Modern Statues and Traditional Methods

A Casting Workshop in Chamba, Himachal Pradesh, Northwest India

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Introduction

Northwest India is renowned among art historians for the Buddhist and Hindu copper alloy statues produced there during the medieval period (7th through 15th centuries). The iconography of these statues is often complex, and the craftsmanship superb. One typical example is illustrated here (Fig. 1). This image represents the four-armed form of the Hindu god Vishnu. He stands with his upper hands holding a conch shell and a lotus flower, while his two lower hands rest atop the heads of his personified weapons, Gadadevi and Chakrapurusha. This particular representation of Vishnu was especially popular throughout medieval northwest India.

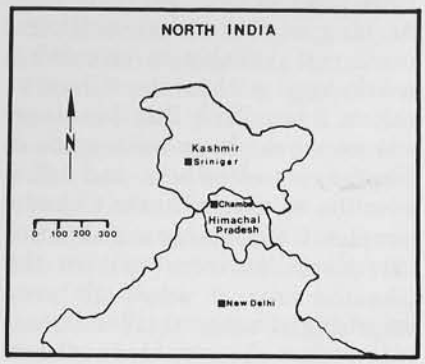
During the medieval period, the area surrounding the town of Chamba in the state of Himachal Pradesh (Fig. 2) was an important political and artistic center. Although archaeological evidence concerning metal casting and artistic production there is scanty, some artwork of the period still remains in the local temples, and a number of statues now in museums and private collections are attributed on a stylistic basis to Himachal Pradesh and to Chamba. (For a wide range of examples see Postel, Neven and Mankodi 1985.)

In order to better understand the casting and decorating features observed on these medieval statues, in 1983 I visited a modern workshop located in Chamba that produces statues technically similar to the older pieces. Techniques of manufacturing and decorating were observed as an aid to understanding the procedures which may have been followed by local artists during the medieval period. This fieldwork is part of a long-term project at the Los Angeles County Museum of Art Conservation Center, in which technical analyses, including studies of casting and decorating techniques, have been used to help establish the regional provenience of medieval Himalayan copper alloy statues.

1
The four-armed form of the Hindu god Vishnu was a popular image in medieval northwest India. This bronze can be attributed to Himachal Pradesh of the 8th or 9th century A.D. (Collection of Mrs. J. LeRoy Davidson)

Geographical and Historical Background

The modern town of Chamba is located along the Ravi river in Himachal Pradesh. The medieval territory included several other towns and small villages surrounding the town of Chamba itself. The administrative capital of the territory during the early medieval period was located 65 kilometers away at Brahmor, but was moved to Chamba in the 10th century. The town occupies a half-mile wide shelf and part of the surrounding hillsides above the Ravi river. Because of the mountainous terrain, historically the economy of Chamba has depended more upon its rich forests and abun-



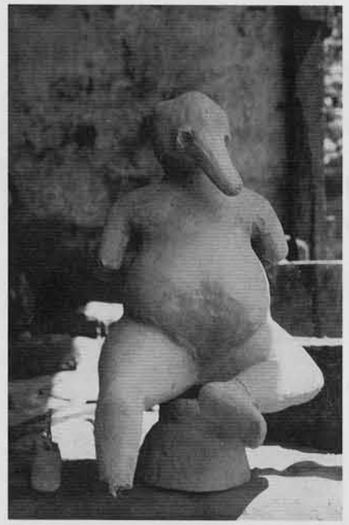
2
Chamba is located in the state of Himachal Pradesh, in the northwest corner of India. For a general map of India, see Horne, Fig. 3, this issue.

dant game than upon agriculture. One advantage of the relatively plentiful supply of trees this region enjoys is that it is possible to acquire locally the wood needed to produce charcoal for smelting ores and melting metals.

Both technically and stylistically, museum statues attributed to medieval Chamba and nearby areas of Himachal Pradesh are very similar to objects produced in the major casting workshops of medieval Kashmir, so distinguishing between production areas is difficult. Links with the nearby Kashmir Valley were strong during this period, both politically and culturally. In the 11th century Chamba was invaded by Kashmir, and remained dependent upon it for many years. There were intermarriages between the ruling families of each state, as well as exchanges of royal visits and other interaction (Negi 1963:108-117).

There is some evidence to support the idea that statues were in fact cast in workshops located in the Chamba area, rather than being exclusively imported from the much larger artistic center of Kashmir. A small group of large-sized copper alloy statues still in use in temples of Chamba District have Sanskrit inscriptions on the bases identifying the patron as Meru Varman, a Chamba king who ruled the area in the early part of the 8th century. The statues range up to 5 feet in height, and show a high degree of sophistication in metal technology. The artist is named in the inscription as a workman called Gugga (Vogel 1904:239-244 and 1911:138-145). As long as there were sufficient resources available to establish a workshop within the Chamba region, it is unlikely that these large statues would have been made in Kashmir or elsewhere and taken over the mountains to the Chamba temples. If these large and sophisticated statues were cast in the Chamba area, it would be very surprising if other smaller statues were not also cast in those workshops.

Additional evidence for the occurrence of medieval period casting in the area is the presence of now-abandoned copper mines near several small villages in the hills outside the town. Local traditions indicate that the mines were in use as far back as the medieval period (Charak 1979:8;Negi 1963:119;Dunn 1964:97). Thermoluminescence dating at the Los Angeles County Museum of Art Conservation Center of copper slag recovered from an abandoned smelting site 12 kilometers outside of Chamba indicates the slag was produced during the medieval period. Although we cannot determine whether the smelted copper was used for producing art objects or utensils, we do know that locally produced metal was available to the artists of the region.



3
Clay core constructed for a statue of Ganesha, the elephant-headed god.

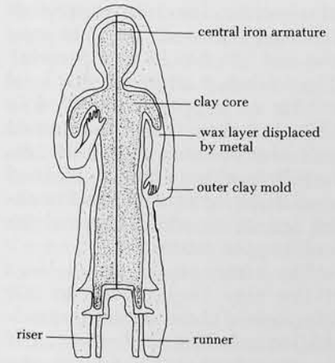
4
Artist Prakash Chand Anand in his workshop carving the wax model for a small solid statue.

Medieval period statues attributed to northwest India have several casting and decorative features in common. All were made by the lost wax process (see below). The majority of the larger statues are hollow with a modeled clay core; smaller statues are usually solid. The hollow statues often have an iron armature running up the center of the figure, and some objects also have armatures in the arms and legs. Casting flaws were usually repaired with a small metal rectangle hammered into an area that had been outlined and partially chiseled out around the flaw; the repairs are generally unobtrusive. High quality copper and silver inlay work commonly decorates the statues, especially the eyes and lips.

Current Technology: The Chamba Workshop

The presence in the town of Chamba of a casting workshop producing traditional religious statues provides an opportunity to study casting and decorating methods which are very similar to those used to produce medieval statues, and to document the range of methods employed by the modern village artists. The artists discussed the general organization and procedures of the workshop, and both the traditional lost wax casting and the more recent sand casting processes were observed.

Religious statues and utilitarian objects are produced in brass, bronze, or unalloyed copper at the workshop of Prakash Chand Anand located near the center of town. The workshop occupies only a small amount of space, approximately 3 meters by 6 meters. It is here that wax models are constructed, and



5
A cross-section of a completed investment assembly for lost wax casting illustrates each of the various assembly stages.

6
The wax model inside the investment is melted out by immersing the mold in a fire at the casting site.

the finishing and decorating steps performed. The casting itself takes place at another workshop at Mr. Anand's home, located on a hill outside of town.

Mr. Anand has trained several apprentices and currently has working with him one advanced apprentice, Hakam Singh, and several junior apprentices, including his son. Mr. Anand's father was also a metalworker, and passed his knowledge on to his son, although the father made only everyday utensils rather than statues. Hakam Singh's father was a goldsmith, and he himself works as a dentist when not pursuing his craft. Mr. Anand would be willing to take on as an apprentice anyone who sincerely wants to learn the craft of metalworking, regardless of his background and whether or not he comes from a family of metalworkers.

Prakash Chand Anand is a well-known and highly respected artist, and has received a National Award for Mastercraftsmen in India. Both he and his apprentice Hakam Singh (a state award winner) have exhibited their work in museums such as the Himachal Pradesh State Museum in Simla. Still, the number of commissions received for producing art objects is not enough to support them and their families, and they depend upon commissions for producing everyday utensils.

Most of the statues they make are commissioned by local people who then donate them to one of the temples in Chamba or nearby villages. The statues require a large investment in expensive materials and in time, so the artists cannot simply produce works which they like and then attempt to sell them later. Instead, statues are always produced individually for specific patrons, according to their particular requests. The Chamba artists make use of a variety of materials and techniques, depending upon what the patron asks for and can afford. They are capable of producing images of any size or subject matter in brass, bronze, or unalloyed copper, with few finishing embellishments or with intricate inlay work.

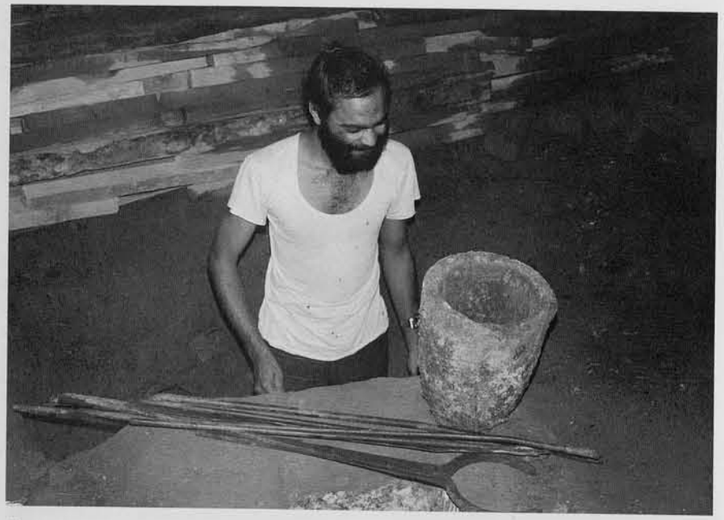
Preparing for Casting

The majority of statues made in the Chamba workshop are produced by lost wax casting. The first step in producing such a statue is usually to model a clay core (Fig. 3). A coarse, sandy clay is obtained near the local riverbed (there are no special deposits from which it is always collected), and mixed with fibers or rice hulls before use. A system of iron rods or wires (armatures) is needed to support the core. This system will usually include a large central armature, and other smaller ones going into the arms and legs. Sometimes grass is wrapped around the iron armature, and the clay packed over that.

The next step is to form the wax model over the clay. If the statue is to be solid, a wax model with no clay core is carved instead (only very small pieces are cast solid). Although apprentices may be employed to carry out many steps in the casting and finishing process, the artist always prepares the wax model himself: it is this image that will determine the artistic quality of the finished statue (Fig. 4).

Sometimes for very large pieces the artist will first make a clay prototype. Using that as a model he will construct a hollow wax figure which is later filled with wet clay to form the core. A simple iron armature will then be pushed into the center of the piece.

A channel for pouring the metal into the mold (runner) and another for release of gases (riser) are attached to the wax model. The wax is then covered by several layers of clay (investment) which reproduces an exact imprint of the wax image on



7
For casting large statues, an indoor furnace dug approximately 1 meter into the ground is used, along with a crucible that has the capacity to hold 50 kilograms of metal.

8
Appearance of the inside of the bucket furnace showing the small opening into which fuel and the crucible are placed.

the inner surface. Iron nails (chaplets) may be used to help hold the wax-mold assembly together, and are found to be especially necessary at the back of the head. The artists make the chaplets and armatures themselves in the workshop.

When the assembly of clay core, wax model, and investment is complete (Fig. 5), it is placed in a fire to melt the wax (Fig. 6). The wax is poured out of the mold, leaving a cavity for the molten metal.

Casting the Statue

The metal used for casting is often obtained by melting copper or brass bowls, utensils, and remnants of runners and risers from previous castings, although the artist may also buy new blocks of pure metal. The workshop artists say that local mining of copper ores ended in Chamba when the British gained control of the area in the 19th century. Before then a few families had specialized in the mining and smelting operations which supplied the local copper market.

The artists report that a large statue may require 200 to 300 kilograms of charcoal (locally available) to melt the metal for casting. If large statues are to be cast, or many objects are to be made at once, a large furnace dug into the ground is used along with a crucible having a 50 kilogram capacity (Fig. 7).

For smaller objects a very small furnace is used which requires much less fuel. This furnace is constructed from a metal bucket lined with clay. When the artists are ready to cast, slag from the previous casting is hacked off the inside surface of the bucket, and it is relined with a mixture of sand and clay (Fig. 8) and allowed to dry in the sun. A hand-powered air pump is connected to a tube at the bottom of the furnace. Wet mud spread along the bottom of the bucket and around the tube makes an airtight seal, preventing air from leaking out, forcing it to move up into the coals. Rocks are placed around the base of the air pump for stability (Fig. 9).

The furnace is filled with wood-shavings used to start the fire, then gradually larger pieces of wood are added as the fire builds, aided by the air pump. Finally, coals are piled up inside the furnace. The metal to be used for the casting is prepared for melting.

A crucible filled with metal is placed in the hole at the center of the furnace, and coals are packed around it (Fig. 10). The top of the crucible is covered with a sheet of metal to hold in heat. A white powder called ***suhaga*** is added to help purify the metal during melting, resulting in fewer casting flaws. X-ray diffraction analysis of a sample taken back to the laboratory shows that this powder is tincalcinite, the dehydrated form of borax. This mineral has traditionally been used in the Himalayan region to improve

the melting process in casting, and was a major export item from Tibet (where it is called *tsha-la dkar-po*) into northwest India, Nepal, Bengal, and Bhutan (Dagyab 1977: 47;Turner 1800:371,406-407). The addition of this powder causes slag to form along the inside of the furnace. Small chunks of this foamy slag are seen scattered around the workshop, sometimes still attached to chunks of clay that had lined the furnace.

When the metal is molten, the mold assembly (Fig. 5) is turned upside down and the metal is poured in through the runner, displacing air which escapes through the riser. If air or other gases are trapped inside, bubbles and casting flaws occur in the statue. The poured metal will take the shape of the imprint which has been formed in the clay mold by the wax model. Cold water is sprinkled over the investment to speed the metal solidification process. After the metal has completely solidified, the clay investment is broken away, and the runners and risers cut off.

The Chamba artists prefer to cast a statue upside down through a runner and riser on the bottom of the piece, since this leaves casting defects on the underside of the base. For objects that are very large, the artists cast the piece face down at a slight angle, so that the head is lower than the feet. In this case the metal is poured in through a runner and riser on the back.

Finishing and Decorating

When the investment is first broken away from a newly cast piece, the surface of the statue exhibits a casting skin and irregularities that must be removed by polishing (Fig. 11). A large statue may require approximately fifteen days of filing and sanding down. The Chamba artists report that the traditional method of finishing the surface was to rub it with river sand, although they themselves use metal files. Repairs of casting flaws are done by cutting out a piece of metal to precisely fit the flaw and hammering it into place, using the same

9
Completed furnace assembly with handpowered air pump supported by large rocks on each side.

10
The crucible is packed into coals and filled with scrap metal ready for melting.

basic technique that is described here for inlay work. No adhesives are used.

Some decorative features may be carved into the wax model prior to casting. These decorations are usually further refined by chiseling, chasing, and engraving after casting has been completed (Fig. 12). Copper, silver, stones, or glass may then be inlaid into precast cavities, depending upon the wishes of the patron. Only pure copper and silver metals are used for inlay pieces, since they soften more easily than an alloy and are easier to work with.

The inlay work can be very time consuming. I observed the job of inlaying silver into both eyes of a statue, which took half a day. Ac-

11
A newly cast object showing the presence of a casting skin and surface irregularities that will need to be smoothed by filing. The protrusion on the bottom of the piece was formed by metal which cooled in the runner and riser channels, and will be cut off and filed down so that the statue will stand flat on its base.

12
A brass statue that had extensive decorative features carved into the wax model, including a crown, earrings, necklace, belt, scarf, and objects held in the hands. These were further refined by chiseling and chasing after casting.

cording to the artist this is one of the easier and faster types of inlay work. Lips are commonly inlaid with copper, which is a lengthier task since it is difficult to shape the inlay pieces for lips.

The tip of the iron chisel to be used for the inlaying process is first hardened by being heated in the fire and then quickly cooled in water. The chisel is then immediately buried in clay for a few minutes to pull all of the remaining heat out of the upper part before it can travel down into the water-cooled tip, and reheat and soften (anneal) it. Throughout the day's work the artist constantly reworked the tip to make it perform exactly the way he wanted it to. No standardized tool set exists in the workshop, since even within one job the artist constantly changes his tool's size and shape by heating in the fire, hammering, and cooling.

For the inlaid eyes, the artist first deepened the incised line delineating the eyes, then chiseled out the area (see cover). Some carving had already been done in the wax, and thus needed only to be refined in the metal. The exact size of the eye area is measured with calipers, and the artist cuts from a sheet of silver a piece slightly larger than needed. This piece is rounded and arched by hammering it into a depression in a cube covered with rounded holes of many different diameters. The inlay piece is then filed down to the necessary size. For shaping and hammering the silver more easily, a coal is placed on the edge of the inlay piece to heat and soften it.

The already molded silver is initially set inside the eye hole by hammering with a round-bottomed tool. A flat punch is then used to set in the edge. The same tool is used to firmly pound the entire silver piece into place. Because the hole is undercut and the silver piece is pre-arched, when the piece is punched in the center it will spread out underneath the brass edge of the eyes. Since the hole is wider at the base than at the top the inlay piece cannot fall out.

The artist finishes by marking out the pupils of the eyes, which are then outlined with a rounded chisel. The sharp point of a punch is used to indent the center of the pupils which are then filled with carbon from charcoal to make them black.

Sand Casting

Small solid objects of simple detail may be produced by sand casting. A bucket of sand is heated

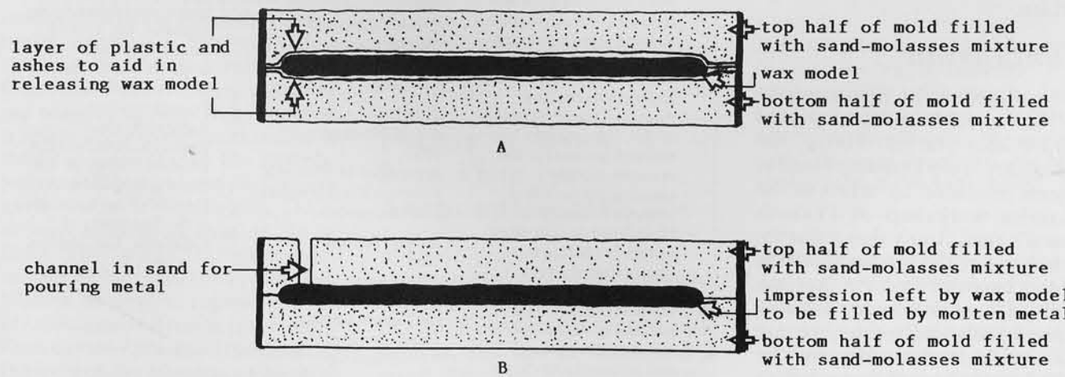
13
The sand mixture is packed into the bottom half of the mold first, around the wax image that is to be reproduced in metal. The object in the right background is a block of wood that will later be used as a stand on which to place the mold.

14
When the first half of the mold impression has been produced, ashes are sprinkled over the top of the sand, in the impression, and over the wax image. The other half of the mold will be placed over this one and packed with sand to produce an impression in it also (here the two wax images are a trident and a small disk).

over charcoal, with approximately 2 cups of molasses added initially to make the sand stickier. The sand is slowly mixed by hand and by feet to the desired consistency—the molasses is easily incorporated because of the heating process—and is kneaded to squeeze out all lumps. The mixture is then dried in the sun so it will reheat enough to allow the molasses to be mixed more fully with the sand. The sand-molasses is continually mixed and kneaded as another cup or two of molasses is slowly added. At this point about 2 cups of fine clay are added to give more coherence to the mixture, and it is kneaded once more. The mixture is now about as viscous as a thick cookie dough, and is set into the sun to be reheated on a flattened sheet from an oil drum. The final sand preparation is covered with a burlap bag and moistened with a few sprinkles of water.

The wax image that is to be reproduced is placed in the bottom half of a metal form or mold. A sheet of plastic is placed over the wax, followed by a thin layer of ashes, and the sand mixture is packed around that layer (Fig. 13). The plastic lining will prevent the sand from sticking to the wax model. The Chamba artists report that sand casting is a new technique in their region, since before plastic was available they had no method of keeping the sand from adhering to the wax image.

The sand is pounded in tightly, and leveled to the top of the mold. When the sand is well packed, the



15
A cross-section of the completed assembly illustrates each layer required for the sand casting process.

assembly is turned upside down so the wax image is now on top. When it is removed (along with the plastic sheet), an impression of the image remains in the sand.

Ashes are sprinkled over the top of the sand and in the impression. The wax image is then put back into its impression, sprinkled with ashes (Fig. 14) and covered with a plastic sheet. Now the other half of the metal mold is placed on top of this one, and filled with sand which is packed around the wax and its plastic lining (Fig. 15). The artists firmly pack the sand by standing on top of the mold and pounding with their feet.

The two halves of the mold are separated, and the wax image (and plastic lining) removed. An impression now exists in both halves of the mold. A channel is cut through the sand so the molten metal can enter into the impression. The molten metal is poured down from the top of the mold (Fig. 16). After only a few seconds the mold is broken open, and the inner layer of the molasses-sand mixture, which has baked onto the sides, is pulled off (looking and smelling like hard molasses cookies). These molasses pieces are saved, crushed up, and later reused.

As soon as they have cooled enough, the metal objects are ready for removal from the mold. According to the artists, sand cast objects do not require as much finishing time as objects produced by lost wax casting (perhaps only an hour or two), as they generally come out of the mold with a much smoother surface.

Conclusion

Northwest India is particularly well known for its medieval period copper alloy statues. Today, the high quality of workmanship found in objects produced by artists in the Chamba workshop of Prakash Chand Anand clearly shows that the techniques of the medieval artistic centers have not died out. Instead, traditional methods, augmented by modern tools and techniques, are still used in Himachal Pradesh by skilled artists to produce religious statues and everyday utensils for local consumption.

16
After the wax model has been removed, molten metal is poured from the crucible into the sand mold through an opening on top which is connected to a channel leading to the impression made by the wax image. The bucket furnace sits in the left background.

Chandra Reedy received her Ph.D. in Archaeology in March 1986 from the University of California, Los Angeles. Her areas of specialization at UCLA were the Himalayan Region and Archaeological Science. She is currently an Andrew W. Mellon Fellow in Conservation Research at the Los Angeles County Museum of Art. Her primary research projects at the museum include carrying out technical analyses of medieval Himalayan copper alloy statues for aiding provenance attributions; and reviewing current methods of statistical analysis of data in art conservation research and archaeometry to try to develop new approaches to the use of statistics in those fields.

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