SHORT COMMUNICATION: CAST BRONZE MOUNTS FOR TEMPORARY EXHIBITIONS AT THE J. PAUL GETTY MUSEUM

MARK MITTON AND ADRIENNE PAMP

ABSTRACT—This article describes the use of cast bronze mounts for securing artworks while on temporary display at the J. Paul Getty Museum in Los Angeles, California, an institution located in an active seismic zone. The development of cast bronze mounts is documented by three exhibitions used as case studies. All mounts were made using the lost wax casting process and required the collaboration of mountmakers, conservators, and a private foundry. In two case studies—"Adriaen de Vries, Imperial Sculptor," displaying 40 bronze sculptures, and "Jean-Antoine Houdon, Sculptor of the Enlightenment," featuring 69 sculptures in bronze, marble, and plaster—the cast mounts were designed as generic clips that could be produced in large numbers. The production process varied for these exhibitions; for the Houdon exhibition, an engineering analysis was helpful in determining the appropriate size and number of mounting clips for each object. The remaining case study features a small number of highly individualized cast mounts designed for sculptures in the exhibition "A Royal Menagerie: Meissen Porcelain Animals."

TITRE—Supports en bronze moulé pour les expositions temporaires au *J. Paul Getty Museum* RÉSUMÉ—Cet article décrit l'utilisation de supports en bronze moulé pour le montage d'œuvres d'art dans les expositions temporaires au *J. Paul Getty Museum* à Los Angeles, en Californie, un musée situé dans une zone sismique active. Le développement de supports en bronze moulé est documenté par trois expositions qui sont utilisées comme études de cas. Tous les supports ont été fabriqués en utilisant le procédé de moulage à cire perdue et ont exigé la collaboration de monteurs, de conservateurs-restaurateurs et d'une fonderie privée. Dans deux études de cas—l'exposition *Adriaen de Vries, Imperial Sculptor* (Adriaen de Vries, sculpteur impérial), contenant 40 sculptures en bronze et l'exposition *Jean-Antoine Houdon, Sculptor of the Enlightenment* (Jean-Antoine Houdon, sculpteur du siècle des lumières), mettant en vedette 69 sculptures en bronze, de marbre et de plâtre—les montures moulées ont été conçues sous forme d'agrafes génériques qui pouvaient être produites en grand nombre. Le processus de production a varié en fonction des expositions; pour l'exposition Houdon, une analyse technique a été utile pour déterminer la taille et le nombre appropriés d'agrafes de montage pour chaque objet. Finalement, la dernière étude de cas présente un petit nombre de supports coulés très individualisés conçus pour les sculptures de l'exposition *A Royal Menagerie: Meissen Porcelain Animals* (Une ménagerie royale: animaux en porcelaine de Meissen).

TITULO—Soportes de bronce fundido para exposiciones temporales en el Museo J. Paul Getty RESUMEN—Este articulo describe la utilización de soportes hechos de bronce fundido para asegurar las obras de arte mientras están en exposiciones temporales en el Museo J. Paul Getty en Los Angeles, California, una institución ubicada en una zona sísmica activa. El desarrollo de los soportes de bronce es documentado por medio de tres exposiciones como estudios de caso. Todos los soportes fueron hechos por medio del método de fundición a la cera perdida y fue necesaria la colaboración de los fabricantes de soportes, los conservadores y un taller de fundición independiente. En dos estudios de caso—*Adriaen de Vries, Imperial Sculptor (*"Adriaen de Vries, escultor imperial"), donde se exhibían 40 esculturas de bronce, y *Jean-Antoine Houdon, Sculptor of the Enlightenment* ("Jean-Antoine Houdon, escultor del Siglo de las Luces"), que incluía 69 esculturas en bronce, mármol, y yeso—los soportes fundidos fueron diseñados como ganchos genéricos que se podían producir en grandes cantidades. El proceso de producción fue diferente para cada exposición; para la exposición de Houdon un estudio de ingeniería ayudó a determinar el tamaño apropiado y el numero de ganchos de soporte para cada objeto. En el otro estudio de caso fue necesario un pequeño numero de soportes fundidos muy individualizados diseñados para las esculturas de la exposición *A Royal Menagerie: Meissen Porcelain Animals* ("Una menagerie real: los animales de porcelana de Meissen").

TÍTULO—Montagens de bronze fundido para exposições temporárias no *The J. Paul Getty Museum*. RESUMO—Esse artigo descreve o uso de montagens de bronze fundido para a proteção de obras de arte durante mostras temporárias no *J. Paul Getty Museum* em Los Angeles, Califórnia, uma instituição localizada em área de atividade sísmica. O desenvolvimento de montagens de bronze fundido é documentado em

três exposições utilizadas como estudos de caso. Todos os suportes foram moldados por processo de cera perdida e demandaram a colaboração de montadores, conservadores e uma fundição privada. Nos dois estudos de caso - *Adriaen de Vries, Imperial Sculptor* ("Adriaen de Vries, Escultor Imperial"), expondo 40 esculturas de bronze, e *Jean-Antoine Houdon, Sculptor of the Enlightenment* ("Jean-Antoine Houdon, Escultor do Iluminismo"), apresentando 69 esculturas em bronze, mármore e gesso,—as montagens fundidas foram desenhadas como presilhas (clipes) comuns que poderiam ser produzidas em larga escala. O processo de produção variou para essas exposições; para a exposição Houdon, uma análise de engenharia ajudou a determinar o tamanho apropriado e o número de presilhas (clipes) de montagem para cada objeto. O caso restante apresenta um número menor de montagens fundidas com projetos altamente individualizados para as esculturas na exposição *A Royal Menagerie: Meissen Porcelain Animals (*"Um Royal Menagerie: Animais de porcelana de Meissen").

1. INTRODUCTION

The J. Paul Getty Museum organizes many temporary exhibitions that typically cycle on a 3-month rotation. The challenges of making mounts for a large number of three-dimensional loaned objects to be displayed temporarily are numerous. Important information regarding a sculpture's dimensions, weight, and condition obtained before the loan can be inadequate or inaccurate. It is difficult to understand the structural integrity of the work before its arrival; direct examination of an object by mountmakers and conservators is essential to determine mount requirements. Because the museum is located in a seismically active region, every object on display requires a mount capable of protecting it from a significant earthquake. Despite limitations in terms of time and access, a consistent level of care must be taken to protect objects during the mountmaking process.

When three-dimensional objects are the focus of a new temporary exhibition, a large number of mounts have to be produced within a limited time frame. An entire exhibition is typically unpacked and installed within 2 to 3 weeks. Often this translates into a 1- or 2-day turnaround per object. If couriers are involved, the schedule is particularly inflexible. Obviously, any part of the mountmaking process that can be performed before the exhibition's arrival will aid the installation. If access is provided to artworks before their arrival, considerable time can be saved, making it possible to meet tight installation deadlines. This early access makes it possible to take impressions in wax or silicone when practical or simply to take profiles that can provide contours for mountmaking. Taking a profile can be accomplished with a profile gauge that provides contours that can then be transferred to paper card stock and checked against the artwork.

The approach to mountmaking differs from exhibition to exhibition, depending on the nature of the objects involved. In two of the three case studies presented, "Adriaen de Vries, Imperial Sculptor" and "Jean-Antoine Houdon, Sculptor of the Enlightenment," the objects were similar in form, allowing for the use of generic clips. The third case study, "A Royal Menagerie: Meissen Porcelain Animals," involved uniquely shaped objects; therefore, standardized mounts could not be used and the design of the clips became highly individualized.

In all three case studies, the mounts are intended to secure three-dimensional objects onto display casework in the event of an earthquake; therefore, consideration has to be given to the artwork's material strength. The objects are composed of materials (i.e., bronze, stone, and ceramic) that will not bend during an earthquake; rather, the objects could potentially spall or crack where the clips are attached. The size and composition of the mount are critical; a wider clip spreads the load and reduces the risk of failure at the point of contact.

Because of the large number of mounts needed, casting was seen as an efficient alternative to hand-forming the mounts. Silicon bronze was chosen because the alloy is tough and corrosion resistant, and can be easily cast and milled as needed. It is also an acceptable display material that will not emit any harmful gas into the museum. This short communication chronicles the use of cast bronze mounts and how their design or fabrication process changed because of the specific situations.

2. CASE STUDY FOR "Adriaen de Vries, Imperial Sculptor"

In 1999 more than 40 cast bronze sculptures by Adriaen de Vries (1556-1626) arrived at the Getty Museum. The objects ranged from 46 cm (18 in.) to

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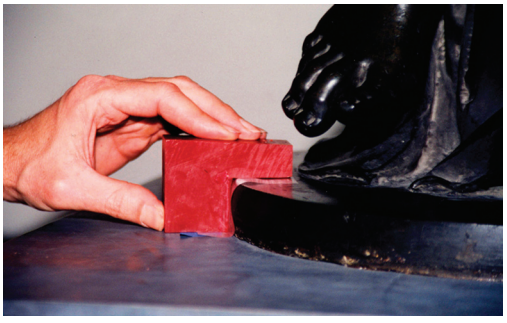

Fig. 1. Wax clip fitted against the base of the sculpture. Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

more than 2.4 m (8 ft.) in height. The goal was to create mounts that would secure the bases of the sculptures to their pedestals. The installation schedule dictated that mounts be fabricated and fitted before the objects arrived. Fortunately, the exhibition was first installed at the Rijksmuseum in Amsterdam, the Netherlands, so it was possible to see all of the objects as they were installed at the first venue. Creation of each mount as a unique structure was too time-consuming and difficult while the works were installed, so generic clips were created out of wax that could be fine-tuned for each object while on display at the Rijksmuseum. Once the wax models were finished, they would be sent to a foundry for bronze casting, thus producing a large quantity in a short time.

After the clip-making process was decided on, a generic wax model was designed that could be adapted for all the sculptures in the exhibition. A good deal of information regarding the objects' dimensions was obtained in advance, enabling the determination of overall sizes for the wax models. On approval of the mount design by the Exhibitions curatorial and conservation departments, a machinable casting wax manufactured by M. Argueso Company was selected to produce the models. The wax selected needed to be hard enough to withstand packing and transportation to and from Amsterdam.

The wax models were brought to the exhibition in Amsterdam to be fitted in situ. The height of the clip was determined and the wax models were cut to size using a heated knife. The model was then moved into position against the sculpture and checked for accuracy as illustrated in figure 1. With Mylar as a barrier between the wax and the sculpture, a soft dental wax manufactured by Heraeus Kulzer was added as needed to fill any gaps between the clip's interior and the sculpture. If necessary, a heat gun was used to further soften the dental wax before it was fitted against the sculpture. Each of the wax models was marked with an exhibition item number and an indication of its location on the object.

On completion of this phase of the project, the wax models were packed for the return trip to the United States and delivered to Decker Studios, a fine arts foundry in North Hollywood, California, to be cast in bronze. The next phase began once the cast bronze clips arrived at the Getty Museum. The bronze clips were drilled and the bottom tapped to attach them to pedestals. Threads were not cut on the wax models because of possible thread deformation during the casting process. The bases of the clips were tapped to allow threaded rods to secure them to the display pedestals. The threaded rod was screwed into the bottom of the clip, passed through a hole in the pedestal top, and was secured from below with a nut. This attachment design requires a pedestal that has an accessible interior. This means of attachment is preferred at the Getty Museum for objects of any scale because it is stronger than screwing the mount to the top of the wooden deck. In contrast, using screws in the wooden pedestal top poses the risk of screws tearing out or shearing off if they are subjected to enough force. Drywall screws in particular have poor shear strength. Lastly, the clips were given a chemical patina to match individual objects, and an acrylic felt barrier was attached to the inside surface.

3. CASE STUDY FOR "Jean-Antoine Houdon, Sculptor of the Enlightenment"

The methods used in the de Vries exhibition were adapted for "Jean-Antoine Houdon, Sculptor of the Enlightenment." The exhibition featured 69 sculptures made out of bronze, marble, and plaster. Once again, the installation schedule demanded that the large number of mounts needed to be made in advance. Two factors allowed for the use of the deVries prototype clip design: the sculptures were similar in form and the exhibition was on view at the National Gallery of Art (NGA) in Washington, D.C., which allowed Getty Museum staff to access the collection before the installation in Los Angeles, California. The mounts for the Houdon exhibition differed from those for the deVries exhibition in

the production process and the contracting of a seismic engineer to assist the mountmakers in calculating an appropriate size and number of clips per object. Professor Ziyad Duron of the Engineering Department of Harvey Mudd College performed ambient vibration monitoring of the special exhibitions gallery at the Getty Center, which then allowed him to devise a calculation spreadsheet for clips (Duron and Sutoyo 2003). He developed a calculation that included the gallery response characteristics, the frequency content of an expected earthquake, and specific information about the artwork, such as scale, weight, material densities (kilograms per cubic meter), and center of gravity. When the number of clips recommended per object was more than 4, base isolation of the pedestal was incorporated in the installation (Duron 2003) (a topic not discussed in this short communication). Often, for aesthetic and budgetary reasons, a compromise had to be made on the clip scale; however, there is often an extremely high factor of safety incorporated in engineering calculations.

In fall 2003, a Getty Museum conservator and mountmaker traveled to the NGA to see the sculptures as they were being installed to assess the objects and begin the mountmaking process. Sizing and fitting wax models would not be possible in the midst of another institution's installation period; therefore, a more efficient method was necessary. Silicone impressions were taken from the sculptures (only in the location where the clips would be positioned) using a fast-curing dental silicone manufactured by Coltène/Whaldent. This dental putty was chosen because it is firm, is easy to mix, and sets in only a few minutes. Plastic wrap was used as a barrier between the sculpture and putty. It is important to capture the angle of the pedestal deck and the side of the object in the impression, so the silicone putty was reinforced using strips of perforated aluminum sheeting as a backing. The perforation allowed the putty to penetrate and be captured, and the sheet metal could be bent to capture the plane of the deck. The result was an impression with very good fidelity to the original that could be taken back to the Getty Museum and cast in plaster. The plaster casts were then used to finalize clip production ahead of time. Figure 2 shows the resulting plaster cast of a section from a round, marble socle that was mounted with four bronze clips.

Three sizes of generic clips ranging from 7.6 to 18 cm (3 to 7 in.) in interior height were designed

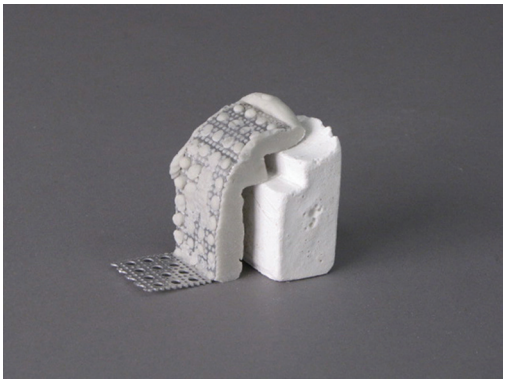

Fig. 2. Dental silicone impression with aluminum reinforcement (left) and plaster cast from impression (right). Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

based on dimensions obtained during the NGA visit. Wax models from these designs were produced by the foundry and cast in bronze (fig. 3). The bronze clips arrived at the museum and were cut to height for individual sculptures. Then the bottom of the clips were drilled and tapped to allow for connection to pedestals as described for the de Vries exhibition. The bronze clips were then ready to be fitted against the plaster positives. A layer of Phillyseal R epoxy putty was used to fill voids between the bronze clips and the contours of each sculpture. Plastic wrap was used as a barrier between the epoxy putty and the plaster to prevent sticking.

When the objects arrived for the Houdon exhibition the clips that were prepared using the plaster casts were test-fitted against the actual sculptures. The mount was assessed by temporarily securing the object to a deck, where the clips could be mechanically attached. This process was facilitated with pallets that had been previously fabricated. The wooden pallets supported the sculptures and allowed access so the clips could be secured to the pallet from below. Threaded studs that were fastened into the bottom of the clips passed through the slots and were secured underneath by washers and nuts. Slots cut into the pallets made it possible for clips to be moved into position against the sculptures, which primarily had round or square bases (fig. 4). The slots are cut in two patterns, depending on the shape of the base of the artwork: at right angles to one another for a square or rectangular bases or three evenly spaced slots

Fig. 3. Cast bronze clips in a range of sizes. Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

Fig. 4. Pallet with precut slots for temporary attachment of bronze mounting clips, allowing final measurements of positions for mounting holes in pedestals. Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

radiating out of a central point for a round base. These patterns eliminated the need to drill individual holes to locate clips for each sculpture. By placing a piece of 3-mm-thick Mylar between the sculpture and the platform and carefully marking the locations of the clips relative to the base of the sculpture, a template for drilling the actual pedestal was obtained. After fitting, filing, and painting, acrylic felt was attached to the inside of the clips and the sculptures were installed.

The installation went well, although the results of this production method were not as accurate as the one used for the de Vries exhibition. One of the possible reasons for the inaccuracy is that the dental putty appeared to distort and/or shrink over time. Also the aluminum sheet used as the backing material for the mold was not rigid enough to hold its exact shape during travel from Washington, D.C., to Los Angeles. Subsequently, more time was spent making minor adjustments to the prefabricated clips when the actual objects arrived. The procedure could be improved by casting the plaster replicas soon after making the mold, before the silicone can distort, and by using a thicker aluminum backing.

4. CASE STUDY FOR "A Royal Menagerie: Meissen Porcelain Animals"

Another opportunity to use bronze mounting clips came in 2001, when "A Royal Menagerie: Meissen Porcelain Animals" was exhibited at the Getty Museum, and the nature of some of these objects required a different approach from generic mounting clips. The porcelain objects in the exhibition were produced by the Royal Porcelain Factory in Meissen, Germany, around 1730. Frederick Augustus I, elector of Saxony, commissioned 259 nearly life-sized animals, and the objects represent a technical triumph in European ceramics. The works have rarely been seen outside Germany, and 14 of the animals were exhibited at the Getty Museum.

The objects ranged in height from 46 to 120 cm (18 to 48 in.), were fragile, and had many firing cracks that were of particular concern (fig. 5). Two conservators from Dresden, Germany, acted as couriers and remained with the objects during the installation process, and their intimate knowledge of the pieces helped immensely. Because the objects could not be viewed in advance, assessment for mounts had to be made on arrival. Many of the mounts could be concealed internally because all the pieces were hollow and most had openings large enough to fit a mount inside. When the openings were not large enough to accommodate a mount, external clips had to be fabricated. The base of the pieces that needed clips had no horizontal surfaces to allow for an L-shaped clip, such as the prototype used for the de Vries exhibition. An alternative approach by way of an armature that extends up the backside and grabs the object from the top was not acceptable to the curators for this exhibition. Several stops placed strategically around the base of the objects would prevent horizontal movement but would need to be tall to prevent the sculpture from tipping or

Fig. 5. Firing cracks in porcelain animal. "Fox with a Chicken," Johann Gottlob Kirchner, ca. 1732, J. Paul Getty Museum (2002.47). Height, 46 cm (18 in.); width, 34 cm (13⅜ in.); depth, 20 cm (8 in.). Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

lifting, which also posed an aesthetic problem to the curators. The ideal scenario was to produce thin clips around the base (large enough to avoid the porcelain failing in a seismic event) that would conform to the complex contours of the objects' exterior shape with a tight enough fit to capture grooves as shallow as 2 mm (1/16 in.) in depth. In addition, firing cracks had to be avoided when choosing locations for mounts.

Casting bronze mounts was the solution again. Individualized clips were formed with thin sheet wax, slightly warmed to conform to the complex shape of the area being mounted. When cast in bronze, the thin, tall mounts would be strong enough to hold the sculptures. Because only a few mounts had to be made and bronze casting at a foundry is a time-consuming procedure, the casting was performed in-house using jewelry-making equipment, with consultation from Decker Studios. The fit and function of the cast bronze mounts were excellent, such that the padding between the clip and the object could be thin polyethylene suede. To make them less noticeable on display, the clips were easily primed and painted to match the porcelain glaze (fig. 6).

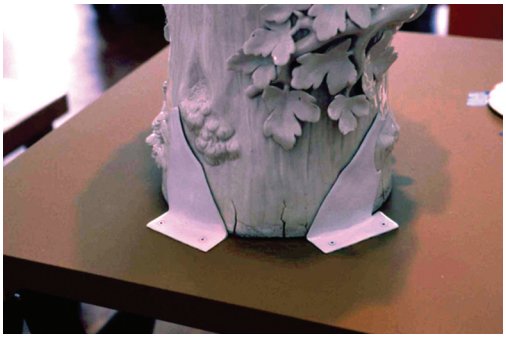

Fig. 6. "Bearded Vulture" from the Staatliche Kunstsammlungen, Dresden, on display with cast bronze mounts. Johann Joachim Kandler, 1734. Height, 80 cm (31½ in.); width, 45 cm (17 1/16 in.); depth, 31 cm (12 3/16 in.). Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

5. DISCUSSION

Cast bronze mounts were developed at the Getty Museum to produce a large quantity of mounts for loan objects on temporary display. This first generation of mounts to be used in the new Special Exhibitions Gallery at the Getty Center represented a response to the demand for a large quantity of mounts to be produced in a limited time frame. The lessons learned from the case studies presented in this article inform the present method of mount fabrication. At this time the direct method of casting bronze clips, as used in the de Vries exhibition, is seldom used for temporary exhibits. Although excellent results were achieved in terms of fit and function, the necessary advance access to the artworks is not always possible. The indirect method for creating bronze clips, as used in the Houdon exhibition, is labor-intensive, and the accuracy of the results varies. The experience gained in the creation of the cast bronze clips used in the first two case studies has led to the use of the same techniques for making other clips, such as those made from machined steel. The temporary attachment of the mounting clips to the object on the pallet allows both the determination of the clip position and the molding of epoxy putty for exact duplication of the object base details (fig. 7). The result is not as streamlined in appearance as a unique, hand-formed mount, but the excellent fit, coupled with a quick turnaround time, makes this type of mount extremely useful in temporary exhibitions.

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Fig. 7. Fitting of machined steel mounts using methods developed from use of cast bronze mounts. An object is shown placed on the pallet of fig. 4, and the machined steel mounts are attached through the slots in the pallet. Beneath the clip on the right is the isolating plastic sheet and epoxy fill to conform exactly to the object base. Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

Cast mounts seem to be best suited for the complex, highly individualized type of mount described in the Meissen case study. Forming the initial model out of such an easily manipulated material as wax facilitates the capture of complex shapes and minute detail. The result is a highly contoured, extremely strong yet thin mount. An example of the recent use of this type of cast bronze mount is the support for the "Warrior on Horseback" (acc. no. 84.SB.90), attributed to Willem van Tetrode (ca. 1525-1580), on display in the Getty Museum permanent galleries. The weight of the sculpture rests on the two back legs of the rearing horse. The rear hooves also serve as the attachment points to the socle. Over time, a break developed on one of the legs that had been repaired twice before. A mount was needed to reduce the load on the often-repaired leg. A wax model, consisting of a support rod and a "seat," was made, fitted against the sculpture, and then cast in bronze, producing a strong, discreet mount (fig. 8).

6. CONCLUSION

This article details the implementation of the lost wax casting technique to produce mounts for artworks to be displayed at the J. Paul Getty Museum. Casting bronze mounts was first conceived as a way to produce the large quantity of mounts needed to meet an accelerated exhibition schedule. In developing

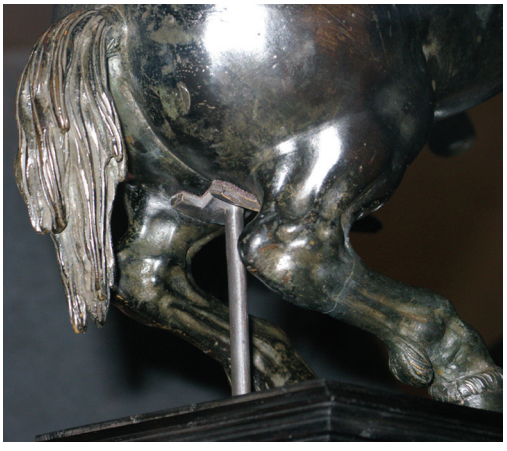

Fig. 8. Cast bronze mount for "Warrior on Horseback." Attributed to Willem van Tetrode, ca. 1560, J. Paul Getty Museum (84 SB 90). Bronze. Height, 40 cm (15⅝ in.); width, 28 cm (11 in.); depth, 49 cm (19¼ in.). Courtesy of the Decorative Arts and Sculpture Conservation Department, J. Paul Getty Museum.

cast mounts for two large exhibitions, the concept emerged of creating premade generic clips that could be customized later. The generic clip was developed during the production of cast bronze mounts but is not limited to that process; these clips can be fabricated, milled, or hand-formed from a range of materials. The Getty Museum currently fabricates more often than casts generic clips. The casting of mounts is reserved for instances where an object's complex contours or the need to capture shallow surface detail makes a hand-formed mount too obtrusive to be aesthetically acceptable.

ACKNOWLEDGMENTS

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Professor Ziyad Duron of Harvey Mudd College in Claremont, California.

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SOURCE OF MATERIALS

Coltene 8805 Lab Putty
Coltène/Whaledent Inc.
235 Ascot Pkwy.
Cuyahoga Falls, OH 44223
www.coltene.com

2-U660 Machinable Wax
M. Argueso and Co. Inc.
2628 River Ave.
Rosemead, CA 91770-3395
626-573-3000
626-573-3005

Utility Wax Strips
Heraeus Kulzer Dental Products
300 Heraeus Way
South Bend, IN 46614
800-431-1785
customer.serviceHKNA@heraeus.com
http://heraeus-dental-us.com/en/ourproducts/dentistry_1/dental_start.aspx

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