in relation to the body (Salmony 1946). As typical of Northern Wei period horses, this horse stands still on all four legs (Schloss 1977). Sculptures of horses from other periods are often depicted in the act of movement.

Collector and art historian Ezekiel Schloss describes the costume of a drummer on horseback, a sculpture similar in design to the *Guard on Horseback*, as a "...long sleeved tunic and baggy trousers flared out at the bottom," stating that this is a component of the classical Northern Wei style. (Schloss 1977 vol. 1:193). The description of this costume is very similar to the costume of the rider in the *Guard on Horseback* ceramic sculpture. An image of this sculpture is found in *Into the Afterlife*, an exhibition catalogue of tomb sculptures from the Schloss collection (Lewis 1990).

3.2 Analysis of the Ceramic Body and Surface Decoration

Figures from the Northern Wei dynasty were most often formed from an iron rich grey earthenware coated with a white slip. Mineral pigments in an animal glue binder were often used to decorate the white slip (Strahan 2005). In some instances the figure would have been painted a solid color (commonly red), while in other cases pigmentation was only used to accent shapes on the figures (Kuwayama 1987, Salmony 1946).

With consideration to the materials used in traditional methods of fabrication and decoration, the figure, *Guard on Horseback*, was analyzed. Elemental analysis of the ceramic body was performed with the use of the non-destructive analytical technique, X-ray fluorescence spectroscopy (XRF). The presence of iron in the ceramic body, as found in many of these figures, was confirmed. Lead was also detected during this analysis.

A core sample, 3mm in diameter x 7mm in length, was removed from the interior of the horse's body and prepared into a polished thin section 30 μ m thick by American Petrographic in New York. With the use of a polarizing microscope the sample was viewed in both plane and crossed polarized light. The thin section depicts a finely textured paste with non-plastic mineral inclusions consisting of small rounded crystals. These mineral inclusions, likely quartz, are fairly regular in shape and size throughout the sample. Also present in the sample are two extremely large rectangular crystals that exhibit polysynthetic twinning, these are likely feldspar crystals. The feldspar and quartz crystals may have been present naturally in the clay material or added as temper material as it was prepared. The ceramic is a low-fired material. The clay particles have sintered together without the development of an extensive vitreous phase.

A golden brown layer exists on the surface of the sculpture and appears to be a partial decorative coating. There is no evidence of the white slip observed on other sculptures attributed to this time period. A sample of the golden brown layer was analyzed with optical microscopy. Two different materials were detected in this initial analysis: a small opaque crystalline material and larger flakes of a translucent material. Further analysis with Fourier transform infrared spectroscopy (FTIR) using the microscope accessory in transmission mode allowed us to analyze both of these materials. The resulting spectra from different areas of the sample indicate that the layer is composed of a silicate (the crystalline material) mixed in a proteinaceous binder (the larger translucent material). This is consistent with a clay or ceramic material in an animal glue binder. The partial coating is visible underneath the materials used in restoration; it could either

be the first stage of that restoration (perhaps a consolidation of the original surface layer) or material related to the original surface decoration.

3.3 Authenticity Test

Visually this sculpture appears to be from the Northern Wei dynasty, however as mentioned previously there are issues of authenticity with Chinese ceramic tomb figures. Therefore, prior to radiography, a sample was taken from the interior cavity of the horse for thermoluminescence dating. This solid sample, 4mm (h) x 8mm (w) x 4mm (d), was sent to Borolot Daybreak Nuclear in Connecticut for analysis.

The results of this test, 1900 years old +/- 400-500 years, place the firing of this ceramic to between 400 BCE and 600 CE, a window of time surrounding the stylistic attribution dates of this piece (386-535 CE). This dating verifies the authenticity of the main body of this sculpture. Other components added during restoration have not been dated.

3.4 Fabrication

While burials of the ruling class included full size unique figures, as seen in the famous tomb of Emperor Qin (221-206 B.C.), burials of members of the middle class contained small cast sculptures. These pieces were cast by pressing clay into several piece molds. Simple figures were cast by pressing a slab of clay into a bivalve mold (Lewis 1990). More complicated pieces, such as *Guard on Horseback*, were cast as several components. The trunk of the horse and the lower body of the rider would have likely been cast as one piece, the head of the horse as another, and the upper body and head of the rider as the last major component (although the head may have been cast separately from the body). The legs of the horse may have been shaped by hand or individually cast. Clay for each component would have been pressed into a two-part mold to create an approximately 1/4" wall. It is thought that the two part molds would then be pressed together while the clay was still damp to ensure a strong bond between the two halves, and then allowed to dry until it could support its own weight. The components of the sculptures may have been removed from their molds prior to reaching the leather hard stage and pressed together (Schloss 1977, Strahan and Boulton 1988).

Evidence of construction of *Guard on Horseback* is observed on both the interior and exterior of the sculpture. Join lines from the two-part molds are seen under the horse's chin and in the interior of the horse's body. Attachment joints of the component parts, specifically the neck of

the horse to its trunk, are observed in the interior cavity of the sculpture. Impressions from the potter's fingerprints in the ceramic of the interior cavity are interpreted as evidence of pressing the clay into the original mold.

3.5 Condition

The major conservation issue with this sculpture was the structural damage at the legs of the piece. This damage could have occurred as a failure of the previous repairs or from a blunt force trauma to the piece that caused the legs to break. The piece arrived at the Art Conservation Department broken at all four legs, leaving the piece in fragments. The only component completely missing from the sculpture was the right ear of the horse. The damage to the body of the sculpture allowed us to analyze the materials used in fabrication and previous restoration using several forms of analysis.

3.6 Analysis of Previous Restoration Materials

Prior restoration is evident throughout the piece (*figure 2*). With the assistance of x-radiography and ultraviolet radiation during examination, major breaks have been identified. These exist in the body of the horse—behind the saddle, just below the neck of the rider and in the slab base. Previous repair is also evident at the top and bottom of each of the horse's legs.

Radiography helped to further define areas of repair. The xeroradiograph in *figure 3* shows areas of damage and repair: breaks and cracks in the sculpture, fine metal pins used in previous restoration and a fill in the right front leg. This fill was capped with components from the original sculpture and covered with fill material and overpaint.



Figure 2. Areas of prior restoration have been highlighted in color.

Small samples of the repair materials were taken. These were exposed to microchemical tests, solubility tests, and optical microscopy to gain some understanding of these substances.

The main adhesive used throughout the piece is white in normal illumination and fluoresces bright white when exposed to long wave ultraviolet illumination. This material swells in warm water and tested positive for calcium using nitric and sulfuric acid and carbonate using hydrochloric acid (Odegaard 2000: 100-104). It is likely calcium carbonate in animal glue used as a bulked adhesive. A second adhesive observed at the repair of the head of the rider fluoresces bright orange in long wave ultraviolet illumination, a characteristic that identifies it as shellac. The repair areas are filled with a grey sandy material with a water-soluble binder and covered

with a dark gray water-soluble paint used to visually integrate the repairs with the ceramic body. Each of these materials appears to be stable with no physical or chemical evidence of deterioration.

4. TREATMENT

4.1 Cleaning

The initial treatment stages of this artifact were centered on further investigation of earlier repairs. Dirt and overpaint applied to the surface of these areas was reduced with the application of de-ionized water with cotton wool swabs. Thick accretions of dirt were delicately reduced

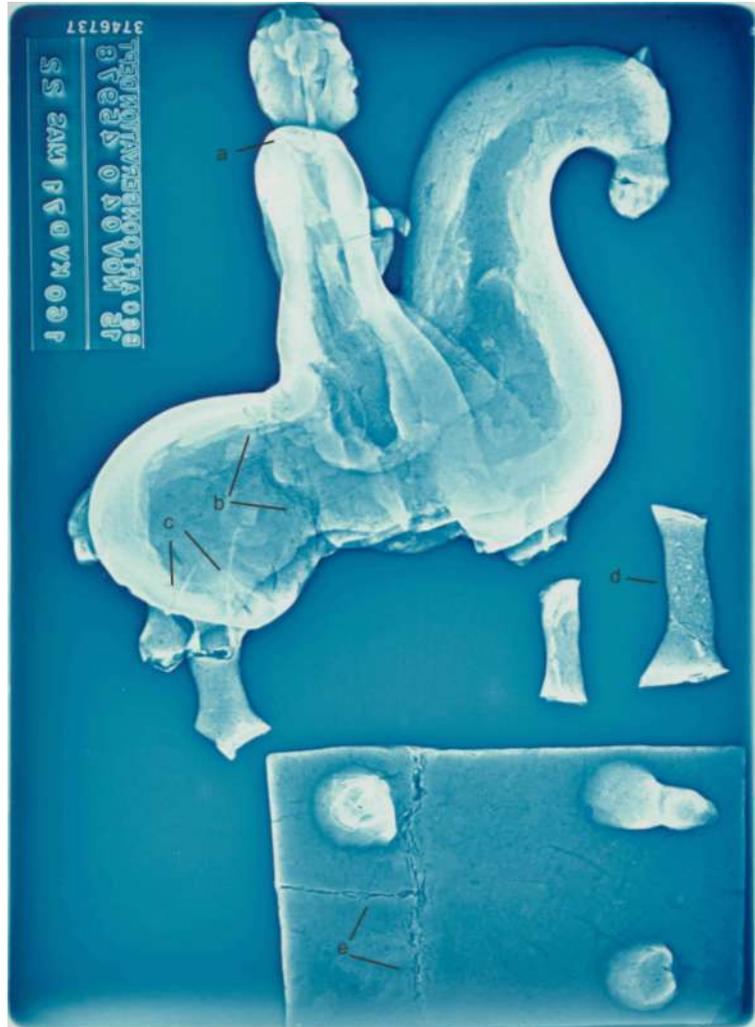


Figure 3. Xeroradiograph depicting damaged and repaired areas: a) break lines at the shoulders, b) break lines behind the saddle, c) metal pins used in prior repair, these are seen in the other legs as well, d) fill, e) break lines in the base.

with the sharpened edge of a wooden tool. Other areas of the sculpture with no evidence of repair were lightly cleaned with cotton wool swabs dampened with de-ionized water. Accumulations of dirt in these areas were considered to be archaeological dirt and were left alone.

This initial cleaning fully exposed the fill and adhesive materials used in the previous restoration. Removal of the dirt and overpaint also exposed paper with printed characters adhered in the repairs on the bottom of the base and Chinese characters marked in pen directly on the surface of the ceramic (also found on the bottom of the base). These characters are similar to ones initially found on a slip of fibrous paper stuck in the mud in the interior cavity of the horse's body and on the dirt on the bottom of the base. The handwritten characters have been identified as Chinese; reading from right to left, "Wen Chuan", possibly the name of the restorer (Kelly 2005). These marks are found on both the base and the body of the horse; perhaps they were used to mark components of the broken sculpture for reassembly.

Reduction of the dirt on the head of the rider, the tail and right rear leg of the horse exposed new information about these components not recognized in earlier examination. Initially these were presumed to be areas of repair coated with the dark grey overpaint and dirt. Once cleared of the soft layer of dirt that covered these locations, these components appeared to be formed from a darker grey ceramic. These are likely fragments from other artifacts, used to complete the sculpture. A



Figure 4. Break edges of base and leg fragment.

sample of the ceramic from the head of the rider was examined with reflected light microscopy and appears to be a reduction fired red earthenware. The leg fragment is composed of a dark grey ceramic body, varying in tone from fairly dark around the exterior edge to lighter in the middle. *Figure 4* depicts the break edge of the leg fragment and the break edge of the base. It is clear when comparing these cross sections that the ceramic used for either component is not the same. Comparison of the components with the main body of the sculpture in the xeroradiograph, *figure 3*, shows similar that they all have similar densities. The replacement components are currently considered contemporary with the original sculpture.

Removal of the dark grey overpaint also exposed the fills to two of the legs. The majority of the left rear leg and the right front leg are composed of a coarse pink material, considered to be ceramic parts created specifically for this piece. The pink material is insoluble in both polar and non-polar solvents and has a similar texture and appearance as ceramic. This material was observed in the xeroradiograph in *figure 3* as a coarser material with greater variation in density than the rest of the sculpture.

After the initial cleaning and reduction of the upper layers of the previous restoration, the repairs were re-assessed. The repairs that remained whole-- at the base, the body of the horse and attachment of the head to the neck, were all determined to be secure. In most of these areas the fill material was excessively applied. This material was reduced with de-ionized water and an angled edge of a wooden tool to recover the intended shape of the sculpture.

The repairs made in the previous restoration campaign to each of the legs had either failed or become weak. In order to create strong repairs to these areas the old fill and adhesive materials at the break edges were removed. The original repair adhesive, calcium carbonate in animal glue, was removed from the break edges by swelling the material with warm de-ionized water and then peeling the softened material from the ceramic.

The ceramic recreations at the legs and the three components from other sculptures: the head, tail and right rear leg, remain with this piece.

4.2 Repair

To reassemble the sculpture, a support structure was created to suspend the piece upside down allowing for the attachment of the smaller components (the legs) to the main component (the body). A rectangular form was constructed to allow the heads of the horse and rider to slip through the opening while supporting the sculpture at the horse's body.

Prior to repair each of the break edges were isolated with B-72 acrylic resin in acetone. The first series of repairs to the sculpture adhered the legs to the body of the horse. Only one of the legs has break edges that align with the break edges on both the base and the body; the rest have only contact points and require structural fills to securely adhere the leg fragments in place. A bulked adhesive was formulated with 50% B-72 acrylic resin in acetone and glass microballoons to

create a toothpaste-like consistency and used to adhere the legs securely in place and structurally stabilize the sculpture.

The second series of mends adhered the base to the legs. The bulked adhesive was applied to each of the break edges then the base was set into position. The sculpture was left in the support for a week to allow the solvents to fully leave the adhesive, creating strong, secure mends.



Figure 5. Treatment completed and the figure stands on its own!

4.3 Compensation

The majority of loss compensation occurred during the repair phase of treatment with the bulked acrylic resin. These areas were finished with a surface application of lightweight spackle to visually incorporate the fragments with the sculpture.

The missing right ear of the horse was reconstructed with Pliacre epoxy putty to match the earlier restored left ear. Study of other horse figures from this time period indicate the ears may not be the correct shape, but may have originally been longer.

Both the areas of previous restoration and the recent repair areas were color compensated with pigmented acrylic emulsion to visually integrate them with the rest of the sculpture.

5. CONCLUSION:

Initial examination, analysis of the materials and treatment of the sculpture all contributed to understanding the original construction and the initial restoration campaign. Visual examination in conjunction with radiography and ultraviolet induced fluorescence helped define break areas and the repair materials used in previous restoration. Some of these materials were identified with XRF and FTIR, for instance - the elements that make up the ceramic body and the components in the golden brown surface layer. Other materials, such as the calcium carbonate/animal glue adhesive, were identified with microchemical and solubility testing. These

assessments gave greater understanding of the materials used in and the strength of the old repairs, which ultimately lead to the decision to remove the repair materials at the legs but leave the stable repairs in the body of the sculpture intact. Solubility testing of the overpaint, fill and adhesive materials used in previous restoration determined that these materials could be reduced with polar solvents, allowing them to be removed very safely with water.

The discovery of the different components used in earlier repair of the sculpture: parts from other sculptures and reconstructions, the paper imbedded in the mends, and handwritten characters found on several locations of the ceramic and the restoration dirt, lead to the belief that the sculpture was reconstructed soon after it was unearthed in China and likely sold on the collectors market.

Treatment decisions made during this project retained the history of the materials used in the initial restoration. There was no attempt to recreate the legs, head or tail; the original restoration decisions were respected. Treatment procedures stabilized the weakest of these repairs (and the weakest area of the sculpture) by replacing the repairs between the legs, base and body. The materials and fragments used in previous restoration remain as a record of the history of the piece.

ACKNOWLEDGMENTS:

I would like to thank Jonathan Thornton and Dr. Anikó Bezúr, Professors in the Art Conservation Program at Buffalo State College, for their contributions and guidance to the development and execution of this project. Additionally I would like to extend by gratitude to: Ruth Norton, Kate Garland, Donna Strahan, Drs. Elizabeth and Ted Peña, Kathy Leacock, and Kevin Kelly for their assistance with the research and editorial assistance.

Thermoluminescence dating of the ceramic body was performed by Dr. Victor Bortolot of Bortolot Daybreak. The sample used for thin section analysis was mounted at American Petrographic.

REFERENCES:

- Baker, Janet, *Appeasing the Spirits: Sui and Tang Dynasty Tomb Sculpture From The Schloss Collection*. New York: Hofstra University, 1993.
- Buffalo Museum of Science, *The Art of the Chinese Potter from Prehistoric Times to Kubla Khan*. April 4-May 2, 1943.
- Fleming, S.J., H. M. Moss, and A. M. Joseph. "Thermoluminescence authenticity testing of some 'Six Dyansties' Figures", *Archaeometry* 12 (1) (1970): 57-65.
- Fleming, S. J., "Thermoluminescent Authenticity Studies of Unglazed T'ang Dynasty Ceramic Tomb Goods", *Archaeometry* 16 (1) (1974): 91-95.
- Kelly, Kevin, Personal communication, 2005.
- Kingery, W. David. and Pamela B. Vandiver, *Ceramic Masterpieces*. New York: The Free Press 1986.
- Koob, Stephen, "Obsolete Fill Materials Found on Ceramics", *Journal of the American Institute for Conservation* 37 (1) (1998):49-67.
- Kuwayama, George, "The Sculptural Development of Ceramic Funerary Figures in China" *The Quest for Eternity*. San Francisco: Chronicle Books, 1987.
- Lewis, Candace J., *Into the Afterlife: Han and Six Dynasties Chinese Tomb Sculpture from the Schloss Collection*. Poughkeepsie: Vasser College Art Gallery, 1990.
- Norton, Ruth, Personal Communication, 2004.
- Odegaard, Nancy, Scott Carroll and Werner S. Zimmit, *Material Characterization Tests for Objects of Art and Archaeology*. London: Archetype Publications Ltd, 2000, pp:100-104.
- Renbo, Wang, "General Comments of Chinese Funerary Sculpture", *The Quest for Eternity*. San Francisco: Chronicle Books, 1987.
- Salmony, Alfred, " Wei and T'ang Chinese Ceramics as Funerary Offerings", *Hobbies*. 26 (4) (1946): 113-122.
- Schloss, Ezekiel, *Ancient Chinese Ceramic Sculpture: From Han through T'ang*. Volume 1. Stamford: Castle Publishing Co., LTD, 1977.
- Strahan, Donna and Ann Boulton, "Chinese Ceramic Quadrupeds: Construction and Restoration", *The Conservation of Far Eastern Art*. London: IIC, 1988. pp:149-154.
- Strahan, Donna, Personal Communication, 2005.