EXPERIMENTAL RECONSTRUCTIONS OF COPPERWORKING TECHNIQUES OF THE PRE-COLUMBIAN PEOPLES OF THE EASTERN WOODLANDS

THESIS

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by

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For my Mother, Rita Ann McCarthy, for all her support and love.

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CHAPTER 1

INTRODUCTION

If I would study any old, lost art, I must make myself an artisan of it (Frank H. Cushing, 1895).

The artistic tradition of Pre-Columbian copperworking in North America has had a long and continuous history dating back to at least the early stages of the Middle Archaic (B.C. 5000 - 3000)(Halsey 1996:11; Martin 1999:143). For thousands of years indigenous Native Americans exploited and mined large copper deposits from the Lake Superior region and the Appalachian Mountains or from the glacial drifts located in the Mississippi and Illinois River valleys. These aboriginal peoples traded this rare and exotic material to cultures existing in all regions of the prehistoric Eastern Woodlands of the United States (illustration 1.1).

Certainly the non-technologically complex recipients of copper worked it into a multitude of utilitarian and ritually sacred objects. However the exact methods used by native craftsmen to work the copper has been lost over time and can only be reconstructed today by careful replication. It is the goal of this applied thesis project to fabricate these copper objects by utilizing carved wooden templates. I will demonstrate that this template method is most likely the manufacturing process used to create these ritually powerful objects especially during the Hopewell (A.D. 1 - 400) and Mississippian (A.D. 900 - 1600) Periods.

A few amateur and professional scholars have attempted to reproduce some copper artifacts but the near absence of research into the technological methods and procedures used in creating these sacred objects warrants further study. Early experiments in indigenous copper working were performed by noted archaeologists Frank Hamilton Cushing and Charles C. Willoughby at the conclusion of the 19th century. However, not until the conclusion of the 20th century that a few scholars would again attempt to discover how these specialized artifacts were both crafted and created (Leader 1998; LaRonge 2001; Neubauer 2003).

To accomplish the goals of replicating the copper-crafting methods I must first revisit with these few researchers who have experimented in copper to see their methods. In Chapter Two, I will present a brief description of their works.

To work copper, one must first understand the physical and mechanical properties of the metal. Therefore, in Chapter Three, I will discuss the physical characteristics of copper.

In Chapter Four, I will explore the techniques for crafting copper objects. It is likely that the tools used for the fabrication of these copper artifacts were modifications of stone, shell, and wood artifact technologies.

In Chapter Five, I will look at the cultures of the Eastern Woodlands that worked and used copper in their daily and ritual lives.

In Chapters Six through Nine, I will present my specific methods, techniques, and tools used for fabricating these copper artifacts. This will include the use of carving wooden templates and use of pine pitch. By utilizing line drawings and published photographs of the copper plates, I will illustrate the methods of replication using different crafting methods. I will show the steps on how I created the different pieces through the use of my photographs and illustrations.

Finally, no discussion of the Pre-Columbian Native American use of copper can develop without an understanding of the sacredness of the material. Chapter Ten will present the roles, meanings, and ritual beliefs surrounding copper in the Eastern Woodlands. With that in mind, I will further propose criteria for identifying the ritual and ceremonial boundaries that not only surrounded copper workshops, but also infused those workshops with sacredness.

The thesis will conclude by presenting my findings and discussing questions that surfaced during the work and possible avenues for future investigations in the subject.

My experiments will assert that: 1) Later Mississippian copper plates and costume regalia could have been fabricated utilizing carved wooden templates; 2) that the use of templates would have been the first stage of copper plate construction; 3) that readily available pine pitch employed in ceramic crafting and lithic production in conjunction with templates would have been used in copper plate construction; 4) that duplication of certain copper objects such as badges of office and costume regalia would have been made easier by the use of templates.

In the long run, it must be kept in mind that the limited experimental reconstructions and analysis proposed in this thesis demonstrate the possibility of a number of manufacturing methods. My skills in copper working are limited to only a few short years compared to the lifetime of learning, training, and practice that supported aboriginal artisans.

Background

There has been an abundance of academic research on the origins of the raw copper used by aboriginal Native peoples to create these wonderful artifacts (Griffin 1961; Bastian 1963). Research has also focused on the categories of copper artifacts created with the procured copper including tools, costume regalia, plates, earspools, and projectile points (Brown 1980; Goodman 1984). Early tool manufacturing was limited in typology while later periods saw a plethora of styles and uses. Finally, much work has been accomplished to pinpoint the origins of raw copper sources, as well as the areas where the finished goods were traded (Goodman 1984).

Copper was most-likely first exploited by Native Americans of the Archaic Period (8000 - 1000 B.C.). Copper was intensely utilized by artisans during the Middle Archaic (5000 - 3000 B.C.) through the Middle Woodland (150 B.C. - A.D. 500), and was acquired from the large copper deposits of the Lake Superior region. Also float copper was found in the glacial tills of Illinois, Indiana, and Ohio. After the decline of the Middle Woodland Hopewell

Interaction Sphere[1] which saw exotic raw materials moving over long distances, Mississippian period cultures appear to have lost the knowledge of the northern copper resources exploited in earlier eras. These Mississippian craftsmen took advantage of glacial float copper deposits and exposed outcroppings scattered throughout the Appalachian Mountain range (illustration 1.2).

As has been previously stated, long-distance trade in non-local exotic resources began early in North American prehistory. Raw copper was extensively traded throughout the northeastern and southeastern United States during all prehistoric cultural periods. A dramatic example of this trade are copper artifacts made from copper originating from the Lake Superior region excavated by archaeologists at the large Middle Archaic sites of Poverty Point, Louisiana and at Crystal River in Florida (Trevelyan 2004:179). Remarkably, Middle Woodland Ohio Hopewell peoples are known for their wide-ranging exchange of exotic raw materials from such distant places as Wyoming, North Carolina, North Dakota, Lake Superior, and the Gulf Coast. Later Mississippian groups also traded rare non-local materials and finished goods. These raw materials and

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[1]An influential trade network involving the exchange of exotic raw materials, artistic concepts, and technological ideas over vast geographic distances (Baugh and Ericson 1994).

worked goods are found throughout the Eastern Woodlands particularly at the Great Mortuary site at Spiro located on the Arkansas River. Singularly, worked copper was also discovered as far north at the Aztalan village and mound site in south-central Wisconsin.

During the Middle Archaic Period, artifact fabrication of copper served originally as ornamental objects and functional tools. This is not to say that the artifact fabrication of earlier periods was simplistic as the process of transforming raw copper into useful objects required skilled crafting. Specifically, Archaic peoples created from copper, large cold-hammered socketed projectile points, semi-lunar knives, and an abundance of ornamental beads (illustration 1.3).

However, by the Middle Woodland period (200 B.C. - A.D. 400) copper utilization had gradually evolved and shifted to assume a more ceremonial function. It is during this time period that the use of carved wooden templates might have first been employed by Native craftsmen. The later Middle Woodland Hopewell culture (1 - 400 A.D.), which flourished in central and southern Ohio, practiced detailed mortuary rituals and constructed numerous large-scaled earthworks. An intricate component of these burial practices appears to have been copper objects. Copper was transformed by Hopewell artisans into elaborate geometric cut-outs and realistic representations of falcons and bears (illustration 1.4). Also representational of the Hopewell culture were the thousands of finely crafted copper earspools found interned within the burial mounds (illustration 1.5).

Following in the tradition of the Middle Woodland Hopewell, the function of worked copper during the later Mississippian Period (900 - 1500 A.D.) continued to be ornamental and to be utilized for specific ritual functions. Native Americans, using technologically simple stone, bone, and wood tools as well as specialized smithing techniques, transformed their limited copper resources into elaborate and detailed ceremonial and religious objects. Mississippian Period copper excavated from mound burials included the multitude of Birdman effigy plates from the Spiro Mound Site in Oklahoma and the stunningly detailed Rogan Plate from the Etowah Mounds of Georgia (illustration 1.6). In my opinion, the specialized skills needed to transform copper into even the simplest of artifacts required extensive training. It can be speculated that a well-organized division of labor, from procurement of the raw resource to the completed product, existed in the manufacture of copper pieces during all time periods. It can be also assumed that since the copper was only used for the construction of elite religious artifacts that only individuals with the necessary talent and extensive training would have worked such a sacred and highly-coveted metal.

Finally, novice craftsmen would have likely studied under master copper-workers in restricted kinship moieties or societies. In many non-technological societies, this initiation occurred in workshops that the uninitiated were possibly not allowed to view (Herbert 1993). The creation of copper artifacts, at least in the later Hopewell and Mississippian periods, likely involved a great deal of ritual and ceremonialism that visually sanctified the process of the raw copper becoming finished pieces.

CHAPTER 2

STUDIES IN EASTERN WOODLAND COPPER CONSTRUCTION: REDISCOVERING TECHNOLOGICAL METHODS

We can only study the past if we make the basic assumption that the same processes we can observe in the present world also occurred in the past, with similar material consequences (Carla M. Sinopoli, 1991).

Archaeological research has lacked a systematic replication of Native American copper production techniques. When prehistoric copper artifacts are discussed in the literature, the actual processes of manufacture are rarely considered. Only a handful of amateur and professional scholars have taken the time to analyze, much less replicated, these production processes.

Myths of the Moundbuilders

During the late nineteenth century, many scholars and laymen questioned the origins of the great Eastern Woodland burial mounds and the artifacts associated with them. The prevalent view of that time was that these ancient mounds, dotting the landscape, were constructed by an earlier more advanced non-Native people. In this view, the copper artifacts found interned within the mounds could not have been fabricated with primitive implements of stone and so could only be of European origin. These mysterious moundbuilding peoples were viewed as ancient Egyptians, Israelites, Celts, or Phoenicians, who were later replaced by the less sophisticated aboriginal Indian populations (Silverberg 1986:66).

Prevalent views of the late nineteenth century such as these were one of the excuses for the mass removal of Native peoples from their ancestral lands by the Federal Government. The issue of origin was not settled until John Wesley Powell, the first director of the Smithsonian's Bureau of American Ethnology, hired archaeologist Cyrus Thomas to explore the question. Thomas (1894) proved that contemporary Indian tribes and the prehistoric moundbuilders were ethnically and cultural related.

Frank Hamilton Cushing (1857-1900)

One of the first scholars to attempt to reproduce the manufacturing techniques of Native American coppersmiths was Frank Hamilton Cushing (illustration 2.1). Cushing first published on his copperworking experiments in 1894 and stated that he had

> *...neither seen nor heard of a single object of copper from the mounds which I can not reproduce from native or nodular copper with only primitive appliances of the kinds described, by successive processes of stone-hammering, beating and rolling, scouring, embossing and grinding* (Cushing 1894:105).

Cushing's 1894 publication *Primitive Copper Working: An Experimental Study* was a response to the widespread belief among many anthropologists that Native American Indians, being little more than *primitive savages*, were incapable of creating the elaborate copper masterpieces found throughout the eastern United States.

Cushing (1894:93) is foremost known for his immersion for five years among the Southwestern Zuni as an archaeologist and ethnologist studying their customs and culture. During this time period, Cushing obtained metal-working experience from observing and participating in Zuni silver-smithing.

Cushing is also known for his pioneering excavations at the Key Marco site on the southwest coast of Florida in 1896. This Mississippian era site provided numerous well-preserved carved wooden artifacts and some of the finest native Precolumbian art uncovered in the Americas.

Cushing's background made him ideal in challenging the hotly debated question of the origin of the burial mounds and the copper artifacts contained within the mounds. He was a pioneer in the field of experimental archaeology and had a life-long hobby of experimentally reproducing Native American craft items (Kolianos and Weisman 2005:10).

Cushing was a controversial figure in the still evolving field of archaeology. He wanted to comprehend not only how an object was fabricated, but also how it was connected to other objects and to larger cultural systems (Kolianos and Weisman 2005:12). Cushing detailed the thought processes of the toolmaker in the act of making an implement to better understand the native craftsman (Kolianos and Weisman 2005:85). Although his techniques of participant observation combined with archaeology were initially scoffed at by the scientific community, Cushing's belief in an interdisciplinary approach, detailed field observations, and note-taking were innovative at the time (Kolianos and Weisman 2005:xiii, 86). Cushing was also a pioneer in archaeological techniques. His techniques included formulating research questions prior to excavations, and the aforementioned testing methods of reproduction to understand the manufacture of artifacts. Cushing also employed ethnographic resources to gain knowledge of prehistoric Native American life ways (Kolianos and Weisman 2005:85).

Cushing (1894) completed multiple experiments on copperworking techniques including reproducing a Mississippian era sheet-copper raptor plate excavated from a mound near Peoria, Illinois (illustration 2.2). Cushing provided extensive instructions and illustrations on the process of reproduction of the Peoria plate. He detailed the methods from preparing the blank copper plate by grinding to obtain a uniformed thickness, to *pressure-drawing* the image outline (Cushing 1894:101)(illustration 2.3). After creating a groove by pressure-drawing the pattern, Cushing (1894:103) flipped the plate over and carefully ground out the image utilizing a flat piece of sandstone (illustration 2.4). He noticed that many of the plates showed bilaterally symmetrical patterns and suggested that flexible half-patterns were used to trace the whole image (Cushing 1894:103). These template patterns would also have lent to repeating the image multiple times.

Unfortunately, Cushing suffered from frequent illness most of his later life and passed away at the age of 42 before revisiting the copperworking subject or publishing his extensive work on his Florida expeditions.

Charles C. Willoughby (1857-1943)

Charles C. Willoughby is best known for his significant archaeological publications pertaining to the sites of Hopewell, Turner and Madisonville in Ohio (Greber and Ruhl 2003:xix). Willoughby, much like Cushing, was also known for his pioneering work in the field of experimental archaeology and his replication of native stone, copper, and textile artifacts. His work in reproducing copper artifacts also emerged out of the late 19th century climate of skepticism on the origins of the Moundbuilders and their sheet copper artifacts. In 1894, Willoughby duplicated Cushing's copper working experiment but instead of a Mississippian plate focused on the methods to replicate a Hopewell-style copper earspool utilizing raw materials found mainly on a Lake Superior beach (illustration 2.5). Willoughby argued that his experiments clearly illustrated the skill of Native craftsmen:

> *...practical demonstrations have shown that any of the (copper) metal objects... could have been made by processes known to the Indians at the time of their first contact* (Willoughby 1903:57).

Willoughby (1903:55) made two successful trials at producing sheet copper utilizing archaeologically obtained native copper from an altar of an Ohio Hopewell mound and from the Lake Superior region. His tools were various sized smooth water worn stones used alternately as hammers and anvils and a small driftwood fire. By grinding the hammered sheets between two flat stones, Willoughby was able to obtain a uniform thickness of the copper. Four circular forms were cut out using sharp flints through a process of scoring and snapping off the superfluous metal (Willoughby 1903:55). The rough edges of the copper discs were ground smooth and Willoughby then lightly pressed and burnished the annealed copper discs into a carved driftwood form (illustration 2.6). Willoughby greatly expanded his original brief copper working publication with detailed instructions and illustrations but unfortunately the bulk of his unfinished manuscript remained unpublished until recently (Greber and Ruhl 2003).

Only through the continuing work of early archaeologists and scholars like Thomas, Cushing and Willoughby, were the widespread beliefs that Native Americans were unsophisticated primitive savages finally dispensed.

20th Century Research

Unfortunately, following Cushing and Willoughby there was a near absence of research on North American aboriginal metalworking techniques until just the last few decades. The study of aboriginal copper work was given a boost in 1988 with Jonathan Leader's dissertation *Technological Continuities and Specialization in Prehistoric Metalwork in the Eastern United States*. In this work, Leader discussed the fabrication processes of prehistoric copper artifacts in the Eastern Woodlands. Another scholar, Michael LaRonge (2001), experimented on Archaic coppersmithing in the Great Lakes region. This study expanded on the author's undergraduate senior thesis and centered on copper projectile point fabrication. Finally metalsmith Joseph Neubauer (2003), mainly focusing on Archaic copper tools, used his sixty years experience forging metal to offer invaluable experience regarding the indispensable techniques to understanding how the indigenous artisans created their copper masterpieces.

Jonathan Leader (1988)

Jonathan Leader's dissertation evaluated prehistoric copper artifact fabrication and function during the Archaic, Middle Woodland, and Mississippian Periods. This technological study gave an overview of the history of copper utilization in the eastern United States and reevaluated prior research by early experimenters like

Frank Cushing. Leader addressed copper artifact typology, techniques of manufacture, and summarized archaeological localities producing copper objects. Leader also discussed evidence for full-time and part-time craft specialization among the varying Archaic, Hopewell, and Mississippian cultures. Finally, Leader considered the problems harassing archaeologists in the identification of copper workshops, the evolution of copperworking tool kits, exchange and trade of copper, and the exploitation of the raw resource by Native craftsmen.

Michael LaRonge (2001)

The experiments of Michael LaRonge centered on the manufacturing processes utilizing non-technological aboriginal tools to create Archaic period socketed projectile points.

LaRonge's (2001:371) experiments were designed to approximate the manufacturing environment and the available tool array. LaRonge documented the visual and audio cues that he believed allowed indigenous metal workers to successfully transform the raw resource into usable forms.

By recreating the production methods and comparing his outcomes with archaeological specimens, LaRonge presumed to uncover techniques utilized by Middle and Late Archaic metalworkers. LaRonge (2001:373) deduced that the earliest North American metalworking and those of later traditions probably used hot and cold forging techniques in tandem. Cold working of copper takes longer to forge but is easier to control and handle. Due to the increased elasticity of heated copper, larger copper nuggets would have been worked hot and reduced to nearly completed states (LaRonge 2001:373).

Non-ferrous metals like copper go through visible stages during heating. LaRonge assumed that prehistoric copper-workers used these visual clues as guides during forging. Aboriginal smiths would have also known when it was time to anneal work-hardened copper from auditory cues. In LaRonge's (2001:375) experiments, worked-hardened copper made a high pitched ringing as opposed to the dull metallic clank that of annealed copper. Finally, LaRonge (2001:377) also discussed certain metal working techniques such as punching and drifting for creation of enlarged holes in copper sheet.

Joseph Neubauer (2003)

Joseph Neubauer, an accomplished experimental metallurgist in the late 1990s, focused on artifact fabrication processes beginning with raw float copper and finishing with completed Archaic copper tools. Over the years, Neubauer has manufactured hundreds of authentic copper tools and ornaments. He found that the average finished reproduction of an Archaic copper tool required fifteen annealing-hammering cycles and upwards of thirty cycles for more complex styles (Peterson 2003:169). Neubauer concluded that the physical properties of a raw copper nugget prior to manufacturing played a major part in determining the final production piece form (Peterson 2003:174).

Some of the observations and conclusions that Neubauer has made, over his four years of reproducing copper ornaments, included the fact that Archaic copper artifact forms could be reproduced through a cycle of hammering and annealing and that smelting or melting was not required to obtain these forms (Peterson 2003:169). Impurities in the copper such as arsenic can cause manufacturing failures during forging. A difference in malleability between hot and cool exists with the former being more malleable due to the continuing realigning of the molecular structure even while being hammered (Peterson 2003:104). Neubauer also observed that swedging could have been used to shape copper by pounding the metal into specialized stone or wood forms (Peterson 2003:106).

The Pre-Columbian copper works studied by Cushing, Willoughby, Leader, and others demonstrated that the objects were manufactured utilizing simple technological procedures by specialized and skilled artisans who worked the exotic and rare raw material with rudimentary tools. These replication experiments demonstrate that copperwork of these indigenous peoples did not require complex technology or sophisticated industrial processes, instead most of the work could be accomplished with the same tools used in general stone and wood artifact manufacture.

CHAPTER 3

PHYSICAL AND MECHANICAL PROPERTIES OF COPPER

By the Hammer and Hand all the arts do stand (Mark E. Williams, 1998).

To work copper, one must first understand its properties. For thousands of years indigenous Native craftsmen utilized raw copper for the manufacture of ornamental objects, sociotechnic tools[2], and ceremonial pieces. Copper was the first metal to be exploited by prehistoric humans due to its relatively soft malleable state, excellent working qualities, and its characteristics of yield and tensile strength (Ehrhardt 2002:131). This non-ferrous metal is lustrous when polished and extremely resistant to corrosion. Copper also tends to preserve organic materials as the copper oxides retard the growth of bacteria (Cronyn 1990:244). Cloth, fibers, and other organic materials in contact with copper can be preserved for extremely long periods of time.

[2] Sociotechnic objects are non-functioning hypertrophic renditions of real objects meant to be understood as emblematic of rank in societies that conferred status on the basis of individual exploits (Brose 1985:123).

In its native state, copper can be found in large dendritic exposed surface outcroppings, in smaller float nodules from glacial tills, in thin sheets, or in arborescent states. Exposed on the surface, native copper becomes oxidized and can appear bright green, blue, yellow-brown, or orange according to its associated minerals (Jopling 1989:50). Trace mineral impurities found in copper include silver, arsenic, and iron. Lesser amounts of nickel, tin, chromium, indium, and antimony can also be found in trace amounts (Ehrhardt 2002:131).

Significant deposits of copper are found in the Lake Superior region, located around the Keweenaw Peninsula area (illustration 3.1). These copper sources are considered the purist copper deposits in the world and generally exceed 99.9% in purity (Martin 1999:30). The continuously eroding deposits were heavily exploited by local Native Americans using rudimentary mining techniques. Other sources of copper of sufficient quantities to be mined are found along the Appalachian Mountains and in the foothills of the southern Piedmont (see illustration 1.2). The largest and most extensive of these copper deposits are near Copper Basin in Polk County, Tennessee (Goad 1976:62).

Float copper nodules and nuggets were also heavily exploited by prehistoric Native groups. This mass of native copper was removed from its original deposits by tens of thousands of years of glacial movements. These glaciers would discard the copper often hundreds of miles away from its original points of origin. Native peoples residing in the vicinity of these float deposits would obtain the copper from streams and subsurface accumulations (Goad 1976:61). After processing, the metal would have been exchanged to other groups for elite and non-elite trade items.

Certainly melting, smelting, casting, and alloying of copper occurred in prehistoric South and Central American and in portions of the southwestern United States. However, none of these processes were ever developed in the Eastern Woodlands (Martin 1999:136). Although pure copper melts at the relatively low temperature of 1083°C, archaeometallurgists widely believe that Eastern Woodland copperworking groups did not melt copper (Martin 1999:136). Consequently, casting methods were not used to fabricate finished objects (Ehrhardt 2002:136). This is not to say that Native craftsmen did not have the means of obtaining the temperatures to melt copper as multiple underground furnaces were excavated at the Turner Earthworks in Ohio by Charles Willoughby (1922:38)(illustration 3.2). However, these furnaces were in all probability associated with the cremation of human remains and not utilized for artisan crafting.

Copper can be manipulated in both hot and cold states. Prehistoric Eastern Woodland artisans probably used both processes in tandem while working copper. LaRonge (2002:372) speculated that larger raw nuggets might have been worked hot to facilitate reduction before being finished cold. Copper would have been hammered and worked into shape after repeated annealings in campfires or fire pits. Annealing relatively pure native copper above 225°C initiates the recrystallization process (Martin 1999:120). Recrystallization is the formation of new grain structures in the work-hardened copper (illustration 3.3). Higher temperatures cause grain growth in copper and the larger grains make the metal more malleable after the annealing process. Cold-hammered copper becomes work-hardened and must be annealed repeatedly to continue to work it. During hammering, the metal deforms plastically and its grain structure becomes deformed and compacted (Ehrhardt 2002:137). Micro-fractures can occur if the metal is overworked in a hardened state. If the hammering continues the copper can become brittle and crack. In some cases the overworked copper can crumble into unusable pieces.

Annealing occurs at temperatures higher than 600°C, and in some instances upwards to 800°C depending on the impurities within the metal (Marin 1999:121). Since prehistoric peoples did not have the luxury of monitoring campfire temperatures with a gauge, visual and audio clues were most-likely used to know when the copper was ready to be annealed or worked again (LaRonge 2001).

Non-ferrous metals like copper go through three visible stages during heating (LaRonge 2001:374). During the first stages of annealing, a rainbow of iridescent colors can be observed shimmering across the surface of the metal. This stage is referred to as "gloss-off" by contemporary metalworkers (LaRonge 2001:374). When the metal turns black, the copper has entered the second stage. In this stage the surface of the metal oxidizes, turns black, and loses reflectivity (LaRonge 2001:374). Once the copper obtains a dull red glow, the copper is at the final stage and is at a sufficient temperature for annealing. The lower the temperature, the longer it takes the metal to anneal. At 500°C, it takes approximately 15 minutes to accomplish recrystallization; a small campfire of yellow pine burns around 732°C (Martin 1999:121). Annealed copper regains its malleability and can then easily be worked again.

LaRonge (2001:375) observed the easiest method to determine whether a copper piece is ready for annealing is to gently strike the piece against an anvil stone. As previously stated, if the piece makes a high pitched tinny ring, opposed to a dull metallic clank, the copper has been sufficiently work-hardened and is ready to be re-annealed (LaRonge 2001:374).

From a personal observation, it should be remarked that thinned work-hardened copper possesses a different tactile quality than annealed copper. Experienced metalworkers can learn to gauge the difference by handling the copper and can determine if the copper can continued to be worked or if the metal is ready to be annealed.

CHAPTER 4

COPPERWORKING TECHNIQUES AND ARTIFACT FABRICATION

Despite the fact that replication can never provide more than a inferential conclusion about the actual techniques of prehistoric copper working, it may provide a broader set of hypotheses or probabilities than metallography alone (Susan Martin, 1999).

Native American artisans manufactured artifacts from raw copper using several crafting techniques. Charles Willoughby listed seven basic steps of artifact construction including hammering, annealing, grinding or abrading, cutting, embossing, perforating (punching or drilling), and polishing (Martin 1999:116). Willoughby's list could be expanded to incorporate other general fabricating techniques including sinking copper into molds, rolling over mandrels, cold- and hot-forging, bending and twisting, folding, drawing, punching-and-drifting, riveting, cladding, and utilizing carved templates. As stated previously, there is no evidence of alloying, casting, melting, or smelting of copper in the prehistoric Eastern Woodlands region of the United States.

The rudimentary tools utilized by Eastern Woodland artisans included various sized stone and wood hammers; stone and wood anvils; stone grinders; bone, antler, wood, and stone hand tools used for embossing, punching, cutting, and the other techniques for working the copper. Aboriginal metallurgy was developed by employing techniques already in use in the fabrication of stone, bone, shell, and wood artifacts and was essentially a modification of these technologies. Out of context, most of these tools would be unrecognizable from tool kits used to craft non-copper artifacts. Tools constructed of wood rarely survive in an archaeological context. Certainly these tools would have been ideal for copper repoussé as they were plentiful and could be easily reshaped. Other crafting tools would have been needed to handle hot pieces of copper; tongs carved from green branches would have sufficed in removing copper from the fire after annealing.

Hot-forging, Cold-working, and Annealing

Copper can be worked in hot or cold states. Cold-worked copper would first be annealed in a campfire or fire pit until red hot and then either air cooled or cooled in water. The annealed copper would then be ready to be worked. Copper, unlike iron, can be quickly cooled by emersion in water without the risk of hardening. In hot-forging, the copper is worked at a temperature at which hardening can not occur. Hot-forging occurs when temperatures are above 1000° C (just below the 1083° C melting point). The metal becomes more elastic and moves quicker and easier than cold-worked copper, thus quickening the process of thinning the piece. As stated previously, hot manipulation may have been used by native peoples to quickly reduce larger copper nuggets to nearly finished states (LaRonge 2001:373). Ehrhardt proposed hot forging as a possible method of manufacture of copper artifacts by Archaic indigenous peoples but stated that the metal-working technique is difficult to detect (Martin 1999; Ehrhardt 2002). Thinned copper artifacts in the hot-forged state could also be easily sunk and formed in sandstone molds similar to the one described by Squier and Davis (Squier and Davis 1848:206, 207)(illustration 4.1).

Handling red-hot or white-hot copper at these high temperatures is very difficult and dangerous. The metal is hard to control when worked and minute fragments of fire scale can fly off the hammered copper and burn or blind unprotected individuals. Consequently, copperworking artisans might have preferred to cold hammer the metal instead. If the copper was to be hot-forged, then aboriginal artisans would have needed to wear protective clothing especially eye protection, possibly something akin to the goggles used by Arctic cultures to protect from snow blindness (illustration 4.2). Chapurukha M. Kusimba (1996:395) noted that older Swahili smiths of sub-Saharan Africa suffered from eye infections and blindness due to years of forging hot metal unprotected.

It is difficult to determine if aboriginal artisans were hot forging as microstructural analysis can not differentiate between copper hot forged or cold-worked, since the microstructural features are similar (Vernon 1990:502). Although microstructural evidence for hot-forging is inconclusive (Ehrhardt 2002:140), researchers have failed to look at evidence of hot-forging on the stone anvils themselves. When red hot copper is worked on stone, small pieces of the stone's surface will crack and pop off due to the copper's excessive heat. These missing pieces leave minute pockmarks that can be observed on the surface of the stone (illustration 4.3). Archaeologists could use these pockmarked anvils as evidence to determine whether copper artifacts were worked hot or the location of copper workshops.

Oxidation and Cleaning

One problem associated with the annealing process is the formation of oxidizing fire scale on the surface of the metal. If the fire scale is worked back into the copper, it can pit and discolor the metal's surface. Cushing (1894:100) recognized that during the hammering process, a granite or quartzite maul would pit the surface of the copper at a multitude of minute points and thus the plate was not so liable to scale. Grinding would also remove the fire scale after each annealing, but grinding is a time consuming activity (Leader 1988:81) and becomes impractical during the final stages of working copper especially on intricately designed pieces such as the Rogan Plates from Etowah (illustration 4.4). Modern copper-workers employ mild acidic solutions to chemically remove oxidized fire scale. This process is called pickling. Soaking a finished copper piece for a short period of time in a pickling solution would remove the scale during the final fabrication stage, cleaning the surface of the metal. Once the pickling solution was washed off, the copper piece could be polished.

Whether aboriginal Native Americans used an acidic cleaning solution during the fabrication process can only be speculated upon. However acid solutions might have been available as a by-product from such activities as the leaching of tannic acid from acorns or the process of tanning hides. A mixture of salt and vinegar, possibly distilled from acidic unripened berries, quickly cleans oxidized copper. Indigenous artisans might have brewed a vinegar mixture from the sap or bark of certain trees. The annealed copper would have been submerged into this vinegar-acid solution, left for a short period of time, and then neutralized in a water bath. Utilizing an acidic cleaning solution along with polishing mixtures made of wood ash, fine sand, and tallow or beeswax makes more sense than scrubbing fragile copper artifacts with this mixture alone as is suggested by some scholars (Cushing 1894; Willoughby 1903; Leader 1988). Glauconite, a clayey green ferric-iron silicate often found in Southeastern burials containing copperwork, is an effective polishing agent for copper (Trevelyan 2004:110). Trevelyan (2004:110) observed that many precontact copper artifacts appear to have a "brushed" look that might be the result of repeated polishing with such an agent like glauconite. Sir Walter Raleigh mentioned that the copper worn by elite individuals on their heads were so highly polished that they were, at first, mistaken for gold (Squier and Davis 1848:205).

Finally, considering the amount of time and effort it took to clean the thousands of ornamental copper beads excavated by archaeologists, the premise of a cleaning solution does sound plausible. Acidic solutions were most-likely known and used by native peoples of the Eastern Woodlands, but that falls outside of the scope of this research project.

Copperworking Tools

Native artisans would have used stone, bone, and wood tools to work copper. These implements would be unrecognizable when compared to other crafting technology tool kits.

Hammers

The hammering of copper artifacts would have been undertaken with different sized hammers of stone and wood. The hammers would have been hafted on to handles or held in the hands for more detailed or delicate work. Stone hammers would have accomplished the bulk of the cold-work or hot-forging needed by aboriginal artisans. Wood hammers, possibly covered in leather, could have been used for flattening copper sheets without the apprehension of denting or scoring the metal.

Hammering of annealed copper begins at the center of the piece and spirals outward, displacing the metal towards the edges and thus thinning the piece (illustration 4.5). The process would be repeated multiple times after annealing returned the copper to its malleable state. Alternately, grinding could be incorporated into the hammering process. Both Frank Cushing (1894:100) and Charles Willoughby (1903:55) detailed the process of reducing irregularities from raised surface areas for uniformity of thickness. Virtually all Late Archaic copper tools from the Lake Superior region show evidence of grinding (Martin 1999:124).

Once the metal was sufficiently thinned by hammering and grinding, the piece would be ready for embossing or shaping. Archaic copper tools and projectile points would have been worked by hammering and annealing, and then cold hammered and ground to increase hardness along the edges while ornaments would have been left in a final annealed state. Jonathan Leader (1988:56) recognized that some Archaic copper projectile points were found in a final annealed, unworked state. This suggests that this kept the points from breaking during use and that the points could be bent back into shape after use (Leader 1988:57). A center work-hardened rib could have been added to provide support and strength to the annealed points while still allowing the piece to bend instead of break (Leader 1988:58).

Anvils

Hammering of copper would have occurred on anvils of wood or stone. It can be assumed that the various sized wood anvils employed by Native craftsmen would not have survived in an archaeological context. Undoubtedly, wood stumps make excellent secure anvils. Stone anvils would have been utilized from large smooth river cobbles or smaller smoothed stones. These smaller stones could also have substituted as hammerstones. Researchers might scrutinize any large smooth stones uncovered archaeologically near potential copper workshop location. It might be possible to distinguish trace amounts of copper residue left on the surface of these stones (illustration 4.6). If Native craftsmen were working copper hot, small pockmarks and pits would likely be distinguishable on the surface of the anvil stones due to the excessive heat of the metal. Finally, it is plausible that wood and stone anvils would leave different discernible impressions on worked copper.

Hand Tools

Chisels, burnishers, and punches employed in the process of copper work would have been similar to the tools of other crafting technologies. Chisels made of lengths and thicknesses of hardwood can be reshaped over and over again and then ultimately discarded. Hardwood tools have the advantage of being easily formed and are incapable of making damaging scratch marks on the finished work. Much like wood anvils, these tools would probably not show up in archaeological contexts. Stone tools used as engravers could be reflaked and then discarded when exhausted. Stone copperworking tools found archaeologically would generally lack traits that would distinguish them from other crafting uses although it is possible copper residue would survive. Jonathan Leader (1988:137) speculates that deer antler points may have been used as pressure embossers for copper. Antler tines are easily shaped and would have been discarded after use or utilized for other crafting purposes. Split and modified bone would also have served the same purpose as antler tines.

Finally some copperworking tools were manufactured from copper. These tools would have played an important part in cutting out the detailed and delicate work found in some of the Hopewell and Mississippian copper pieces.

Small copper tools have been excavated from multiple mound sites. Squier and Davis mention sharpened copper rod-shaped awls and chisel-shaped graving tools found on the remains of several Hopewell altars (Squier and Davis 1848:200). Post-historic Native Ohioans were described as employing heated copper rods to perforate shell, wood, and bone artifacts (Rickard 1934:284).

Examination of some of the least corroded copper plates from Etowah showed detectable tool marks on the concave side of some of the artifacts (Moorhead 2000:46). This suggests that the design had been pressed into a carved shape or template with burnishing tools.

Finally, small copperworking tools have been found associated with cut mica artifacts. These copper tools have been excavated at the site of Moundville, Alabama and were used in cutting the fragile mica objects (Reilly personal communication).

Artifact Fabrication

Molds

Native artisans utilized pre-carved hollow circular depressions or molds in wood or sandstone for the creation of concave copper objects (Squier and Davis 1848:206-207). These types of molds would have been used for shapes that were repeatable. Molds would have been utilized for mass production of concave artifacts such as copper disc-shaped earspools or bracelets.

During the Archaic period, molds or carved forms might have been employed to fabricate the socketed ends of copper projectile points (Leader 1988:54). In manufacturing an Archaic point, sinking the metal into the form would have resulted in a three-dimensional shape of the socketed artifact's base. Leader (1988:88) states that the technique has not been identified as being present in the Archaic Period, but Martin (1999:127) suggests that the Late Archaic socketed projectile points might have been formed using this method. Archaic socketed projectile points also demonstrate the first technological evidence of riveting (Leader 1988:109).

Molds would have been employed for bracelet manufacture during the Hopewell period. As stated previously, Squier and Davis (1848:206-207) mention a large compact sandstone boulder excavated from within a mound. The block, weighing between thirty and forty pounds, had multiple circular pecked depressions of various dimensions. They speculated that this was a constructed mold for forming disc-shaped copper artifacts, probably earspools halves and bracelets (Squier and Davis 1848:206-207).

Copper discs would have been pressed into shape (*but probably hammered and pressed*) similar to the steel swage blocks used by present day metalworkers. This fabrication technique, of hammering metal into a form, is known as sinking. Later Mississippian copper disc-shaped artifacts were also likely formed utilizing shallow molds although the shapes can easily be fabricated by an experienced metalworker on the anvil face.

Stretching Limited Resources

Cladding of artifacts is a technique of covering or laminating a form with a thin layer of copper foil. The process achieved prominence during the later Mississippian period and was probably used in response to the shrinking availability of copper resources. Flat sheet copper would be hammered until foil thin. The copper foil would then be folded around and burnished onto the object. This would give the impression of a solid copper artifact and thus possibly increasing its sacred or economic value. Copper clad objects would also be lighter than those of pure copper, which would be more practical in the case of such artifacts as earspools. Evidence of copper clad artifacts is seen in the multitude of copper covered earspools, rattles, and beads found throughout the Eastern Woodlands.

Examples of copper clad artifacts include copper-covered turtle shell effigy rattles excavated from the Mitchell site in Illinois (Sampson and Esarey 1993:457) and a variety of carved wooden artifacts from Spiro (Hamilton 1974). These artifacts are covered with or retain evidence of having had a thin copper layer burnished over them and include copper-covered wooden human effigies, life-sized human effigy masks with carved antlers, carved rattlesnake rattles, and a realistically carved wooden turtle rattle (Hamilton 1974:176).

Other methods of utilizing and stretching limited copper resources include the folding of sheet copper and riveting of small sheets of copper. Folding is a manufacturing technique of overlaying and working smaller copper sheets together and then consolidating them into larger sheets. The edges of two copper sheets would be hinged and then hammered down flat, thus locking the two together (illustration 4.7). Multiple copper sheets could have been attached to form larger pieces; and where hammered, the joined areas are virtually indiscernible. Possible evidence of this metalworking technique might be seen in some of the copper Wulfing Plates found in southeastern Missouri. Virginia Watson (1950:6) mentions that the plates were manufactured from multiple sheets hammered together to form double sheets. In all likelihood, she was describing folding. Many of the Spiro mound coppers seem to show evidence of folding to create larger sheets before embossing.

Aboriginal peoples of the North American Arctic used folding techniques to build up their metal artifacts from a number of small hammered native copper fragments (Franklin 1982:50). This was likely a response to their limited or restricted copper resources.

The second method for stretching scarce copper resources is the riveting of copper sheets together. Small copper rivets would be rolled over mandrels or between two flat stones, much like copper beads. The rivets would then be inserted in perforations made in the copper sheet and carefully hammered down, cementing the pieces together and creating a larger sheet. Riveting was also used in repairing damaged or broken copper sheet artifacts, sometimes crudely. Again, indication of this manufacturing technique used in tandem with the folding technique is evident at Spiro (Hamilton 1974:51,75)(illustration 4.9).

Leader (1988:199) suggested that the shift to using folding and riveting fabrication methods may have been a response to better quality copper being tied up in the creation of larger copper ornaments for ceremonial apparel.

The less "sacred" objects and general ornamental pieces would have been manufactured with smaller leftover copper.

Pitch

Modern metal-workers employ a pine pitch mixture as a supporting bed when repoussé and chasing designs into metal. Pine pitch was also utilized by Native Americans in their daily lives to waterproof boats, basketry and pottery, and as an adhesive to haft stone tools into handles or fix projectile points into shafts (Jones 2005:18)(illustration 4.10). In all likelihood, Native craftsmen also used pine pitch mixtures as bedding when working designs onto copper plates. Willoughby observed that pitch of just the right consistency may have been used as a supporting matrix upon which the copper was embossed by pressing the pattern to be raised into the yielding mass with tools (Moorhead 2000:46). Pitch allows copper to be hammered without obstruction yet pitch is soft enough to yield as the copper is pressed into it. Pitch would have been made either from pine resin or naturally occurring tar or asphaltum, and mixed with an emollient like beeswax or tallow. The emollient acted as a lubricant to soften the pitch. Crushed or powdered limestone would have been added for resistance and to bind the mixture together. This pitch concoction would create a solid yet yielding support needed to work copper (Moorhead 2000:46).

Repoussé and chasing are two terms used interchangeably throughout this paper. Repoussé is a method of creating a shallow relief design on the reverse side of a metal surface by hammering or pressing. This creates a raised design on the obverse or front of the plate. Chasing sinks a design on the front side. Used in conjunction, the two methods form and define the relief.

Native craftsmen would have harvested pitch from a variety of resin bearing trees including Longleaf Pine, a coastal plain species, or sweetgum which exudes a sticky resin (Jones 2005:12).

Once the pattern is decided on, the pitch is heated until it liquefies. The heated pitch is poured onto the reverse side of the copper plate or the plate is pressed into the mixture. The hardened pitch anchors the copper and provides a solid working surface. The design is then chased onto the piece using various sized hammers and hand tools. Once the work is completed, the copper and pitch are heated and the plate is released. Next the excess pitch adhering to the copper is removed by burning and the plate cleaned. After annealing, the copper plate is flipped and the process repeated with the pitch being applied to the obverse side. The design is then hammered into the backside using the repoussé technique, the pitch removed, and the piece re-annealed. The process of working the front and back sides of the copper plate is repeated numerous times until the design is finalized.

Alternatives to pitch could have included dense leather-hard clay slabs, thin sheets of soft leather, or planks of soft wood.

Templates

Carved templates, used in conjunction with pine pitch, would have simplified the fabrication of repeated designs in copper. Repetition of designs or motifs could be explained as unifying distant religious groups or moieties with one another.

Templates would have been carved from certain widely available lumbers such as basswood (Tilia americana). Basswood is soft, easily carved, lightweight with little grain yet strong and stable. Basswood, along with copper and birch bark[3], was considered an important non-food resource by Native Americans (Martin 1999:43). Artisans would have used hafted sharks teeth, flaked stone tools,

[3] Birch-bark pitch has been used to manufacture adhesives since the Middle Palaeolithic (*ca.*300,000-30,000 BC) in Europe (Koller, et al. 2001).

and possibly copper chisels and awls to carve out the required pattern (Leader 1988:122). Once the design was completed, a copper sheet would be pressed and embossed onto the template form, transferring the image into the copper. If necessary, the copper image would be further worked and detailed by employing a pine pitch or asphalt backing. By utilizing carved templates and pitch in tandem, multiple detailed copper plates could be fabricated in short periods of time by skilled craftsmen.

Templates could have been employed in the creation of certain similarly shaped copper falcon plates. Such plates have been widely found throughout the eastern United States. Watson (1950:47) mentioned the similarities in size and shape between many of the eight copper Wulfing Plates. These Late Braden style plates were most-likely manufactured at Cahokia or at least by craftsmen influenced and trained in the Cahokian tradition (Brown 2004:113). Frank Cushing (1894:103) suggested that leather parfleche patterns or templates might have been used in some copper plate manufacturing. The parfleche silhouette template would have been traced on the plate to repeat certain shapes (Leader 1988:76). In all likelihood, the general outlines of the Wulfing plates were created employing a flexible template.

Unfortunately, very little evidence of actual wooden templates has been found archaeologically in the Eastern Woodlands. Organic materials such as wood decompose quickly in that environment. Retired or exhausted designs in wood were probably burnt as offerings or interned as burial deposits and thus would not have survived in the archaeological record. A few indications of the utilization of carved templates have been discovered at Spiro. Hamilton (1974:97) discloses that three small, centrally perforated copper covered plaques are known from the site (illustration 4.11). These carved *templates* are evidence of one means of copper plate manufacture - that of carving the design in wood and then embossing the copper on it (Hamilton 1974:97).

Jonathan Leader (1988:120) proposes that templates might have been employed in the creation of bilobed headdresses found in and around Etowah. He observed that similarly shaped sea turtle shells were found at the Etowah site (Leader 1988:120). These small pieces of sea turtle shell had been cut into the shape of bilobed arrows and might have served the same purpose as parfleche templates. The flexible templates suggested by both Cushing and Leader would only give the general outline of a shape and not internal details. A symmetrical image would be obtained by flipping the parfleche template over and repeating the image. The parfleche template could be used to repeat the design multiple times. Cushing also mentions that the place from which the design had been cut resembled a stencil and could have been used to repeat the pattern on other plates (Watson 1950:4). Once the silhouette pattern was embossed into the plate, internal details that would differentiate the plates would be added by the craftsmen. There are unembossed hawk-like figure plates from the Spiro site. These blank copper plates are in an outline hawk form and may have originally been intended for finishing and embossing (Hamilton 1974:137). In all likelihood these blank copper plates were cut from a template pattern, unfortunately corrosion and breakage has taken its toll over time on the plates and it difficult to discern the shapes. Finally, Charles Willoughby observed that from covering wooden forms with copper foil, to embossed ornamentation is just but a step (Moorhead 2000:46).

CHAPTER 5

PREHISTORIC COPPERWORKING IN THE EASTERN WOODLANDS

By reviving part of the tradition, you find something that helps you look forwards to the future (Jereldine Redcorn).

Copper utilization spans a large period of North American prehistory from the Middle Archaic well into post-historic times. A brief introduction is required to the various time periods, associated cultures, and the major sites in which copper played key roles. Native American's utilization of copper evolved from technologically simple tools and implements into richly detailed sacred objects that functioned on multiple levels. From the earliest periods of use, copper played a pivotal role in long-distance trade and exchange and the distribution of religious belief and ceremony.

Paleoindian Period (ca. 12,000 - 8000 B.C.)

The earliest verifiable evidence for the peopling of North America dates to around the end of the last major glacial advance about 10,000 B.C. Archaeologists have based the dates upon radiocarbon samplings from various archaeological sites where stone tools were recovered near extinct megafauna (Dixon 1999). Earlier dates of nearly 30,000 to 40,000 years are hypothesized by archaeologists but the evidence is scant and very problematic (Meadowcroft Rockshelter, Pennsylvania; Monte Verde in south-central Chile; Channel Islands, California) (Dixon 1999). The evidence for this early occupation of the Americas is scarce but as each year goes by evidence that supports these hypotheses accumulates.

Paleolithic Indians crossed the exposed Bering Strait from Siberia into the Americas following herds of large migrating mammals. These Paleoindian groups moved southward along ice-free corridors towards more favorable environments (Walthall 1990:20). Scholars also speculate that some Paleoindian groups skirted the Pacific coastline in boats exploiting seal and salmon populations, while others look towards Paleolithic Solutrean groups from prehistoric Europe as possible early New World travelers (Dixon 1999; Toner 2006:44).

Evidence for copper utilization during the Paleoindian period is mostly non-existent. John Halsey (1996:11) sets a ca. 8000 B.C. date for the first use of copper based on worked copper artifacts from the Starved Rock site, Illinois. Susan Martin (1999:147) asserts that the earliest copper use probably occurred in a mix with Late Paleoindian stone tools. Artifacts from the Late Paleoindian/Early Archaic Lac La Belle site (20KE20) in Keweenaw County, Michigan included some copper implements (Martin 1999:147). Martin (1999:147) suggests that the inclusion of copper at sites like Lac La Belle demonstrates an uncertain association of copper with the lithic technologies practiced during the Late Paleoindian Period. There are copper artifacts from the western basin of Late Superior that resemble Paleoindian lanceolate projectile points (Martin 1999:148). Halsey (1996:11) states that distinctive Plano lanceolate points and possible stemmed forms are also known. Late Paleoindian hunters seem to have been replicating their traditional lithic projectile forms in copper, but the points are poorly dated surface finds that lack tight associations with better provenanced artifacts (Martin 1999:149).

One can speculate that the malleability of copper would have been observed early on and in an absence of available raw lithic material, utilized to replicate traditional lithic points and tools. Some scholars also hypothesized that the exotic material trade networks, which included copper and are so abundantly evident in the

Woodland and Mississippian periods, also originated in the Paleolithic Period (Leader 1988:10).

Archaic Period (ca. 8000 - 1000 B.C.)

The first strong evidence for copper use by prehistoric Native American cultures in North America occurs during the Archaic period at approximately 8000 - 1000 B.C. Early Archaic groups (8000 - 5000 B.C.) tended to be small, seasonally-mobile foragers whose temporary habitation sites depended on the abundance of particular local resources. These people exploited various high-yield natural food sources including hickory nuts, acorns, shellfish, turtles, rabbits, deer, and other animals. It is during the Early Archaic Period that the clearest supportable evidence for copper utilization is first observed.

Copper artifacts manufactured during the Middle (5000 - 3000 B.C.) and Late Archaic (3000 - 1000 B.C.) consisted mainly of simple fabricated ornamental objects and tools. These metal artifacts tended to be thick, heavy, unornamented, and seemingly of utilitarian use (Leader 1988:108). There is debate on whether the tools were actually utilized by their fabricators or were for ceremonial use only. Some archaeologists speculate that these tools, large cold-hammered socketed projectile points, awls, and semi-lunar knives were sociotechnic objects and thus non-functional (Reilly personal communication). Reilly postulates that the thinner copper artifacts were not used as tools or weapons in a general sense but were objects utilized for ceremonial rituals and spiritual combat (Reilly personal communication). Sociotechnic copper objects conferred status from the shape and from the scarcity of the raw material itself. Even during proto-historical times, copper was considered to contain protective supernatural power.

Alternatively, Trevelyan (2004:122) believes that the flawless condition of many of the prehistoric copper implements uncovered would be more easily explained if they were mostly used for the defleshing of bodies in an advanced stage of decomposition. An interesting hypothesis, but this does not explain the multiple tool shapes found in copper. Thus, the purpose of the copper artifacts originating during the Archaic period, whether actually functional or utilized during ritual activities, has yet to be ascertained.

The time and effort and considerable skill needed to fabricate copper tools is lengthy. Certainly not much time is needed to create the same tool out of lithic material.

This temporal expenditure lends support to the belief that these Archaic copper artifacts were in fact sociotechnic. Archaic North American people had to either travel long distances to obtain the scarce material or exchange objects of equal worth for the intensively traded and highly coveted copper. Considerable time would have then been invested in fabricating the material into usable objects. To break or lose a copper piece after all the energy expended seems unreasonable.

Copper, during the Archaic period, was acquired mainly from the Lake Superior region and from the glacial drifts of Illinois, Indiana, and Ohio. The copper found in the Lake Superior region is considered the purist copper in the world and can be cold hammered into simple shapes without annealing. More elaborate copper shapes required multiple annealings. As previously discussed, annealing would have occurred in campfires and the work completed on nearby stone or wood stump anvils.

Late Archaic copperworking sites include the Duck Lake Site, located in the Ontonagon River watershed of Michigan's Upper Peninsula (Hill 2006). Two hearth features were excavated at Duck Lake, each with concentrated clusters of copper. Mark Hill (2006) reported finding a worked copper nugget resting on the pitted upper surface of an anvil stone right next to a hearth feature. The pitted anvil suggests that the craftsmen were working the copper in a heated stage to facilitate thinning the copper quickly. Duck Late shows distinct stages of copperwork production representing a continuing sequence of copper artifact manufacture (Hill 2006). Copper artifacts excavated included unworked copper nuggets, worked copper nuggets and waste, worked and shaped copper pieces, projectile point preforms, edged tools, beads, and bead blanks (Hill 2006). Radiocarbon dates at Duck Lake suggest one of its components is roughly contemporary to the Late Paleoindian copperworking site Lac La Belle (20KE20)(Hill 2006). Hill also points out close similarities between experiments by Michael LaRonge and the copperworking activity areas at the Duck Lake Site (Hill 2006).

Examples of Archaic period burial accoutrements manufactured in copper and uncovered archaeologically, include cold-hammered socketed projectile points, awls, semi-lunar or "crescent"-shaped knives, fish hooks, gorges, bracelets, and ornamental beads. Socketed projectile points included tanged spear points, notched spear points, and rolled cone spear points (Leader 1988:53). Many of the socketed points also show evidence of hafting with rivets. Martin (1999:127) reasoned that some of the sockets of Late

Archaic projectile points might have been hammered around predesigned wooden or sandstone forms or molds. Beads, most-likely made from surplus copper fragments, would have been rolled over mandrels or between flat stones. Beads strung in necklace-form would have also been an excellent way to store various sized precious copper fragments for later use.

By about 4000 B.C., the exchange of non-local exotic materials, among them copper, had expanded substantially due to intergroup interaction and trade (Brose, et al. 1985:19, 25). Trevelyan (2004:152) sees this as possibly less than trade of exotic materials and more of a sharing of ritual paraphernalia by religious specialists. By the Late Terminal Archaic period, copper from the Lake Superior region had made its way by long-distance trade to the large mound site of Poverty Point, in northeastern Louisiana.

In every period of North American prehistory, copperwork was utilized almost exclusively in mortuary and death rituals (Travelyan 2004:156). Archaic people commonly buried their dead in natural knolls or low mounds on high bluffs overlooking adjacent floodplains (Milner 2006:53). Mortuary accoutrements within the burials contained large caches of copper implements, weaponry, and ornaments. Archaeological evidence suggests that burials, including grave offerings, indicate the earliest emerging concepts of elite status among these semi-sedentary aboriginal groups (Walthall 1990:92; Travelyan 2004:156).

Old Copper Culture (ca. 3000 - 500 B.C.)

The major prehistoric complex associated with copper working during the Late Archaic Period is the Old Copper Culture (OCC). This complex geographically and temporally overlapped with two other archaeological complexes during the Middle and Late Archaic Stages: the Glacial Kame Culture (ca. 1500 - 1000 B.C.), and the Red Ochre Culture (ca. 1500 - 400 B.C.). The Old Copper Culture was not one single group but a number of different societies interacting and sharing related technological and cultural traditions. Ehrhardt (2002:138) states that this widespread tradition is most densely evidenced in eastern Wisconsin and in adjacent regions of the Upper Peninsula of Michigan. However, the artifacts of the Old Copper Culture have been found as far south as Fannin, Georgia; Custer County, Oklahoma; and Crystal River in Florida (Trevelyan 2004:179).

Fabricated copper objects figured most importantly in the Old Copper Culture mortuary customs and rituals. Archaeometric studies aimed largely at revealing the Old

Copper Culture's manufacturing processes and production sequences show that many of the artifacts of the period were fabricated mainly from nuggets or laminar plates of copper which were hammered, flattened, and repeatedly folded over and bent into shape (Ehrhardt 2002:140). Much like later Hopewellian artisans, Archaic craftsmen experimented with both organic and geometric designs including scrolls of serpentine bands and concentric circles (Powers 2004:20).

Although some scholars state that Old Copper Culture mortuary accoutrements indicate the earliest emerging concepts of elite status (Walthall 1990:92; Travelyan 2004:156), this explanation does not explain the disproportionate amounts of copper found included with fetus, infant, child, and female burials (Martin 1999:162). The inclusion of copper with these burials suggests that emerging elite rank was ascribed opposed to obtained.

Archaeologists place the end of the Archaic Period around 800 B.C. with the introduction and widespread acceptance of fiber-tempered pottery.

Woodland Period (ca. 500 B.C. - A.D. 1000)

The Woodland time period is divided into three subgroups: Early (500 - 150 B.C.), Middle (B.C. 150 - 500

A.D.), and Late Woodland (500 - 900/1000 A.D.) with a transition period between the Late Archaic and Early Woodland (1000 - 500 B.C.). The complex Middle Woodland exchange network, found during the Hopewell Period, emerged from previously existing exchange networks of the Early Woodland and Late Archaic (Brown 1977:173). Woodland artisans continued and greatly expanded many of the artistic accomplishments obtained from the previous Archaic Period (Power 2004:21).

The Woodland period is best know for its elaborately constructed large geometrical earthworks and burial mounds. Major traits that defined this period include the introduction of ceramics across much of the Eastern Woodlands, and developments in agriculture and subsistence strategies.

Social organization and ceremonial life also played a more significant role in the lives of Woodland peoples. Exotic and rare materials continued to be exchanged over vast territories. Objects made from the exotic trade materials such as copper became more common and tended to be found associated with high-status or elite burials. Knowledge and artistic concepts circulated as well through this exchange sphere, indicating not only the similar symbols, forms, and techniques, but the shared mortuary use as well (Power 2004:32).

The height of the Woodland burial-mound ceremonialism occurred with the development and spread of the Adena (1000 B.C. - A.D. 200) and Hopewell (A.D. 1 - 400) cultures. These cultures were centered in the Ohio River Valley. Hopewell ceremonialism in this region included the construction of large burial mounds, huge geometric earthworks, and the procurement of exotic materials through long-distance trade networks (Walthall 1990:105). These exotic raw materials were manufactured into a wide variety of status-oriented finished products that ultimately functioned as grave furnishings upon the death of their owners (Walthall 1990:105). The Adena people also constructed large conical ceremonial burial mounds. Some of these Adena burial mounds contained log-lined tombs. Burial accoutrements interned within the tombs included stone platform pipes, small carved stone tablets with raptor bird designs, polished copper bracelets and breastplates, and elaborate pieces of cut mica (Milner 2006:38). The Adena culture is considered as the precursor to the Hopewell Culture although many of the dates for the Adena were determined before the advent of radiocarbon dating (Milner 2006:54).

Hopewell culture possessed many of the same attributes of the earlier Adena Culture, but the manifestations of Hopewell culture were generally on a more enhanced scale (Waldman 1985:20). The Hopewell culture covered a larger region than that of the Adena, included larger earthworks and richer burials, more intensified ceremonialism, a greater refinement in art, and a greater concentration of peoples (Waldman 1985:20).

Hopewell sheet copper artifacts include exquisite two- and three-dimensional artistic representations of mammals, fish, and birds. Copper sheets were also fabricated into human figures, hands, and heads (illustration 5.1). Bird imagery in copper includes that of turkey buzzards, parrots, and eagles (illustration 5.2). *Pars pro toto*[4] feathers, wings, and other avian and mammal features were also embossed in copper (illustration 5.3). These objects may possibly have related to the supernatural sky realm within Hopewell ideology. Copper-covered deer antler head pieces that would have been worn by religious specialists might have also signified a connection with the supernatural realm (illustration 5.4). The works in copper show strong realism and were fashioned into cut-outs, silhouettes, and stylized shapes (Power 2004:52).

[4] Pars pro toto is an iconographic term meaning the "part (taken) for the whole" where a portion of an object represents the entire object.

The elaborately designed copper artifacts of the Ohio Hopewell were created by part-time and possibly full-time craft specialists. These artisans expanded on the earlier metalworking techniques of the Archaic period cultures and added repoussé-chasing, cladding, sinking forms, rolled tube rivets, templates, and a greater emphasis on motif and design (Leader 1988:109).

Hopewell Earspools

The most iconic symbol of the Hopewell era would be the copper earspool (illustration 5.5). Thousands of copper earspools have been found interned in Hopewell burials. The detailed and complex constructions, which would not be seen again in prehistoric Eastern Woodlands metalworking repertoires, are extremely difficult to reproduce even to this day by experienced metalworkers. Trevelyan (2004:34) believes that the consistency in design and distribution of copper earspools suggests that they were central items in exchange and ritual ceremony. Many copper earspool were manufactured in the core Hopewell area and probably exported along with the specifics of Hopewell religious belief (Trevelyan 2004:34). Most excavated copper earspools consisted of two circular copper discs connected by a central hollow copper rivet that acted as an axis (illustration 5.6). These Hopewell earspools were most-likely highly valued elite burial accoutrements.

Mississippian Period (ca. 900 - 1600 A.D.)

Around AD 900, there was a major transformation in the Eastern Woodland cultures. As the 500 year transitional period between the demise of the Hopewell Interaction Sphere and the newer Mississippian Period ended, population levels climbed. Maize agriculture, combined with age-old hunting and gathering practices, rapidly gained importance in diet. With increases in populations, social ranking became greatly pronounced (Cob and King 2005:168). Elaborate ritual activities centered round large earthen pyramids and plazas. Early Mississippian ideology focused on the Morning Star and Hero Twins and symbolic metaphors of the supernatural cosmos. The culmination of these traits produced the apex of prehistoric culture in the southeast, the Southeastern Ceremonial Complex (Reilly and Garber 2007).

The rise of the Southeastern Ceremonial Complex involved a dramatic upsurge in the production and exchange of a wide variety of ritual and prestige goods across the Eastern Woodlands (Cob and King 2005:169). Chief among these prestige goods were copper birdman plates found in the elite mortuary deposits of mound sites such as Spiro, Oklahoma and Etowah, Georgia (illustration 5.7).

During this time period, significant refinement in copper sheet working and copper sheet decoration emerged. Large quantities of decorated copper artifacts were recovered at Spiro and Etowah. Smaller amounts of worked copper have also been excavated from ritual burial deposits at Moundville, Alabama and various other southeastern mound sites.

Much like the early Ohio Hopewell, copper sheets and foils were used for the manufacture of elaborate ceremonial, symbolic, and ornamental artifacts such as highly decorated plates and badges (Ehrhardt 2002:153)(illustration 5.8). It is obvious that neither the mining technology nor the manufacturing techniques were lost during the transition from the Hopewell to the later Mississippian period.

One difference between the Hopewell and Mississippian time periods was how indigenous groups acquired the copper used to manufacture their elaborate artifacts. The knowledge of the large useable copper deposits from the Lake Superior region seemed to have been lost, and so the smaller copper resources that are found throughout the Appalachian Mountain region and the tri-state area of

Georgia, Kentucky, and Tennessee were exploited. The reason for this shift from Great Lakes copper to primarily southeastern resources has not yet been ascertained. It could have been the effect of restricted territorial passage to northern sources, or the loss of knowledge of trade routes over the 500 year time span between the cessation of the Hopewell Interaction Sphere and the start of the Mississippian Period.

Much like the earlier Hopewell Period peoples, the Mississippian peoples exchanged exotic materials like copper over long distances. Major sites such as Cahokia in Illinois, acted as trade centers for raw resources, while probable workshops at Cahokia and Etowah processed the material into the elaborate ritual objects (Brown and Kelly 2000; Reilly and Garber 2007). These ritual objects were then later interned in burial mound sites such as the Craig Mound at Spiro and Mound C at Etowah.

The four major Southeastern ceremonial centers - Cahokia, Spiro, Moundville, and Etowah - were pivotal to the creation, distribution, and manipulation of the Mississippian iconographic art style. At each of the four sites, these extraordinary copper plates and artifacts seem to represent ceremonial or cult paraphernalia (Brown 2004:119). Similar symbols appeared on ceramics, shell, and copper, yet aboriginal artists also created their own regional styles. The similarity of the iconographic art was one method of artistically uniting the religious beliefs of these numerous people over a large expanse of land (Power 2004:66).

Cahokia (ca. A.D. 1000 - 1350)

Cahokia, the largest temple-town center in North America, resides on the banks of the Mississippi River in southern Illinois. This major Precolumbian ceremonial center is located near East St. Louis and contains over 100 earthen temple and burial mounds on a 2,200 acre site. At the center of this ceremonial complex is the largest single earthen construction in North America - Monk's Mound. This enormous 100 foot structure, and the surrounding mounds and plazas, was enclosed by a massive wood palisade constructed for either defensive reasons or to screen private religious ceremonies.

Cahokia, situated near the convergence of the Mississippi, Missouri, and Illinois rivers, was in an ideal position from which to control trade activities and the distribution of raw materials (O'Connor 1995:30). Cahokia was very influential and its elite trade goods and iconographic art style appear as far south as the Gulf

Coast and as far north as the Aztalan site in Wisconsin (Young and Fowler 1999:292).

Cahokia also appears to have been a major center for craft specialization. Specialized workshops were manned most-likely by full-time artisans producing exotic stone, ceramics, and mica trade goods. These full-time artisans would have been *attached* and worked under the sponsorship of political-religious leaders (O'Connor 1995:31; Inomata 2001:321). Attached artisans produced specialized goods for elites and this arose from the explicit desire of the ruling elites to control certain politically charged commodities and ideology (Inomata 2001:321). O'Connor (1995:31) stresses that the right to handle or possess these spiritually powerful objects, especially copper, was frequently based on family or kinship affiliations.

Cahokia is viewed as being the origin point for the Classic Braden iconographic style (Brown and Kelly 2000). This style is epitomized in embossed copper and shell engravings. The artistic skill level demonstrated in Classic Braden engravings and embossing could only have come with decades of specialized training (Brown 2004:117). Classic Braden copper works include the Etowah Rogan Plates and the multitude of Spiro shell engravings (illustration 5.9).

Oddly, embossed copper plates are conspicuously absent at the site of Cahokia. This is because the elite burials at Cahokia predate the copper plate phase found at sites like Etowah and Spiro (Brown and Kelly 2000:484). Very few examples of embossed copper occur anywhere in Cahokia's immediate area and the most elaborate copper in Illinois clearly postdate Cahokia (Sampson and Esarey 1993:472). Iconic symbols such as the embossed falcon plates were simply not in use prior to the decline of Cahokia (Sampson and Esarey 1993:472).

Although copper plates are absent at Cahokia, there has been plenty of copper artifacts excavated at the site, and more importantly, two possible copper workshop have been located east of Monk's Mound at Mound 34 (Kelly et al. 2007:3).

Mound 34 is an unobtrusive mound situated on the northwest corner of the Ramey Plaza just outside the east palisade. The mound was dubiously excavated with bulldozers by Perino in the late 1950s and two copper workshops were identified (Kelly et al. 2007:8). Later excavations (2007) to locate one of the workshops uncovered large amounts of small copper fragments and copperworking tools including sandstone abraders and a basal hammerstone (Kelly et al. 2007:17). It is unknown if any of these tools have been scrutinized for copper residue. More importantly, this copper workshop could possibly be the manufacturing location relating to the production of the large copper plates associated with the early stages of the Southeastern Ceremonial Complex (Kelly et al. 2007:11).

Interestingly, shark teeth and chert-imitation shark teeth have also been excavated from Mound 34 (Kelly et al. 2007:14). These were in all likelihood related to the carving of wood templates employed in copper plate production. Leader (1988:31, 122) states that caches of shark's teeth were found at Lake Jackson and were probably used for carving purposes.

Spiro (ca. A.D. 1350 - 1450)

One of the most spectacular and best known Mississippian copper mortuary deposits was uncovered at the Craig Mound at Spiro in eastern Oklahoma. Called the America's King Tut's Tomb, the site was heavily looted in the early 1930s. Large caches of over 265 repoussé copper plates, many with embossed birdman figures, were discovered in the Craig Mound (Sampson and Esarey 1993:452). Other copper artifacts found at Spiro include numerous solid and foil-clad copper beads, needles, pins, axes, and spud-shaped objects. There were also many copper-clad wooden and stone objects including plaques, antlers of red cedar, small cedar masks, earspools, bear teeth, and elliptical blade-like knives of red cedar (Hamilton 1952:33, 55)(illustration 5.10). Hamilton estimates that the site contained as many as 400 earspools nearly all clad in embossed sheet copper (Hamilton 1952:55). The copper-clad plaques could be viewed as examples of template utilization for the creation of copper birdman plates.

Spiro is also known for its abundance of engraved shell cups and gorgets. The vast amounts of engraved shell artifacts are in the Classic and Late Braden style which is closely related to the Braden A style from Cahokia (Brown 2004:120)(illustration 5.11). Amongst the artistic styles represented at Spiro, there are many fine examples of the Classic Braden style embossed onto copper repoussé plates (Brown 2004:120)(illustration 5.12).

At this point in time, there is no archaeological evidence of copper manufacturing workshops at Spiro. Workshops might be present unexcavated in the nearby vicinity but that remains to be seen. If there are no copper workshops at Spiro, then the finished products would have been delivered from another locality, most—likely Cahokia. The Spiro site was the recipient of an abundant amount of Cahokia's Classic Braden-style copper plates suggesting a substantial gift exchange was occurring between the two sites over many generations (Brown 2004:119, 120).

Etowah (ca. A.D. 1250 - 1500)

The Mississippian period ceremonial center and town of Etowah is located in northwest Georgia on the banks of the Etowah River (Morgan 1999:197). The three large truncated mounds and three smaller platform mounds are surrounded on three sides by a moat and palisade (Morgan 1999:197). Over the course of three different excavations, archaeologists uncovered some 350 burials from Mound C and recovered one of the largest collections of SECC artifacts in the Southeast (Cobb and King 2005:181). Copper artifacts include the embossed copper Rogan plates, as well as several other anthropomorphic or zoomorphic embossed plates (Sampson and Esarey 1993:452)(illustration 5.13). Other copper artifacts include embossed gorgets, headdress plumes and badges, cutouts, and copper-clad axes, beads, earspools, and anthropomorphic and zoomorphic rattles (Sampson and Esarey 1993:452). These embossed copper artifacts are in the distinctive Classic Braden-style of Cahokia and show the close connection to the supernatural realm maintained by the rulers of Etowah possessed (King

2004:158, 163). This sheer amount of Braden-style artifacts suggests that Etowah was closely tied to the larger Illinois site and that the rulers of Etowah relied on Cahokia's foreign symbolic motifs to validate their political power (King 2004:160).

Although a plausible copper workshop has been uncovered on the platform associated with Mound B, the Rogan Plates in all probability were originally constructed at the site of Cahokia (Brown and Kelly 2000:498).

Fabrication techniques employed at Etowah included earlier methods employed by Hopewell artisans. However like other Mississippian sites, the fabrication methods at Etowah show a trend towards thinner copper sheet objects and wood and stone copper-clad artifacts (Leader 1988:198). This shift may have resulted from several factors including the relative scarcity of copper derived from southeastern sources, or the increased use of large copper ornaments for ceremonial and everyday apparel (Leader 1988:199). The basic fabrication techniques utilized by aboriginal artisans are still difficult procedures for modern metal workers to master, despite the major advancements in metallurgical technologies (Leader 1988:46).

Moundville (ca. A.D. 900 - 1550)

One of the largest prehistoric village-ceremonial mound sites in North America is situated over looking the Black Warrior River in central Alabama. Located just south of Tuscaloosa, Moundville contains over twenty truncated platform mounds spread over 300 acres. The site is second in size only to Cahokia and was fortified by a wooden palisade that enclosed the site. The palisade suggests that conflict existed in the region of Moundville.

Moundville began to flourish after the decline of Cahokia sometime around A.D. 1250 (Sampson and Esarey 1993:472). Over 3000 burials have been excavated at Moundville suggesting that the site later evolved into a necropolis. The layout of Moundville implies that a highly stratified society resided at the site with elite structures appearing in the northern section of the complex. This hierarchical layout shows similarities to the protohistorical Chickasaw moiety camp square layout with higher moieties or ruling clans situated at the top and lower ranked clans at the bottom (Knight and Steponaitis 1998)(illustration 5.14).

An impressive amount of copper artifacts has been found at Moundville much like the regional centers of Etowah and Spiro (Sampson and Esarey 1993:452). A quantity of smaller copper paraphernalia has been recovered at the site. These copper objects included numerous pendants, gorgets, plumes, axes, copper-covered earspools, and in one instance a ritually crushed copper bilobed arrow (Sampson and Esarey 1993:452; Reilly personal communication). James Knight suggests that some of the copper symbol badges excavated at Moundville actually originated at Etowah (Leader 1988:168). Unfortunately, no large birdman copper plates similar to those found at Spiro and Etowah have been excavated at the site.

Although Moundville had a relationship with Cahokia similar to Etowah, only one Classic Braden style engraved shell fragment has been found at the site (Brown 2004:120).

Other Localities

Outside of the major copper centers of Cahokia, Spiro, Etowah, and Moundville only limited quantities of copper have been unearthed. However, copper artifacts with similar forms and styles have been found at many localities, either singularly or in caches, throughout the Eastern Woodlands (Sampson and Esarey 1993:452).

Wulfing Plate Cache

The eight repoussé copper Wulfing Plates were discovered in a cache in southeastern Missouri (illustration 5.15). These plates bear a striking resemblance to copper plates excavated at Spiro and other Eastern Woodland mound locations. It is plausible that these similar yet geographically distant plates were made by the same craftsman or at workshops influenced in the iconic Cahokian art style.

The Wulfing Plates are unusual as the cache was not associated with any other artifacts or with any archaeological mound or village site (Watson 1950:1). Deposited for some unknown reason, the copper plates were probably part of a sacred bundle (Reilly personal communication). The plates are in a damaged and fragmentary condition partly due to being originally struck by a plow when first uncovered and partly to their great age (Watson 1950:1). Watson (1950:6) observed that the plates were not constructed using single sheets of copper but were apparently manufactured with multiple thin sheets hammered together to form sheets large enough for the required design. The Wulfing Plates also show multiple repairs by different hands indicating the plates had some antiquity before they were interned (Watson 1950:49). The fact that the plates were constructed with multiple sheets suggests that there were limited copper resources available for the craftsmen. The repairs also imply that great value was placed on the plates by their original owners and that the raw medium was just as important as the images. Damaged plates were repaired utilizing various methods with varying degrees of workmanship (Watson 1950:6). This appears as evidence of less skilled craftsmen attempting the repairs. Repairs included riveting, overlapping and hammering partial breaks or a mixture of the two (illustration 5.16). Watson (1950:15) remarks that there is no correlation between the manufacturing of the blank plates and the execution of the embossed design. Some copper plates are beautifully and carefully embossed but on poorly manufactured blanks while blanks manufactured with greater skilled display inferior and carelessly made designs (Watson 1950:15). This suggests that the raw blank manufactured plates of varying quality were brought in and the design added much later by different artists of different artistic caliber. As stated previously, unembossed blank hawk-shaped plates similar to the Wulfing plates were excavated from Spiro (Hamilton 1974:137). Watson (1950:15) implies a division of labor in the manufacturing of the plates with separate individuals manufacturing the blanks and executing the design.

It is possible that some of the damaged observed on the Wulfing plates was from the plates being *killed* in antiquity and then repaired and reused. Ritually killed copper plates are also found at the site of Spiro (Hamilton 1974:97). Although there is uniformity in the eight Wulfing Plates, Watson (1950:44) does not believe that a stencil-like pattern as suggested by Cushing was used for transferring a similar pattern or outline to another plate. This does not rule out the plates being constructed with carved templates, only that each of the eight plates is dissimilar enough to rule out one *master* template.

Lake Jackson (ca. A.D. 1100 - 1500)

Located in the Florida panhandle just north of Tallahassee, the Lake Jackson site is a ceremonial center consisting of six truncated mounds and one conical-shaped mound. Nine noteworthy copper plates have been excavated from elite burials at the site. These include five cutout falcon shaped copper plates with forked eye motifs and four birdman plates showing a marked similarity to the Rogan Plates of Etowah (illustration 5.17). These plates were constructed from copper nuggets hammered into sheets and riveted together before embossing (Milanich 1994:375). Milanich (1994:375) observed that repairs to the plates are evident and that the plates were reinforced with supporting split-cane and wood frameworks. This would seem to suggest that the plates had some antiquity before being deposited within the burials. Scraps and pieces of other copper plates were also excavated suggesting that other plates were possibly *killed* before being deposited within the burials. Other copper objects excavated at the Lake Jackson site include copper pendants, arrow-shaped costume regalia, and copper badges (Milanich 1994:375). The remarkable similarities between the Lake Jackson copper plates and the Rogan plates suggests that the Lake Jackson was closely connected to other Mississippian chiefdoms in the Eastern Woodlands especially Etowah. These Lake Jackson coppers were probably crafted at the same workshop, if not by the same hand, as were the Rogan Plates.

Other Unique Copper Works

There are plenty of other notable embossed copper plates found singularly or at mound sites throughout the eastern United States (for example: Upper Bluff Lake Plate and the Peoria Plate)(illustration 5.18). These copper plates illustrate the close connection of smaller

Mississippian sites to the four major ceremonial centers previously discussed. The plates exhibit design elements similar to ones found on the Wulfing Plates suggesting that, although found at geographic distant sites, the plates were constructed by a single craftsman or by a close group of artisans.

The Mississippian copper plates constructed from carved templates were in all likelihood emblems of clan membership or other social units or sociotechnic symbols of ritualistic authority and power (Townsend 2004:26). The striking similarities of symbols and motifs between many of these plates indicate a significant amount of shared artistic interaction between these diverse, geographically distant groups (Power 2204:119). Finally, it should be reiterated, Mississippian craftsmen utilized their limited copper resources not for the production of everyday ornaments and tools, but for the production of thin copper sheets and plates chiefly for the manufacture of ritual regalia.

After approximately A.D. 1400, prior to the first European explorations in the region, the Mississippian cultures of the Eastern Woodlands underwent a rapid demise (Walthall 1990:2). The major ceremonial centers and mound sites were abandoned and the aboriginal groups broken into smaller villages and more mobile hunter-gatherer units. There are numerous theories on the abandonment including climate deterioration, regional conflict, and the introduction of European pathogens (Cobb and Butler 2002:636; Milner 2006:193; Nash and Strobel 2006:85). Whatever the causes, it ultimately led to the depopulation of the region and the collapse of the Southeastern Ceremonial Complex's socio-political and religious belief system.

CHAPTER 6

TOOLS AND TEMPLATES

When you make the tool, you learn something about the toolmaker (Bulletin of Primitive Technology, 2005).

The methods and techniques utilized to replicate the copper objects in this thesis are no way guaranteed to be the same processes employed by the original native craftsmen. It is possible to arrive at the same endpoint by journeying on different paths. In actuality, the advance level of skill need to work and create the masterful ceremonial regalia could only be obtained with years of training. The copper objects created by the craftsmen of the Hopewell and Mississippian cultures were undoubtly created by full-time practitioners. One cannot just pick up a hammer and manufacture a Hopewell earspool or one of the Mississippian Rogan Plates. Only a master metalworking artisan had the knowledge and skill to produce such objects. In all probability, the knowledge necessary to achieve this level of metalworking was held by a few individuals and was a secret and highly coveted technology.

In the succeeding chapters I will detail the methods and techniques for replicating varying copper artifacts of the Middle Woodland Hopewell Culture and the later Mississippian Culture. Within this section, I will discuss tool construction and use, template construction, and the process of fabrication of each of the fore mentioned copper artifacts. Subsequently, I will replicate a number of times the Hopewell and Mississippian copper objects in order to demonstrate the different possible methods of fabrication.

Tool Construction

The tools used for the creation of prehistoric Eastern Woodland copper artifacts were in all likelihood similar to the tool kits employed to fabricate stone, shell, and wood artifacts. Tools utilized and discussed in this paper were modeled on artifacts excavated from archaeological sites and current metalworking implements.

Wooden Tools (illustration 6.1)

Wooden tools used during the reconstruction processes included various sized chisels, punches, and burnishers. The wood tools I used were shaped from scraps of 150 year old Longleaf Pine (*Pinus palustris*) and Walnut (genus *Juglans*). Longleaf Pine was selected as it is an extremely hard, dense wood found throughout the southeastern United States. The wood tools retained their shape throughout the repoussé process and needed little reshaping.

Small wood stumps with flattened tops were also obtained to use as anvils (illustration 6.2). These anvils were employed mainly during the manufacturing of small flat copper pieces especially the Hopewell earspools. Finally, cut lengths of smoothed and rounded lumber were also used in the hammering process.

Stone Tools (illustration 6.3)

Small stone tools were constructed from flaked lithic debitage obtained from modern flintknapping. These flaked stone tools were employed to trace or scratch desired images onto the surface of the copper. In all likelihood, Native craftsmen also used lithic tools such as chisels and small celts for chasing designs onto the copper plates.

Smooth fist-sized stone hammers were used exclusively to hammer the metal or hand-held tools. Lastly, small smooth river cobbles, supported by sandbags, were utilized as anvils.

Antler and Bone Tools (illustration 6.4)

Deer antler tines were utilized as alternatives for wooden tools. The antler tips were modified and ground to desired shapes much like the previously discussed wooden tools. Antler tines were mainly used to chase and burnish the initial image onto the copper plate after tracing.

Modified bone was also most-likely exploited by Native craftsmen for manufacturing copperworking tools. Bone was an easily obtained resource and could be shaped and modified with little effort.

Copper Tools (illustration 6.5)

An indispensable small copper chisel was constructed from a leftover copper fragment. The rectangular piece was rolled into a tube and one end hammered down flat. This flattened end was shaped and sharpened by grinding it on the surface of a stone anvil. The chisel edge was sharp enough to cut through a thin copper plate backed with pitch and was used extensively to cut-out the complex and intricate patterns.

Modern Tools

Modern carving tools were employed for carving designs into the wood templates. Native craftsmen would have utilized flaked stone tools, almost wholly, for this manufacturing process. Jonathan Leader (1988:122) stated that tool marks left on the interior of wooden artifacts from the Lake Jackson site suggested that both stone and shark tooth tools were used for carving wooden objects.

Other Tools Utilized

Copperworking requires a great deal of preparation before it can commence. Protective gear is extremely important. As discussed previously, Native copper-workers most-likely employed goggles or coverings as eye protection. Optional equipment would include leather gloves and wooden tongs used for handling the hot copper during annealing.

For the research presented here, copper plates were annealed utilizing a propane torch. The torch accelerated the normally lengthy annealing process.

To clean the copper plates of fire scale after annealing, different methods of cleaning were used. One method was to first submerge the red hot metal into water which *shocked* a portion of the fire scale off the plates. Afterward, the plate was immersed into a mixture of vinegar and salt and scrubbed to clean the metal. Alternately, a greatly diluted solution of hydrochloric acid was employed instead of the vinegar mixture.

Wood Templates

The utilization of carved wooden templates is a plausible hypothesis for the manufacture and duplication of embossed copper plate artifacts. Carved templates simplify the process of plate production and greatly reduced the time needed to create a plate. Leader (1988:172) stated that one copper piece took a week for him to construct, but with the use of carved templates, a simple plate could be finished in less than a day. Willoughby's (2000:46) examination of some copper plate artifacts exhibited tool marks on the reverse side of some of the patterns, as though the plate had been pressed into a shape, most-likely a carved wooden template.

Before construction on a copper plate can commence, the template needed to be carved. Firstly, the pattern would need to be designed and approved insuring the scarce copper resource would not be wasted. Motifs could be added or removed, patterns flipped, or the design discarded altogether. Once the design was accepted, the image would be carved into a template.

Templates employed for reproducing the Hopewell and Mississippian era coppers were carved from planks of Basswood (*Tilia americana*). Basswood is an easy to carve hard wood that has a close, straight indistinct grain. This native tree is found throughout the eastern United States and was heavily exploited by Native Americans. Susan Martin (1999:43) lists basswood as one of the three important non-food resources used by eastern Native Americans. The flowers, leaves, and bark of the tree had a multitude of medicinal properties while the inner bark fibers were utilized for making thread and fabric (Erichsen-Brown 1989).

One inch thick boards of pre-cut basswood were used for template construction. The selected design was enlarged to the approximate size of the original artifact and then, either free hand or using carbon paper, was transferred onto the board and carved out.

Pitch and Pitch Alternatives

Pine pitch, when used in tandem with carved templates, simplifies the fabrication and duplication process of copper plate production. Copper plates formed from templates could have been finished on a bed of pine pitch resin, on a bed of dense clay, or free hand over leather.

Layers of leather can be used as a substitute for pitch, as could soft planks of wood. Cushing (1894:103) worked his copper Peoria raptor bird plate over a yielding support of buckskin, folded and laid over a level spot of ground. Both Watson (1950:4) and Hamilton (1974:294) mention the use of leather as a pad upon which to work copper. Although leather can be supportive during chasing designs, cutting out the plate over leather becomes difficult. The edges of the copper become deformed and tear and bend instead of being cut. Pine pitch is the better alternative.

As mentioned previously, Native craftsmen employed pine pitch and resins in their daily lives to waterproof boats, basketry and pottery, and as an adhesive for stone tools. It is conceivable that Native artisans would have realized the properties of pitch in constructing their copper plates. Willoughby (2000:46) speculated that pitch of just the right consistency may have been used as a yielding support for working copper.

A thin layer of pine pitch would have been heated into a sticky, near liquid consistency. The copper plate would then be pressed down into the pitch for a solid seating and the pitch allowed to cool. Alternately, a pitch layer could be smeared over the plate surface to insure that air bubbles did not adhere to the copper. After the design was chased into the metal the pitch would be reheated and the copper plate removed. Adhering pitch would be burned off and the plate re-annealed, cleaned, flipped and the process repeated.

Alternatives to pine pitch would be dense clays, sheets of leather, or planks of soft wood - as long as the plasticity of the supporting material was hard enough to hold its shape yet soft enough to yield while being worked.

CHAPTER 7

METHODS AND TECHNIQUES: HOPEWELL COPPER

Three Hopewell period copper artifacts were selected for replication: an embossed raptor bird plate; a geometric raptor head plate; and the most iconic of Hopewell artifacts, a copper earspool.

Hopewell Embossed Copper Raptor Bird Plate

A Middle Woodland Hopewell embossed copper raptor bird plate excavated from Mound City, Ohio was selected as the first piece for reproduction (illustration 7.1). The copper plate is simple in design and could have been produced either by a carved template or free handed. In order to estimate how the copper raptor plate was manufactured I decided to reproduce the pieces three times. I first reproduced the plate free hand, second employing a carved wooden template, and third utilizing the carved template and pine pitch. The original copper artifact is approximately 20.4 cm in height and 30.6 in length. The thickness of the piece is unpublished. At least two similar raptor plates are known to this author (illustration 7.2). The dimensions of the second raptor plate are unspecified but assumed to be approximately the same size as the first. It will be one of my future goals to measure and compare these plates to see if they are similar in size. The two examples are so similar it suggests that the same hand crafted the plates possibly utilizing the same general silhouette pattern to construct both.

The Middle Woodland Hopewell copper plate consists of a left-facing side profile of a raptor bird in flight. The bird's head has a downward curving open beak, a single large oval eye with rounded forked eye-surround, and a single lined neck collar. Above the bird's eye there are approximately eleven small hash marks that most-likely represent feathers (illustration 7.3). It is probable that the three hash marks directly over the eye are actually a continuation of the rounded forked eye-surround as seen in the other raptor bird example (illustration 7.4).

The body of the plate exhibits two small punched holes that were probably employed to attach the piece to a headdress. These holes might also have played a role in securing the plate to a template during construction (illustration 7.5). Attaching the plate to the template insures the copper will not shift during embossing which would ruin the design (*as I discovered with Cushing's Peoria plate discussed later in the next chapter*).

The body also exhibits a circular anus-like motif similar to those found in later Mississippian raptor bird plates. The tail of the raptor features seven stubby rounded feathers with no added details. These tail feathers originally could have been triangular in shape as demonstrated in the second raptor bird plate.

The bottom of the plate, or the bird's breast, is delineated by a single chased line. There are approximately five V-shaped motifs displayed on the breast, three representing either feathers or other markings. The plate bottom ends with two more V-shaped motifs most-likely representing the drawn up leg of the bird with an attached three clawed foot (illustration 7.6).

The wing of the raptor bird exhibits six feathers, four of which taper into points and two which are rounded. The wing feathers feature multiple oval and C-shaped motifs. Unfortunately much of the C-shaped motifs have been damaged over time and can only be surmised.

For the free hand reproduction, 32 gage sheet copper was cut into an approximately 12 inch square sheet. The copper was heated by propane torch to a dull red hot to facilitate the annealing process and make the metal more malleable. After annealing, the plate was submerged in the acid solution to assist in removal of the fire scale. The plate was then cleaned and dried.

Hammering was accomplished on stone and wood anvils using smooth, handheld stones, and hafted stone hammers. The copper sheet was hammered from the center outward in a spiral pattern (illustration 7.7). In thicker copper sheet, hammering from the center facilitates the thinning of the plate and the moving of the metal outward towards the edges. Cushing (1894:100) recognized that when hammering at a slanted angle, from the center outward, the copper spreads out as rawhide does. Hammering the copper also microscopically pits the surface of the metal, thereby toughening it so it will not scale or crack so easily (Watson 1959:4). The general shape of the raptor bird pattern was then inscribed onto the hammered plate utilizing a paper template and the edge of the sharpened copper chisel (illustration 7.8).

After the raptor bird pattern was transferred to the copper (illustration 7.9), the plate was re-annealed and cleaned by scrubbing with the salt and vinegar solution (illustration 7.10). The copper plate, supported by a bed of dense clay, was cut out carefully utilizing the copper chisel employing a sawing-cutting motion (illustration 7.11 - 7.12).

Once the raptor bird design was cut out (illustration 7.13), the details were chased in utilizing the wooden punches (illustration 7.14 - 7.15). It should be noted that the dense clay did not offer enough support for chasing by hammering, so a plank of basswood was employed. Later I discovered that the dense clay was supportive if the design was burnished using rounded wooden tools instead of hammered tools. Unfortunately, during the final heating to clean the plate of adhering clay, fire scale, and discoloration, two of the wings were damaged due to excessive heat (illustration 7.16). This was due to my being briefly inattentive during the process.

The second reproduction was accomplished utilizing a carved basswood template (illustration 7.17). The raptor bird design was transferred onto the wood using carbon paper and the template carved out using modern hand carving tools. Once the carving was completed, a hammered and annealed 32 gage copper sheet was burnished onto the copper using a number of small pointed hardwood punches and an antler tine (illustration 7.18 - 7.20).

After the general shape of the raptor bird was obtained the plate was secured to the template using nails in the approximate location of the holes on the original artifact (illustration 7.21). The image was then sufficiently impressed and burnished onto the copper (illustration 7.22 - 7.31) and the piece then removed, annealed, and cleaned. The raptor bird plate was finished on a flat supporting bed of dense clay and the details defined by chasing and burnishing. Finally, the plate was cut out utilizing the copper chisel and the supporting bed of dense clay (illustration 7.32).

The final reproduction was accomplished employing both the carved template and a supporting bed of pine pitch. A hammered and annealed 32 gage copper sheet was prepared and secured to the template. The raptor bird pattern was again burnished onto the plate employing the pointed hardwood punch and the antler tine. Once the pattern was completed, the copper plate was then removed and the reverse side of the copper plate smeared with heated pine pitch and embedded into a bed of softened pine pitch (illustration 7.33).

Smearing the reverse side with pitch removes the chance of air bubbles remaining under the plate which can lead to a tool punching through the work. Once the pitch had hardened, the raptor bird design was refined by chasing using rounded hardwood chisels (illustration 7.34). The raptor bird plate was cutout utilizing the copper chisel (illustration 7.35 - 7.37) and heated and released from the pitch and the adhering pitch burned off (illustration 7.38). After the pine pitch was removed, the plate was cleaned and the small copper filaments that were left over from the cutting process were ground off (illustration 7.39 - 7.40).

Discussion

A comparison between the three plates and the original Hopewell copper raptor bird plate photograph suggests that the original artifact would have been manufactured either free hand with the use of a general shaped silhouette template or with a carved template (illustration 7.41 - 7.46). Although a supporting leather bed might have been utilized during chasing, leather offers no support when cutting out the plate.

Cushing (1894:103) stipulated that Native artisans ground out the images with flat pieces of sandstone but this procedure is so extremely labor intensive that it seems nearly impossible to reproduce. Leader (1988:100) speculated that the squared edges observed on the plates are from the abrading technique but this same squaring of the plate edges could have been produced by cutting. Pine pitch offers a solid supporting bed that allows the copper plate to be cut without deforming or shearing and consumes very little time when compared to the abrading technique.

The Native craftsmen who created these plates most-likely employed a solid yet yielding bed to work the copper piece. This supporting bed could have included dense clay, leather sheets, softwood planks, or pine pitch. After employing each of these supporting matrixes, it is in my opinion that the original prehistoric copper raptor bird plate was completed free hand with the use of one of these surfaces. Pine pitch offers the best solid yet yielding surface to work copper plates.

It should be noted that pine pitch was harder on the edge of the copper tool when compared to the clay. The copper chisel had to be hammered back into shape and sharpened multiple times while cutting over the pitch. The dense clay was not as supportive for cutting with the copper chisel (*the edge of the plate tended to bend and deform*) but worked quite well when chasing the pattern with the rounded punches.

Finally, it should be mentioned that the copper raptor bird plates oxidized quickly after cleaning, dulling the surface of the metal (*see* illustration 7.32). Could Native artisans have smeared something on the surface of the copper plate to protect it from oxidation at least long enough for ritual use (*such as animal fat or bee's wax*)?

Hopewell Geometric Copper Raptor Bird Plate

Hopewell artisans were masters at creating elaborate geometric cut-outs and designs in copper (illustration 7.47 - 7.48). The Native craftsmen displayed strong grasps of artistic composition including the concepts of balancing positive and negative space.

The geometric piece selected is a copper repoussé plate showing four mirrored serpentine raptor-type bird heads (illustration 7.48). The copper plate is approximately 14 cm width and 25.5 cm length (Brose 1985:204). Similar raptor bird head motifs have also been found on Hopewell ceramic pottery (illustration 7.49).

The four mirrored raptor bird heads are connected by stylized *M*-shaped serpentine necks (illustration 7.50). Each raptor bird head has an open beak and a circular unadorned eye. The serpentine bodies are mirrored images of each other with the unconnected raptor bird heads facing in opposite directions. The connected heads are similar to one another suggesting a template of either the top two (*labeled 1 and 2 in* illustration 7.51) or the bottom two (*labeled 3 and 4 in* illustration 7.51) was used to create the plate (illustration 7.52 - 7.53).

The geometric raptor plate template was carved out of a basswood board measuring approximately 26 cm length by 14 cm width (illustration 7.54). The raptor bird pattern was transferred to the template by tracing a photocopy of the image over carbon paper. Three copper replicas of the template were constructed and these were compared to the photograph of the prehistoric artifact in order to surmise which method most closely resembled the original process of construction.

The first geometric raptor plate reproduction was completed free handed over pine pitch, the second reproduction burnished over the carved template, and the final reproduction constructed employing both the template and the pine pitch. The original prehistoric raptor bird plate exhibits two holes in the copper piece that were possibly used to suspend the plate for display (illustration 7.55). As previously noted, these holes could have also been used to secure the copper plate to a carved template during construction.

For the free hand replication of the geometric raptor bird head plate an approximately 27 cm length by 15 cm width rectangular copper sheet was cut out, annealed, and cleaned in the acid solution. The copper sheet was embedded in a heated pine pitch bed and allowed to cool. Once the pitch had hardened, a paper template of the original prehistoric artifact was placed over the copper and an impression was made by pressing and tracing with a sharpened walnut dowel. After the pattern was transferred to the plate a hardwood chisel was used to define the raptor image. The plate was then heated and released from the pitch.

Once annealed and cleaned, the obverse side of the copper raptor plate was embedded in the pine pitch and the process repeated. This time a rounded hardwood punch was also utilized to expand or push out the negative spaces between the serpentine bodies of the bird heads. This technique was also used on the eyes of the raptor birds. The plate was then heated to release it from the pitch and cleaned (illustration 7.56).

For the second replication of the geometric copper raptor plate a rectangular copper sheet was again cut out measuring approximate 15 cm in height and 25 cm in length. As in the previous example, this plate was then annealed and cleaned. The copper sheet was placed over the carved wooden template and the image quickly burnished onto the plate using a rounded hardwood punch. Once the raptor image was well defined by burnishing, the plate was heated to remove oxidation and cleaned once more (illustration 7.57).

For the final reproduction of the geometric raptor plate another rectangular copper sheet was again prepared by annealing and cleaning. The copper plate was laid over the template and burnished using the same technique as the second replication. After burnishing, the copper raptor plate was embedded into a heated bed of pine pitch and the image refined by chasing using hardwood chisels. The copper was then heated and released from the pitch, annealed, and cleaned. The plate was then flipped and re-embedded into the softened pine pitch and after the pitch had hardened, the reverse side was refined using rounded and smoothed hardwood chisels. Finally, the copper plate was heated and released from the pitch and the adhering pitch burned off and the plate again cleaned (illustration 7.58).

Discussion

An examination of the photograph of the prehistoric copper geometric raptor plate suggests that the original plate was crafted free hand. The replica free hand copper plate closely resembles the prehistoric plate especially the expanded negative space found between the serpentine bodies. The original copper raptor plate could have been embedded and worked over a bed of pine pitch but more likely was created over a leather surface. Neither the pressed plate nor the pressed and pitched plate resembles the prehistoric plate other than in design. Time wise the pressed plate was by far the quickest to create (*not including carving the template*) and would have been the optimal process if the plate was to have been duplicated multiple times.

Hopewell Copper Earspool

Copper and copper-clad earspools can be considered the iconic artifacts of the Eastern Woodlands Hopewell culture. Thousands of these elite crafted objects have been excavated from burial mound deposits. Two copper earspool reproductions were made based on artifact illustrations using similar techniques but different gages of copper sheet. These two earspool replications were extremely difficult to create supporting the hypothesis that the original artisans were masters of their craft. A third earspool outer disc was replicated for comparison to the techniques Charles Willoughby employed in crafting his Hopewell-style copper earspool.

The basic Hopewell copper earspool consists of two circular outer discs, two circular inner discs, and a central hollow copper rivet that acts as an axis (illustration 7.59). The central rivet would sometimes be wrapped in cordage or fiber to secure the copper discs in place (Greber and Ruhl 2003:108)(illustration 7.60). Copper earspools have been excavated with cordage, preserved by copper salts, wrapped around the central rivets. Greber and Rulh (2003:116) maintain that the cordage functioned only to stabilize the earspool components during construction and did not serve any other purpose.

For the first earspool construction, four three inch circular discs of 18 gage copper were cut out using modern metal shears. The discs were annealed, cleaned, and then hammered using an outward spiraling pattern over a cobble stone anvil (illustration 7.61). This spiraling method of hammering the discs, as previously shown, moved the copper outwards towards the edges. Multiple hammering-annealing cycles reduced the size of the discs to approximately 26 gage.

The prepared copper discs were then hammered over a wood stump anvil to obtain a concave shape and central depression (illustration 7.62). Central holes were formed through a process of carefully punching-and-drifting with consecutive sized sharpened hardwood punches (illustration 7.63). Unfortunately, the punch-and-drift was rushed on one outer copper disc resulting in the metal deforming and tearing slightly (illustration 7.64).

To create the central axis or stem, a small rectangular fragment of annealed copper approximately one inch square was rolled and hammered over a dowel rod. One end of the rivet was upset and the two inner discs inserted onto it (illustration 7.65). The inner plate holes were constructed larger than the outer discs in order to conceal the flared end of the rivet when viewed through the central hole. The opposite end of the stem was upset locking the two inner discs onto the axis. Cordage was then wound around the stem to separate the inner discs. Glue kept the cordage from unwinding and added support to the copper discs (*see* illustration 7.60). The outer circular discs were then attached by carefully rolling the edges over the inner discs and burnishing them together (illustration 7.66 - 7.67).

For the second earspool reproduction, a thinner gage sheet copper was selected. Four copper discs were cut from 32 gage copper with the sharpened copper chisel while the discs were embedded in a bed of dense clay (illustration 7.68). The copper discs were then annealed and cleaned. The concave earspool shape was achieved by hammering the discs at an angle over a cobble stone anvil (illustration 7.69 - 7.70). Attempts to shape the copper in order to obtain the concave shape that exists in prehistoric examples caused some problems in crafting. Only a slight concave shape could be obtained from the thin sheet copper. This was probably due to my inexperience and not the thickness of the metal. It is probable that a more defined concave shape could be obtained if the copper discs were embedded in dense clay or hardened pine pitch.

Punching and drifting the central hole in the outer disc also proved difficult. Again one hole was successful while the other tore much like the first copper earspool. In all likelihood this was due to rushing the punching-and-drifting process and being briefly inattentive during that process (illustration 7.71).

After the central holes of the inner discs were enlarged, an approximate one and a half inch square copper fragment was rolled and burnished over a dowel rod (illustration 7.72). This created the central axis used to join the two inner copper discs. One end of the axis was flared by gently hammering and the two inner copper discs inserted on to it. The other end of the central axis was flared locking the inner two discs onto the stem (illustration 7.73). To keep the inner discs separate, a copper band was wrapped around the central axis and cordage wound and glued to keep the stem stable (illustration 7.74).

The outer circular concave discs were secured to the inner discs by carefully rolling the outer edges over the inner disc edges and burnishing them together (illustration 7.75).

The last copper earspool reproduction was of an outer disc only. This final reproduction was made to ascertain whether the circle-and-cross earspool that Charles Willoughby created in 1894 could be replicated without the use of a carved mold (illustration 7.76). Greber and Ruhl (2003:112) assert that there was no need for Willoughby's carved mold and that Hopewell craftsmen created copper earspools free hand.

Greber and Ruhl (2003:112) emphasized their belief that the original earspool replicated by Willoughby was created without the use of a mold. They came to this conclusion by examining hundreds of earspools from Ohio Hopewell sites (Greber and Ruhl 2003:112). Significant variations exist between the samples confirming Greber and Ruhl's (2003:112) conclusion that copper earspools were individually crafted free hand. Although Willoughby demonstrated that the use of carved wooden molds was technically possible in the creation of some Hopewell copper earspools, the vast majority of earspools were not created this way (Greber and Ruhl 2003:112).

The outer disc of the Hopewell copper earspool that Willoughby replicated can be created utilizing minimal tools. In this case, a rounded hardwood punch, the sharpened copper chisel, and a bed of dense clay were all that was needed.

Firstly, a three and a half inch disc was cut out of a copper sheet using the copper chisel over the dense clay bed. The disc was then annealed and cleaned. The copper disc was laid back over the bed of clay and the circle-and-cross design chalked in free hand. A rounded hardwood chisel was then used, free hand, to impress and chase the circle-and-cross into the metal. After the image was adequately defined, the disc was flipped and the reverse was worked. By flipping back and forth the general design of the circle-and-cross was quickly obtained. The central earspool hole and four outer holes were formed by quickly punching-and-drifting. The earspool disc, similar in form to Willoughby's copper earspool was completed in approximately thirty minutes. Although crude in comparison to Willoughby's creation, it reiterates Greber and Ruhl's belief that this style of earspool would have been crafted without the use of carved wooden molds (illustration 7.77 - 7.78).

Discussion

Hopewell copper earspools are extremely complex artistic creations difficult to replicate even with modern tools. The process for creating one of these iconic copper artifacts would undoubtedly become easier over time with experience. A completed copper earspool could then be finished in a few hours by a skilled metalworker (illustration 7.79).

Although the two copper earspool replications are not as handsome as excavated Hopewell examples, they do show that the technological process is reproducible with practice and a bit of patience. Securing the outer disc with the inner disc proved to be complicated. A steady hand was needed to keep from damaging the discs. The process of punching-and-drifting the central holes was also a difficult procedure. Inattention during the process led to the tearing of the metal. Although this was not structurally damaging to the earspool, it was cosmetically detrimental to the overall look of the earspools.

CHAPTER 8

METHODS AND TECHNIQUES: MISSISSIPPIAN COPPER

Four iconic Mississippian images were selected for this reproduction experiment: a hand-and-eye copper badge from Moundville; the copper raptor bird plate from Peoria, Illinois that Frank Cushing reproduced in 1894; a side-profile human head plate from Spiro; and finally, one of the elaborate copper Rogan plates from Etowah.

Moundville Hand-and-Eye Copper Badge

One of the most distinctive emblems to be associated with Mississippian elites would be the copper badge or gorget (illustration 8.1). Artistically crafted examples of these copper gorgets have been found at Moundville, Alabama. These oblong or circular shaped badges often feature an upper swastika-in-circle or scalloped circle motif (Steponaitis and Knight 2004:176). Often these badges also exhibit motifs duplicated widely throughout the Eastern Woodlands on many different mediums including stone, shell, and ceramics (illustration 8.2 - 8.3). Although the badges exhibit motifs found at other Mississippian sites, the oblong-shaped badge seems to be unique to Moundville (Steponaitis and Knight 2004:176). Thirty-two of the copper badges have been excavated from the site (Steponaitis and Knight 2004:176)(illustration 8.4). These copper badges could be perceived as insignia representing outward signs of clan or elite affiliation and authority.

The central elements of the Moundville copper badge include the hand-and-eye motif, ogee, and the scalloped circle (illustration 8.5). The oblong shape badge is the more common type found at Moundville (Steponaitis and Knight 2004:176) and its general shape is suggestive of the bellows-shaped apron and scalp-hoop motifs found on many of the copper and shell artifacts (illustration 8.6 - 8.7).

Four versions of the Moundville hand-and-eye copper badge were created for this paper. Three of the badges were constructed utilizing a carved wooden template (illustration 8.8) and one badge was crafted free hand. The image used to create the reproductions is based on a 1904 copper badge illustration by Clarence B. Moore (*see* illustration 8.1).

The original prehistoric hand-and-eye copper badge is approximately 13 cm in length. The oblong-shaped badge is broken into two distinct upper and lower registries (illustration 8.9). Depicted on the upper circular portion of the badge is a spoke-wheel design with a central ogee. The spoke-wheel design consists of six cut-out scalloped shapes. Beneath the upper registry is the sleeved wrist of the hand-eye motif containing a central V-shaped cut-out, six horizontal dots, and five horizontal lines. Moore's illustration of the hand-and-eye motif depicts knuckles and fingernails suggesting the back of the hand yet other hand-and-eye examples imply that it is the palm of the hand.

The first Moundville hand-and-eye copper badge in this study was created free hand utilizing a sharpened hardwood punch, the previously discussed copper chisel, and a bed of dense clay. The badge design was first scratched free hand with the chisel onto an annealed copper sheet slightly larger than the original artifact. The copper sheet was then pressed into the clay and the image defined and chased into the copper with a sharpened hardwood punch (illustration 8.10). Once the image was sufficiently impressed into the copper, the central V-shape and the badge outline were cut-out utilizing the sharpened copper chisel (illustration 8.11). The ragged edges left by the chisel were ground and smoothed utilizing a hammerstone (illustration 8.12).

The six upper scalloped shapes proved to be difficult to cut-out. However, this was accomplished by a technique of punching a series of small, closely spaced holes with the copper chisel and then slicing across the copper to cut the pieces out (*similar to spiral notebook perforations*). The badge was placed on a basswood plank during the process as the clay did not seem to offer enough support (illustration 8.13 - 8.15). The ragged edges of the six cut-out scalloped shapes were then ground flat with the hammerstone (illustration 8.16).

Finally the two small suspension holes were hammered into the upper registry using the copper chisel. The backsides of the holes were ground flat with the use of the hammerstone and the finished copper badge heated and cleaned (illustration 8.17).

The second Moundville hand-and-eye copper badge was created by burnishing an annealed copper sheet over the carved wooden template (*see* illustration 8.8). The design was sufficiently impressed into the copper so that it could easily be refined with the use of tools (illustration 8.18 - 8.23). No other work was done on this badge.

The third reproduction of the Moundville hand-and-eye copper badge utilized the carved wooden template and a bed of dense clay for support. An annealed rectangular copper sheet slightly larger than the badge was again burnished over the template. Once the hand-and-eye image was satisfactorily burnished into the metal, the badge was placed on the dense clay bed (illustration 8.24). The image was then defined by chasing both sides repeatedly with the hardwood chisel (illustration 8.25).

The copper badge was cut-out by placing the piece on a hardwood board and employing the technique of punching a series of small closely spaced holes with the copper chisel and then slicing through the copper. The technique was repeated on the V-shape section and the six central scalloped shapes. The ragged edges of the badge, V-shape, and scallops were ground smooth utilizing the hammerstone. After cutting and grinding, the plate was heated and cleaned (illustration 8.26).

The final Moundville embossed hand-and-eye copper badge was created by burnishing an annealed copper sheet over the carved wooden template and finishing the piece while it was embedded in hardened pine pitch. A prepared rectangular copper sheet approximately 15 cm length and 7 cm width was burnished over the carved template. Once the image was satisfactorily embossed onto the metal the badge was embedded in a bed of heated pine pitch and allowed to cool. The design face was defined by chasing with a hardwood punch (illustration 8.27). The pitch was then heated and the copper released and cleaned. The obverse side of the copper badge was then embedded into the heated pitch and the backside of the image defined by chasing (illustration 8.28).

The copper badge was again heated and released from the pine pitch. After cleaning, the badge was again embedded once more into the heated pitch. This time the oblong-shaped badge, the V-shape, and the six central scalloped shapes were cut-out utilizing the copper chisel in a sawing motion in tandem with closely spaced punched holes. The copper chisel had to be repeatedly cleaned of the adhering pitch and occasionally sharpened by rubbing it on a hammerstone surface. The badge was then heated and released from the pitch and cleaned. Ragged edges left by the chisel were careful ground smooth with the hammerstone (illustration 8.29 – 8.30).

Discussion

An examination of Clarence B. Moore’s original illustration of the Moundville hand-and-eye copper badge does not give much evidence on how the badge was created. Although there are similar embossed hand-and-eye copper badges from Moundville, in all likelihood each was created free hand without the use of templates. This is not to say that a template was not used, it is just that it can not be ascertained from the limited illustrations and photographs available.

An uncomplicated designed copper badge similar to this one could go from idea to a final finished piece in a matter of hours. If the copper badge was to denote the outward representation of clan or elite authority among multiple members of the Moundville social order then duplication via template would insure uniformity. Of the four replications, the final badge that utilized the template and pitch was the most prominent of the set. Finally, it should be noted that cleaning the copper badges is much easier when pressed into the original carved template. This method also insures less chance of damage to the delicate copper artifacts.

Cushing's Copper Peoria Raptor Bird Plate

One of the first researchers to attempt to reproduce the copper manufacturing techniques of Native craftsmen was Frank Hamilton Cushing in 1894. Cushing completed multiple experiments on copperworking including replicating a Mississippian era copper raptor plate excavated from a mound near Peoria, Illinois (illustration 8.31). He provided illustrations and instructions on the reproduction process and described his method of preparing a uniformly thick copper plate by hammering and grinding. Cushing also (1894:103) detailed the *pressure-drawing* technique for creating the image outline onto the plate before carefully grinding out the figure utilizing a flat piece of sandstone (*see* illustration 2.3 and 2.4).

The Peoria copper raptor bird plate Cushing reproduced is approximately 26 cm in length and 18 cm in width. The raptor bird is front facing with its head turned to its left. The pose can best be described as a *dead bird pose* with the bird laid out on its back.

The raptor bird has a banded upper and lower curved beak with an extended tongue. The circular eye is surrounded by what can be described as a lightning bolt shaped forked eye motif. The neck exhibits a double band separating it from the raptor bird's body.

The breast of the bird has six oval markings and a circular anus motif similar to the Hopewell raptor bird plate (*see* illustration 7.5). The raptor bird displays double banding on the knees and triple banding along the extended tail feather. Similar banding is seen on many of the copper birdman plates found in the Eastern Woodlands. The three-clawed feet are outstretched and display no markings. Extending below the wings are seven half oval scalloped markings and six wing feathers. Multiple half oval scalloped markings run down each of these six wing feathers. The tail feather is depicted spread out but is incomplete due to damage so its length was estimated for the replication.

The Peoria copper raptor bird plate was replicated four times to determine the best means for fabrication. One replication was done free hand over sheets of leather, similar to Cushing's experiment. Two replications were done utilizing a carved wood template of the raptor bird.

For the free hand replication, a copper sheet approximately 35 cm length and 25 cm width was prepared by annealing and cleaning. The plate was placed on a layer of leather sheets and using a photocopy of Cushing's illustration, the image was traced with a rounded and sharpened wooden punch (illustration 8.32 - 8.33). Once the raptor pattern was transferred to the plate, the wooden punch, held at a 15 degree angle was again used to trace and define the lines of the image (illustration 8.34 - 8.37).

After the obverse face of the raptor plate was completed, the piece was flipped and the work repeated on the reverse side (illustration 8.38). Grinding out the figure like Cushing described would have been an arduous and lengthy task, instead the copper plate was placed over a hardwood surface and the image cut out using the sharpened copper chisel (illustration 8.39 - 8.41). Cutting the plate over the leather bed caused the chisel to bend and shear the copper instead of cutting through it.

The second reproduction of the Peoria raptor bird plate was created by burnishing an annealed copper sheet over a carved basswood template (illustration 8.42). This reproduction was completed twice because, as I previously stated, during the first attempt the copper sheet shifted while burnished and the raptor bird image became distorted (illustration 8.43). For the second attempt, the copper plate was secured to the corners of the carved template with four nails. The raptor pattern was sufficiently impressed into the copper so that the image could easily be refined with the use of tools. No other work was done to this plate (illustration 8.44 - 8.50).

The final replication of the Peoria raptor bird plate was accomplished by first burnishing an annealed and prepared copper sheet over the carved basswood template and then embedding the plate in heated pine pitch (illustration 8.51). After burnishing the raptor pattern into the copper, the plate was embedded into the pitch and the image easily refined with the use of wooden tools. The Peoria raptor bird image was first defined with a narrow tip wooden chisel. Then, using a smooth punch held at a 15 degree angle the lines were redefined and impressed into the metal. The pine pitch was reheated to release the copper plate from the pitch. The raptor bird plate was annealed and cleaned and the obverse side embedded into the reheated pine pitch. The technique of impressing the image into the metal was repeated and the patterned defined (illustration 8.52 - 8.56). The plate was again heated releasing it from the pitch, the adhering pine pitch burned off and the plate cleaned (ill 8.57 - 8.58).

Discussion

The Peoria copper raptor bird plate is an impressive work of Eastern Woodlands aboriginal art. Unfortunately, Cushing provided no photographic evidence of the original prehistoric piece so I am unsure about which method best represents the technique used to create the plate. In all likelihood, Cushing is probably correct in his technique for manufacturing the plate. Copper was prepared by hammering and grinding until it was uniformly thick and then the image was *pressure-drawn* or impressed onto the plate. I take exception to Cushing's method for cutting out the image by grinding the raised grooves of the pattern. Grinding is an arduous and time consuming process, the procedure is more efficient when the image is cut out utilizing a solid yet slightly yielding surface like wood or pine pitch and a sharpened punch. By first poking closely spaced holes around the edge of the pattern, the image can be removed by sawing the connecting copper. Once the plate is removed, the edges can be ground smooth and the plate cleaned.

A carved wooden template similar to the Peoria plate can be created by an experienced Native woodworker in a matter of hours before being given over to the copper-worker. Only shallow cuts are required in the wood template to give the raptor bird form. The copper imprint can then be defined when embedded in pine pitch. The template can be modified during use, if a line is not picked up by the burnishing of the copper the wood template can be carved deeper and modified. It is conceivable that a design like the Peoria raptor bird plate could be carved, burnished and finished within a day.

Spiro Embossed Human Profile Head Plate

An immense amount of copper art was interned within the Mississippian period mound site of Spiro in eastern Oklahoma. Unfortunately most of the copper artifacts were looted before archaeologists had a chance to investigate their locations on the site. Copper artifacts from Spiro include a multitude of copper birdman plates, copper clad carved wood, sociotechnic copper weapons, and copper headdress and hair ornaments. The amount of artistic labor that went into creating the copper artifacts is indicative of the immense value the metal had to the people of Spiro (Hamilton 1974:5).

One of the most impressive copper plates to come out of Spiro was an embossed human profile head plate (illustration 8.59). The copper plate is 24 cm in length and 17.4 cm in width. The head faces to the figure's right and features a diamond-shaped eye enclosed by a forked eye-surround. The mouth is open with the upper teeth prominently displayed. The back of the head exhibits a plain circular earspool and an occipital hair bun in which a curved riveted feather emerges. The neckline appears ragged suggesting that the piece might have been larger at one time but was *decapitated*.

The Spiro profile head plate was replicated four times. The first replication was accomplished free hand over a leather sheet surface. The image was first transferred to a prepared copper sheet approximate 28 cm length by 20 cm width. This was achieved by placing a photocopy of the prehistoric artifact over the copper and tracing the image with sharpened punch. The image was sufficiently impressed into the copper and the plate was placed on a leather surface to be further defined. The best technique for working the copper was to press a sharpened antler tine at an approximately 15 degree angle into the copper and tracing over the image's lines. After the front side was completed, the plate was flipped and image refined from the reverse side. Once the profile plate was finished the piece was cut out from the sheet using modern metal shears and cleaned (illustration 8.60).

The second profile head plate was reproduced utilizing a carved wooden template of the actual profile head plate (illustration 8.61). The image was transferred onto a pinewood board and carved out using modern carving tools. A copper sheet approximate 28 cm height by 20 cm width was prepared, placed over the template and the image quickly burnished onto the plate using a rounded and smooth wooden punch. The profile was quite sufficiently impressed into the copper and could easily be defined further with a little time and effort. The copper profile plate was cleaned, however, it was not cut out of the sheet (illustration 8.62 - 8.65).

The third replication of the profile head plate repeated the previous process except that more care was used in obtaining a stronger image on the plate. This was accomplished by pressing harder with the punch and antler tine. Although this method brought out the profile image more clearly, care had to be taken as the copper sheet was very thin and could easily be punctured with the tools.

After the initial image was obtained, the plate was annealed and returned to the template and the profile image again defined with the tools. The profile head plate was partially cut out with the use of a sharpened longleaf pine chisel. The annealed plate was placed on a bed of dense clay and the chisel was used first to punch a slit in the copper and then a sawing motion used to cut out the image. Only a 10 cm section was completed in order to simply demonstrate the process for cutting sheet copper. The edge of the cut was ragged but the technique illustrates that even wooden tools can easily cut thin sheet copper (illustration 8.66). This process would also be more economical than the technique of grinding.

The forth and final replication of the Spiro profile plate utilized the carved wooden template and a heated pine pitch supporting bed. A prepared copper sheet approximately 28 cm in length and 20 cm in width was burnished over the carved wooden template. After burnishing the raptor pattern into the copper sheet, the plate was embedded into a layer of heated pine pitch (illustration 8.67). Once the pitch cooled, the image was easily refined with the use of the antler tine and smoothed wooden punch. The profile plate was first defined by using the antler tine held at a 15 degree angle to press the metal down into the hardened pitch (illustration 8.68 - 8.73). The pine pitch was then reheated to release the profile plate from the pitch. After the plate was re-annealed and clean, the obverse side was embedded into the reheated pitch. The technique of pressing the pattern into the metal with the smooth punch was repeated and the image completed.

To cut out the profile plate, the sharpened copper chisel was used to saw out the image. First the process began by punching closely spaced holes into the outline with the use of the copper chisel. The holes were then sawed through also using the chisel. The chisel had to be cleaned and sharpened repeated, due to the adhering pitch but the whole process was relatively quick. The excess copper was peeled away from the plate and the piece was again heated and released from the pitch. After the adhering pine pitch burned off, the plate was cleaned in the diluted acid solution (illustration 8.74).

Discussion

The Spiro embossed human profile head plate was actually very simple to replicate free hand and employing the carved wooden template. Either of these techniques for manufacturing the plate could have been utilized to complete the original prehistoric piece. In all likelihood, the piece was created free hand over leather. Cutting the piece could have been accomplished by placing the plate on a hard wood surface and using the punching-and-sawing method. In all likelihood, the use of a carved template would only have been used if the piece was to be reproduced numerous times. Carved templates could have been used by Native artisans as a way to overcome mistakes while working the valuable sheet copper.

Cutting out the copper profile plate was the most time consuming portion of the manufacturing process. Both the sharpened longleaf pine chisel and the copper chisel left slightly ragged edges on the plate however these could be smoothed with the use of a grinding stone. James Brown observed that the original piece from Spiro appeared as if it was cut out from a square plate as the edges are unsmoothed (Hamilton 1974:145). If Cushing's technique of grinding had been used to release the image from the sheet copper assumedly the edges would be smoother.

The original Spiro human profile head plate exhibited a riveted feather unfortunately I did not realize this until after the pieces were completed. A riveted feather would make more sense as that is a fragile part of the whole and is best worked separately.

Finally, although the neckline of the profile plate appears ragged suggesting that it might have been part of a larger plate at one time it is in my opinion that the plate is complete and represents a decapitated individual. Similar artistic war trophy depictions are observed on copper and shell artifacts throughout the Eastern Woodlands (*see* illustration 5.9). Jopling (1989:38) remarks that by taking an enemy head, a chief acquired their supernatural power and at the same time displayed absolute authority.

Rogan Plate from Etowah

The two embossed copper Rogan plates from Etowah, Georgia are the prehistoric artistic masterpieces of the

Eastern Woodlands (illustration 8.75 - 8.76). The plates, crafted in the Greater Braden style, exhibit exemplary expressions of execution and design (Brown 2004:107). The craftsman who created these works of art was most-likely perceived as the Michelangelo of his time and the plates the pinnacle of his artistic output.

The Rogan plates depict supernatural birdman figures in full ceremonial regalia (illustration 8.77 - 8.78). These individuals, assumed to be male, brandish raised war clubs in one hand and a decapitated head in the other. Both figures face right and are best described as being in a *dancing pose*. These birdmen wear elaborate square plate headdresses from which bi-lobed arrows emerge. Facial markings include forked mouth surrounds, forked eye surrounds, beaked noses, open mouths, circular earspools, occipital hair buns with braided pony tails, and fish-tailed shaped ornamental hair pieces.

The individuals depicted on the Rogan plates feature avian attire closely resembling the Peoria raptor bird plate. These include bird wings, feathers with scalloped half-oval motifs, and tail feathers with arching bands.

The arms and legs are beaded at the forearms, wrists, knees, and ankles. Around the necks of the birdmen hang beaded necklaces with columella shell pendants. Central to both plates is a large bellowed-shaped apron and beaded belt from which a fringed sash hangs between the legs.

The larger of the two plates measures 27.9 cm in length and the smaller 27.9 cm. The difference in size and the suggestion of a breast has lead to some researchers to infer that the smaller plate represents a female (Power 2004:83).

Both birdmen grasp a decapitated human head, most likely representing war trophies. The severed heads carried by each birdman figure have open mouths, circular earspools, and forked eye surrounds. The head held by the smaller birdman figure has a beaked nose. This possibly denotes a defeated enemy birdman. This severed head also has six dots on the side of its head which might symbolize scalping.

Although the right arm of the smaller birdman is missing, it assumingly held a baton-like war club similar to the larger Rogan plate. That club has a cross design which possibly represents a stabilizing ridge. Hanging from the war club are two beaded forelocks that are possibly trophy scalps. Similar sociotechnic baton-like weapons are found in stone and copper throughout the Eastern Woodlands.

The smaller of the two Rogan plates was selected for the replication and reproduced twice. In creating the carved template, an illustration by Charles C. Willoughby (illustration 8.77) was enlarged and transferred onto a basswood plank approximately 40 cm length by 25 cm width. Willoughby's illustration was used although it does not exactly represent the actually copper plate as there are a very few small discrepancies between the two.

The first replication of the Rogan plate was achieved free hand. A copper sheet approximately 30 cm length by 25 cm width was prepared by annealing and cleaning. The plate was embedded into a bed of heated pine pitch and the image traced onto the copper from a photocopy of Willoughby's illustration. The preceding step was to chase the image into the plate with a narrow punch and hammerstone. This process took an exorbitant amount of time due to the magnificent sum of detail incorporated within the actual plate (illustration 8.79).

The next step in the process was to cut out the birdman image. The sharpened copper chisel was again employed in this process. The chiseled image lines left noticeable ragged edges all along the plate border. Most could conceivably be cleaned up with the use of a small ground stone and the process is still more desirable than

Frank Hamilton Cushing's time consuming grinding method (illustration 8.80 - 8.82).

After all the details had been chased, a rounded and smoothed punch was used to impress and sink the detail into the plate using only hand pressure. Again this pressure chasing process took a great deal of time to finish (illustration 8.83 - 8.85).

Once the detailing of the birdman was complete, the plate was carefully heated and removed from the pine pitch. The adhering pitch was burned off and the finished piece was carefully cleaned in an acid solution (illustration 8.86).

The second replication of the Rogan plate was made to determining whether a carved template was conceivable used in manufacture of the plate (illustration 8.87). The first step in the process was to anneal and prepare an oblong copper sheet approximately 42 cm length by 22 cm width. The plate was secured to the carved basswood template by driving two nails into the top and bottom of the plate.

The next step was to burnish the image onto the plate. This impression was accomplished by burnishing with a rounded punch using moderate hand pressure. The process of burnishing only took a few minutes to accomplish. The birdman image was distinct enough to support the hypothesis that a carved template was possibly used in construction of the original copper artifact (illustration 8.88 - 8.93).

If the birdman plate was to be taken beyond burnishing, the next step would have been to embed the piece in heated pine pitch and have the finer details chased in. The replication of this plate stopped here and the finished piece was left in the burnished state.

Discussion

The two embossed copper Rogan plates from Etowah probably represent the theme of the supernatural Hero Twins that are found throughout native North, Central, and South America. The two copper plates were in all probability not created with the use of carved wooden templates. This is not to say that the plates could not have been crafted with templates as the illustration 8.93 clearly demonstrates. The Rogan plates were most likely manufactured free hand by one individual master craftsman.

Because of the advance artistic skill necessary, the craftsman who created the Rogan plates would have been a full-time specialist supported by elite patrons and a surplus of resources. The time and immense artistic talent displayed in the plates was not achieved by an individual working part-time. Art of this magnitude could only be possible with the support of the surrounding community and their resources. It could be possible that the artisan created the pieces during the colder months when less time would have been allocated to agricultural requirements but the plates would still have required full-time consideration.

Impressions made by burnishing the copper plate over the template were distinct enough to support the hypothesis that carved wooden templates were conceivably used in construction of the original copper artifacts. Lines carved into the template did not need to be deep and most of the extensive details appeared during the burnishing process. Details of the birdman that did not emerge during the burnishing procedure would have been added later during the chasing process over pine pitch.

CHAPTER 9

BEAD FABRICATION

(ARCHAIC, WOODLAND, AND MISSISSIPPIAN PERIODS)

Many researchers neglect copper beads to study the larger, more impressive ceremonial copper plates and artifacts that have been described in the previous chapters. Considering the vast amounts of rolled copper and clad beads produced from the early Archaic through the post-historic Eastern Woodlands, beads must have played a continuous and significant role in the daily and ritual life of Native Americans (illustration 9.1).

Copper beads were sewn onto ceremonial regalia and the sights and sounds of the beads presumably would have been an intricate part of religious activities. Sounds produced by copper beads might have been perceived as mimicking the sounds of falling rain and thus symbolizing fertility. Martin (1999:121) observed that Native shamans offered copper to the deity *Quioquasacke* in order to control rainfall. Copper beads also had the added effect of reflecting sunlight or firelight during a ritual ceremony.

One can easily imagine a beaded chiefly elite positioned on the summit of a paramount mound brilliantly reflecting the newly dawning sun.

Middle Woodland artisans crafted more copper beads for adornment than any other Native American group in precontact history (Trevelyan 2002:35). Small very pure copper fragments can be extensively hammered and shaped into beads by rolling between flat stone surfaces or hammered over mandrels (illustration 9.2). Carol Jopling (1998:78) speculated that experienced craftsmen could form the highly malleable copper into beads without annealing. Annealing would only be necessary for complex shapes requiring multiple heatings.

The beads crafted for this paper were made from small rectangular fragments of waste copper. The fragments were prepared first by being hammered flat on a stone anvil. Some beads were constructed by wrapping the copper around a dowel rod and lightly hammering the beads into shape. The beads were then burnished using a smooth wooden punch while on the dowel to both tighten the form and clean the surface. Other copper beads were made by rolling between the stone anvil and a hammerstone creating a tube form.

Finally, a few copper fragments were hammered flat and burnished onto shaped wooden beads. The copper overhung the wooden tube-shaped beads slightly so that the ends could be lightly tapped down to secure the copper around the bead. A smooth wooden punch was again used to burnish the copper bead and to tighten and clean the surface of the bead.

Discussion

Native artisans utilized every bit of copper they could obtain, including the scrap. The smallest fragments of copper were rolled into tube beads or burnished over wood, bone, or shell beads. The fact that small copper fragments from larger pieces were not discarded with other crafting debitage is testimony to the value of this precious material.

Jonathan Leader (1988:135) observed that throughout the prehistory of the Eastern Woodlands, the fabrication techniques for rolled tube beads did not change from the earliest Late Archaic forms. Native craftsmen left nothing as waste; tiny copper fragments from the fabrication of larger copper artifacts were utilized as beads or bead blanks (Leader 1988:157). The leftover waste would have also been hammered down to foil thickness and used to clad various small artifacts including wood, bone, and stone beads. These beads would have served as visual and audible symbols of status and as mediums of exchange. Copper fragments in bead form would also have been a secure method for curating small pieces. The copper beads could be strung from a necklace to be kept close at hand.

CHAPTER 10

COPPER ROLES, MEANINGS, AND MYTHS

He Who Controls the Spice, Controls the Universe (Frank Herbert, 1968).

Copper in the Eastern Woodlands functioned as one of the most important ritual mediums in use during prehistoric times (Trevelyan 2004:1). The question remains why did copper play a central theme in mortuary practices and ceremonial activities from the Early Archaic into post-historic times? Native Americans closely linked copper's incorruptibility and capacity for endurance with supernatural beings that had everlasting life (Jopling 1989:20).

Copper was used exclusively by the high-ranking elites of the Hopewell and Mississippian cultures and it is likely that these elites considered copper primarily as a prized economic and political resource. However, the continuous exploitation of copper over thousands of years and its depth of use implies that copper had a profound ritual importance also. The sacred properties of copper explains why Native craftsmen expended so much time and energy obtaining and transforming this exotic natural resource.

The Power of Copper

Native American belief in the intrinsic supernatural power of copper began early in the Eastern Woodlands prehistory. These beliefs most-likely grew out of earlier shamanic traditions that migrated with the first peopling of the Americas. The supernatural power instilled in copper might be why Native artisans did not cast the metal but instead worked it cold. Native Americans might have assumed that melting the copper destroyed the intrinsic supernatural power residing within the metal. Native craftsmen transforming copper into ritually powerful religious objects would have wanted to retain the original earthly powers infused within the copper.

Copper exploitation was not unique to the prehistoric peoples of the Eastern Woodlands. Copper was also fabricated into a multitude of ornamental and sacred artifacts by aboriginal cultures of the Northwestern Pacific Coast. There are many similarities pertaining to copper and its working existing between the Eastern Woodland belief systems and the Northwest Coast.

Similar beliefs of the supernatural power of copper are also found throughout the major ideological systems in the Americas. Much like the Natives of the Eastern Woodlands, Northwest Coast Native cultures were also producing copper artifacts by the processes of hammering, shaping, and annealing, but not by techniques which require the melting of copper (Jopling 1989:74). Nevertheless, Native artisans developed their limited technology to its fullest and fabricated technically accomplished weapons, instruments, and ornamental pieces (Jopling 1989:74).

As previously mentioned, copper for the indigenous peoples of the Northwest Coast played an important symbolic role in their ceremonial and religious beliefs. Copper was fabricated into various sized flat, shield-shaped plates called *Coppers*. Many were painted or engraved in the characteristic northern style with finely stylized representations of land and sea animals (Jopling 1989). The basic form, artistic styles, and manufacturing techniques vary between the five societies (Haida, Tlingit, Tsimshian, Kwakiutl, and Bella Coola) that still utilize copper today. The similarities and differences among the Coppers are specifically linked with the particular functions they were called upon to fulfill in the differing societies that produced them (Jopling 1989:12).

Copper played a primary role in Northwest Coast potlatching, a ceremonial feast that was held to validate a change in rank of chiefly elites. The metal was also present at the mortuary potlatch of deceased chiefs and the success of the ceremony smoothed the way for a chief's spirit to journey into the afterworld (Jopling 1989:34). Similar ritual feastings reminiscent of potlatching were probably also found among the tribes of the Eastern Woodlands.

The supernatural source of Northern Pacific Coast copper was associated with Qomoqwa, an undersea deity similar to the Eastern Woodlands underwater serpent (Jopling 1989:17). Copper contained unknowable quantities of power, which was derived from its underwater spiritual owners.

Jopling (1989:32) observes that in Northwest Coast ceremonies, copper was given at marriage by a bride's father to the groom. This could explain the existence of copper plates manufactured at one locality yet interned at another. Political alliances were secured by marrying off high-ranking individuals to other powerful chiefdoms. Leader (1988:187) recognized that the external uses of copper may have included the exchange of materials to finalize alliances, or gifts to stimulate trade.

Jopling (1989:35) emphasizes that the destruction of the flat shield-shaped plates Coppers by Northwest Coast Natives signified the loss of the intrinsic supernatural power. Destruction of the Coppers also destroyed the possibility of chiefly reincarnation (Jopling 1989:35). The loss of supernatural power might be the reason why many of the copper plates found in the Eastern Woodland, notably the Wulfing Plate cache and at Spiro were repaired with fragments of other, possibly older, copper plates.

Leader (1988:117) proposed that the plates were not simply to be used for special purposes but considered to be sacred and embedded with intrinsic power. Damaged copper plates could be interpreted as having diminished embedded power. Repairing damaged copper plates with fragments of other more severely damaged artifacts might have been a way to restore or recharge the object's intrinsic power (Leader 1988:117). This implies that the medium was just as important as the finished product.

Amelia Trevelyan (2004:3) postulated that beginning early in the prehistoric metalworking tradition, unworked copper nuggets and undecorated objects were just as common as the more elaborately worked pieces. Trevelyan (2004:4) reiterated that this is another indication that the raw medium itself was just as important in function as the finished forms with their motifs. If the raw material did not hold the main power, useless copper fragments would have been discarded along with potsherds and other debris and not interned in elaborate mound burials (Trevelyan 2004:129).

Copper, whether in a raw unworked form or in an elaborately detailed plate, was held in high esteem by its users. Copper would have acted as a supernatural power repository and much of that power was embodied in the nature of the material itself (Trevelyan 2004:117). Thus, the creation process for Native craftsmen would be just as important as the finished object itself. Creation of copper objects especially during the later Hopewellian and Mississippian periods probably involved as much ritual and ceremonialism as did the use of the finish pieces. Copper-workers, much like shamans, would have been seen as important links between the natural world and the supernatural world.

Non-technologically sophisticated metalworking traditions around the world observe strict taboos associated with the forging process. These taboos and prohibitions were probably practiced by Native artisans of the Eastern Woodlands also. Disregarding observances of such taboos might lead to their intrinsic spiritual power becoming polluted and thus bringing sickness or bad luck to the craftsmen and their village.

Supernatural Creatures and Copper

Throughout the prehistoric Americas, copper had a strong association with supernatural beings. These powerful beings were composite creatures constructed of multiple real world animal attributes (illustration 10.1). One category of such creatures is the horned and winged serpent-like supernaturals described as having scales and horns of copper. These deities are also depicted as underwater panthers. They are often portrayed as having a long, coiled tail made of copper (Martin 1999:201). *Mishebeshu,* the Great Serpent, is sometimes described as being scaled with copper, especially his horns which were similar to deer antlers (Lankford 2008:122).

The Piasa, a creature similar to contemporary descriptions of the underwater panther, is a major supernatural construct to many historic Eastern Woodlands Native groups (Lankford 2008:113). The Piasa glittered as the sun and had two horns on its head (Lankford 2008:114). Only great hunters who had made medicine especially for this purpose could kill these supernatural serpents (Lankford 2008:114). In all likelihood, the weapons utilized by these heroic hunters were created of copper and cedar. Good fortune was accrued by those who killed one of these underwater monsters and obtained fragments of its bones or scales (Lankford 2008:121). The trophies collected from these struggles were not given away lightly but were kept carefully bundled away from sight. Native peoples understood such relics would bring them good luck in love, the hunt, and in war (Lankford 2008:120). George Lankford (2008:119) remarked that Mishebeshu bestowed power as gifts of his own body. The three major forms of Mishebeshu's gifts were horns, bones, and scales and these manifested themselves as shells or copper nuggets.

Shamanic practitioners were nearly always depicted wearing horns; the horns identified them as powerful shamans (Lankford 2008:110)(illustration 10.2). Antlered shamans depicted in prehistoric art are found throughout the world (illustration 10.3). Several Hopewell individuals were interned in mounds wearing antlered headdresses made of copper and similar headdresses with antlers and horns were found at crematory locations at Mound City (Brose, et al. 1985:188). Assumedly antlers would logically be associated with deer, but more often antlers were symbolic of horned serpents in historic Native American contexts (Brose, et al. 1985:188). By wearing copper-clad antlers, the horned shaman would be performing a ritual of sympathetic magic, and thus possessing the power to transform into a supernatural being.

Representative of the sky realm were the Thunderers or Thunderbirds. These winged creatures inhabited the upper world and were seen as oppositions to their mortal enemies the underwater panthers. Native Americans believed that copper nuggets found on the surface were either the eggs or fecal droppings of the Thunderers (Martin 1999:204).

Copper Sociotechnic Artifacts

Researchers studying Archaic copperworking debate whether the copper tools and weapons were not utilized in the traditional sense (Leader 1988; Martin 1999; Trevelyan 2004; Reilly, personal communication). Trevelyan (2004:111) contents that copper artifacts rarely show evidence of use as tools and she implies that the artifacts, especially copper weapons, were used to ward off evil spirits or for shamanic-spiritual combat. Travelyan (2004:111) also observed that many Middle Woodland axes and adzes seemed to lack evidence of use. The consistently flawless condition of the copper tools probably indicates that they were never utilized as woodworking tools or weapons (Travelyan 2004:111).

Thus, the implication is that Archaic copper tools and weapons were not used literally, but were used for spiritual combat between elites and malignant supernatural beings. Martin (1999:203) stressed that weapons crafted of cedar and copper were particularly effective against otherworldly denizens such as the underwater panthers. George Lankford (2008:127) observed that killing a supernatural water-serpent was a very arduous task. Even decapitation did not destroy the serpent, only when the head was placed on the top of a cedar tree did the creature die (Lankford 2008:127).

The combination of cedar and copper seems to have been a long-lasting tradition in North American prehistory. The association of copper and cedar is probably due to the similarities in color and resistance to decay. Native Americans viewed their universe as being composed of three levels, an Above World, a Middle World, and an Underworld. Spanning and connecting these three worlds was a central *axis mundi* that took the form of a central pole or sacred tree, often a cedar (Reilly 2004:127).

The long tradition of utilizing copper as symbolic weapons and ritualistic implements for the display of authority and power remained a feature of Woodland and Mississippian period artistic tradition (Townsend 2004:26).

These copper weapons were obviously made for display and like the sociotechnic objects previously discussed were not intended for actual combat (King 2004:160).

These cedar-copper weapons were non-functional *sociotechnic* renditions or effigies of real objects meant to be understood as emblems of rank in societies that conferred status on the basis of individual exploits (Brose, et al. 1985:123). Lewis Binford (1962:219) defined sociotechnic artifacts as material elements having their primary functional context in the social sub-systems of the total cultural system. In other words, sociotechnic artifacts are utilitarian objects modified or created to serve social or ritual purposes.

Multiple examples of sociotechnic copper-cedar artifacts have been uncovered at the Spiro Mound site. Ovate copper-faced wooden knives of red cedar have been recovered from the Spiro site. The knives only had sheet copper facings covering one face of the knife blade and evidently were intended for display in a fixed position since only the one side was carved and clad with copper (Brown 1996:481). Henry Hamilton (1952:45) mentions copper axes hafted in carved wood bird effigy handles that look like woodpecker heads (illustration 10.4). Some of the wood handles are reported to be made of persimmon wood

(Hamilton 1952:45) but there seems to have been no real examination of the wood to determine the species. It is possible that the wood handles are of cedar as an abundant amount of copper objects found at Spiro are associated with cedar. One could speculate that if cedar trees substitute for the central *axis mundi* then objects of cedar clad in copper would transcend the three levels of the universe, making them powerful ritual artifacts.

Portable Mediums of Power

Elites who controlled copper and the technological knowledge of working it possessed an esoteric knowledge unavailable to rest of population. The handling of such powerful and exotic resources as copper would have been restricted to a privileged few. Copper objects, whether on display or worn by elites, would have acted as portable mediums of power advertising elite rulership and connection to the spirit realm.

Throughout the Hopewell and Mississippian periods, copper was worn for ornamentation as earspools, gorgets or head plaques. Since copper contained powerful supernatural elements, it is assumed that it was worn only by the chiefly elite. It is speculated that only a chief could control the immense supernatural power held within the copper and only after considerable rites and ritual had been correctly performed (Trevelyan 2004:132). The control of these powerful portable mediums in turn authenticated the elites' supernatural right to rule.

Knowledge Equals Power

Knowledge of copperworking techniques would have been limited to exclusive fraternal moieties or clans. The esoteric knowledge would have been revealed to those few individuals who displayed the artistic talent to craft copper and thus were equipped to handle this powerful medium.

Copperworking probably was not a single individual's artistic tradition. It took full-time specialized craftsmen working in tandem a considerable amount of time to produce the copper objects.

Transforming hot copper into powerful and sacred objects was a dangerous procedure. Working with fire, as well as possessing the esoteric knowledge to work copper, identified the copper-worker as a spiritually powerful person. The transformation of copper would be perceived by these Native American cultures as a divine act and the process of transforming the metal a ritual experience in itself. Native craftsmen would have required special preparation and precautions before they could begin. More importantly, their copper workshop needed to be protected from dangerous pollutants and restricted from the unclean and the uninitiated.

Trevelyan (2004:171) speculates that only individuals with particularly strong spiritual powers could possess copper items for use in important ceremonies, and maintain and pass along the knowledge necessary to create them. These sacred copper objects were probably never seen and certainly not ever used by the community at large (Trevelyan 2004:171).

Specialized craftsmen, with well-organized divisions of labor, would have worked the metal in an assembly-line fashion with less skilled initiatives dedicated to tending fires, or working raw copper into blanks. These craftsmen were probably part-time specialist during the Archaic period; however by the later Hopewell and Mississippian periods, such artisans were more-likely full-time specialists sponsored by the chiefly elites and supported by surplus resources.

Any examination of copperworking technology must also consider the reasons why Native cultures of the Eastern Woodlands coveted this metal. Copper fulfilled an important role in Hopewell and Mississippian ceremonial activities. To these prehistoric and historic Native cultures, copper was and is viewed as a direct connection to the spiritual realm. Copper functioned much the same way as did gold and silver did for prehistoric South American and Central American cultures. For these cultures, gold and silver represented supernatural links to the sun and the moon, and copper for the Native cultures of the prehistoric Eastern Woodlands, functioned essentially in the same role.

CHAPTER 11

FINDINGS AND CONCLUSIONS

Knowledge is never lost. It may be misplaced for a time, but it is never lost (Mark E. Williams, 1998).

For thousands of years, Native craftsmen of the prehistoric Eastern Woodlands transformed raw copper into a wide variety of utilitarian tools and ritually sacred regalia. The copper was mined from deposits in the Lake Superior region, Appalachian Mountains, and in glacial drifts. Copper is not easily worked and it required skilled artisans to produce even the simplest of objects. Because of the high level of talent needed to work the metal, many nineteenth century scholars believed that the copper artifacts found interned at mound sites were of European origin.

Commencing from at least the Early Archaic period, the role copper played in Native life focused around mortuary activities and mythological beliefs. Native Americans associated and linked copper to the supernatural realms that were inhabited by ancestors and supernatural beings. Not all indigenous Native cultures of the Eastern Woodlands utilized copper. Trevelyan (2004:158) emphasized that the sacred properties of copper was not a universally accepted belief throughout the Eastern Woodlands. Many Native groups choose to not adopt the metal-working technology for one reason or another (Trevelyan 2004:158). Possibly the traditional beliefs of some Native groups did not coincide with the religious beliefs or strategies of the copper-using societies. Trevelyan (2004:158) speculated that this explains why some Native groups apparently had no interest in copper even though nearby neighboring cultures did.

A few researchers, including archaeologist Frank Hamilton Cushing and Charles C. Willoughby, demonstrated that by using tool kits similar to those used by Native artisans to work bone, shell, and stone, the copper objects could be fabricated by non-complex technological means. After Cushing and Willoughby, there was a dearth of information on the manufacturing techniques used by Native craftsmen. Not until the latter part of the 20th century did scholars revisit the question of how exactly Native American metalworkers created these copper artifacts. Jonathan Leader, Michael LaRonge, and Joseph Neubauer Sr. all applied their experience with metalworking to propose manufacturing techniques for copper tools and ceremonial objects.

As I have stated previously, Native artisans of the Eastern Woodlands did not use melting, smelting, or casting technologies to crate their copper artifacts. The relatively soft malleable metal was easily worked into simple forms without annealing. The annealing process was only required for more complex copper objects. It is possible that Native artisans also believed that melting the metal would change its intrinsic supernatural properties.

Along with copperworking tool kits employed by Native artisans, pine pitch and carved templates were probably also utilized in the construction of many of the elaborate copper plates. Pitch was not uncommon to the craftsmen as it was used daily to secure lithic points to shafts and waterproof ceramics.

At the beginning of this thesis I asserted that later Mississippian copper plates and costume regalia could have been created utilizing carved wooden templates. I believe that my experiments employing the carved templates support this hypothesis. Carved templates would have been the first stage used by Native craftsmen for copper plate creation. The templates would have been ideal if a copper plate or badges of office and costume regalia needed to be replicated multiple times. Templates also ensured that the valuable sheet copper would not be damaged during fabrication. A carved wooden template would show exactly what the image looked like before creation on the copper plate commenced. The exhausted carved wooden template could also be displayed after it was used. Finally, pine pitch, readily available to Native craftsmen, would have been utilized in tandem with the carved wooden templates for copper plate construction.

From the foregoing chapters it is evident that the utilization of carved wooden templates in the creation of copper plates most-likely occurred during the Mississippian period. Evidence for use of copper clad carved templates can be found at the site of Spiro. Finally, if carved wooden templates were utilized during the manufacturing process for embossed copper plates, it furnishes researchers an idea of what Eastern Woodlands woodworking might have looked like. Unfortunately, very little prehistoric woodworking survived in the Eastern Woodlands due to the acidity of the soil and variations of climate.

Whether Hopewell artisans employed carved wooden templates is inconclusive. In all likelihood, they did not. The few Hopewell copper plates studied were simplistic in design when compared to the later Mississippian plates. This is not to say that the copper art of the Hopewell peoples was unsophisticated as they created intricately designed and constructed copper earspools, three-dimensional copper animal representations, and elaborate copper abstract cut-outs.

The results of this thesis have opened possible avenues of research that might warrant future investigations. It is probable that the copper residue appearing on the stone anvils and hammerstones illustrated in this thesis might help identify and determine copper workshop locations if the copper stains remain and are still detectable after long periods of time. It might be beneficial to examine any smooth river cobbles associated with the copper stain excavated at the summit of Mound B at Etowah. This would also be true for the copper workshops uncovered at Mound 34 at Cahokia. Further investigations are warranted at each of these copper workshop locations.

The small pitting and pock marks observed on the anvil stones could be used to determine if copper was worked hot or cold-hammered by the indigenous artisans. More importantly, these small pock marks might help archaeologists narrow down copper workshop locations.

Another question that arose during this applied research project was how did Native craftsmen keep copper plates from oxidizing so quickly after cleaning. The copper surface could have been smeared with some sort of material to protect the plates at least long enough for ritual use. Possible materials include animal fat and bee's wax.

Finally, the use of pine pitch in the creation of the copper plates must be explored more closely. Is it possible that pine residue from the pitch might still exist on the plates? Analysis of the underside of the plates might answer whether pitch was utilized in copper plate construction.

There is no guarantee that the manufacturing techniques used here are identical to those employed by the original Native American craftsmen. Although my methods for replicating these finished copper plates are not necessarily identical, they must be close to the technological processes used by those prehistoric craftsmen and artisans.

As previously mentioned, it is easier to first carve the desired image and then press the copper sheet into the wooden template than to chance damaging or destroying the copper plate while working it free hand. The carved wooden design could also be previewed and changed before committing the rare and limited copper resource to the craftsman's hands.

The procedure of crafting these sacred objects was a process of discovery for me. Working copper is not a spontaneous act, the manufacturing processes required thoughtful, careful rendering, especially in the cases of highly detailed and technically fine copper plates such as the Rogan Plates (Powers 2004:118). The master craftsman who created the Rogan Plates was probably viewed as the Michelangelo or Rembrandt of his time; an artist who embodied the sacred and profane, both in his crafting skills and his artistic work. The skill and quality of his artistry could only have come after years of dedicated training to achieve this level of proficiency.

Without a doubt, the greatest achievement of these Native artisans was the degree to which they were able to master the full potential of the raw copper and the non-technologically complex metal-working techniques available to them in order to produce objects of extraordinary artistic and technological skill. While I do not have a cultural affiliation to the material or the symbols, the original artisans probably would have felt a deeply spiritual connection with the art and the acts of creation. These Native artisans would have known that in creating these copper works, they were also creating extremely sacred, special, and unique objects that would be honored for generations.

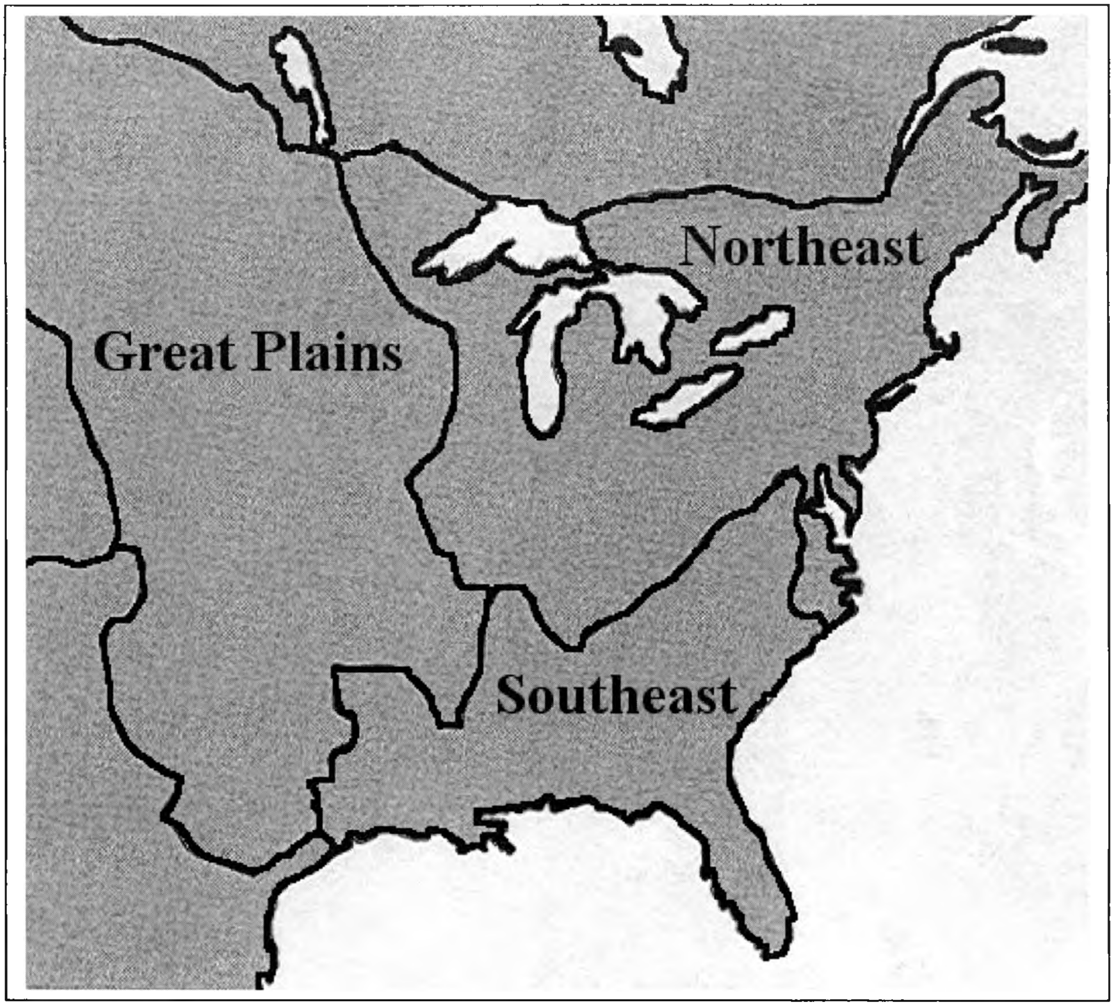

Illustration 1.1 Regions of the Prehistoric Eastern Woodlands

Illustration 1.2 Lake Superior and Appalachian Mountain Copper Deposits

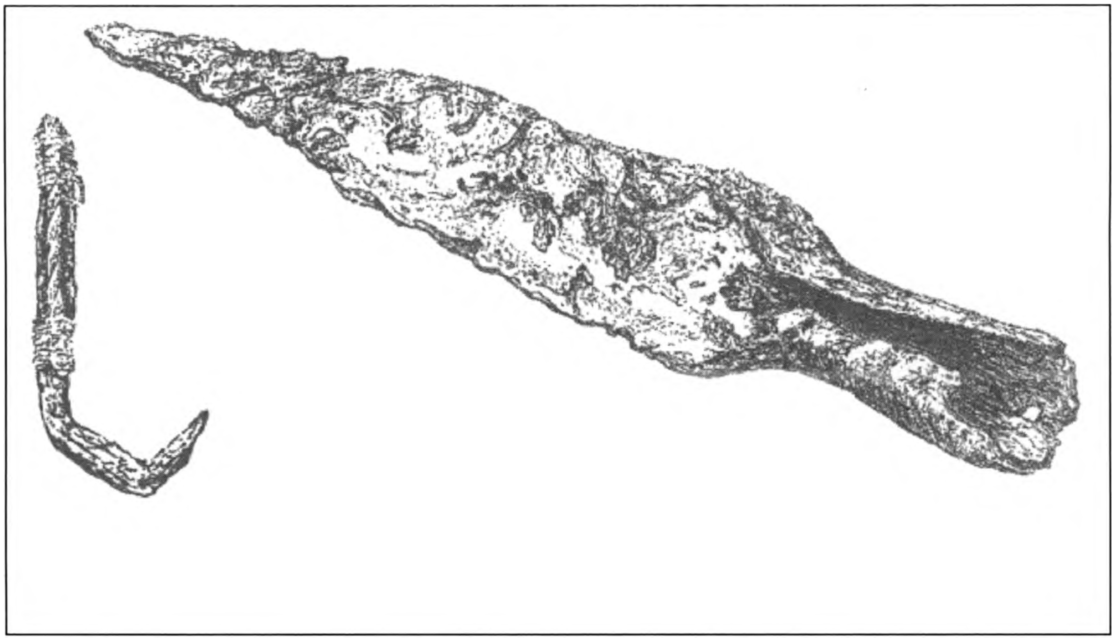

Illustration 1.3 Archaic Copper Hook and Socketed Projectile Point

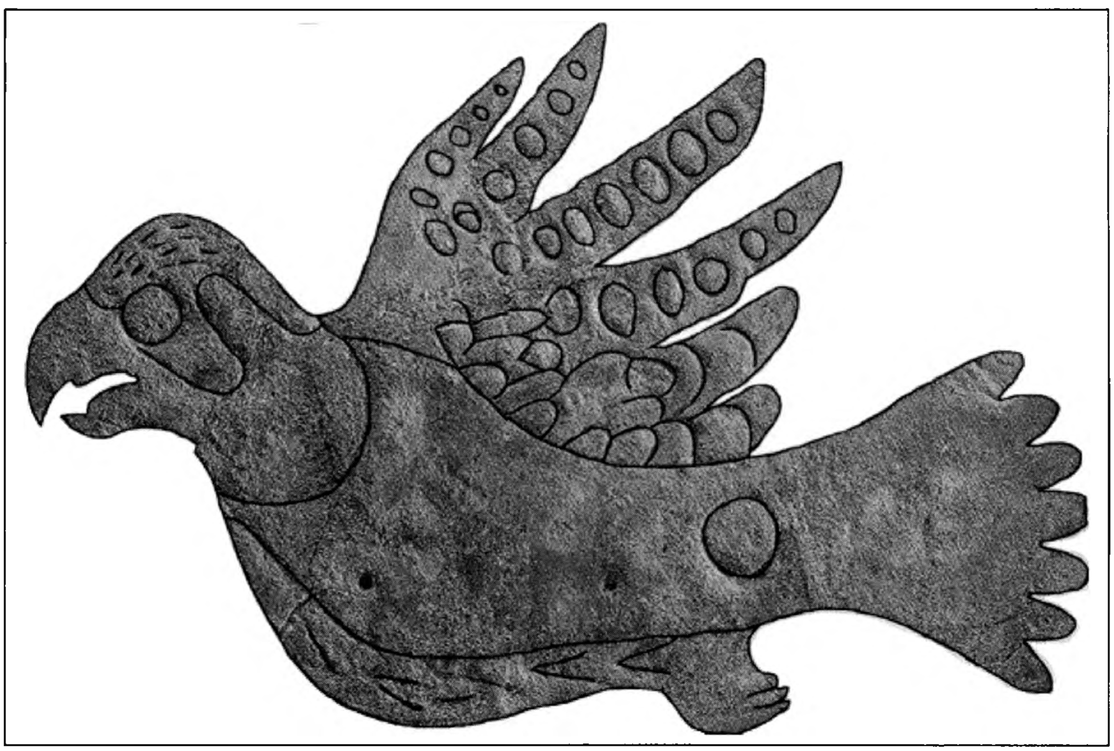

Illustration 1.4 Hopewell Copper Falcon Plate

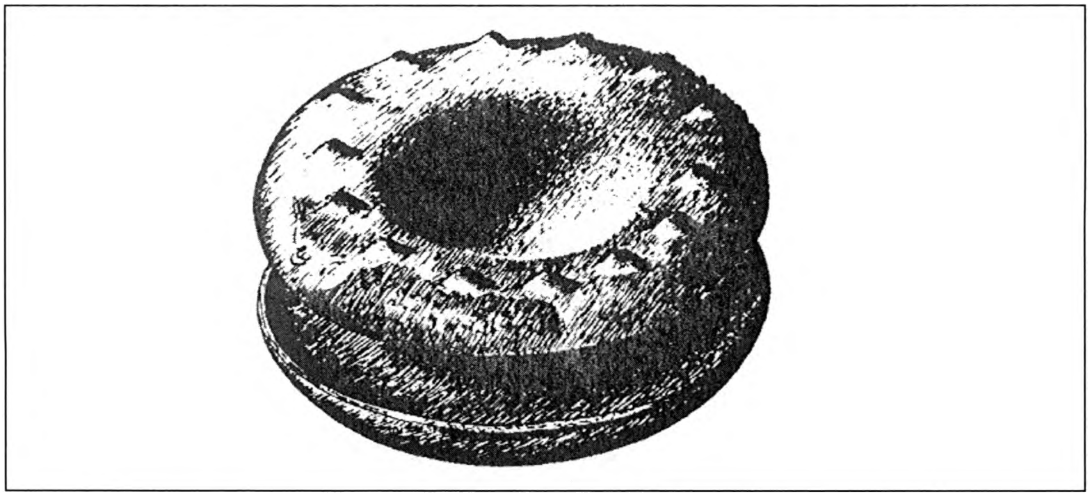

Illustration 1.5 Hopewell Copper Earspool

Illustration 1.6 Copper Rogan Plate

Illustration 2.1 Frank Hamilton Cushing

Illustration 2.2 Peoria Copper Raptor Plate

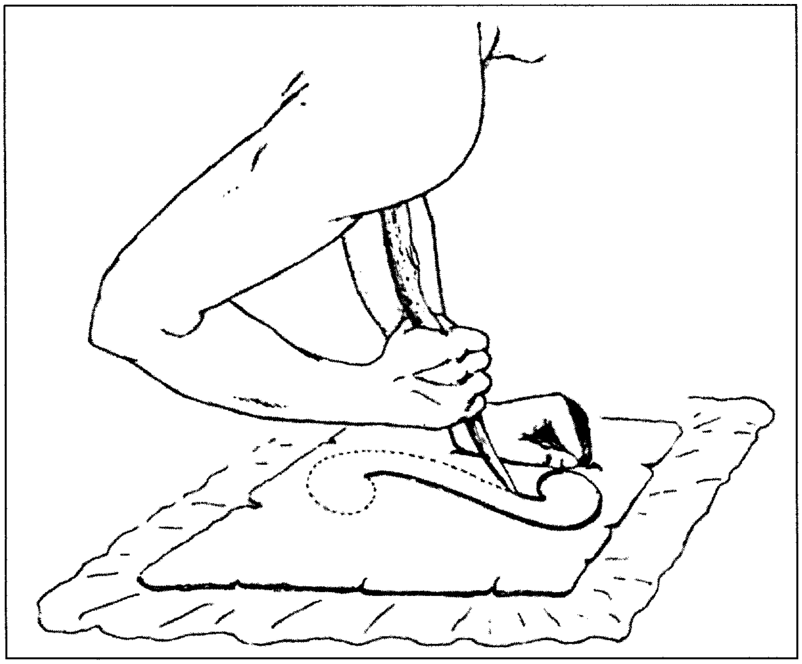

Illustration 2.3 Cushing's Pressure-Drawing

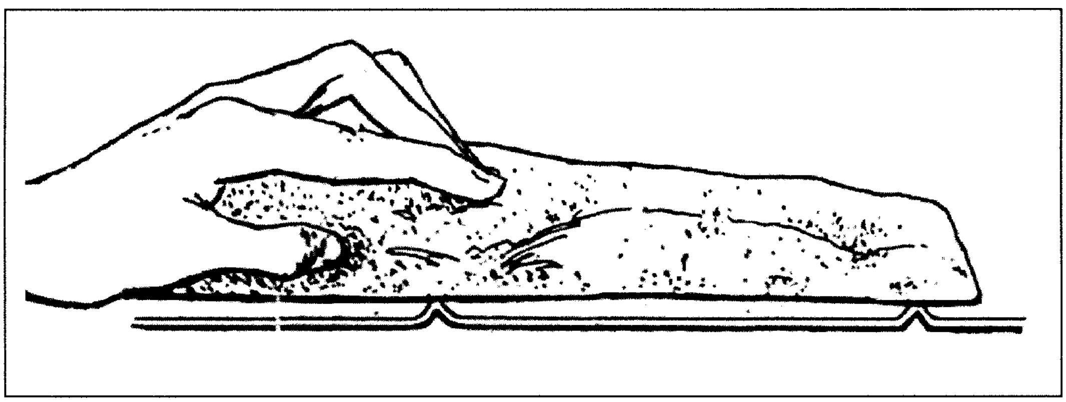

Illustration 2.4 Grinding with Sandstone

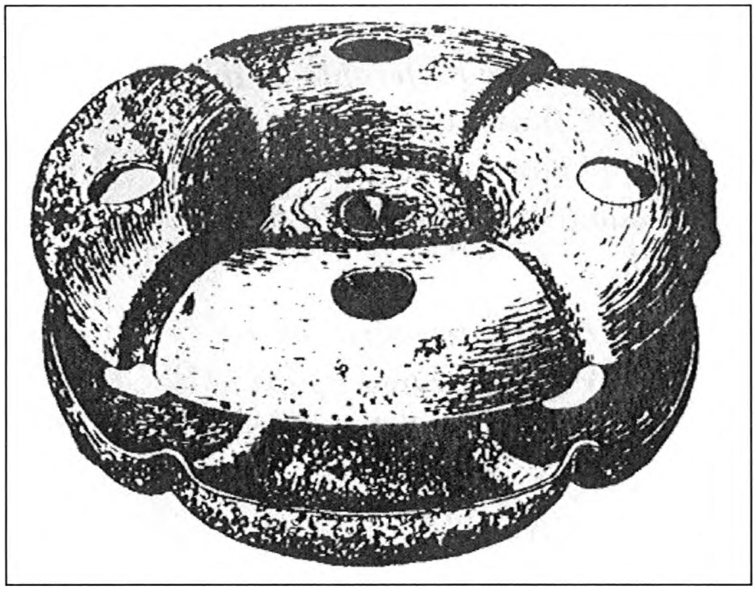

Illustration 2.5 Willoughby's Hopewell Style Earspool

Illustration 2.6 Carved Driftwood Form

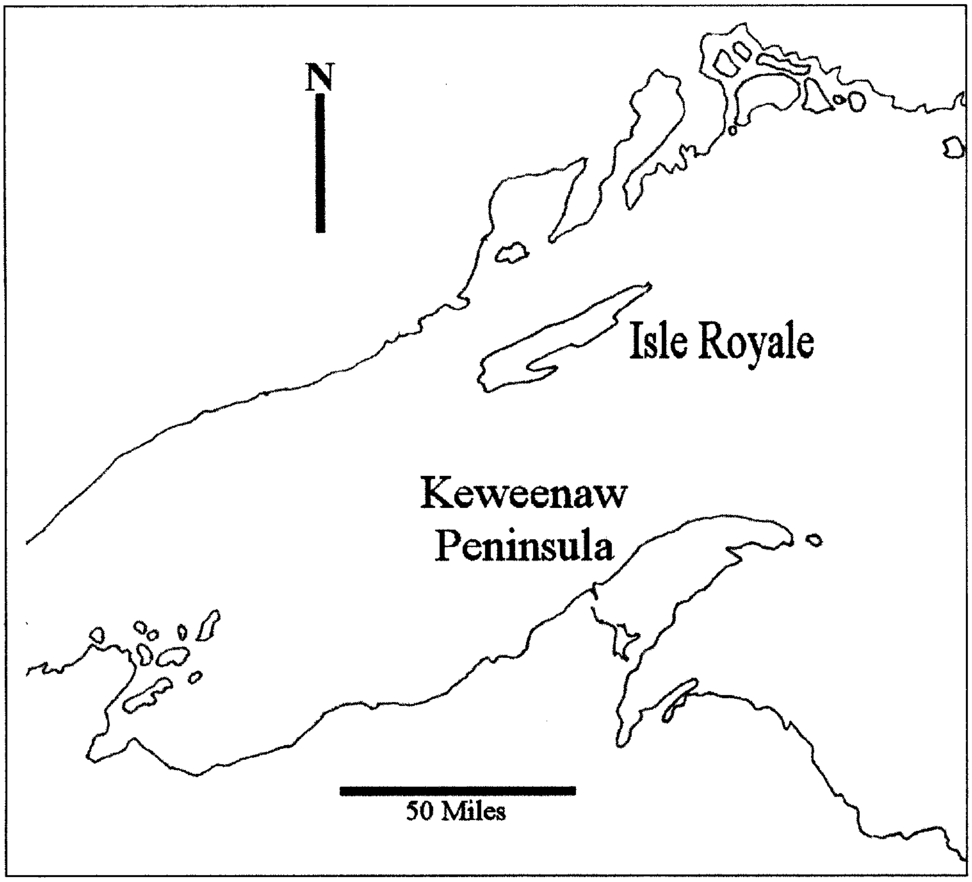

Illustration 3.1 Keweenaw Peninsula

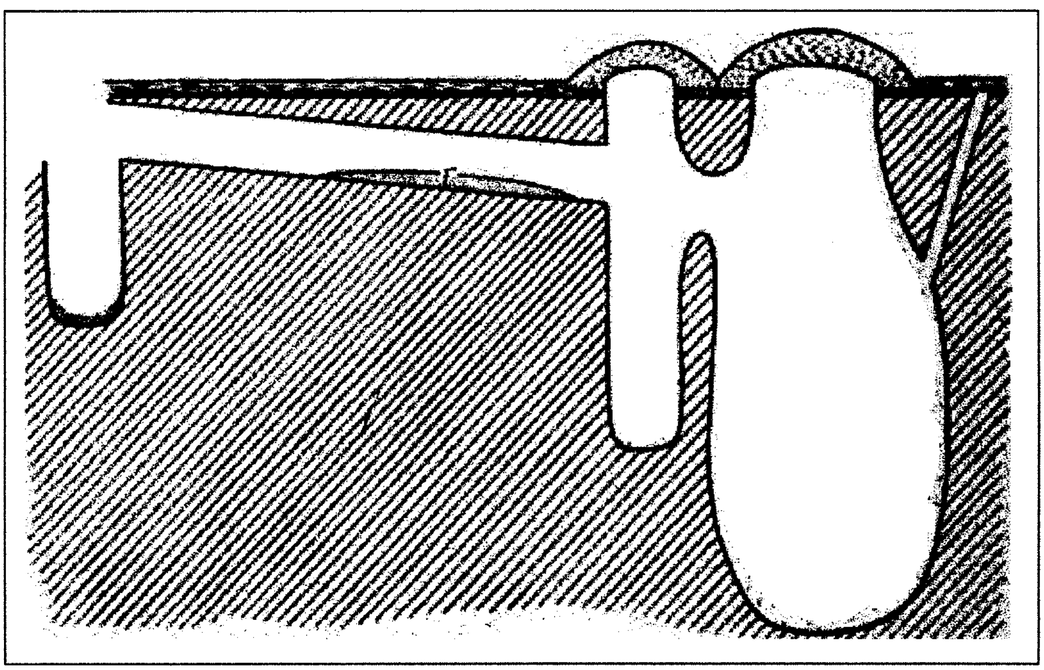

Illustration 3.2 Turner Earthworks Furnace side view

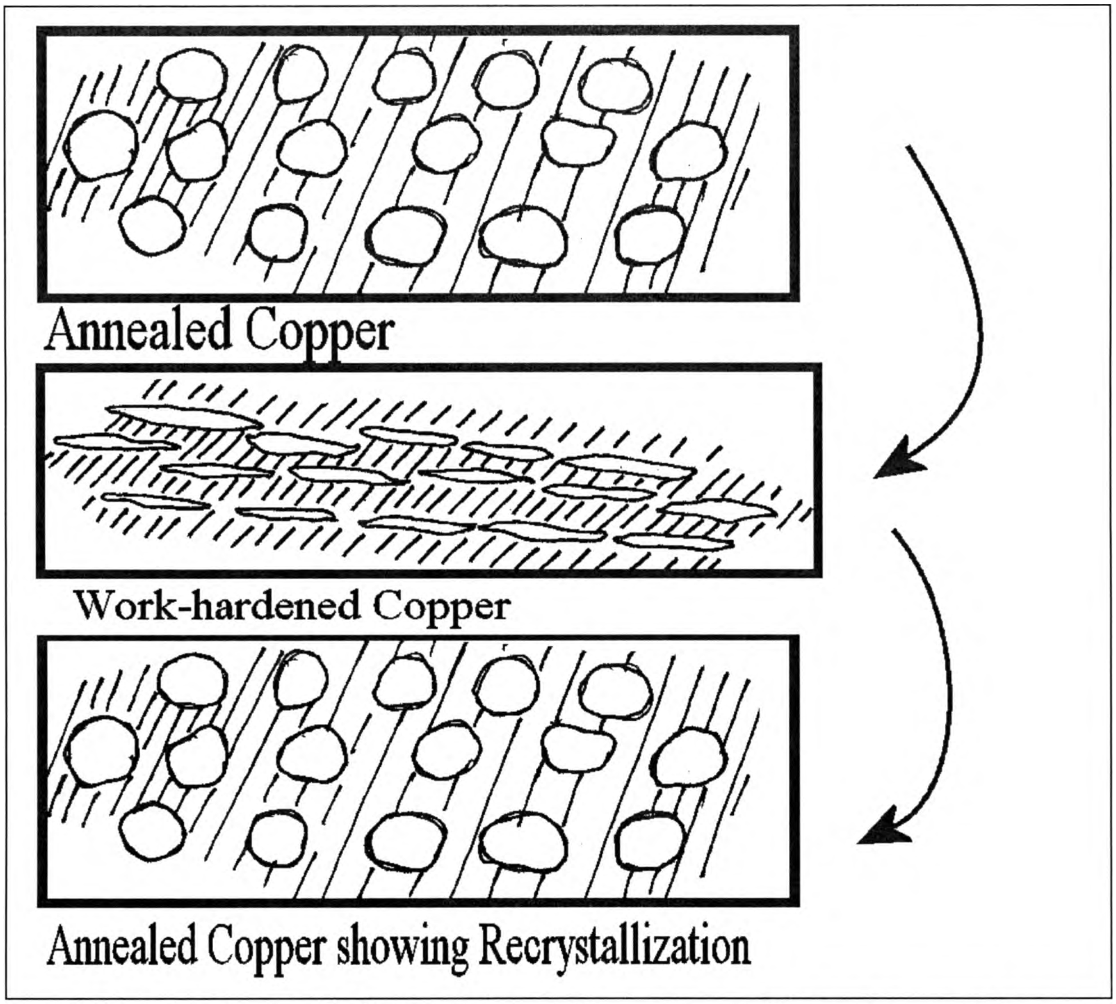

Illustration 3.3 Recrystallization of Copper Grains

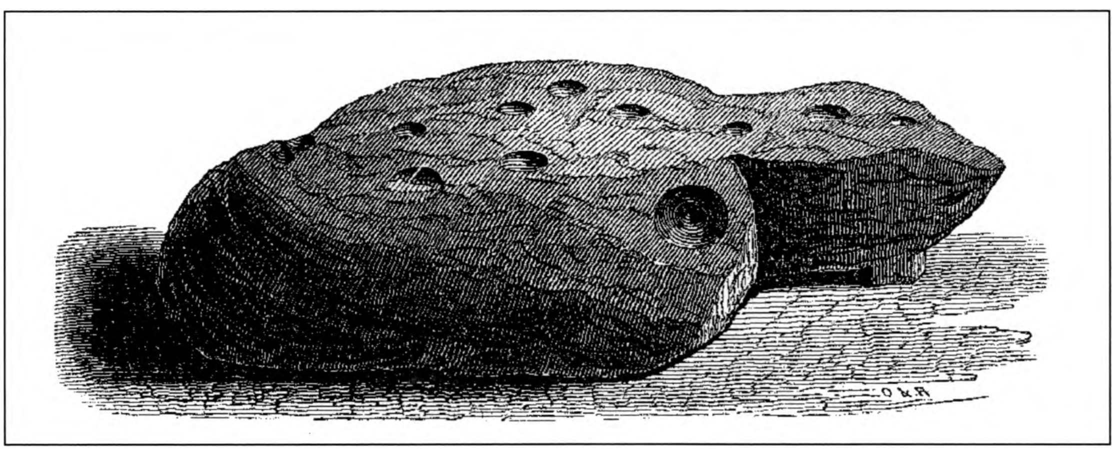

Illustration 4.1 Sandstone Mold

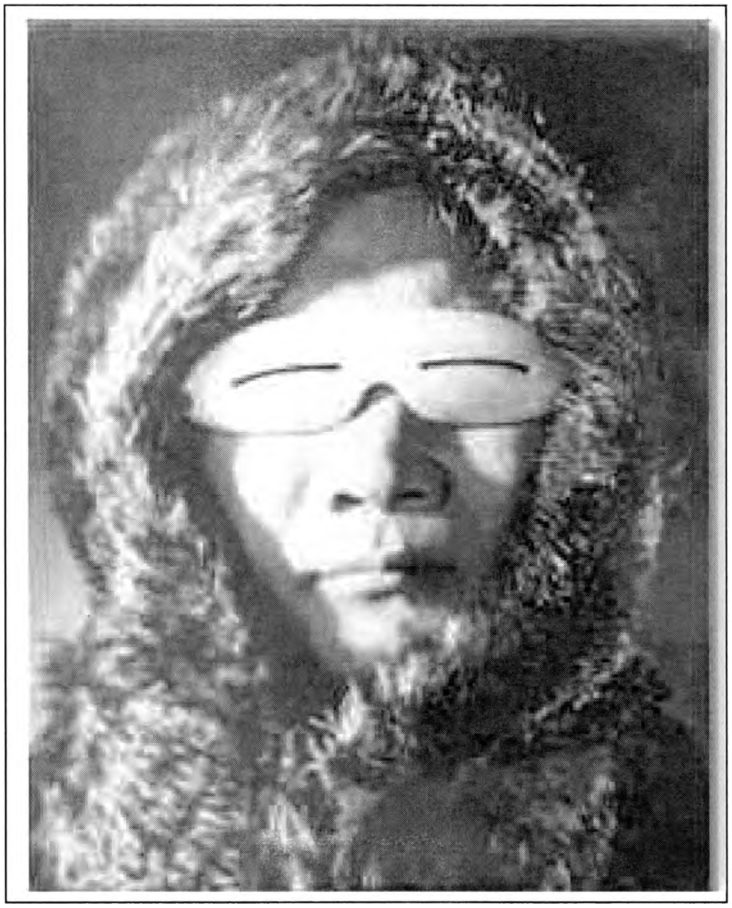

Illustration 4.2 Arctic Snow Goggles

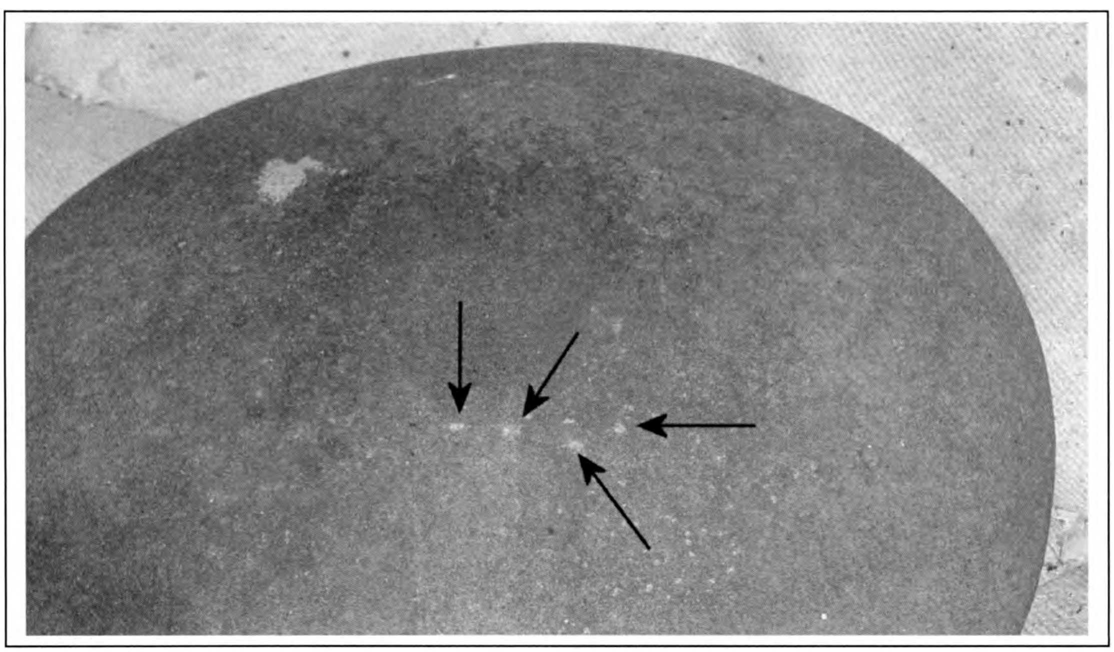

Illustration 4.3 Pockmarks on the Surface of Anvil Stone

Illustration 4.4 Rogan Plate from Etowah Mounds

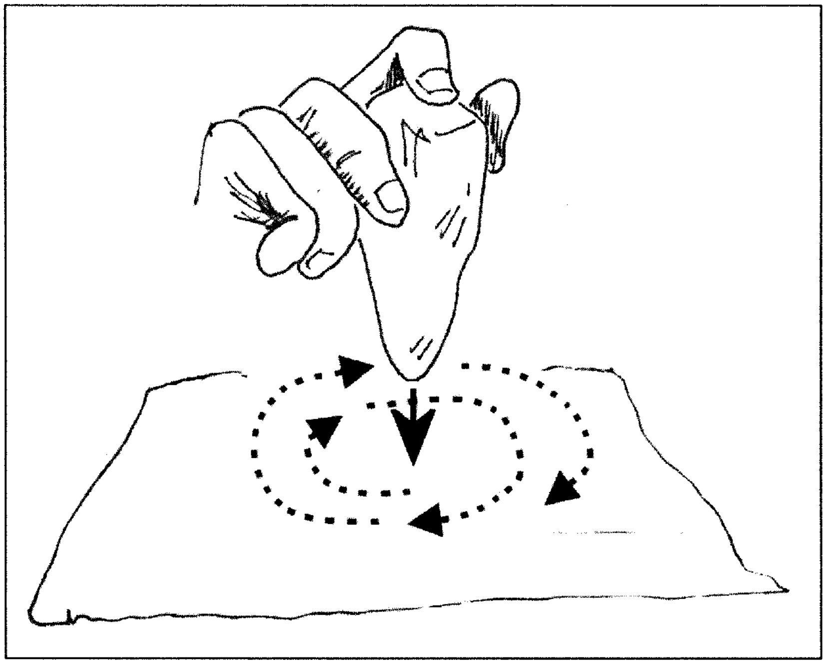

Illustration 4.5 Spiraling Hammer Technique

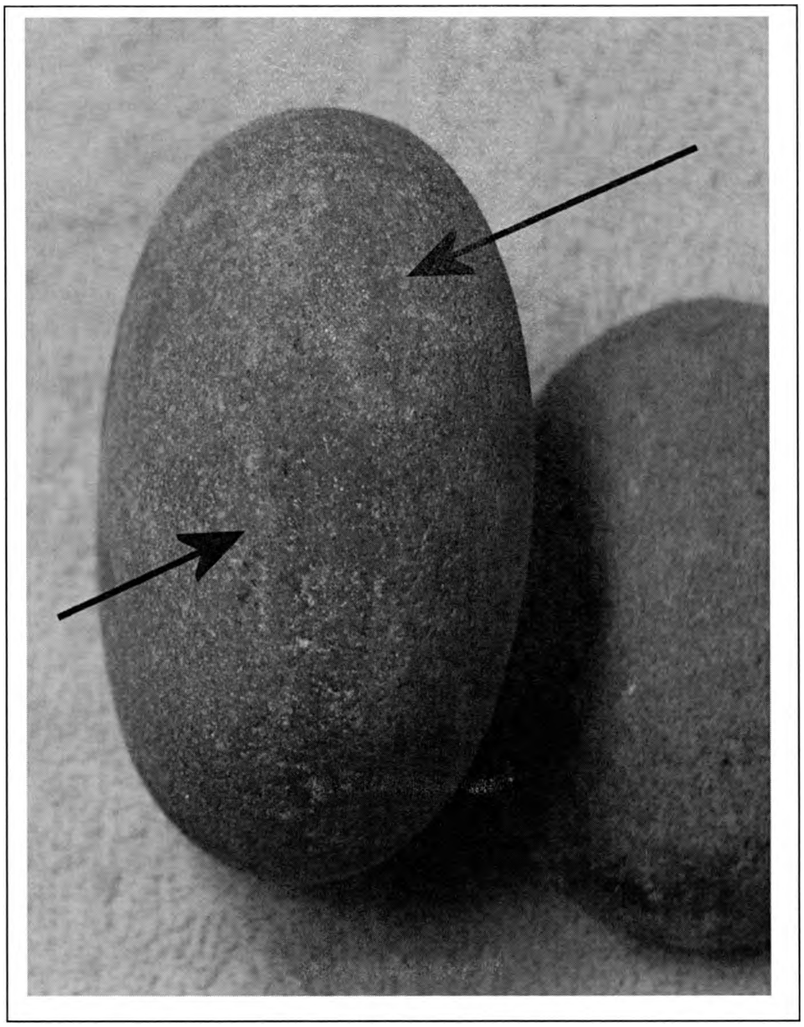

Illustration 4.6 Copper Residue on Hammerstone

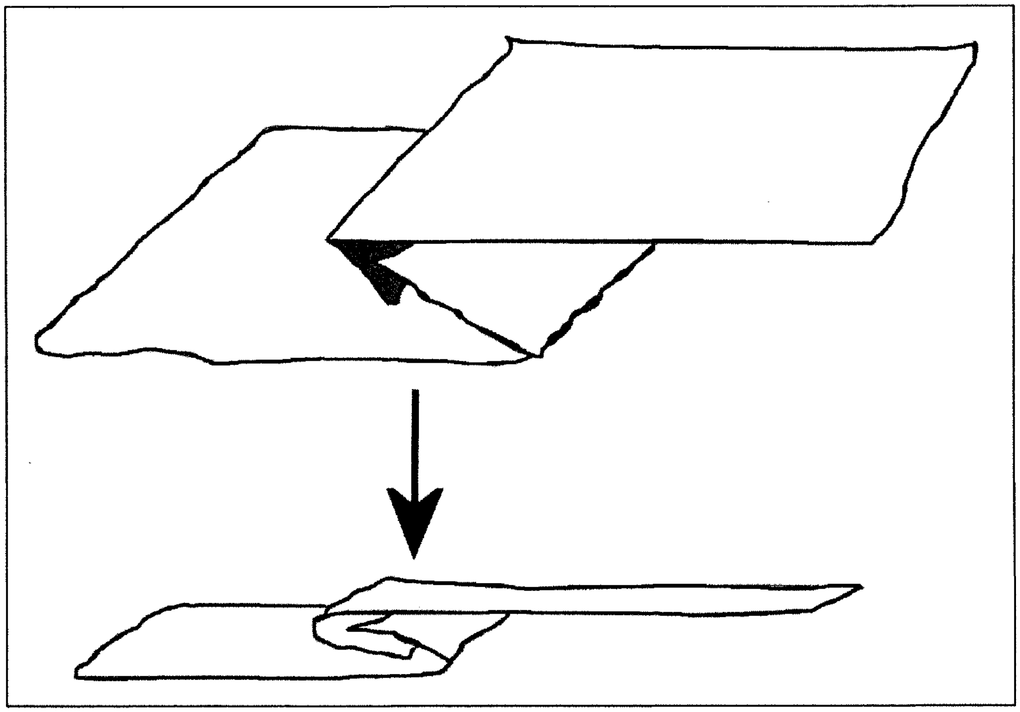

Illustration 4.7 Folding Technique

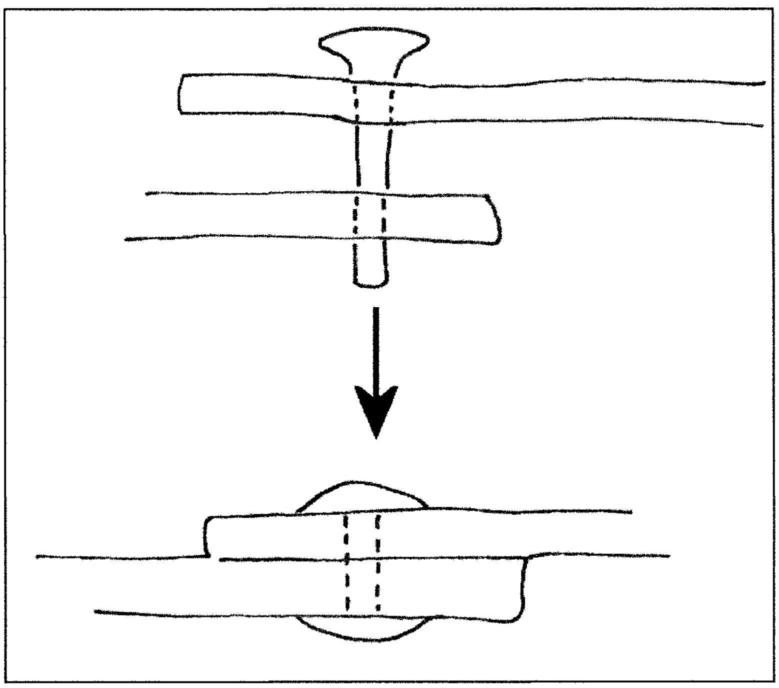

Illustration 4.8 Riveting Technique

Illustration 4.9 Evidence of Riveting and Folding Repair Work

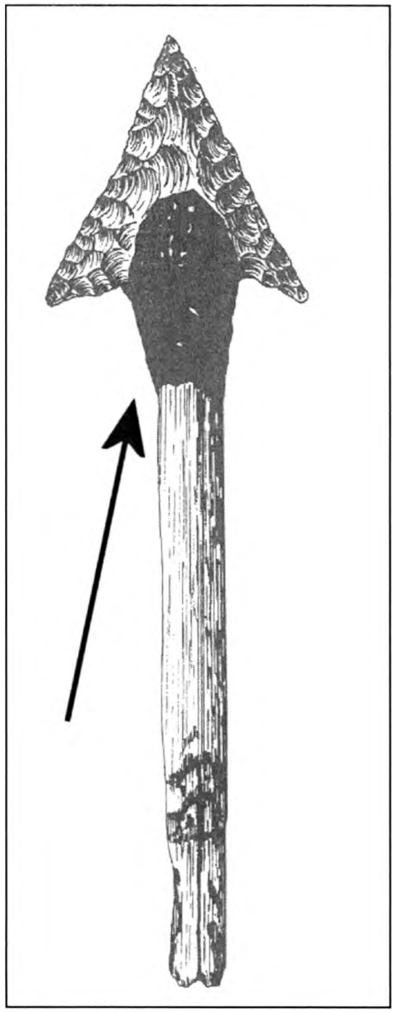

Illustration 4.10 Pitch Use to Affix Projectile Point

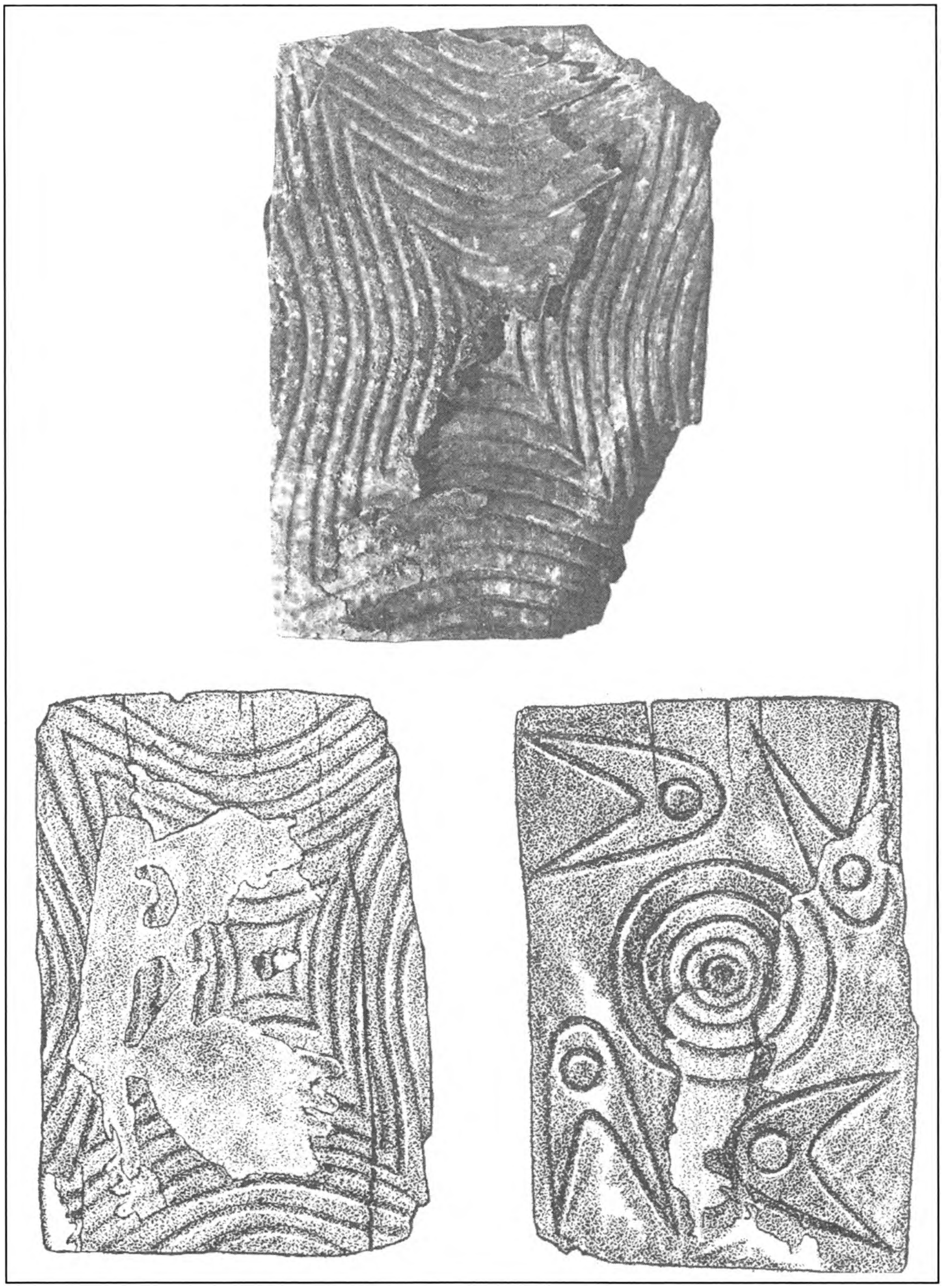

Illustration 4.11 Spiro Copper Covered Plaques

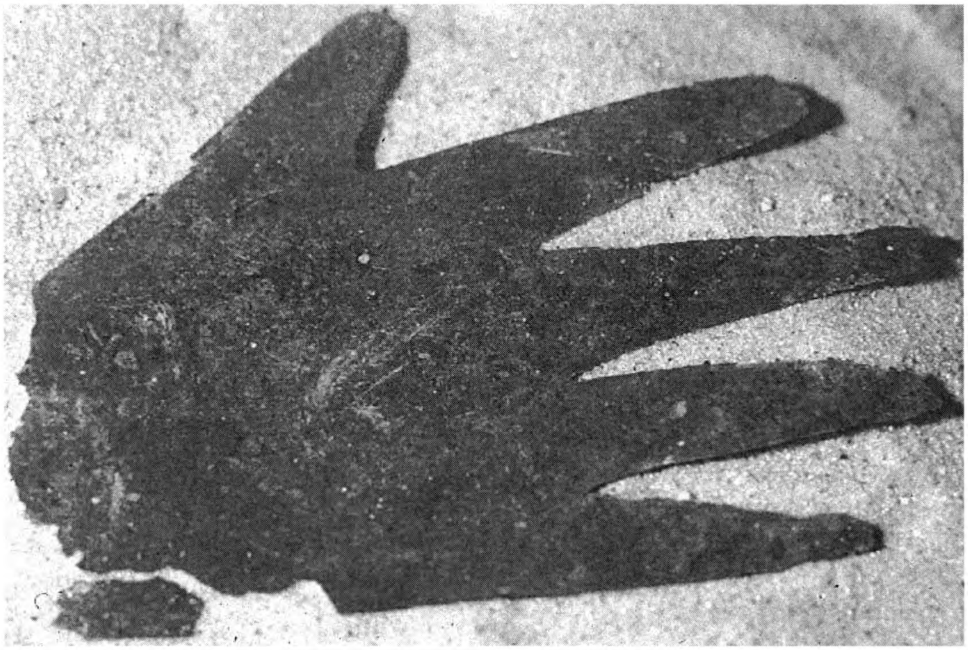

Illustration 5.1 Copper Hand

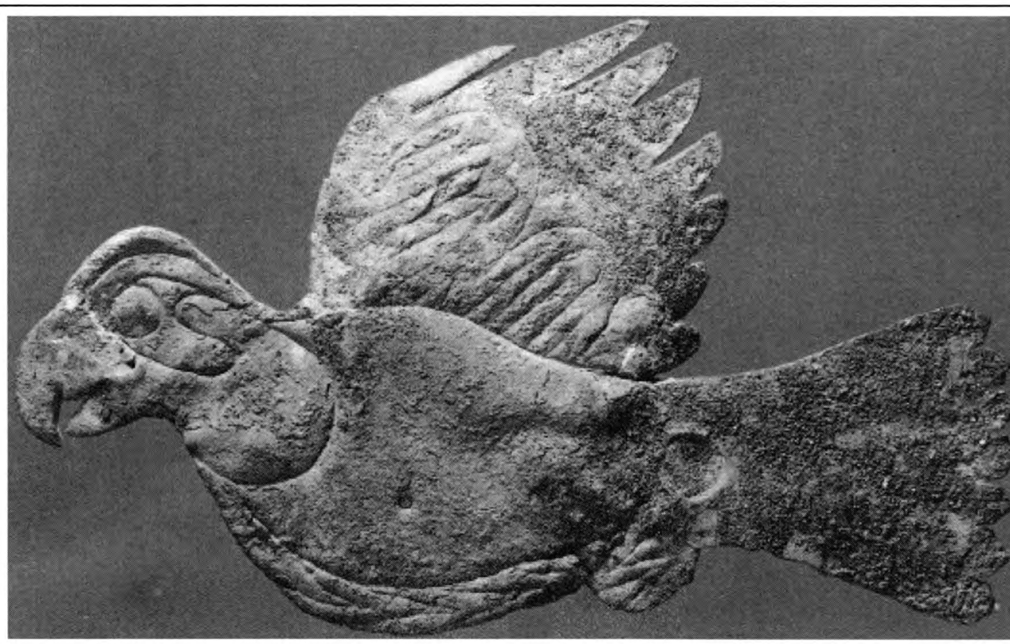

Illustration 5.2 Copper Raptor Plate

Illustration 5.3 Copper Bear Claw

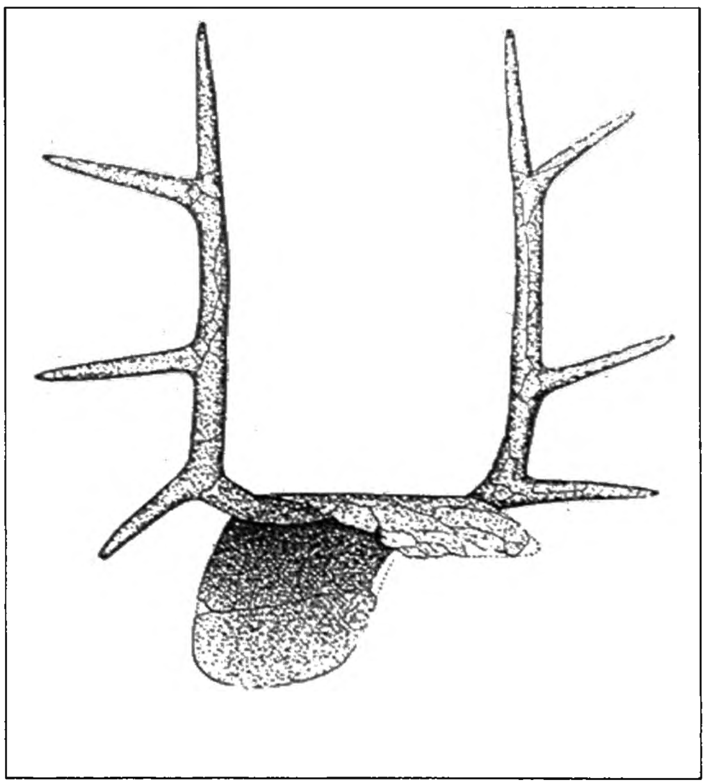

Illustration 5.4 Copper-Covered Deer Antler Head Piece

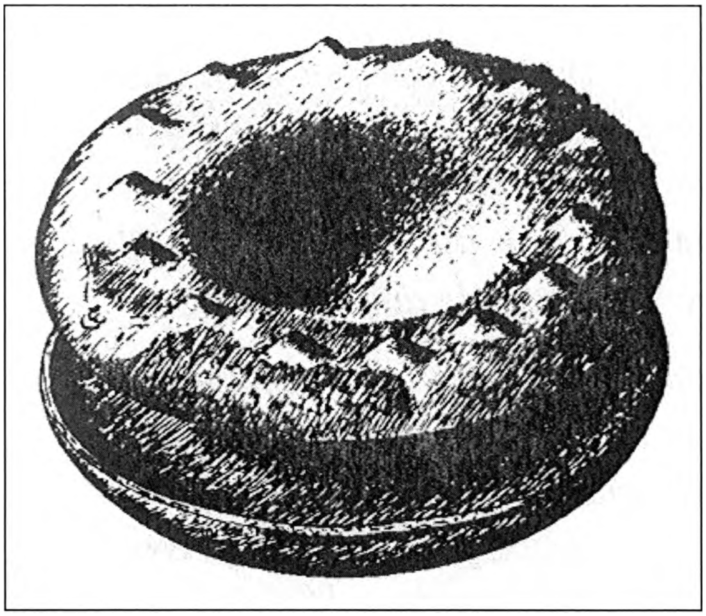

Illustration 5.5 Hopewell Earspool

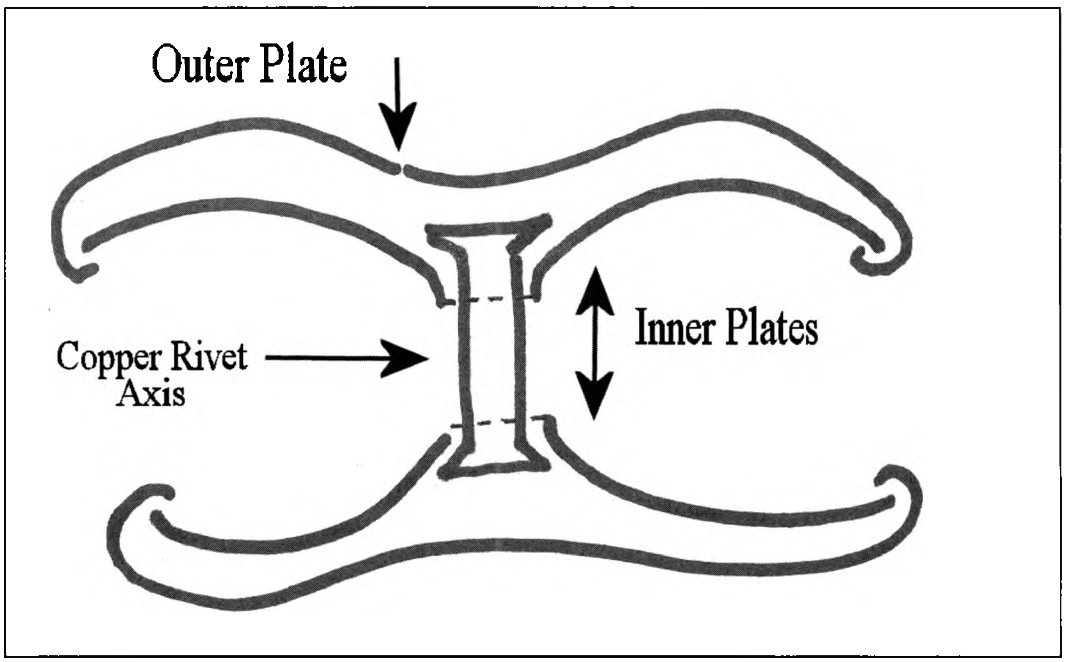

Illustration 5.6 Copper Earspool Diagram

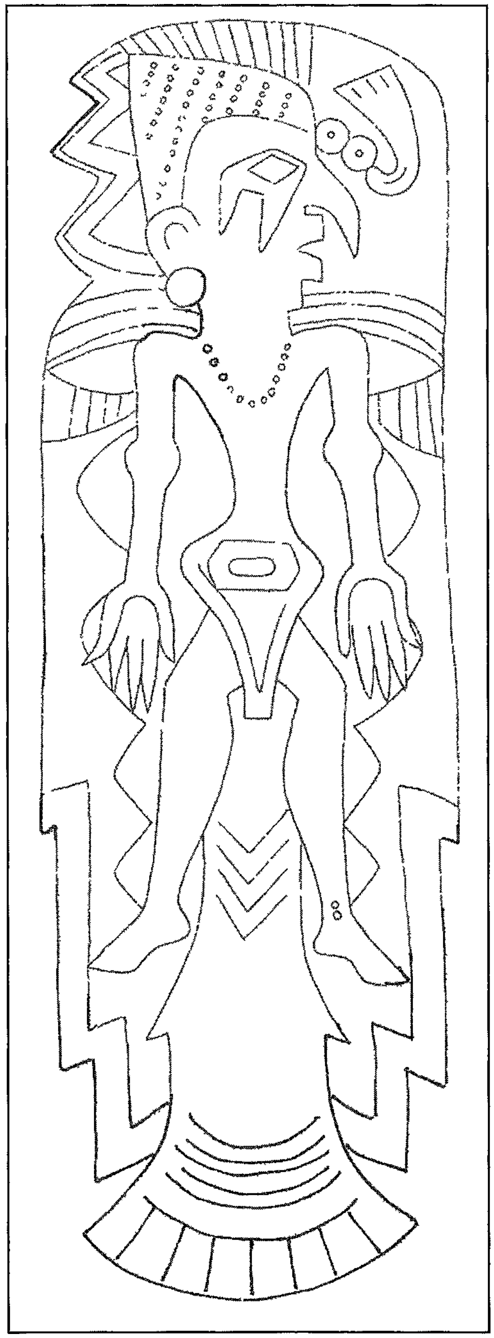

Illustration 5.7 Birdman Copper Plate, Spiro Mounds, Oklahoma

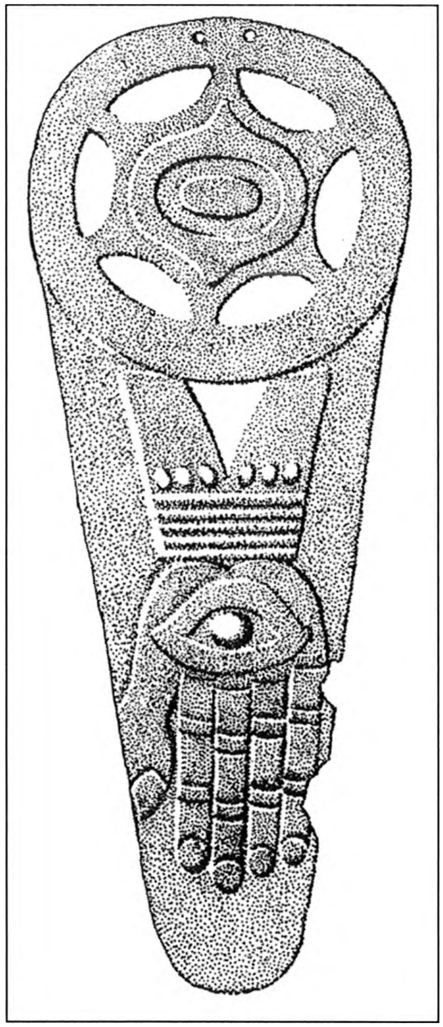

Illustration 5.8 Mississippian Copper Badge

Illustration 5.9 Spiro Shell Engraving

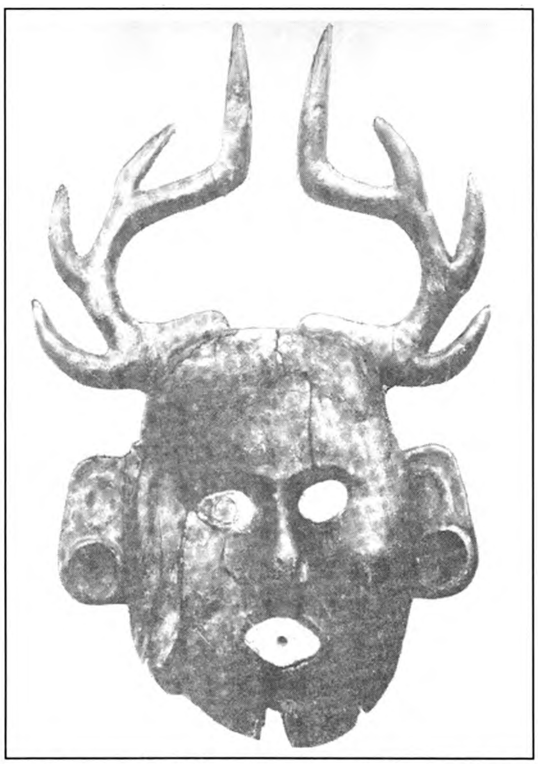

Illustration 5.10 Copper-Clad Spiro Mask

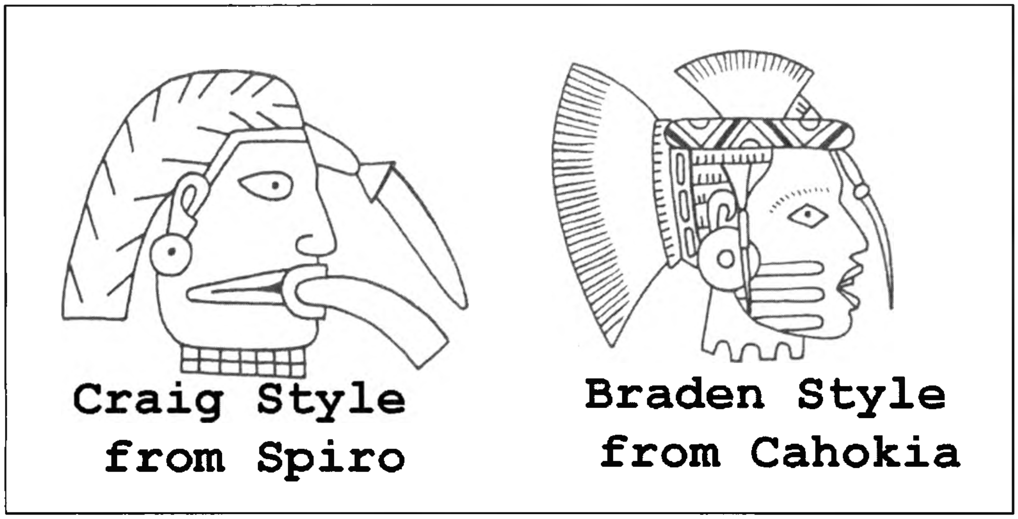

Illustration 5.11 Engraved Shell Styles

Illustration 5.12 Spiro Copper Repoussé Plate

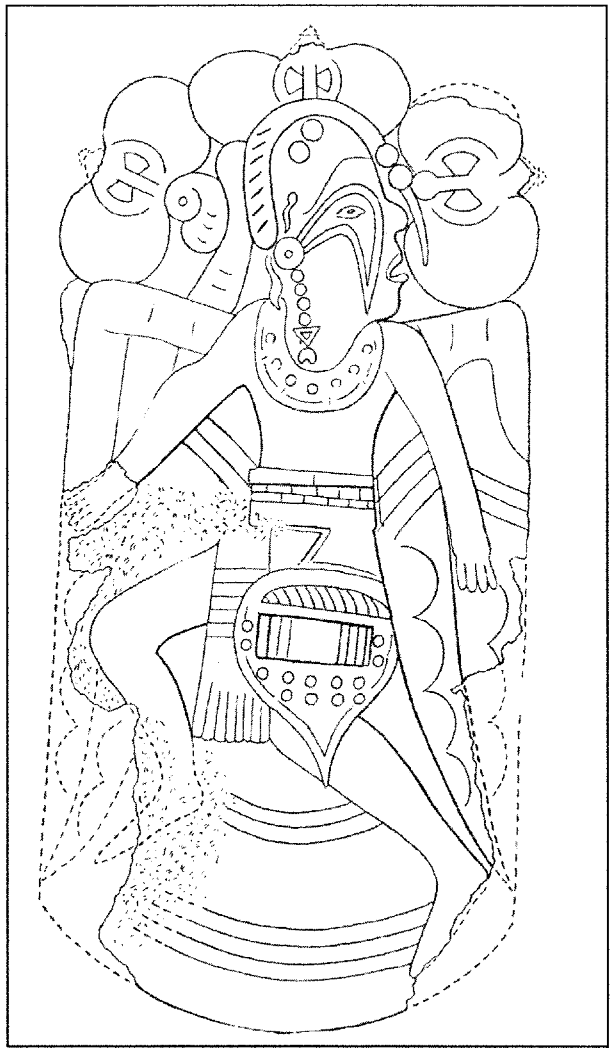

Illustration 5.13 Etowah Copper Embossed Plate

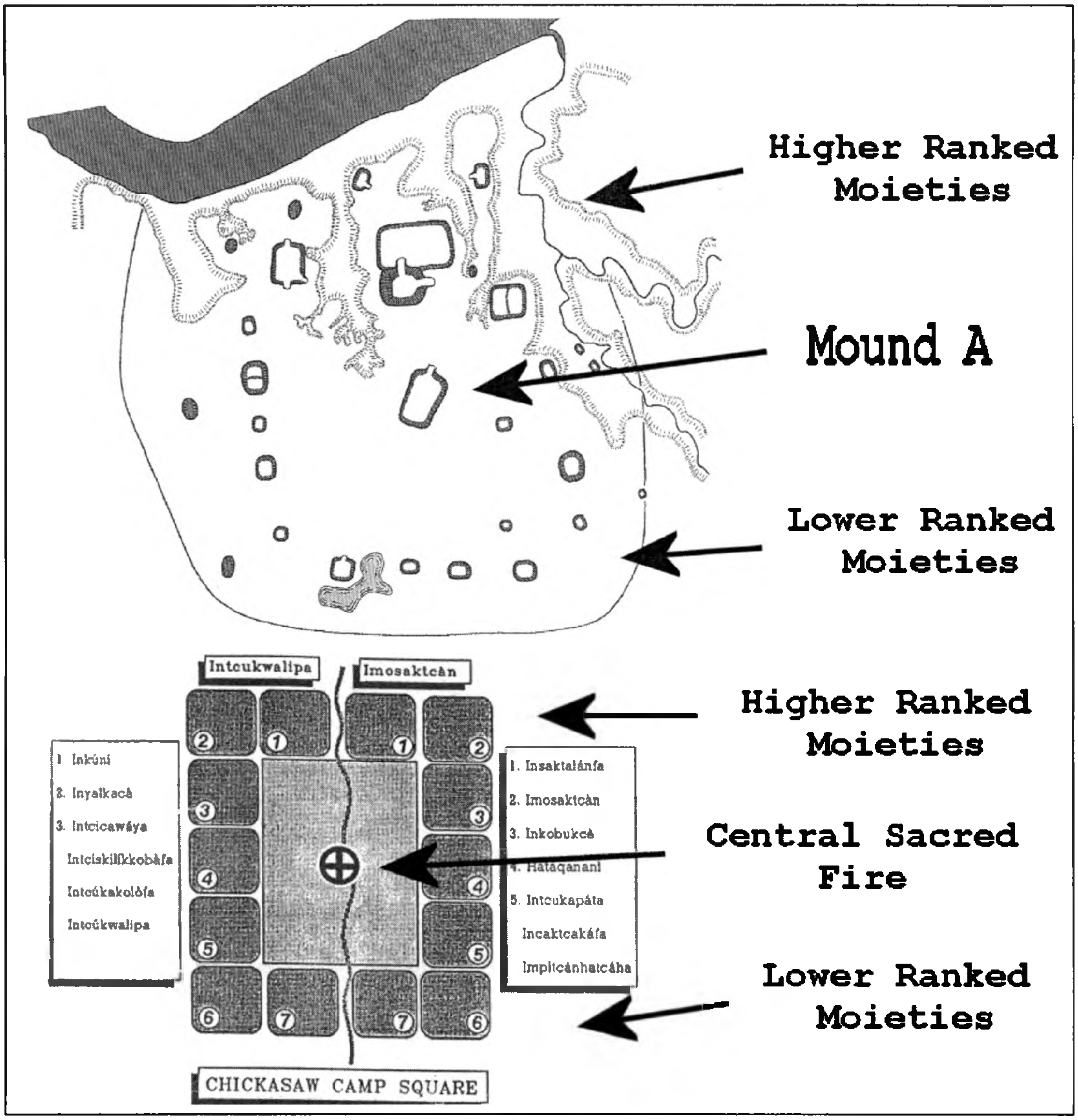

Illustration 5.14 Comparison Between Moundville and Protohistorical Chickasaw Camp Square

Illustration 5.15 Wulfing Plates

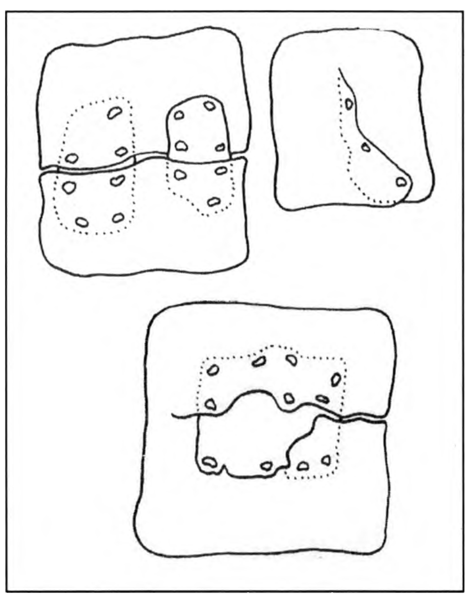

Illustration 5.16 Examples of Repair Work

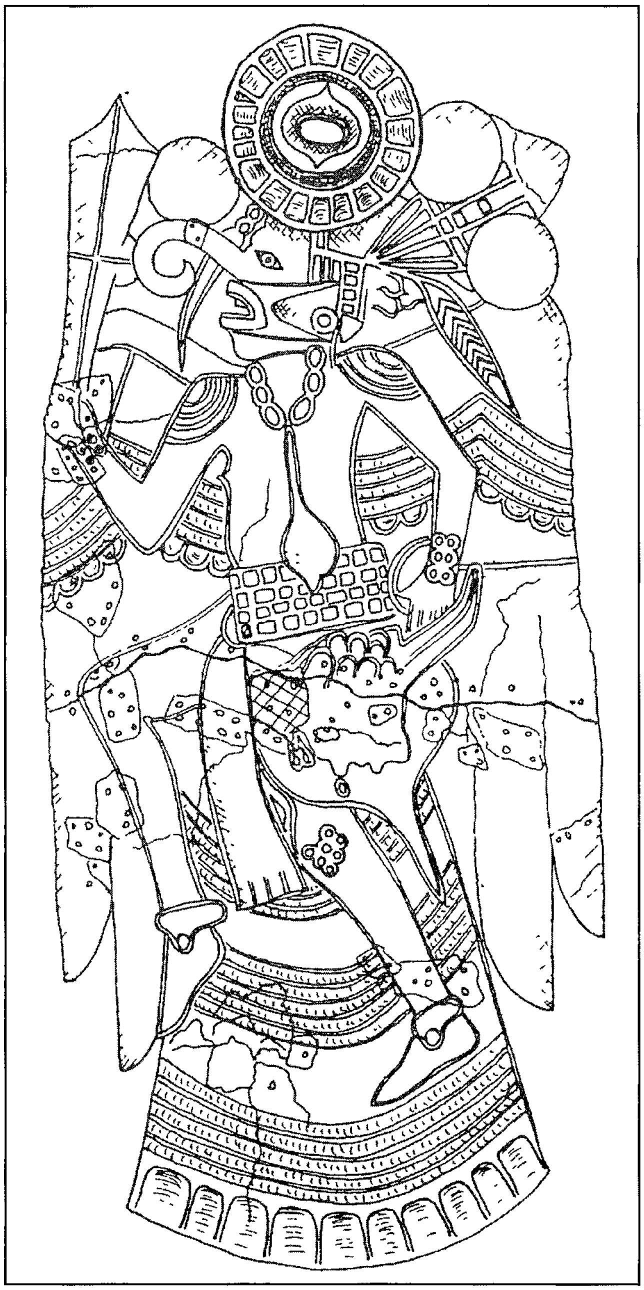

Illustration 5.17 Lake Jackson Copper (Drawing by B. Calvin Jones)

Illustration 5.18 Peoria Plate and Upper Bluff Lake Plate

Illustration 6.1 Wooden Tools

Fig 6.2 Wood Stump Anvils

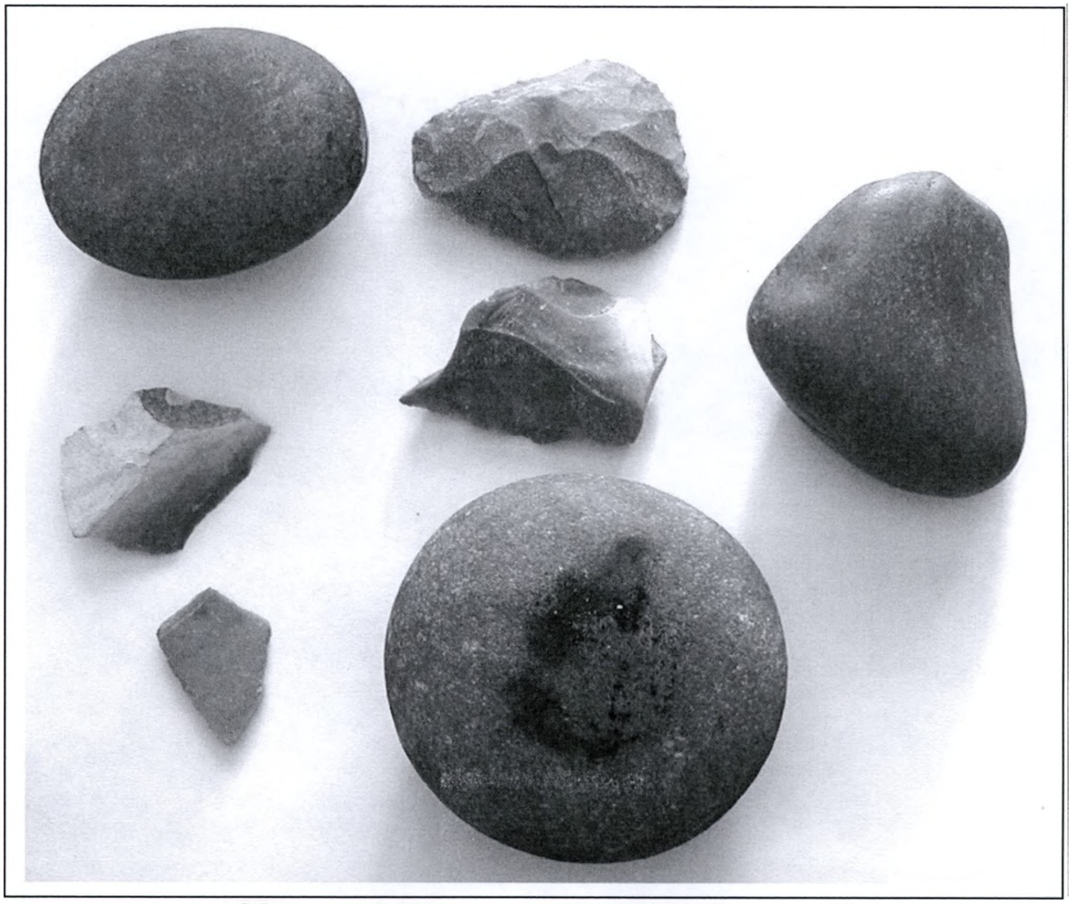

Illustration 6.3 Stone Tools Used

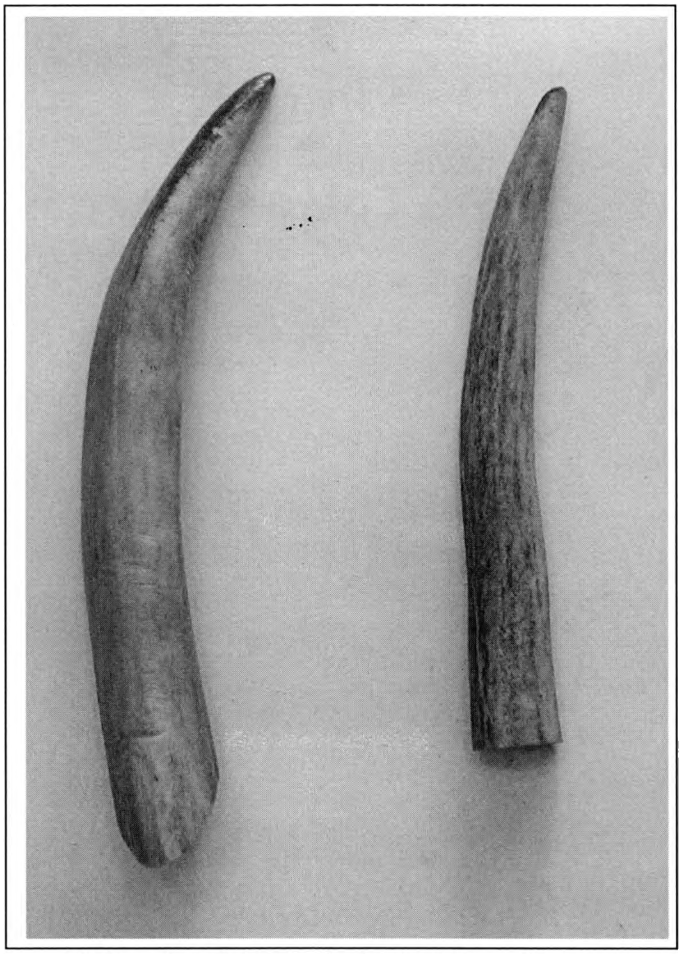

Illustration 6.4 Antler Tools

Illustration 6.5 Copper Chisel Tool

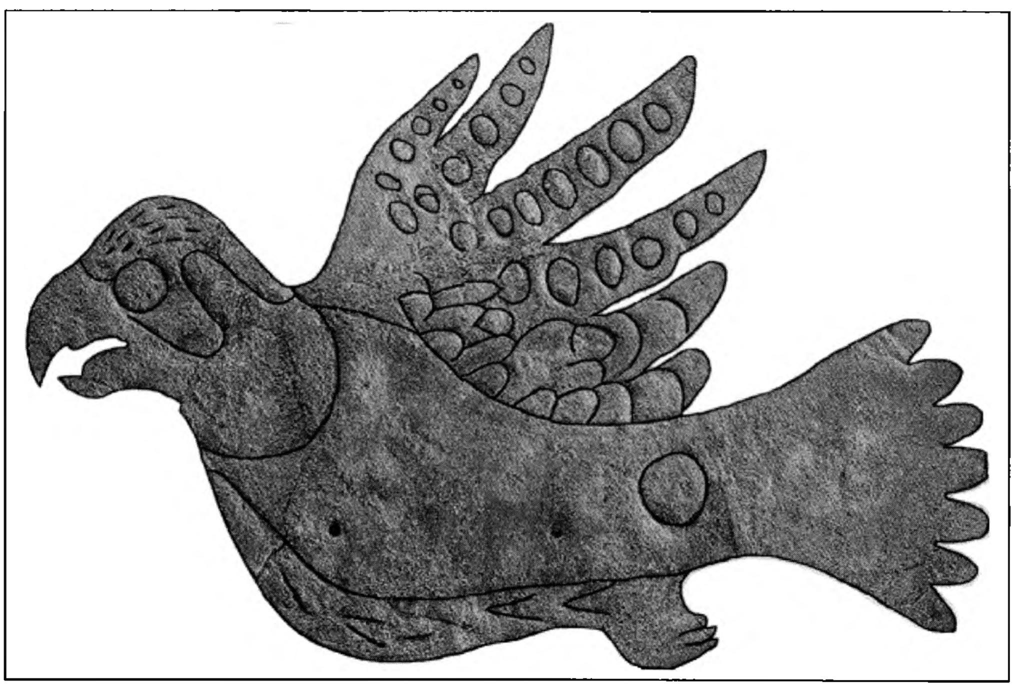

Illustration 7.1 Hopewell Copper Embossed Raptor Bird Plate

Illustration 7.2 Comparison of Similar Embossed Raptor Bird Plates

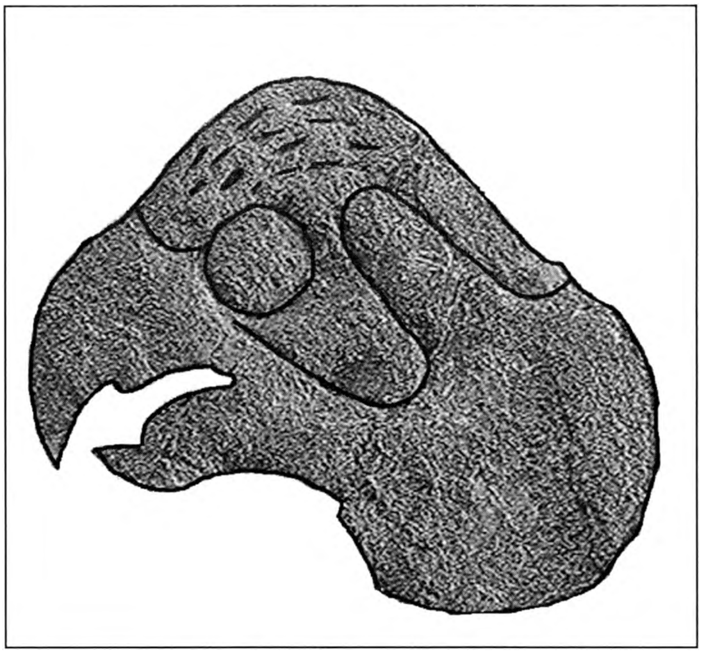

Illustration 7.3 Head Detail

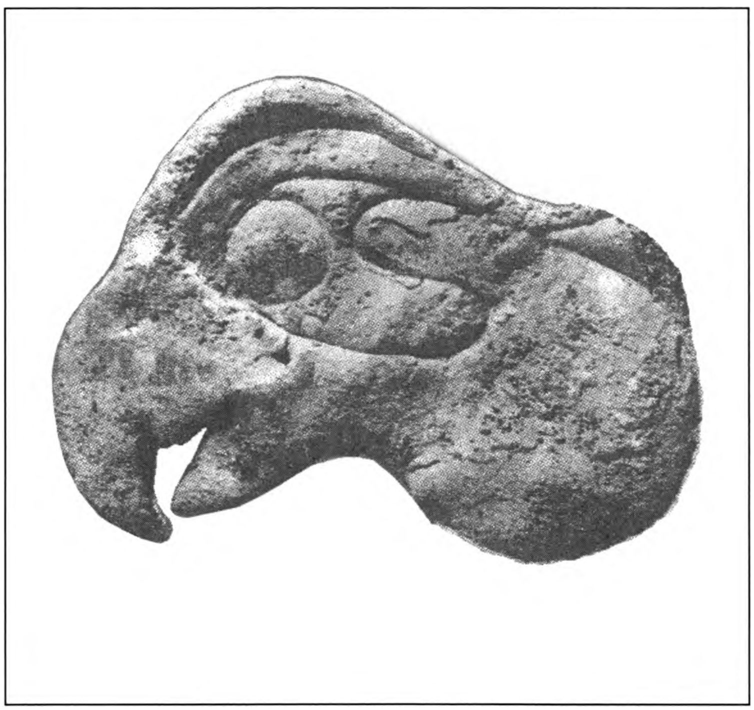

Illustration 7.4 Second Raptor Head Detail

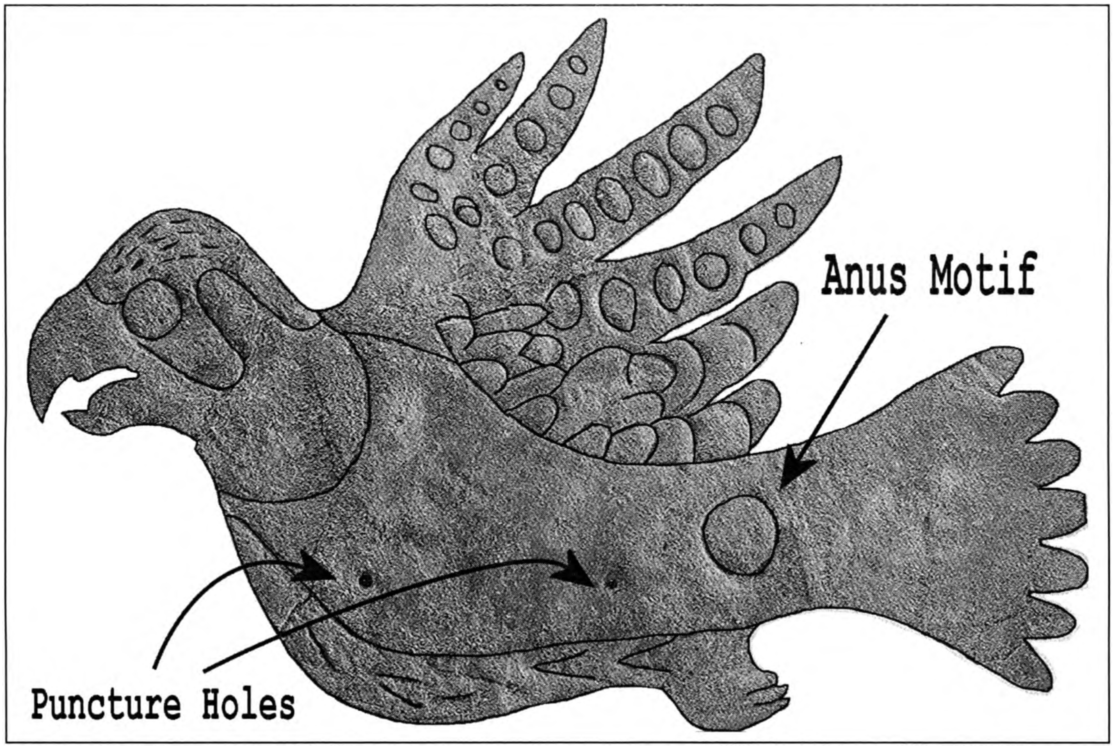

Illustration 7.5 Puncture Holes and Anus Motif Detail

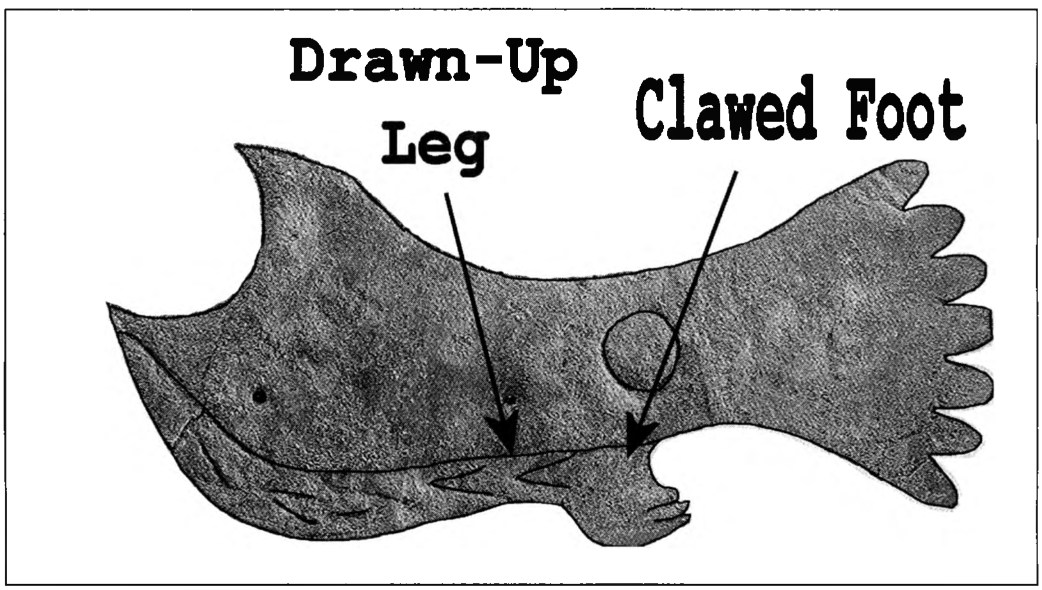

Illustration 7.6 Leg and Foot Detail

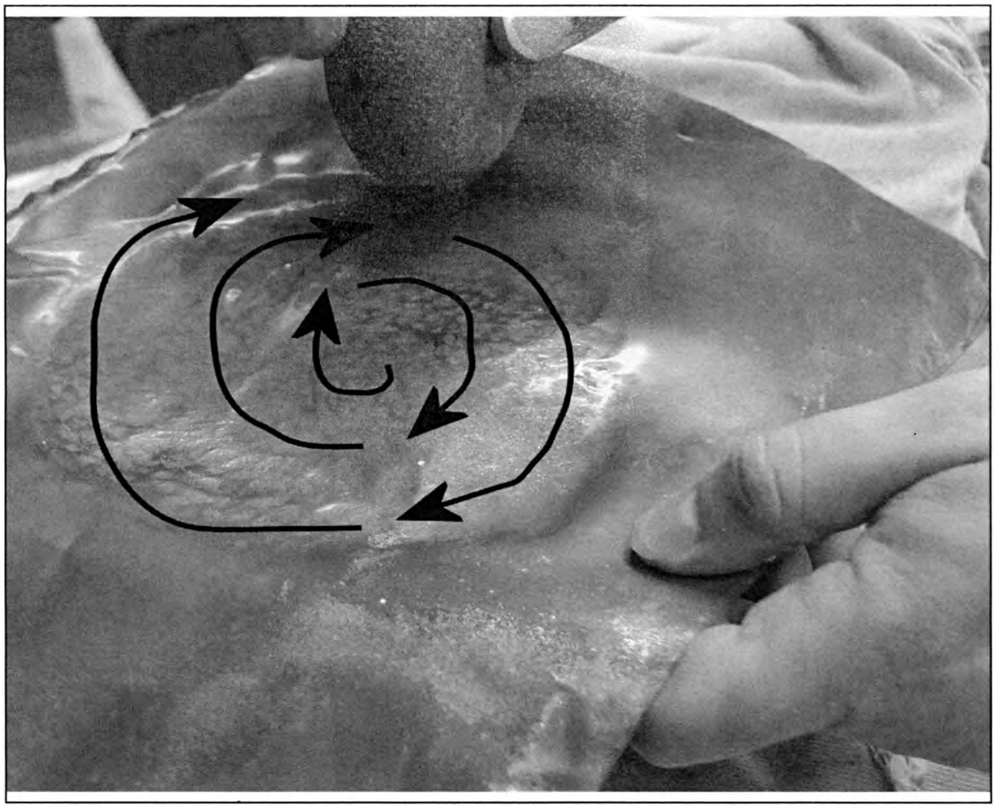

Illustration 7.7 Spiral Pattern Hammering

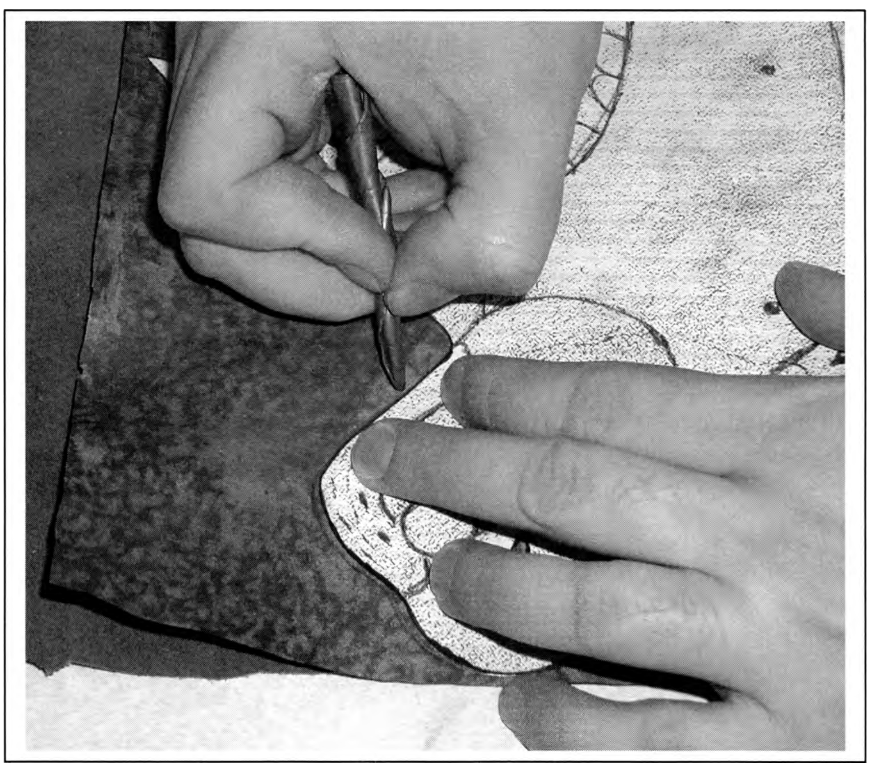

Illustration 7.8 Tracing the Raptor Bird Pattern

Illustration 7.9 Etched Raptor Bird Image

Illustration 7.10 Freehand Plate after Annealing and Cleaning

Illustration 7.11 Cutting with Copper Chisel

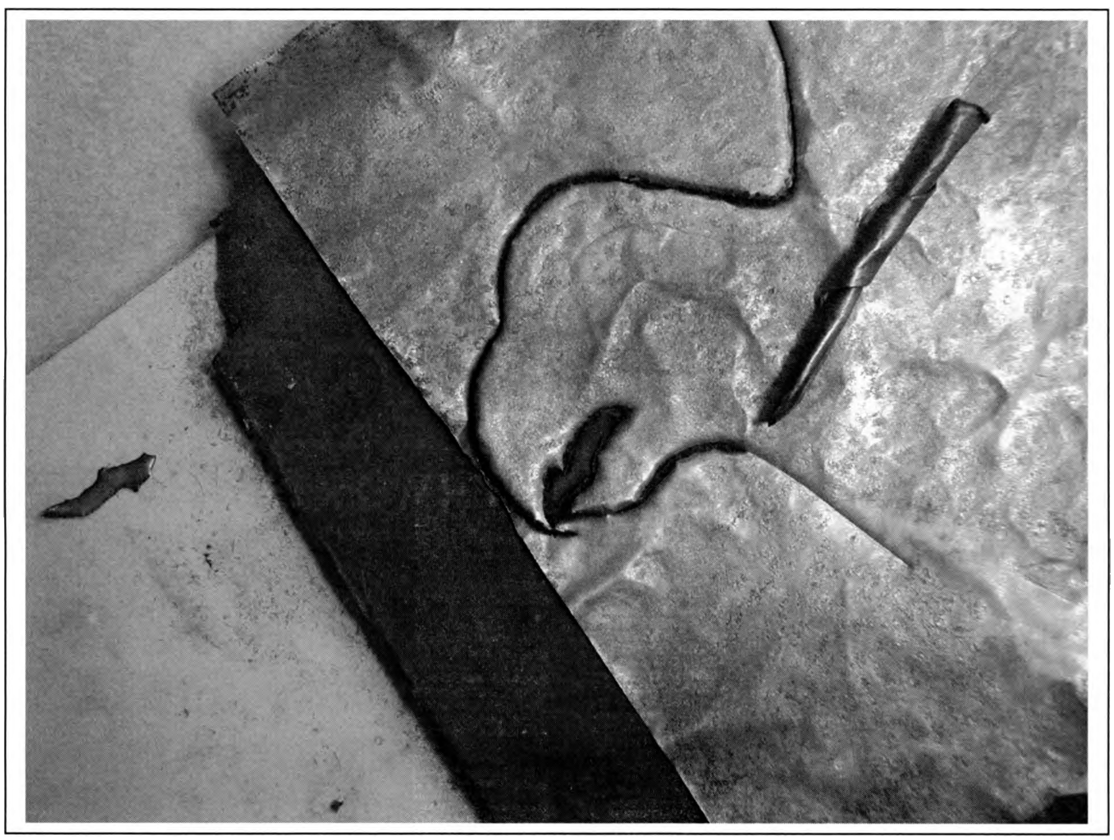

Illustration 7.12 Raptor Head Cut-Out

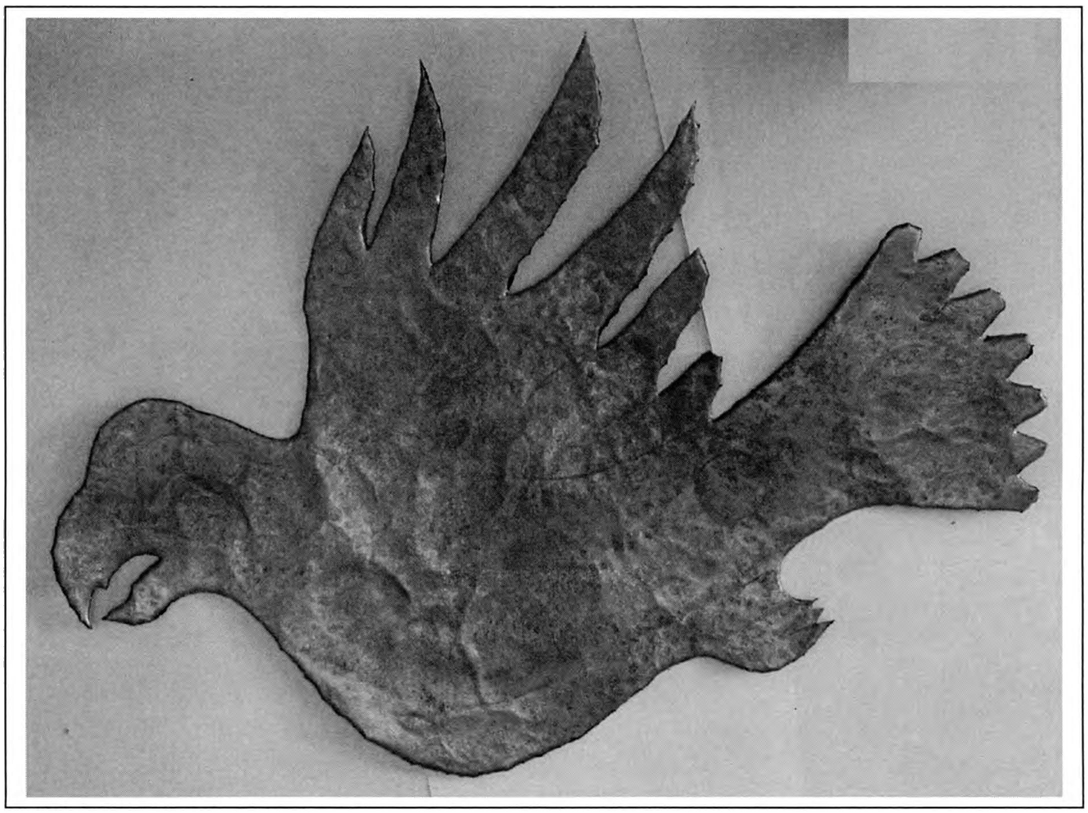

Illustration 7.13 Raptor Freehand Cut-Out Outline

Illustration 7.14 Partially Chased Freehand Plate

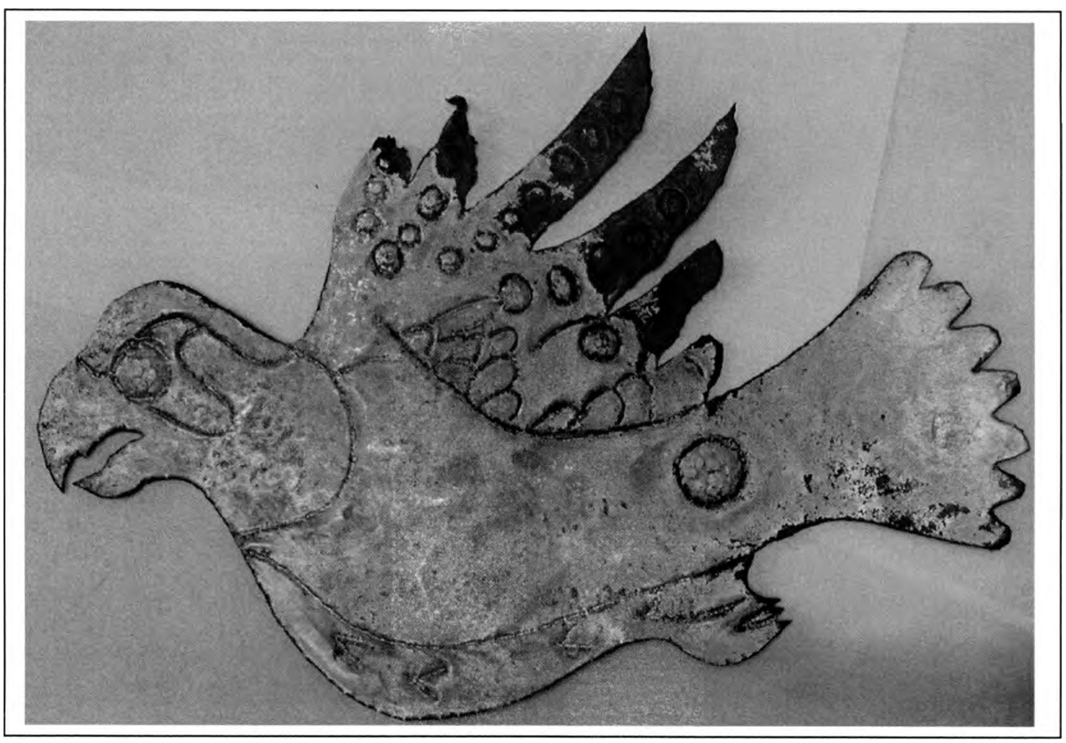

Illustration 7.15 Finished Freehand Plate

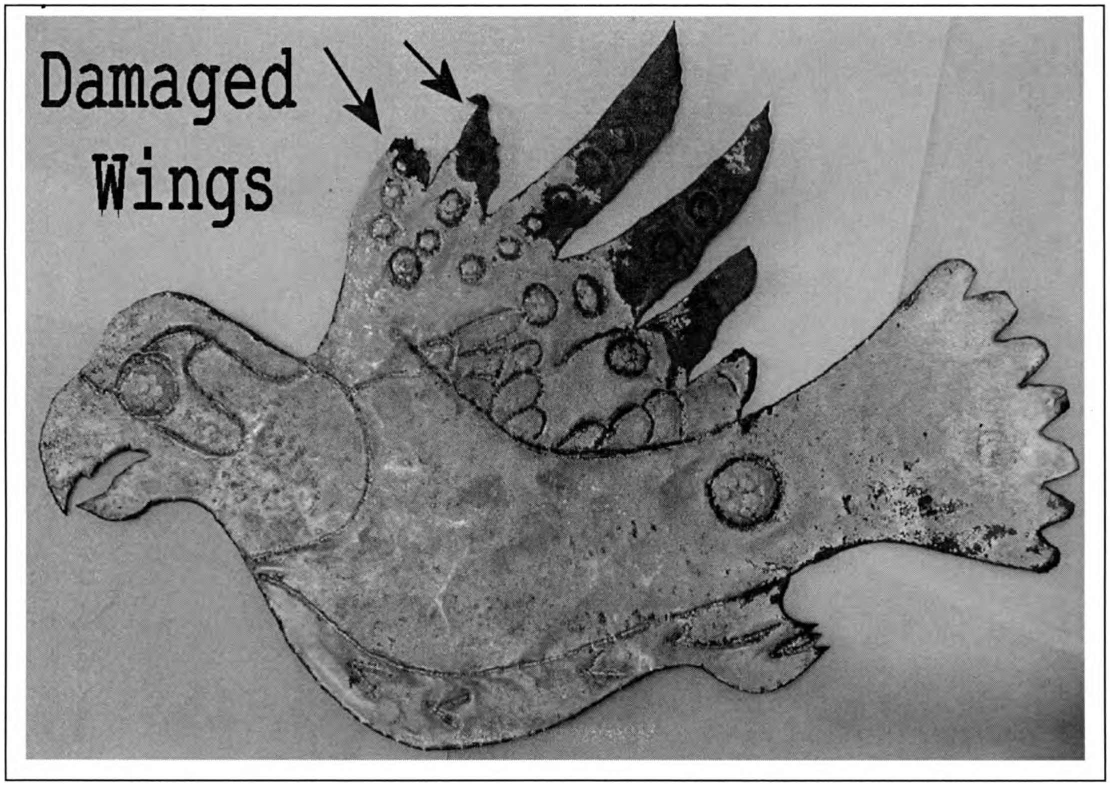

Illustration 7.16 Damaged Wings Due to Excess Heat

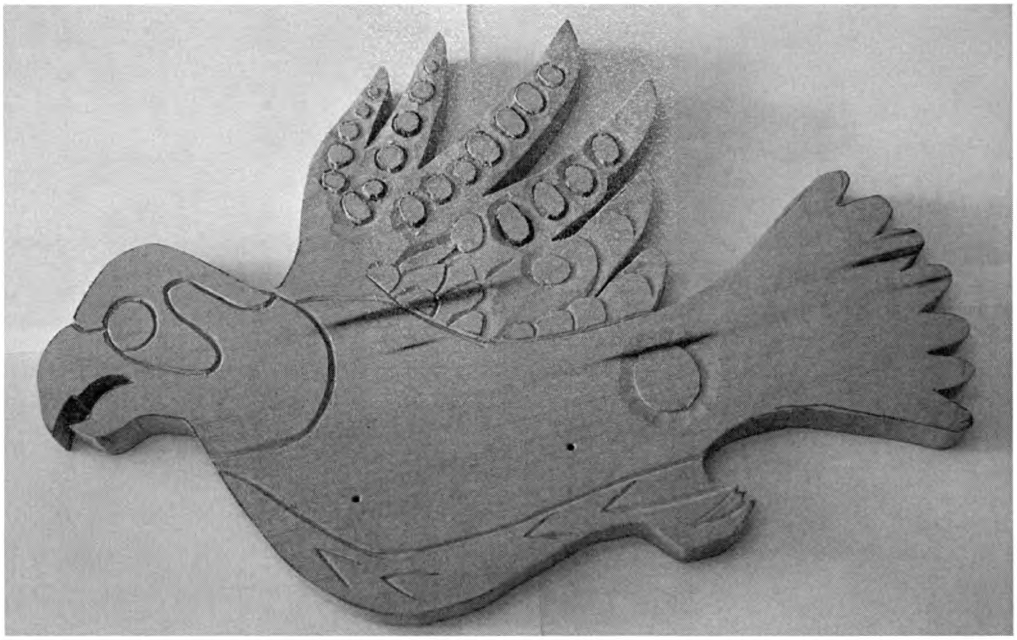

Illustration 7.17 Carved Wooden Template

Illustration 7.18 Burnishing the Design

Illustration 7.19 Burnishing the Raptor Head

Illustration 7.20 Using the Antler Tine to Define the Raptor Shape

Illustration 7.21 Nails Used to Secure the Plate to the Template

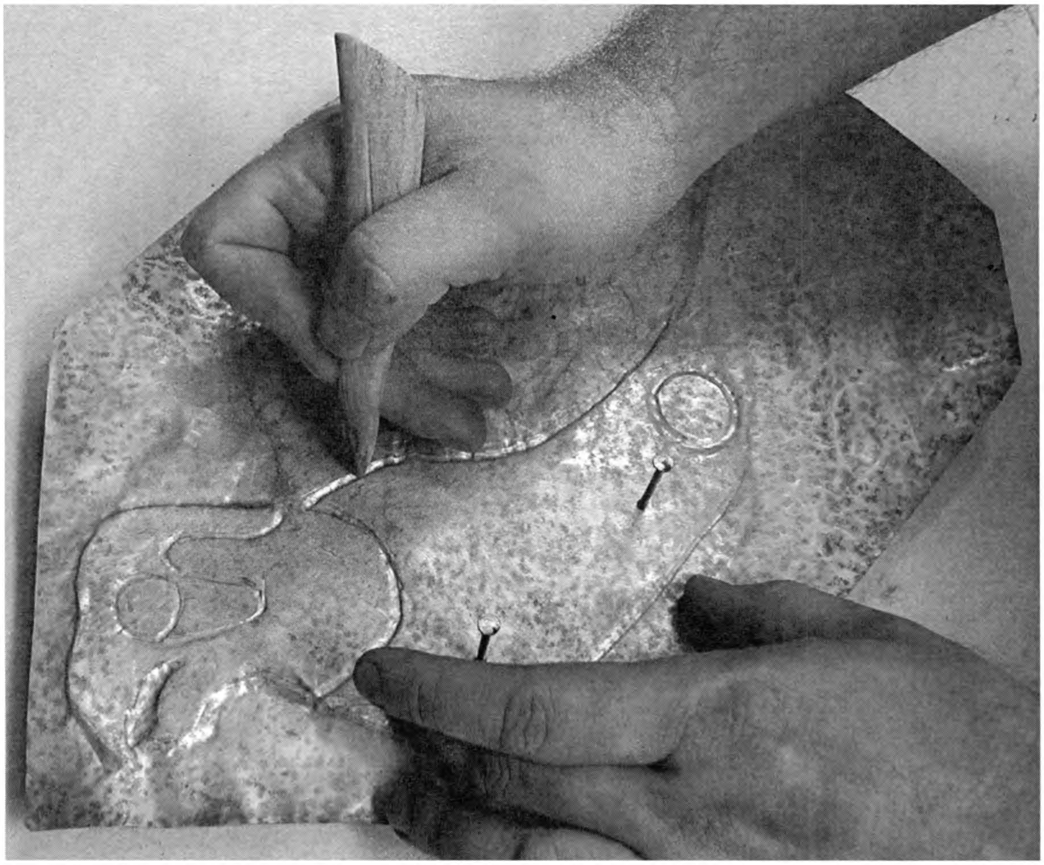

Illustration 7.22 Utilizing Antler Tine

Illustration 7.23 Burnishing Continued

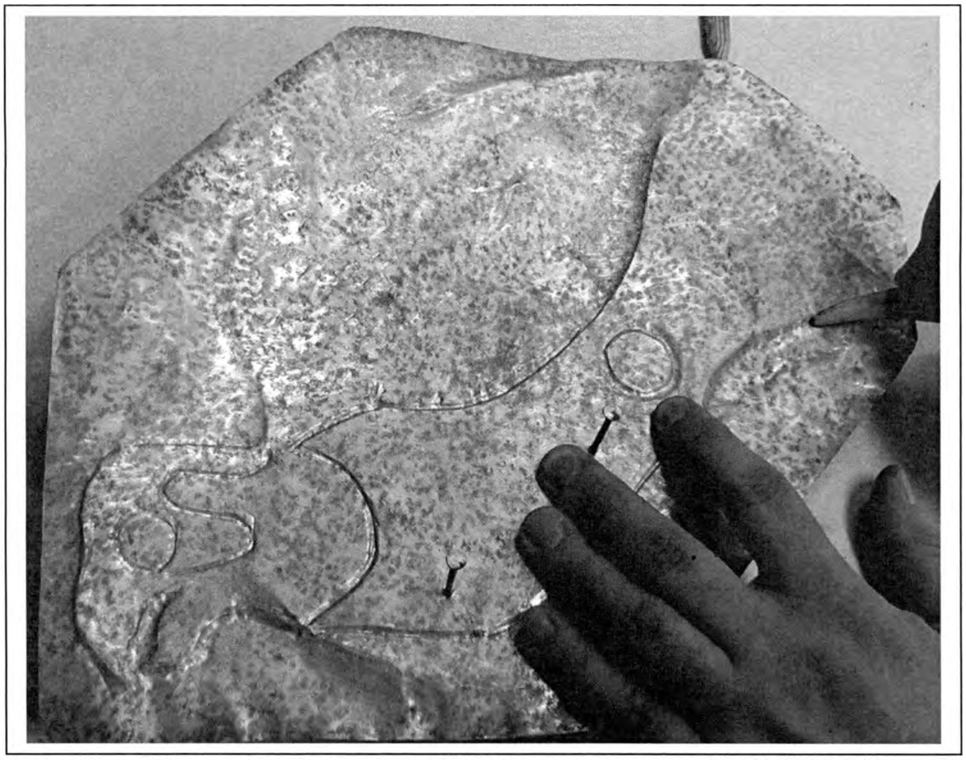

Illustration 7.24 Burnishing Continued

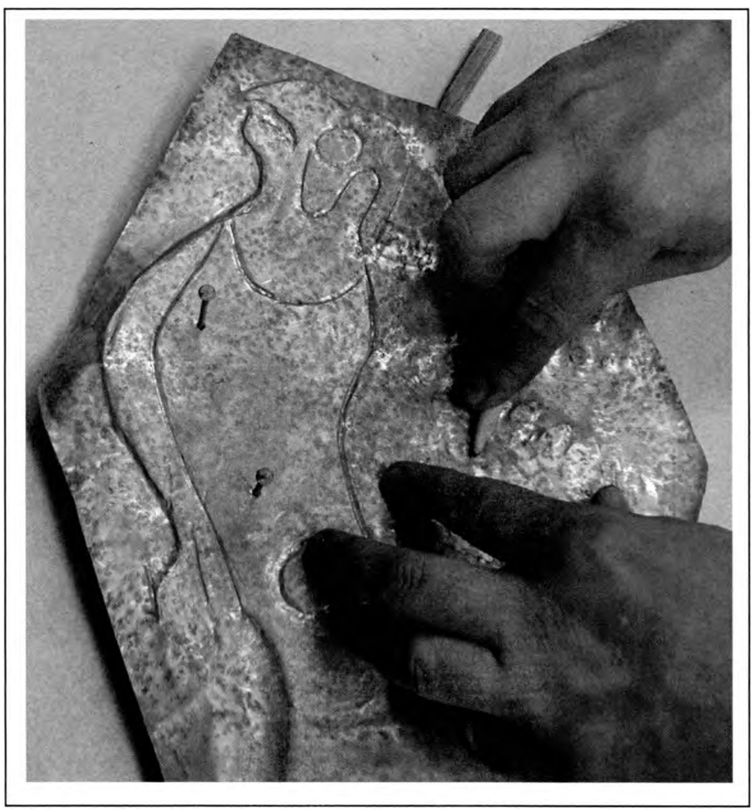

Illustration 7.25 Burnishing Continued

Illustration 7.26 Burnishing Continued

Illustration 7.27 Burnishing Continued

Illustration 7.28 Burnishing Continued

Illustration 7.29 Hammering to Define Image

Illustration 7.30 Burnishing Continued

Illustration 7.31 Nearly Finished Burnished Plate before Re-Annealing and Being Cut Out

Illustration 7.32 Plate Utilizing Template Only (*notice oxidation of metal*)

Illustration 7.33 Plate Embedded in Pine Pitch

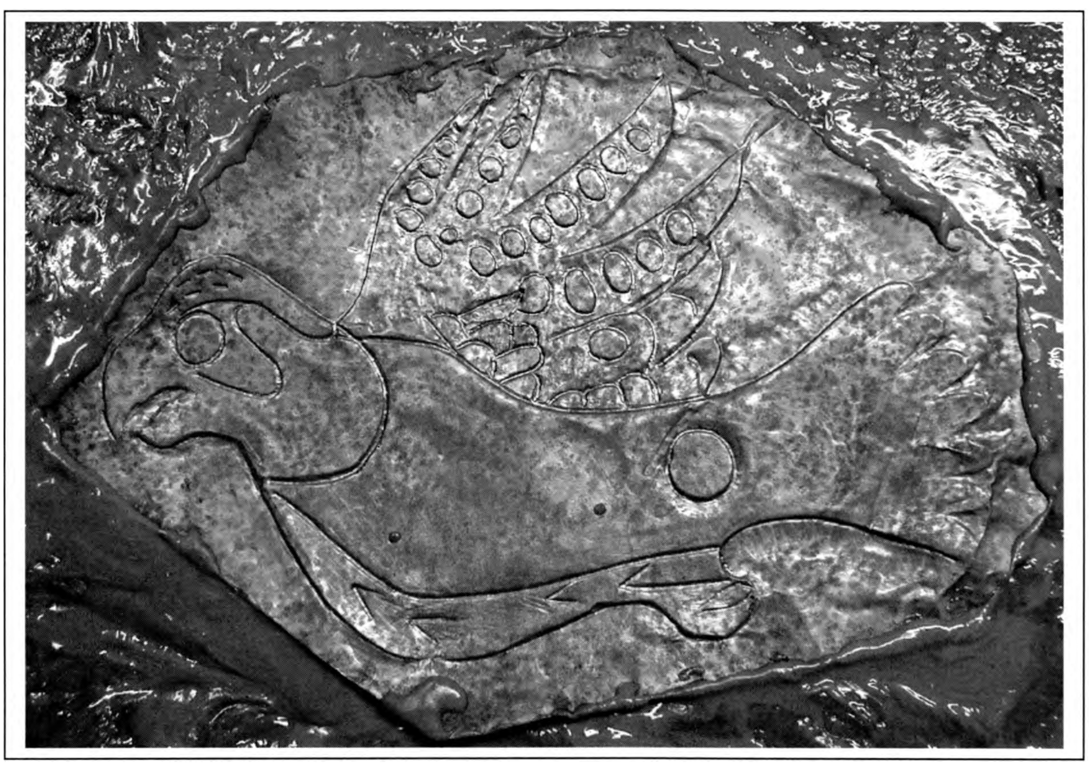

Illustration 7.34 Plate After Chasing

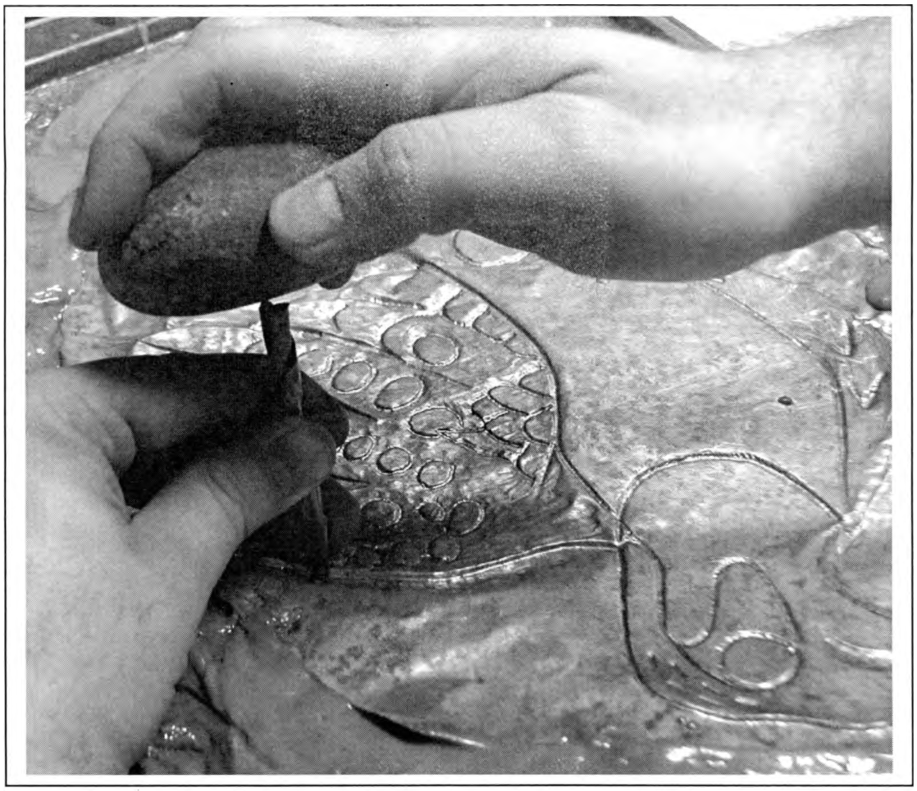

Illustration 7.35 Cutting Out the Plate

Illustration 7.36 Raptor Plate Completely Cut-Out

Illustration 7.37 Excess Copper Removed

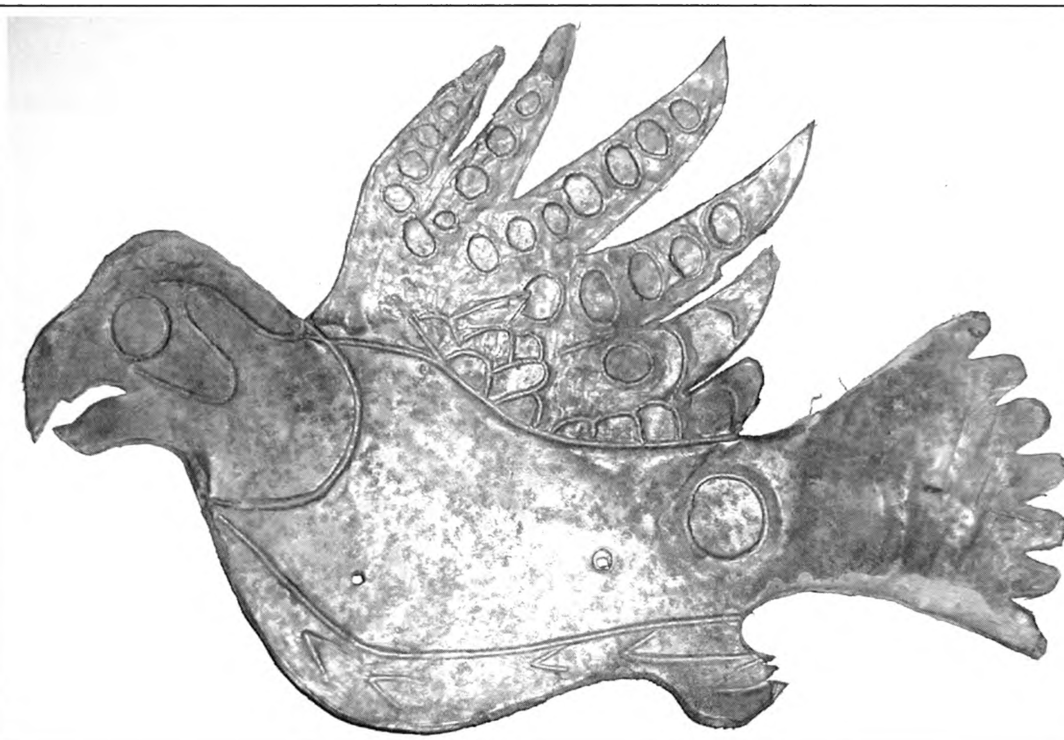

Illustration 7.38 The Plate After Burning Off Excess Pitch But Before Cleaning

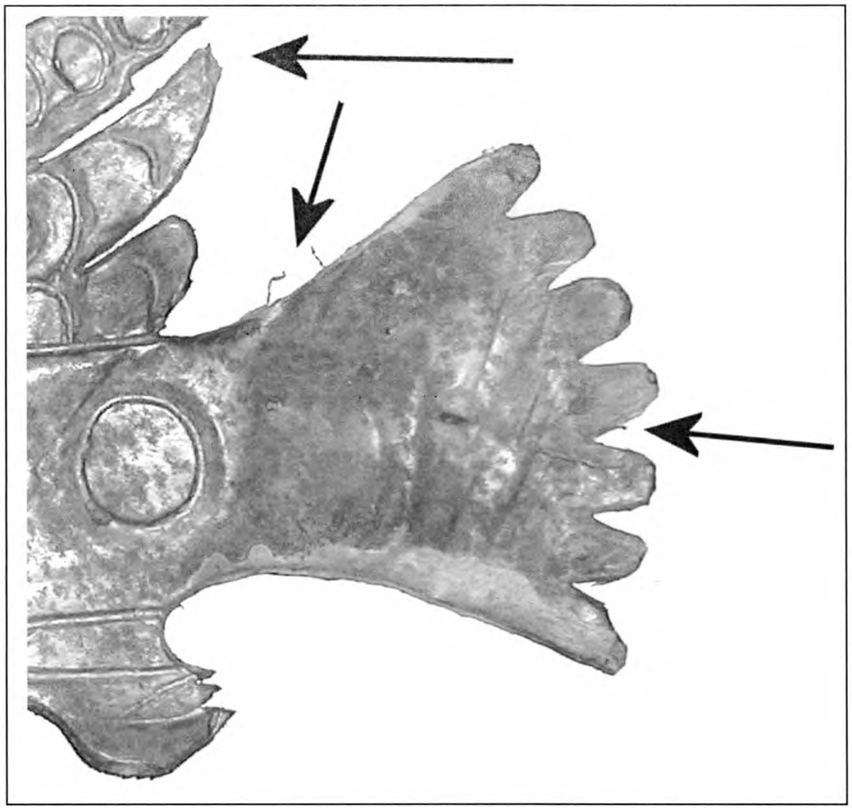
Illustration 7.39 Metal Filaments to be Ground Off


Illustration 7.40 Grinding Edges after Cleaning

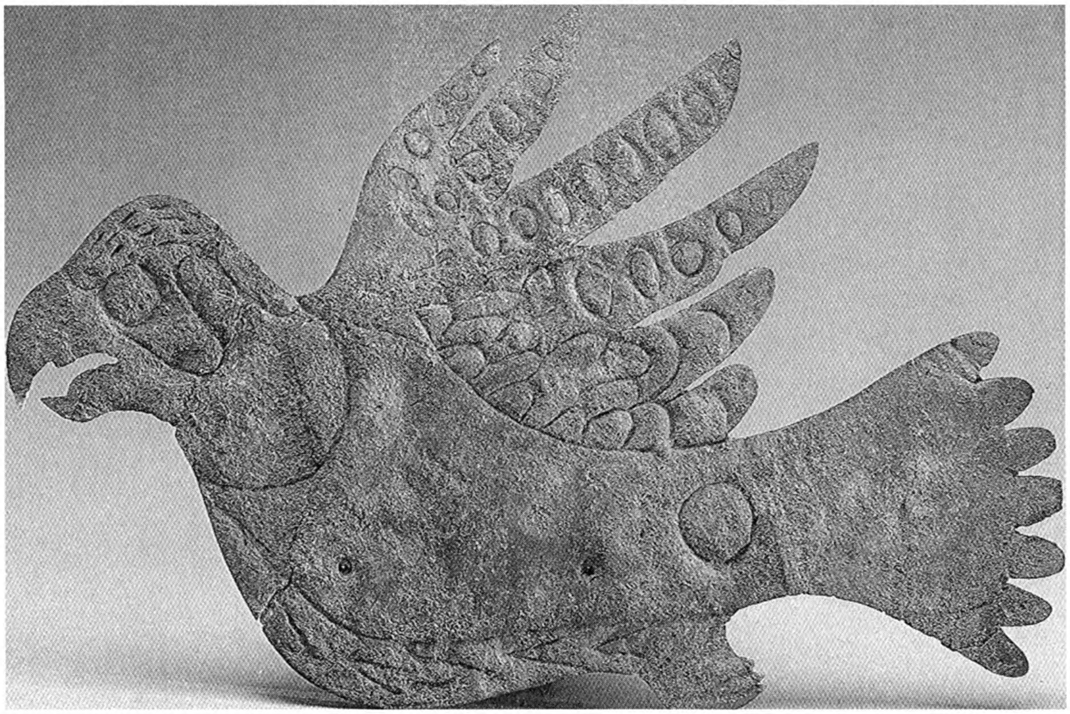

Illustration 7.41 The Original Hopewell Raptor Plate

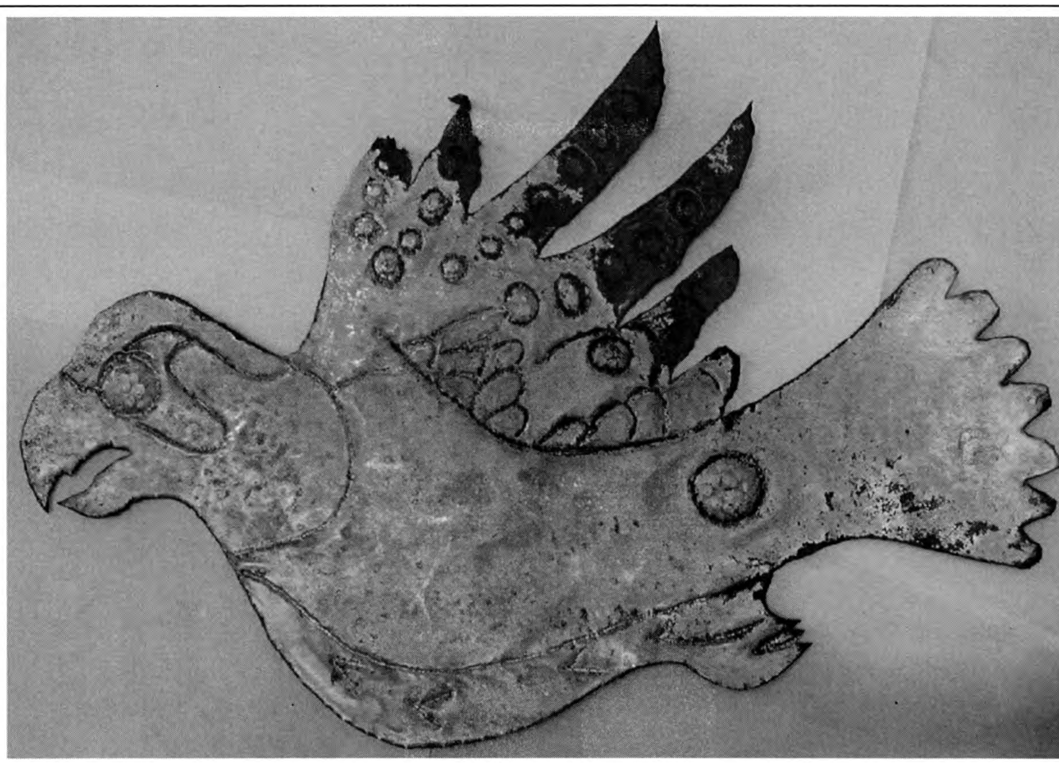

Illustration 7.42 Comparison with Freehand

Illustration 7.43 Original

Illustration 7.44 Pressed without Pitch

Illustration 7.45 Original

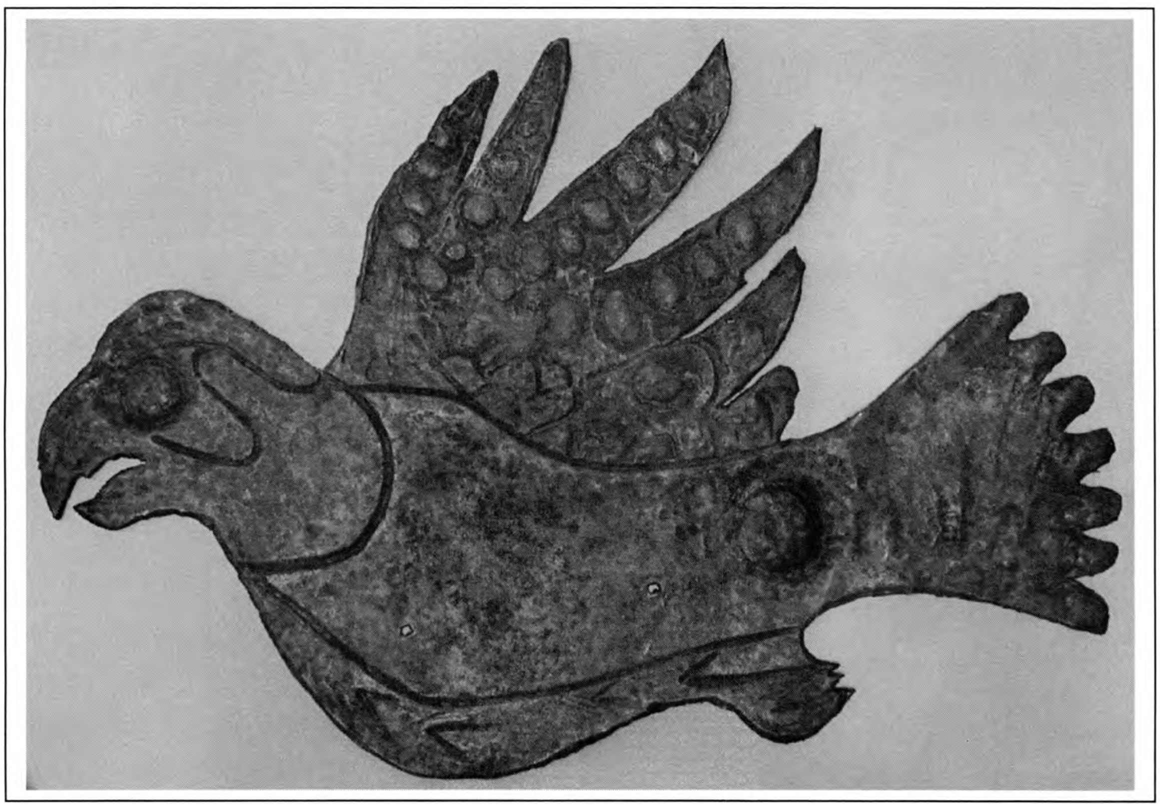

Illustration 7.46 Plate Utilizing Template and Pine Pitch

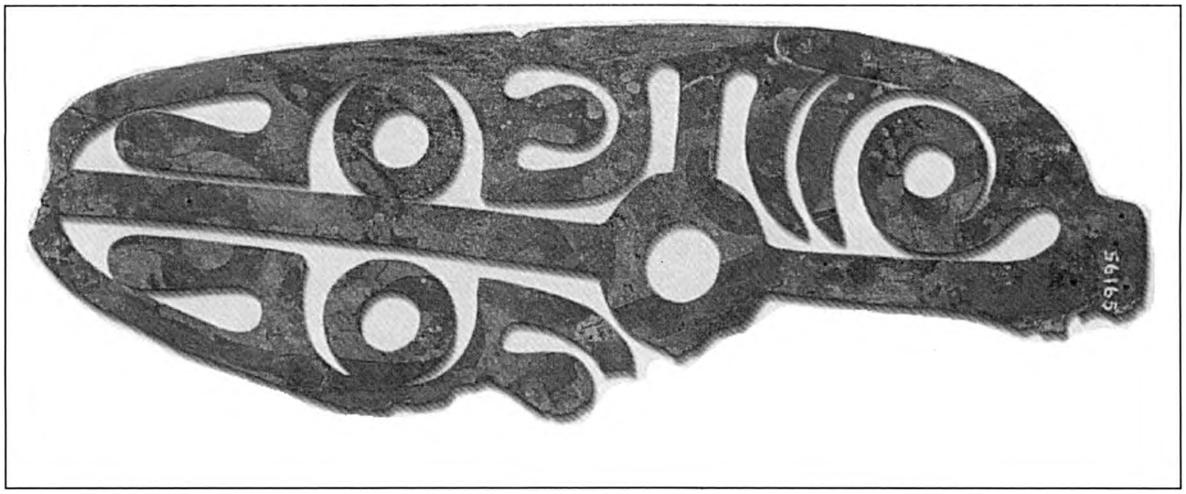

Illustration 7.47 Hopewell Copper Geometric Cut-Out Deer Ear

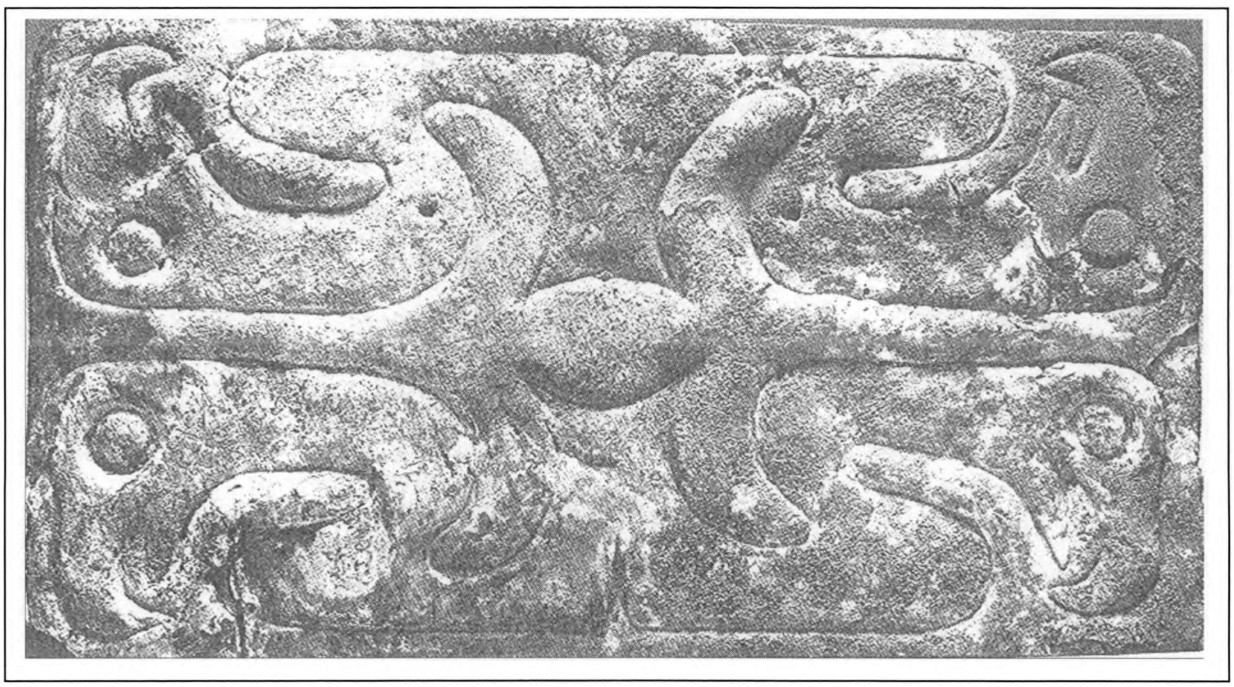

Illustration 7.48 Hopewell Copper Geometric Raptor Bird Head Plate

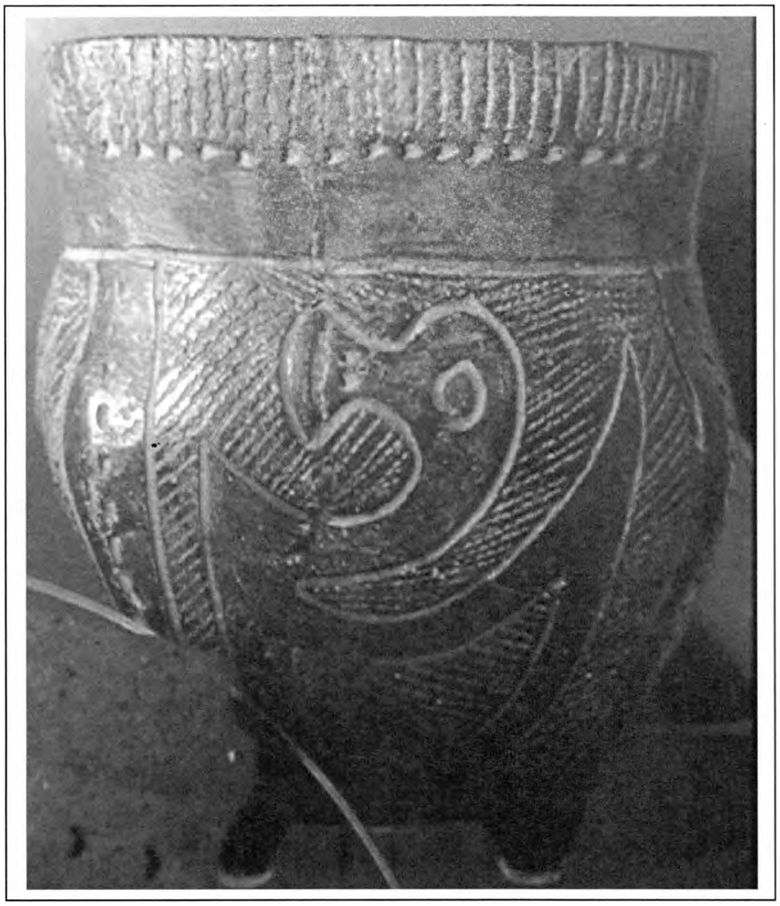

Illustration 7.49 Hopewell Ceramic Pot

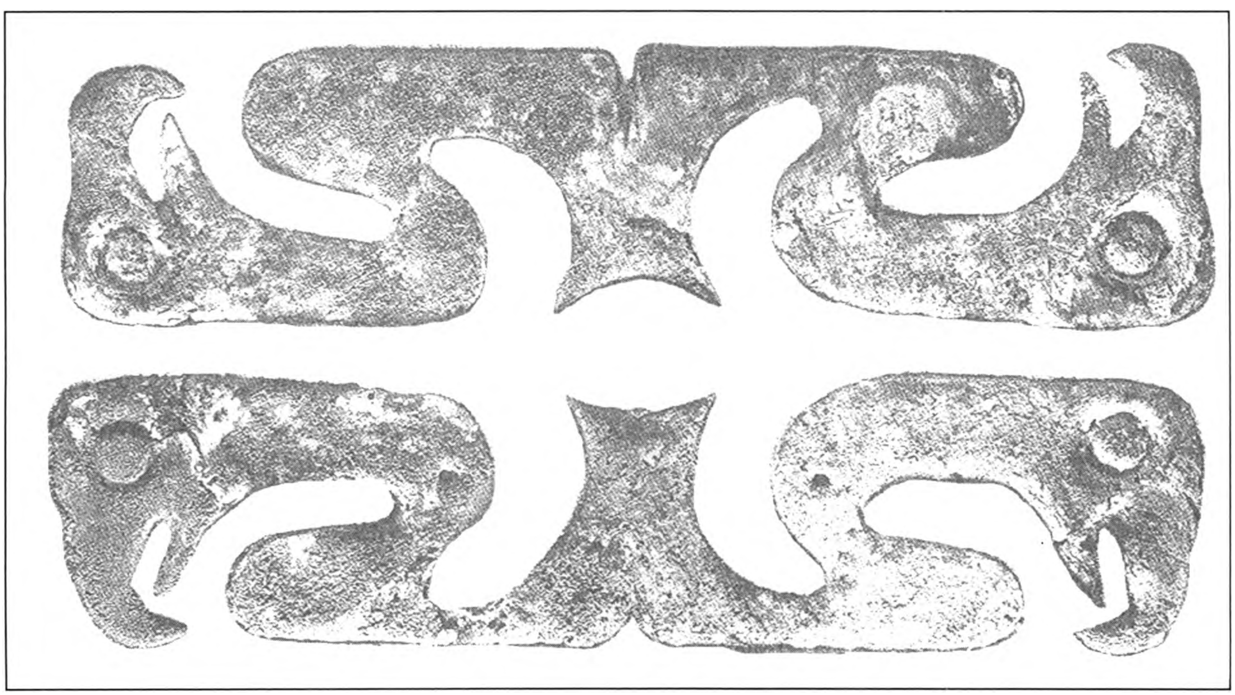

Illustration 7.50 Raptor Bird Heads Detail

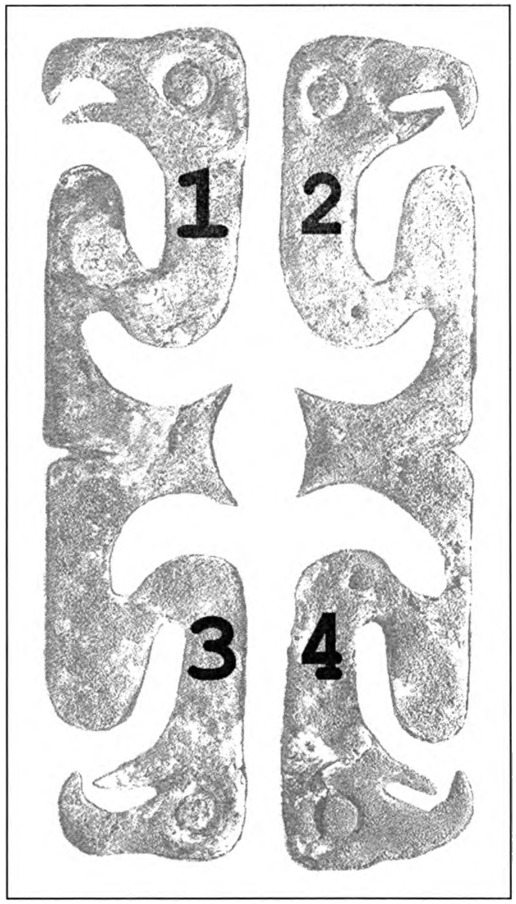

Illustration 7.51 Similarities

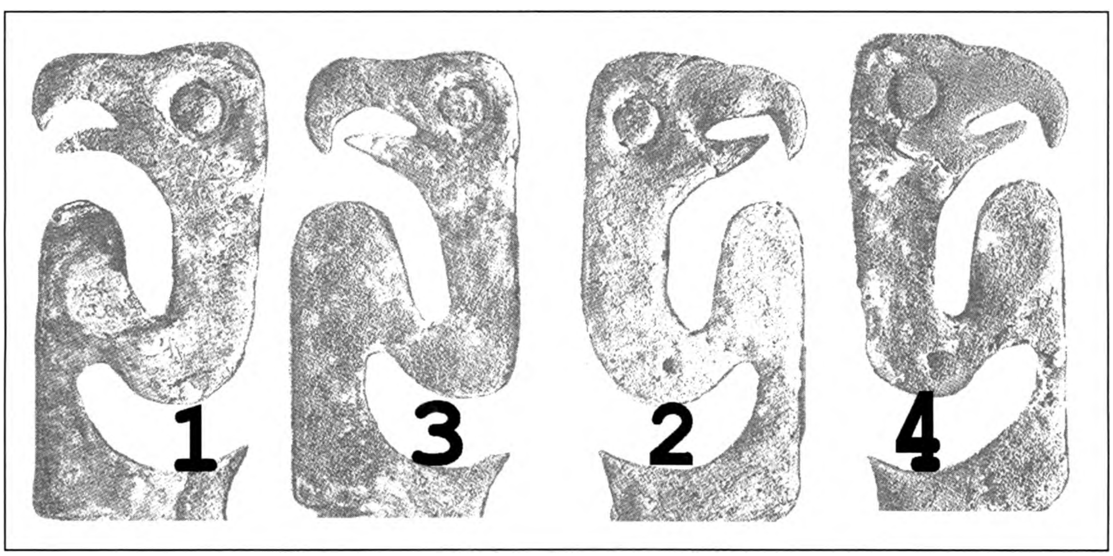

Illustration 7.52 Similarities of the Top and Bottom Heads

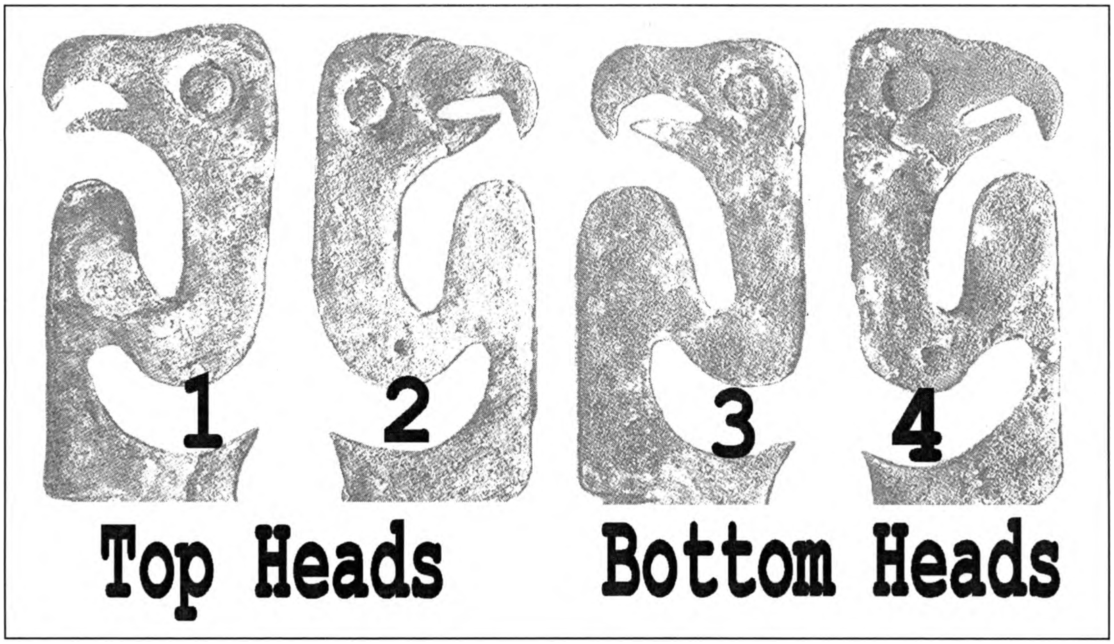

Illustration 7.53 Similarities

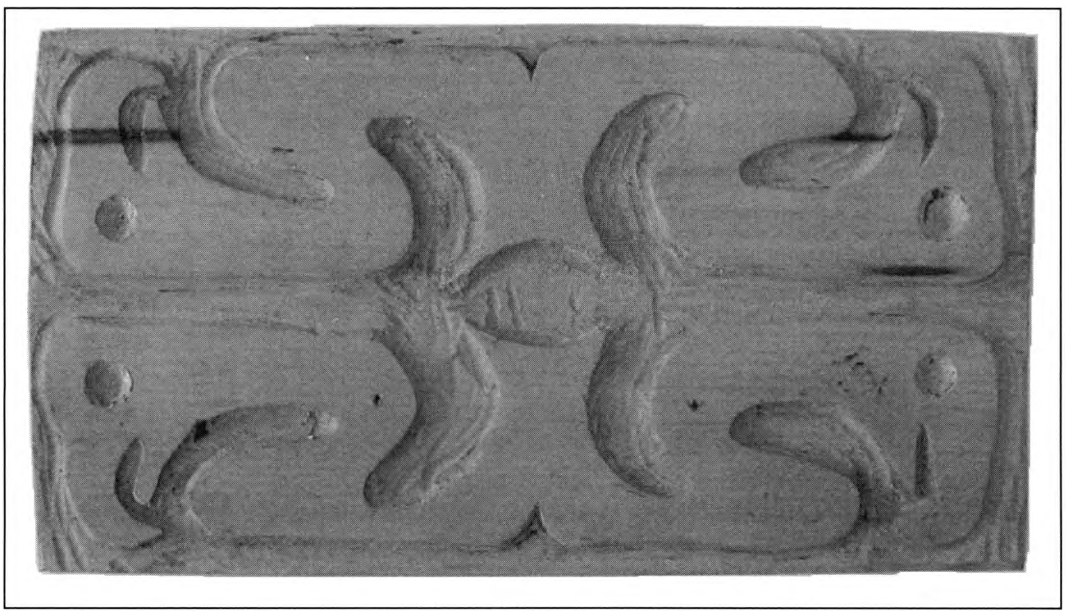

Illustration 7.54 Carved Hopewell Geometric Template

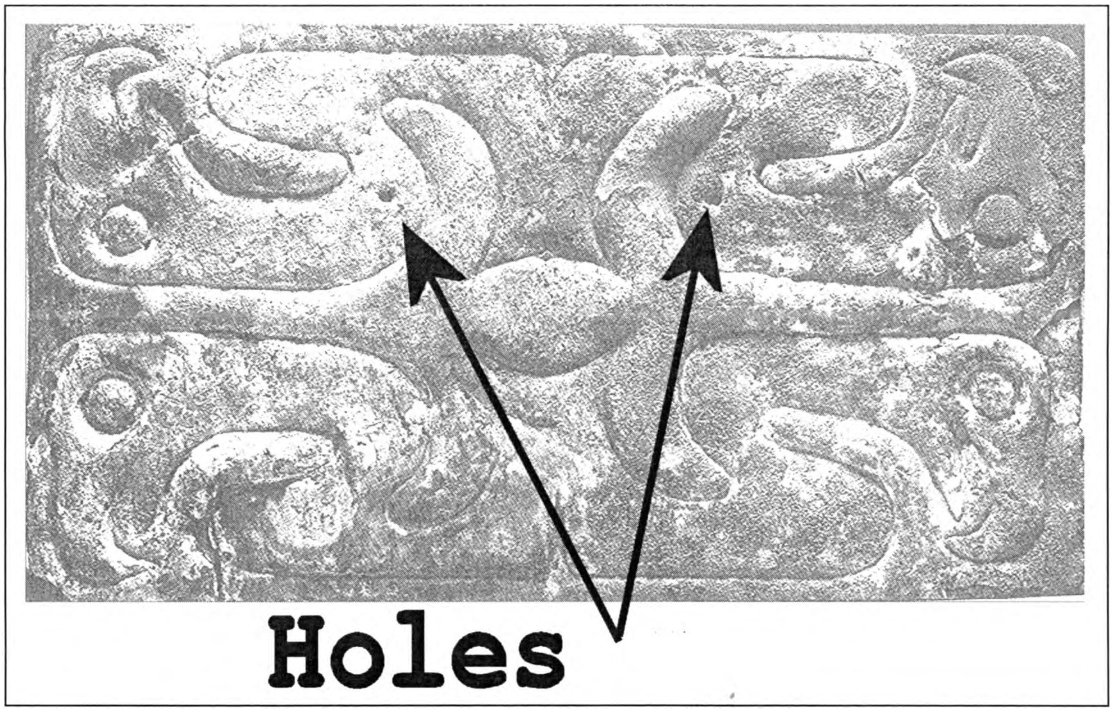

Illustration 7.55 Suspension Holes

Illustration 7.56 Freehand Geometric Raptor Bird Head Plate

Illustration 7.57 Template Plate

Illustration 7.58 Template and Pine Pitch Plate

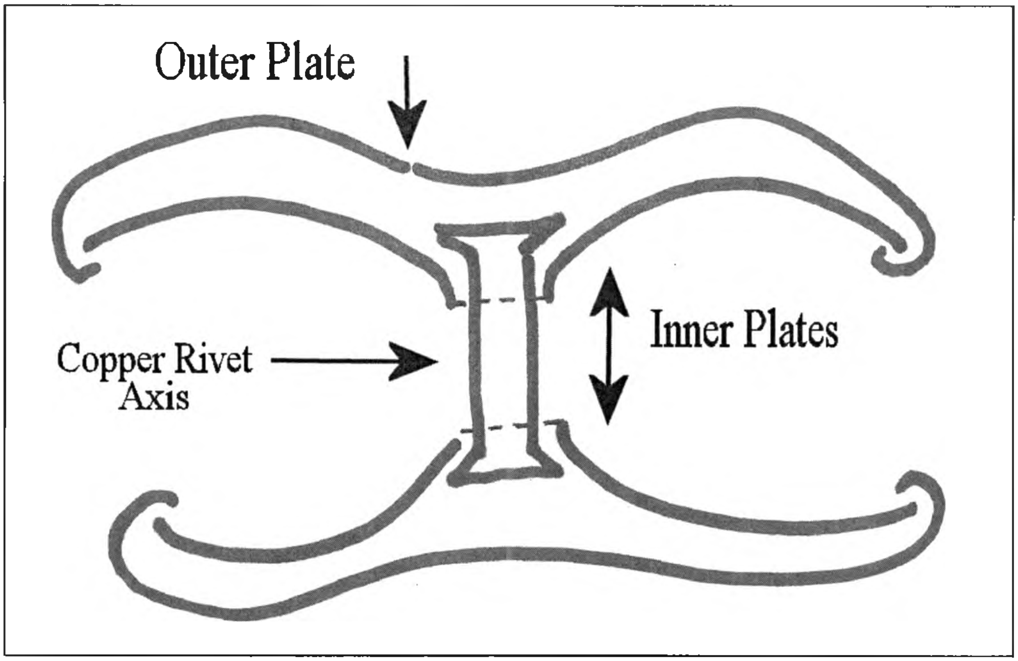

Illustration 7.59 Basic Earspool Construction

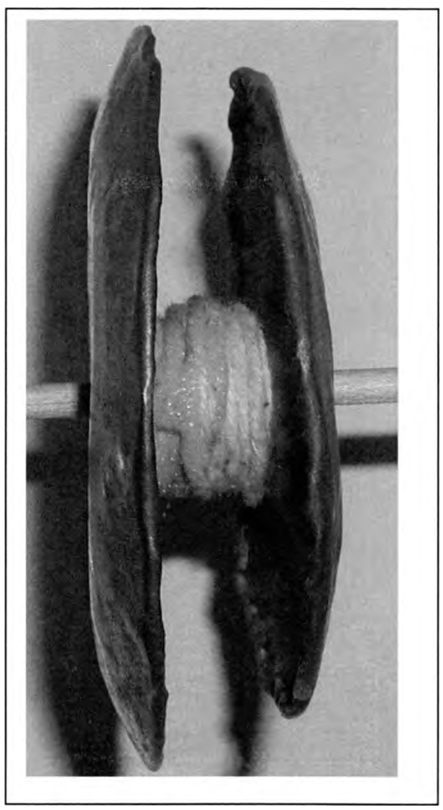

Illustration 7.60 Cordage Used to Secure Earspool Discs

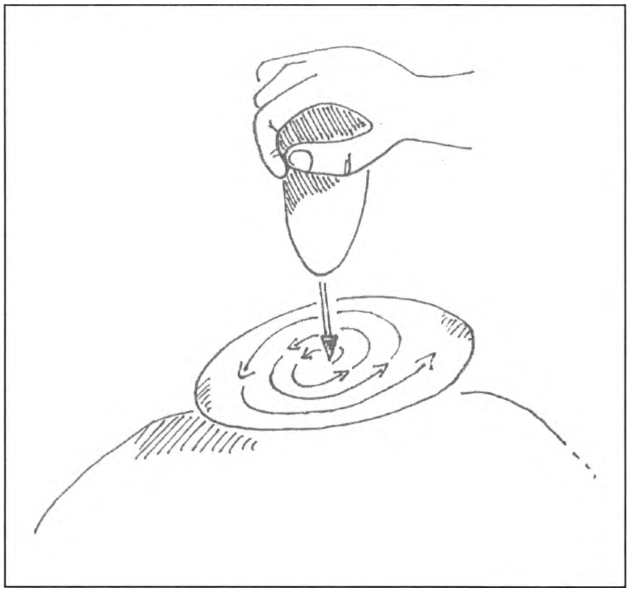

Illustration 7.61 Spiral Hammering Used on Discs

Illustration 7.62 Forming the Earspool Concave Shape

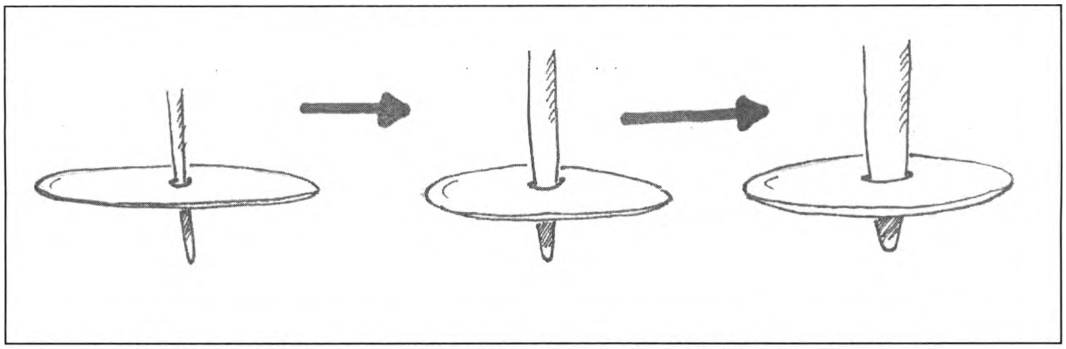

Illustration 7.63 Punch-and-Drift Technique

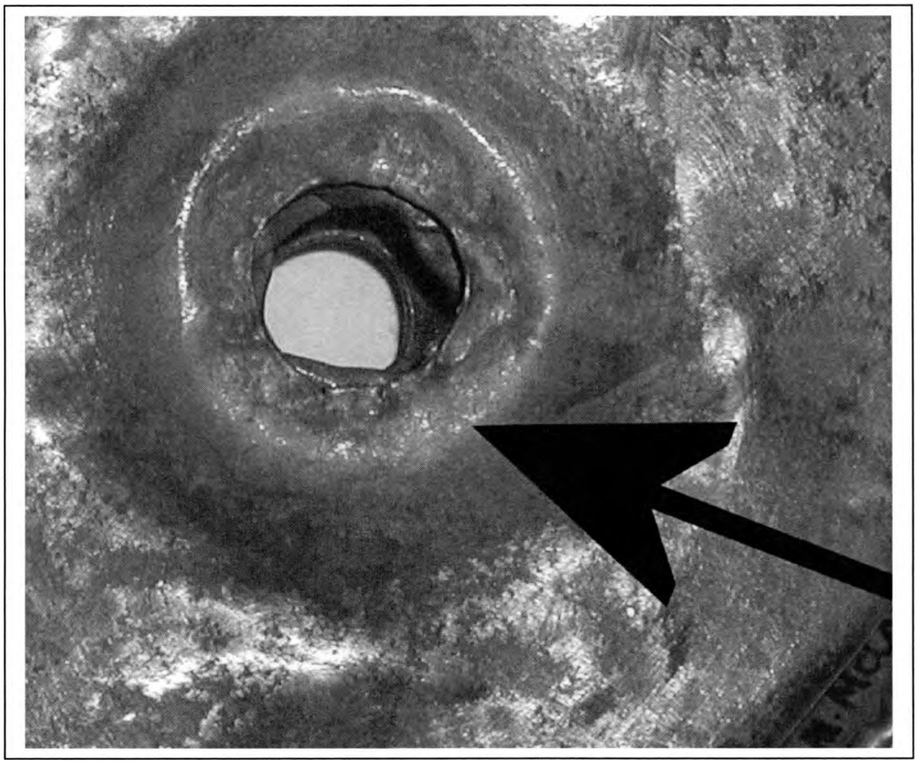

Illustration 7.64 Deforming of Central Hole

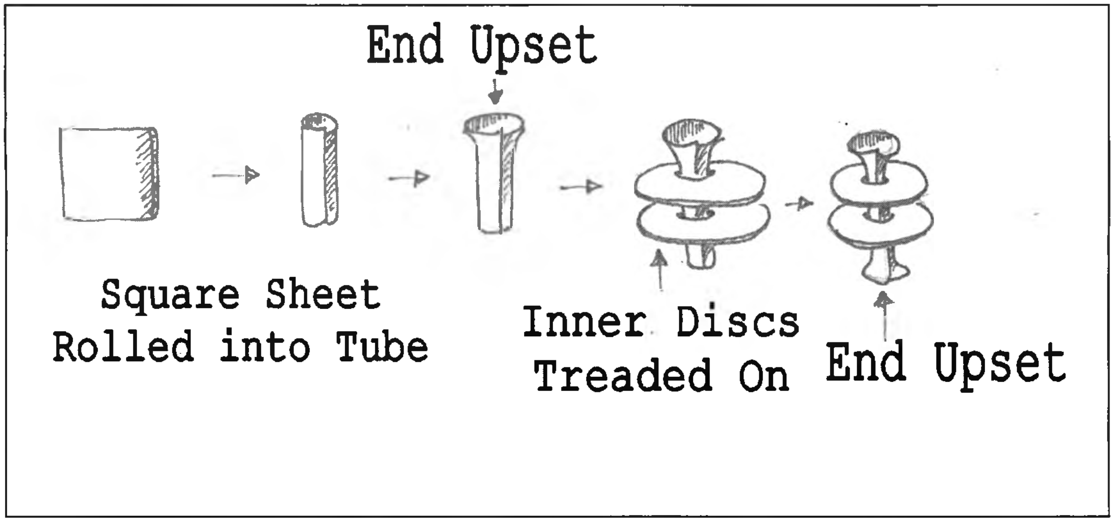

Illustration 7.65 Central Axis Fabrication Steps

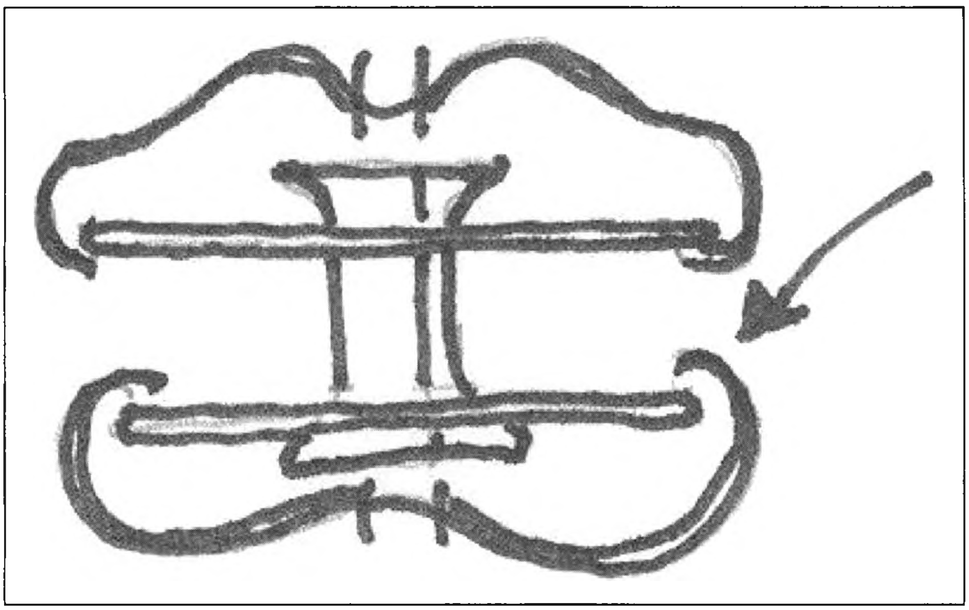

Illustration 7.66 Outer and Inner Disc Edges Rolled Over

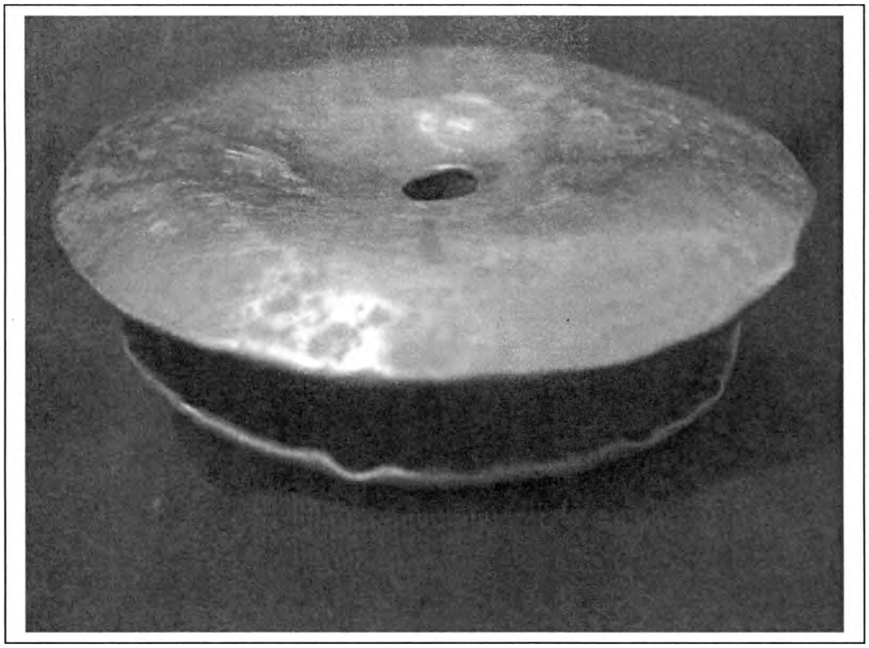

Illustration 7.67 Finished Copper Earspool

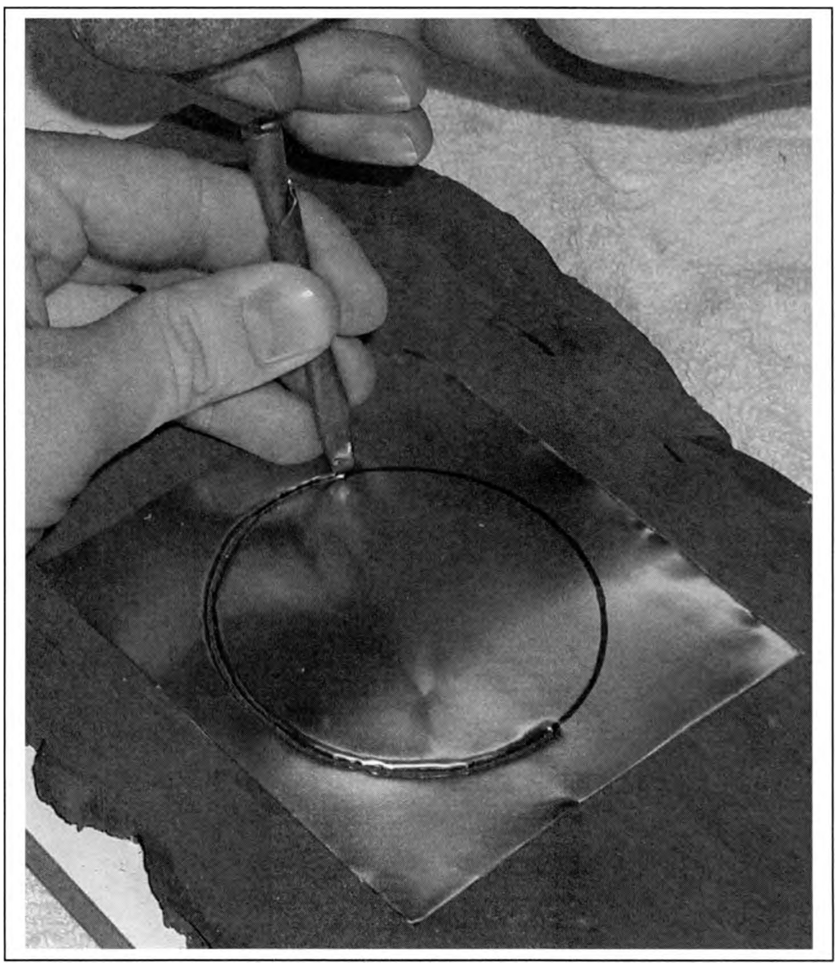

Illustration 7.68 Cutting out Earspool Embedded in Clay

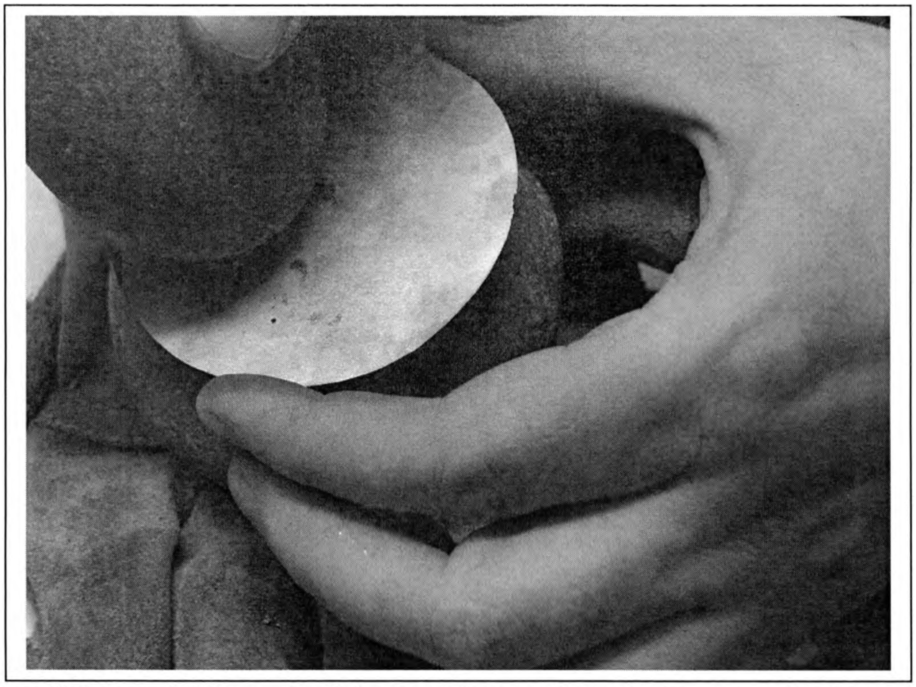

Illustration 7.69 Forming the Concave Shape

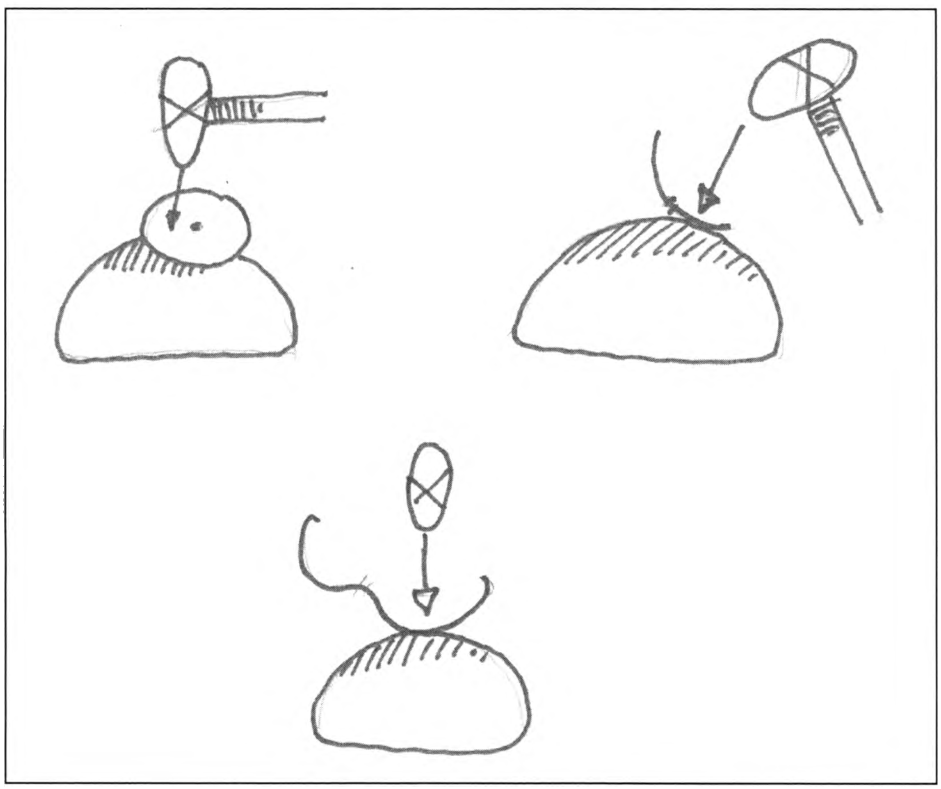

Illustration 7.70 Hammering to Form Concave Shape

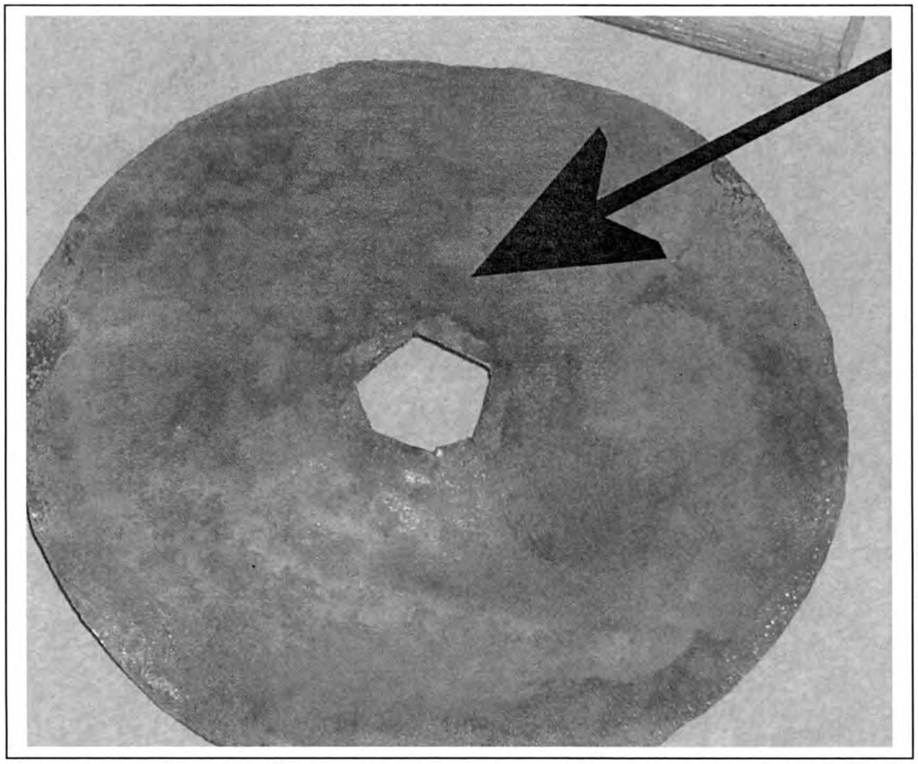

Illustration 7.71 Tearing During Punching-and-Drifting

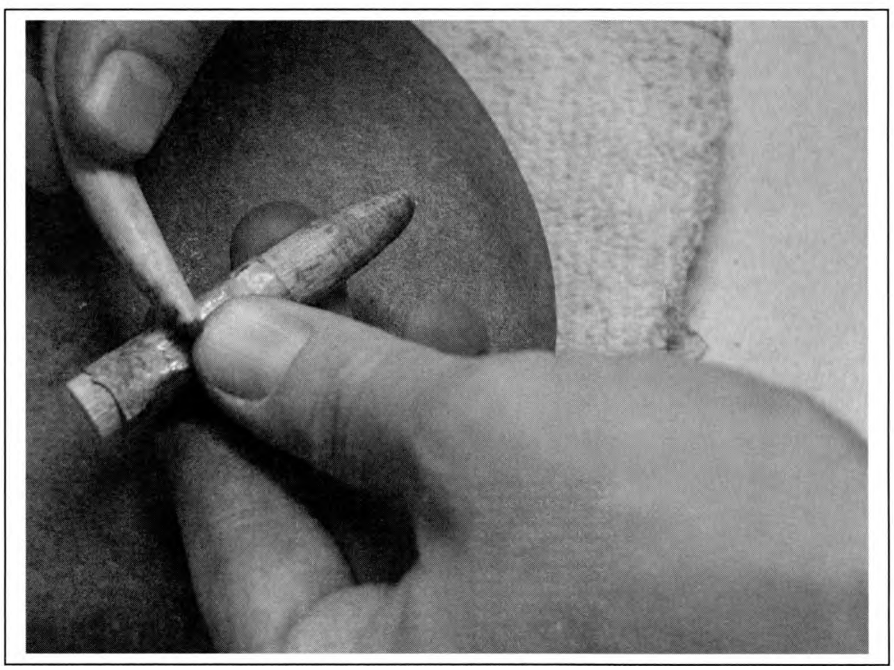

Illustration 7.72 Central Axis Fabrication

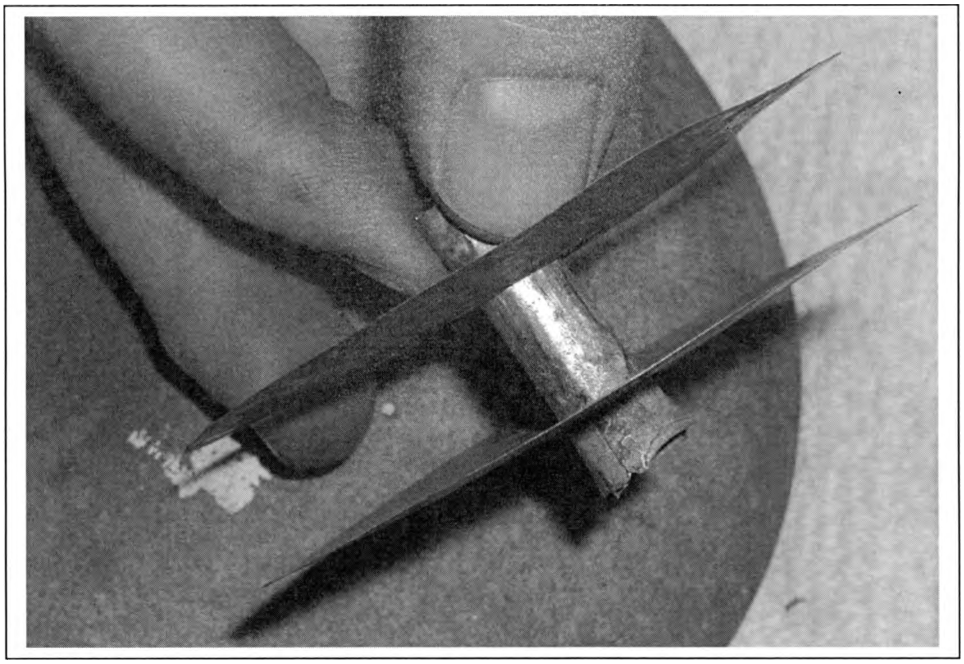

Illustration 7.73 Flared Axis

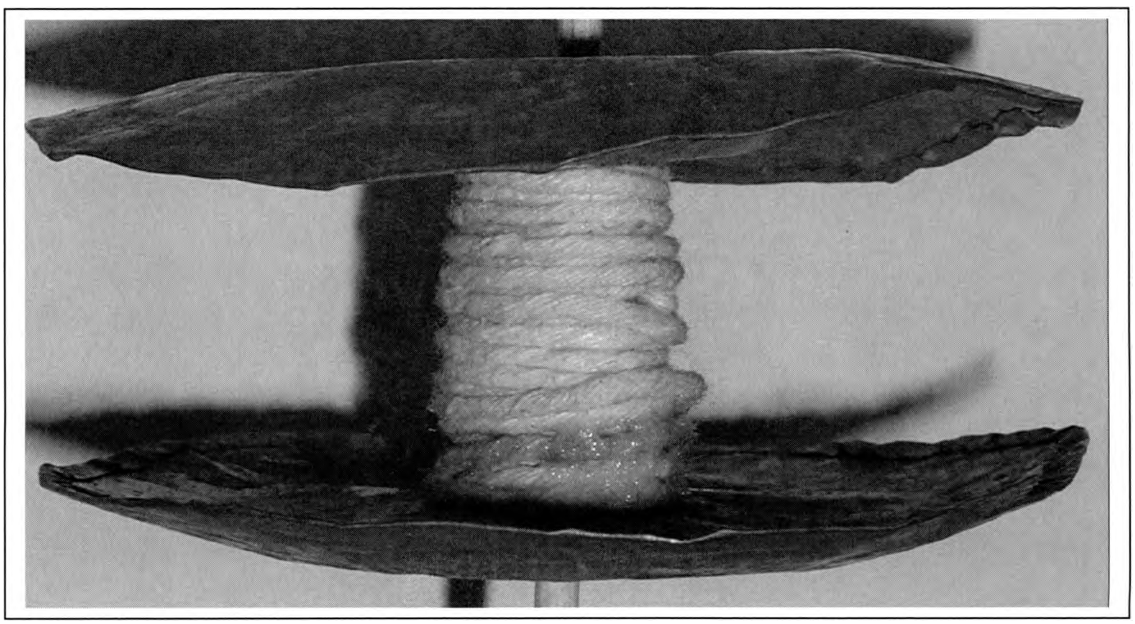

Illustration 7.74 Central Axis and Wound Cordage

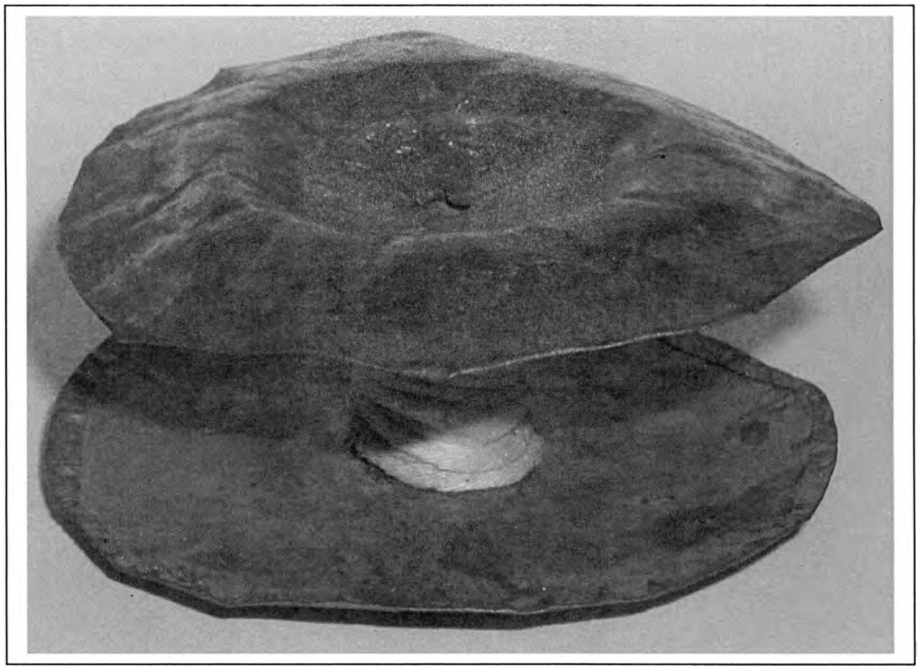

Illustration 7.75 Finished Copper Earspool

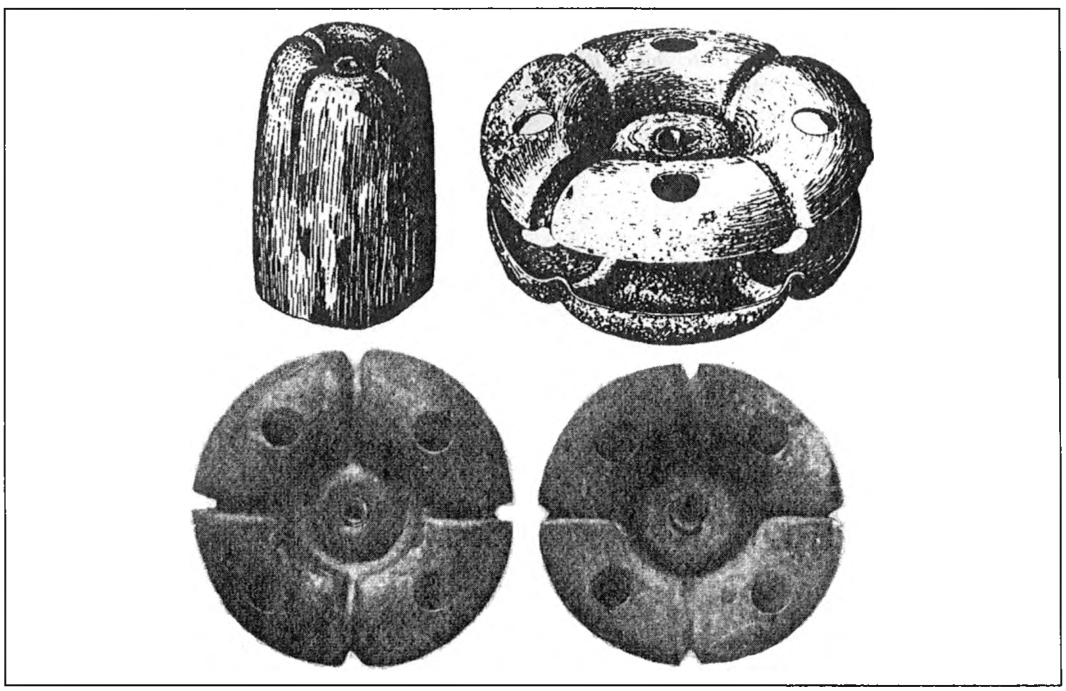

Illustration 7.76 Willoughby's Earspool Including Carved Mold

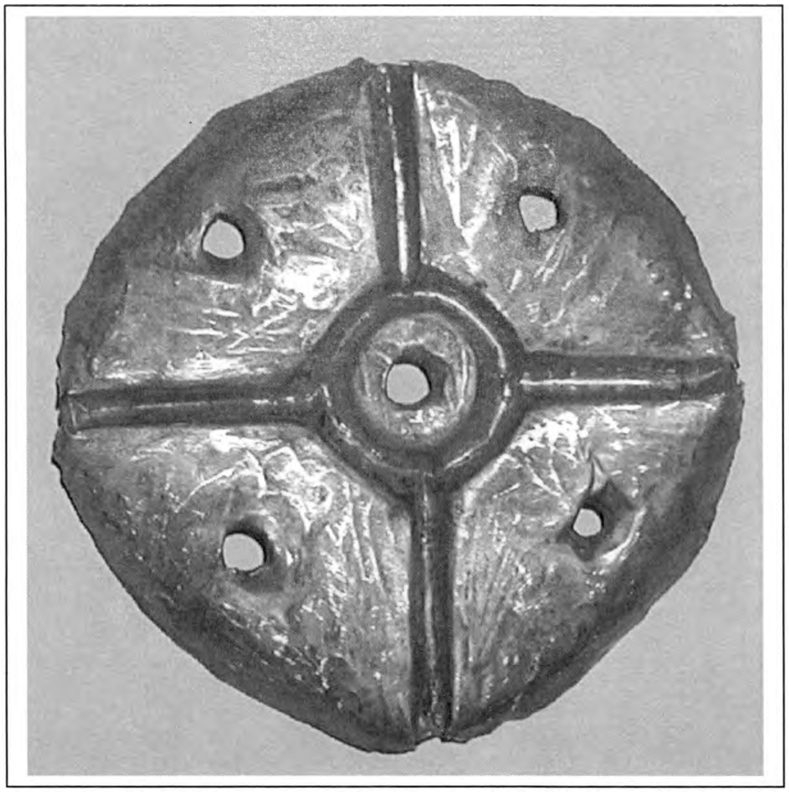

Illustration 7.77 Reproduction of Willoughby's Earspool

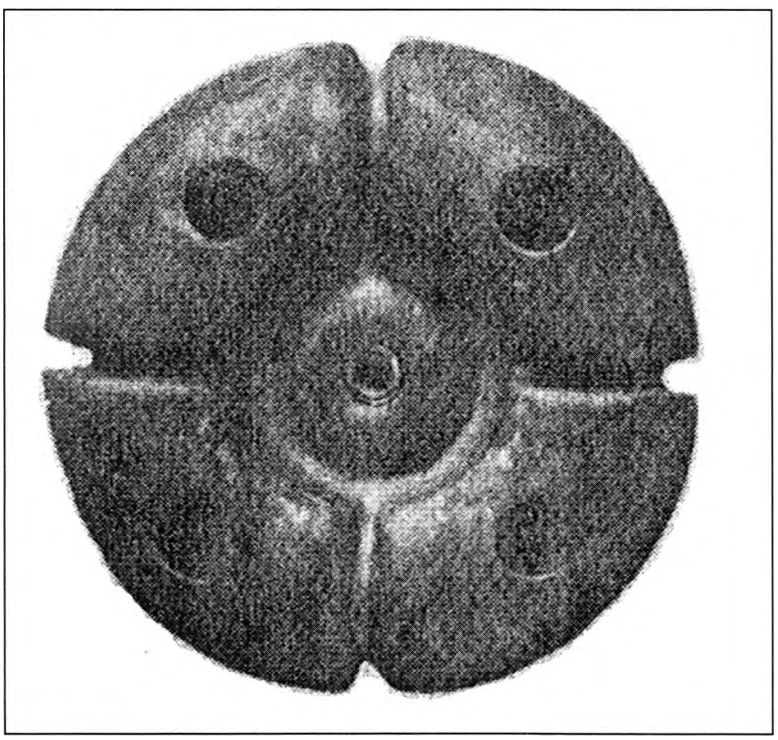

Illustration 7.78 Willoughby's Earspool

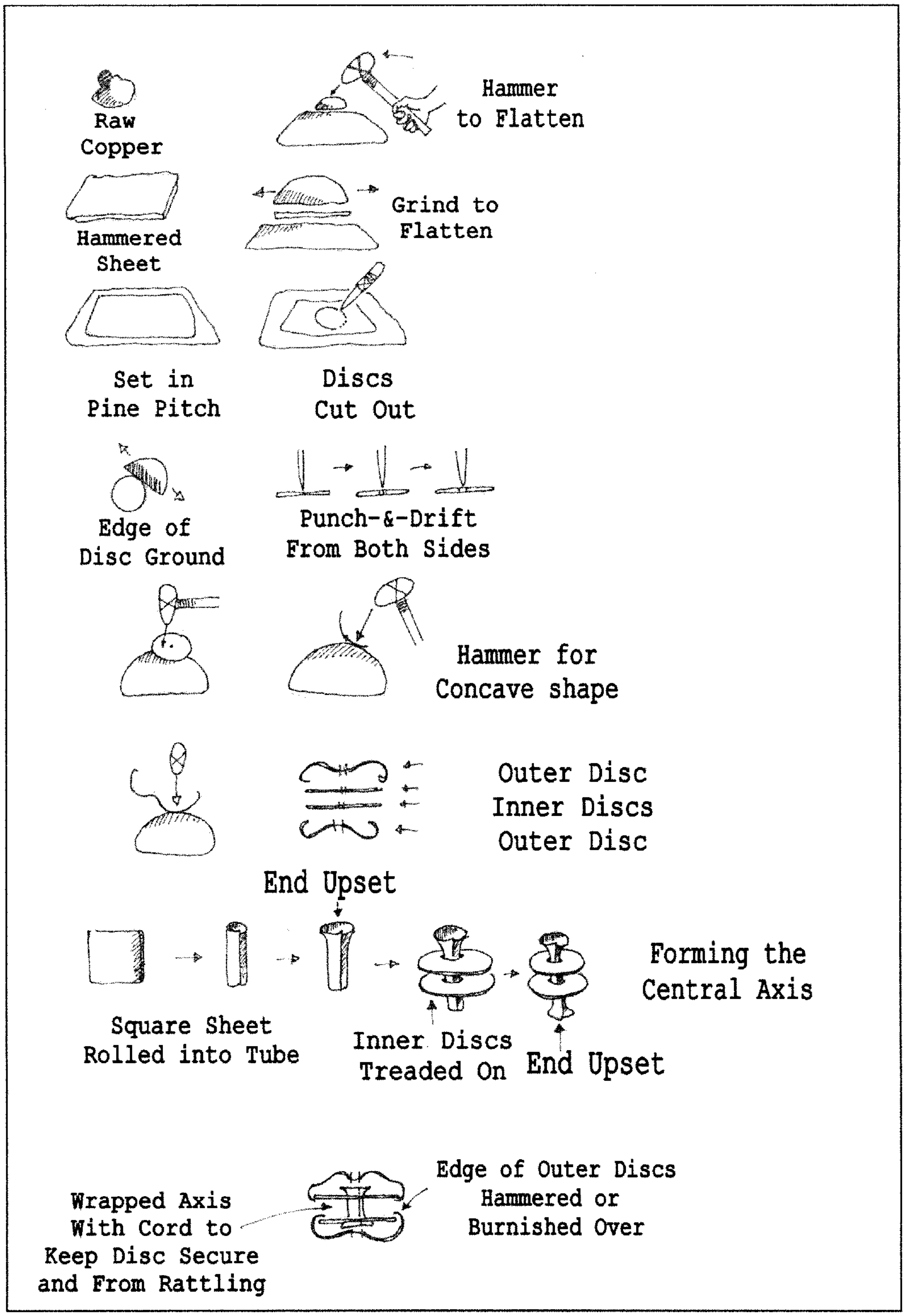

Illustration 7.79 Steps for Earspool Construction

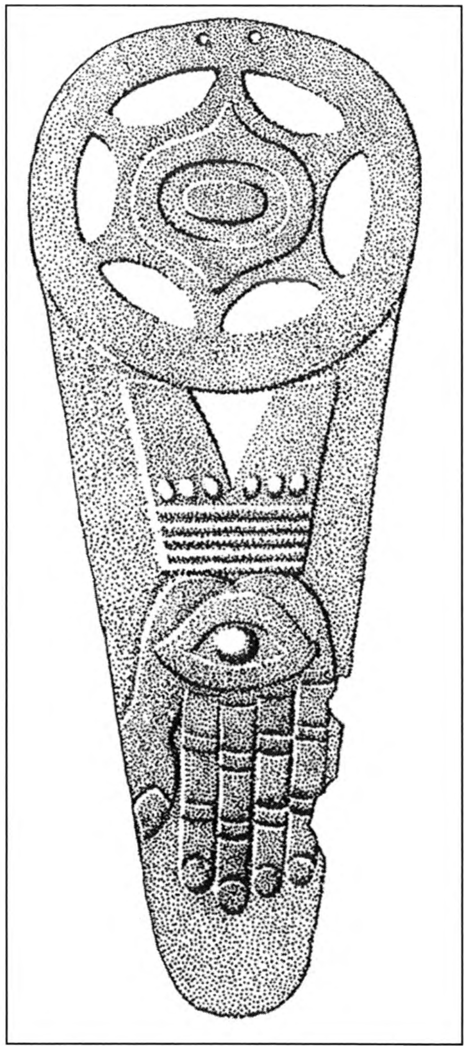

Illustration 8.1 Moundville Hand-Eye Copper Badge

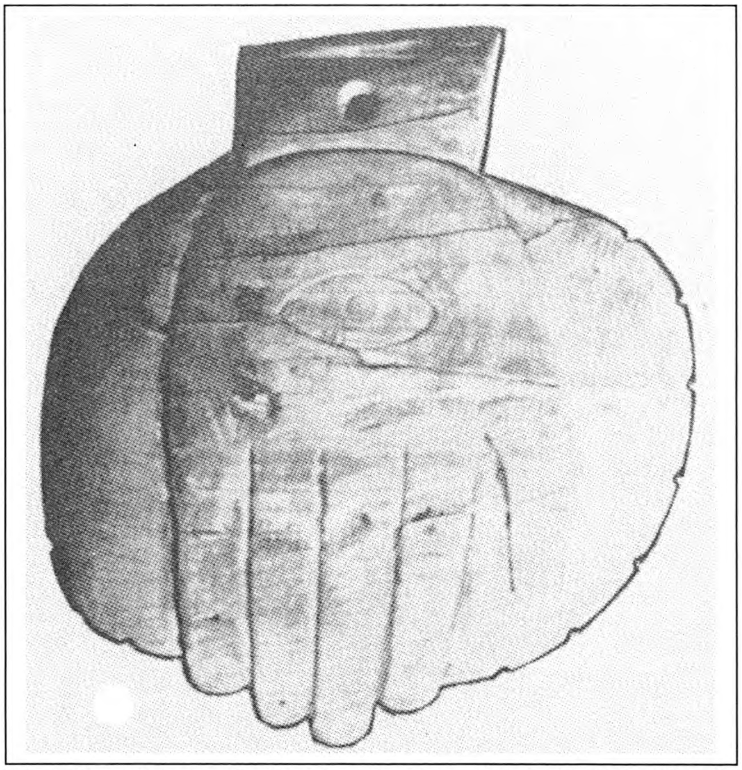

Illustration 8.2 Hand-Eye Motif in Shell

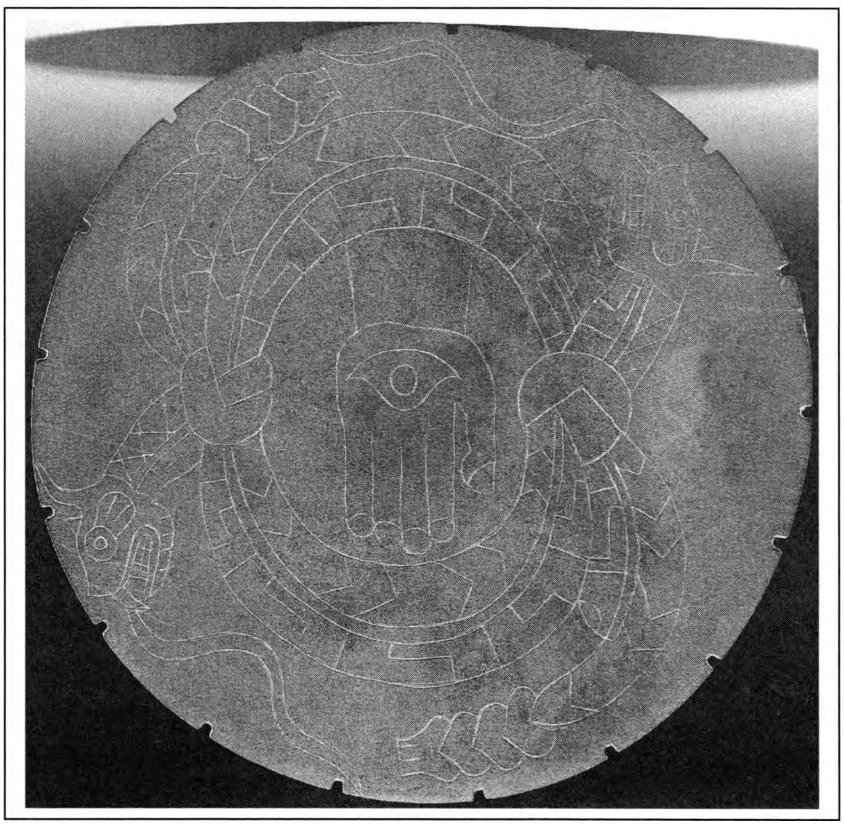

Illustration 8.3 Hand-Eye Motif on Stone

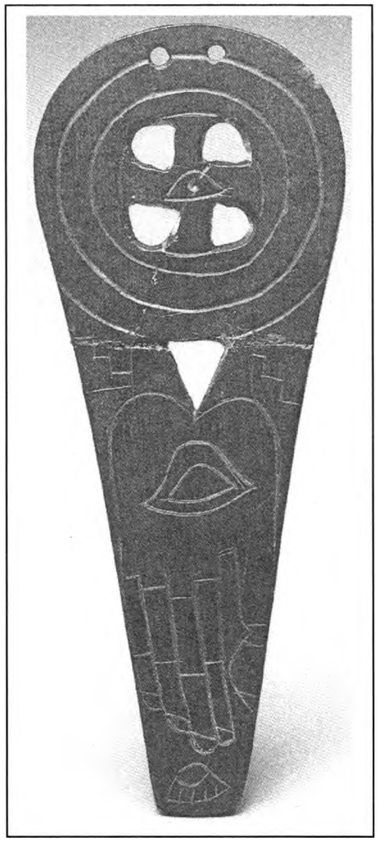

Illustration 8.4 Slate Moundville Badge

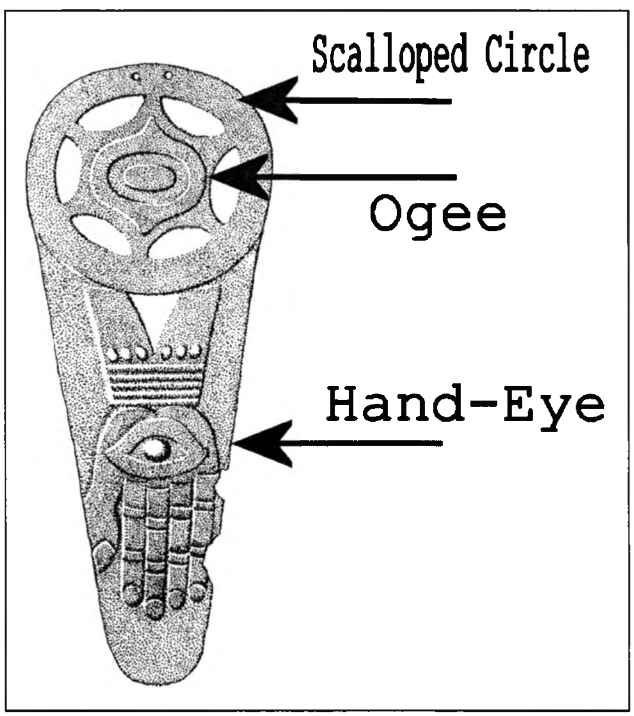

Illustration 8.5 Associated Motifs

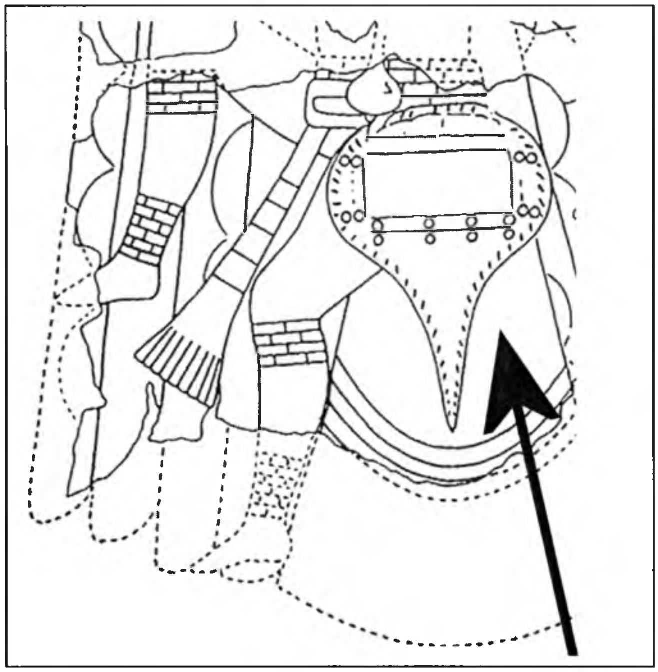

Illustration 8.6 Bellowed-Shaped Apron

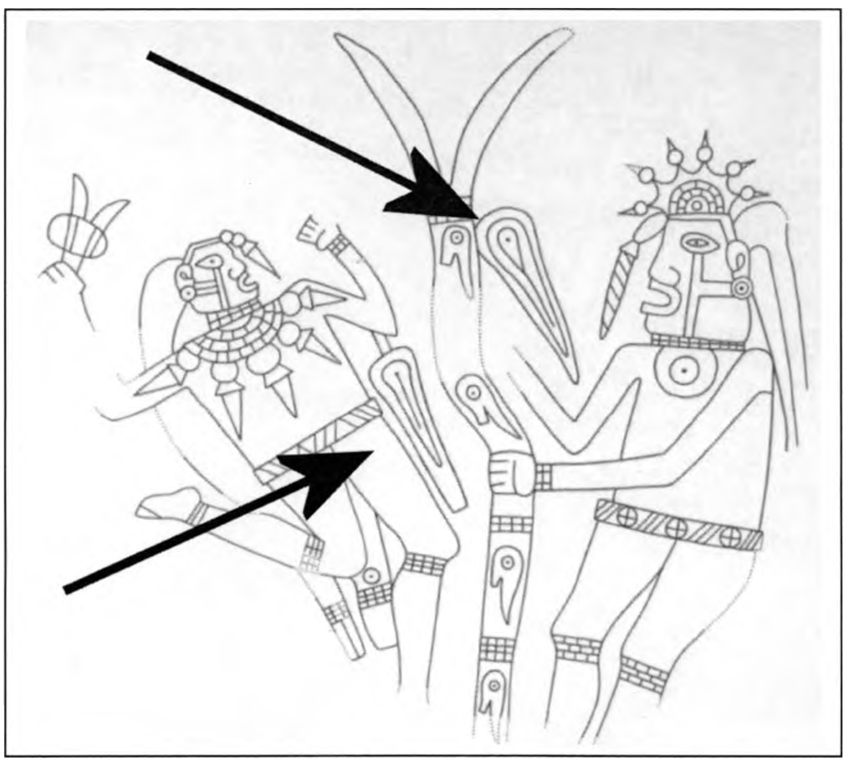

Illustration 8.7 Scalp-Hoops on Spiro Shell Engraving

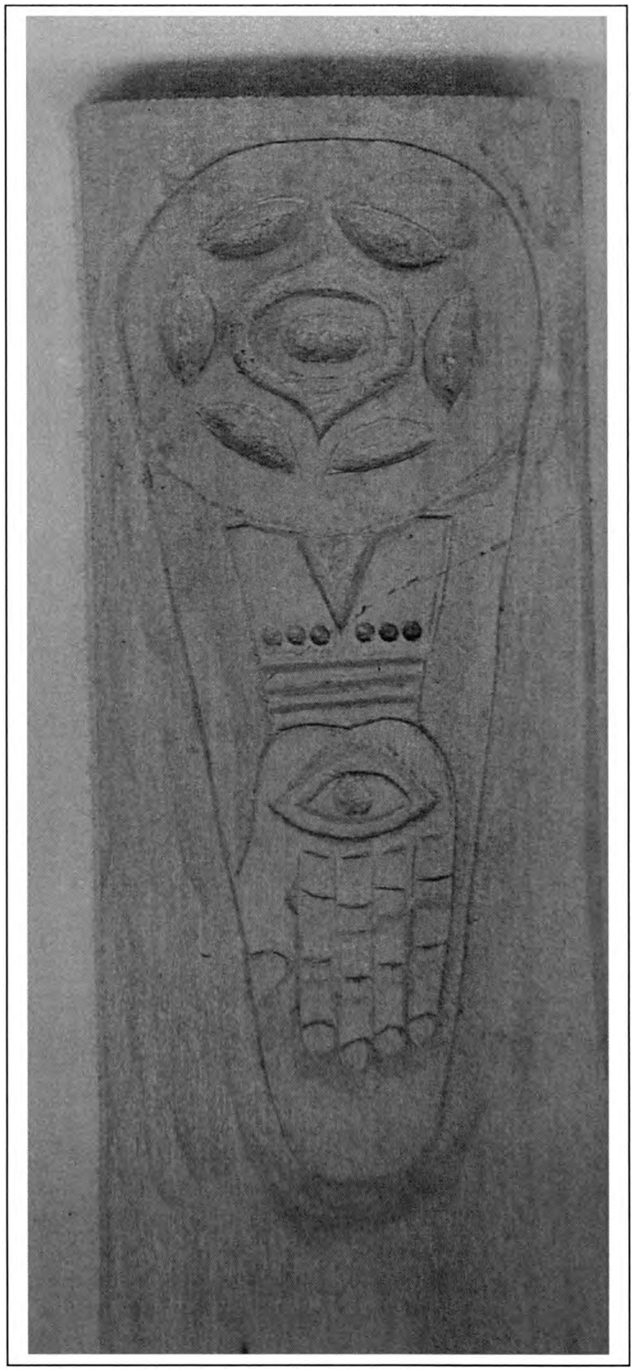

Illustration 8.8 Carved Hand-Eye Template

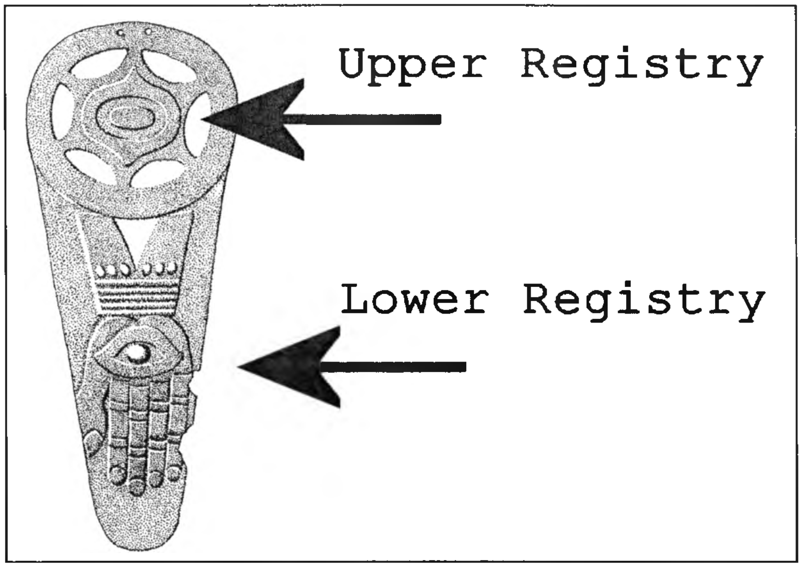

Illustration 8.9 Upper and Lower Registries

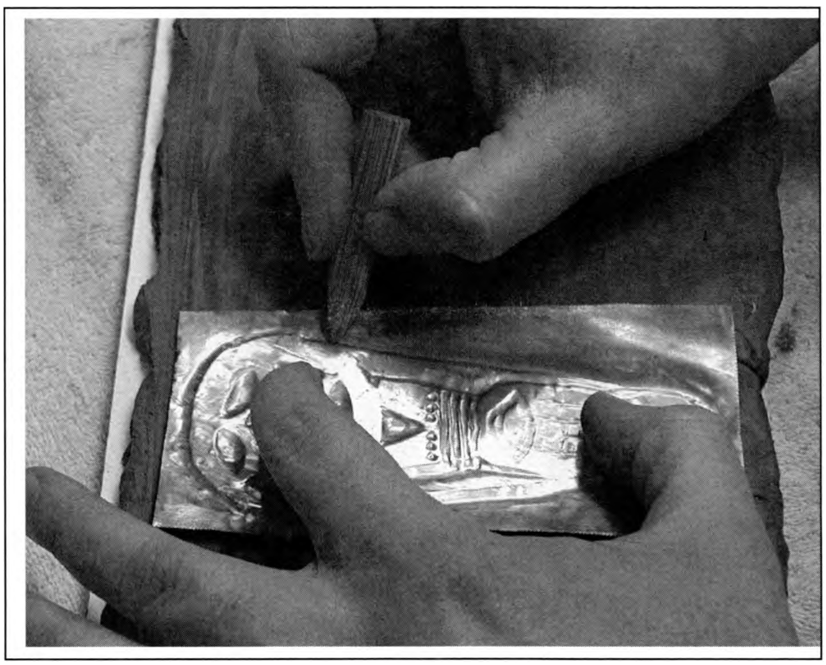

Illustration 8.10 Chasing the Image

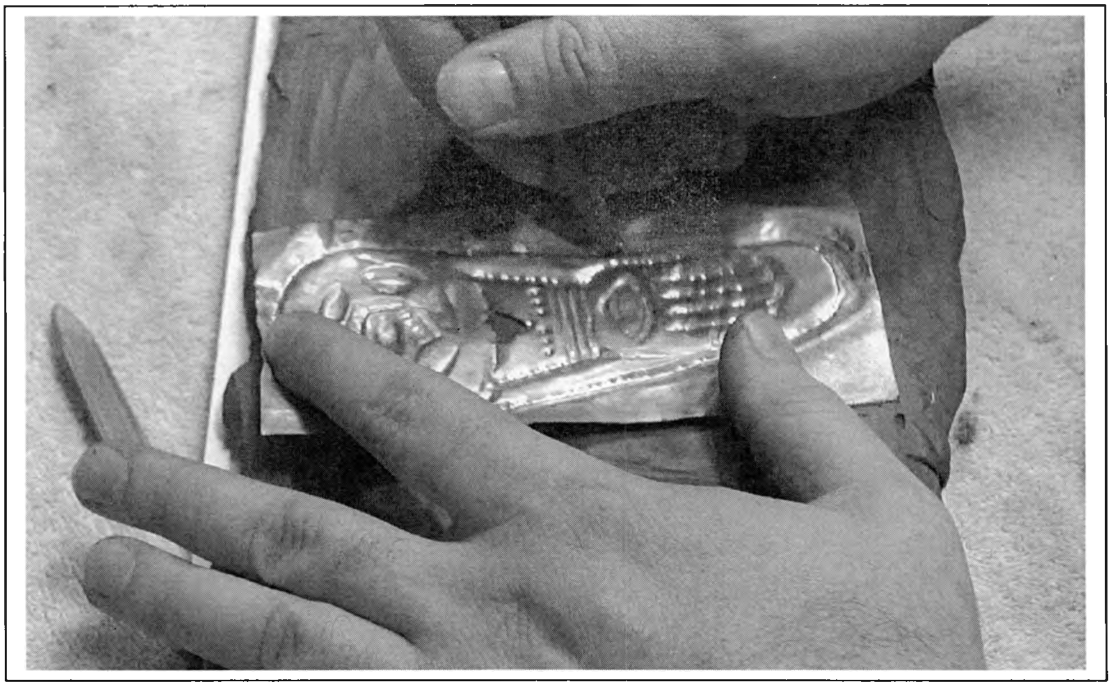

Illustration 8.11 Cutting Out the Badge

Illustration 8.12 Example of Grinding the Edges

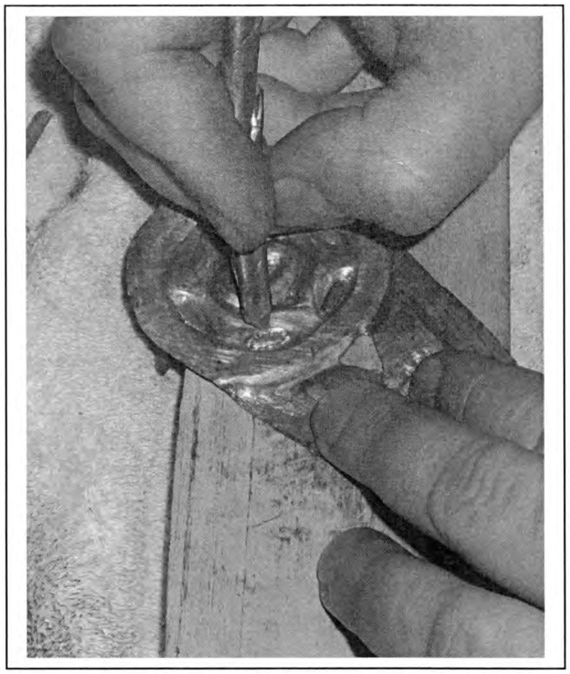

Illustration 8.13 Cutting over Basswood

Illustration 8.14 Cutting over Basswood

Illustration 8.15 Close-up of Cutting Technique

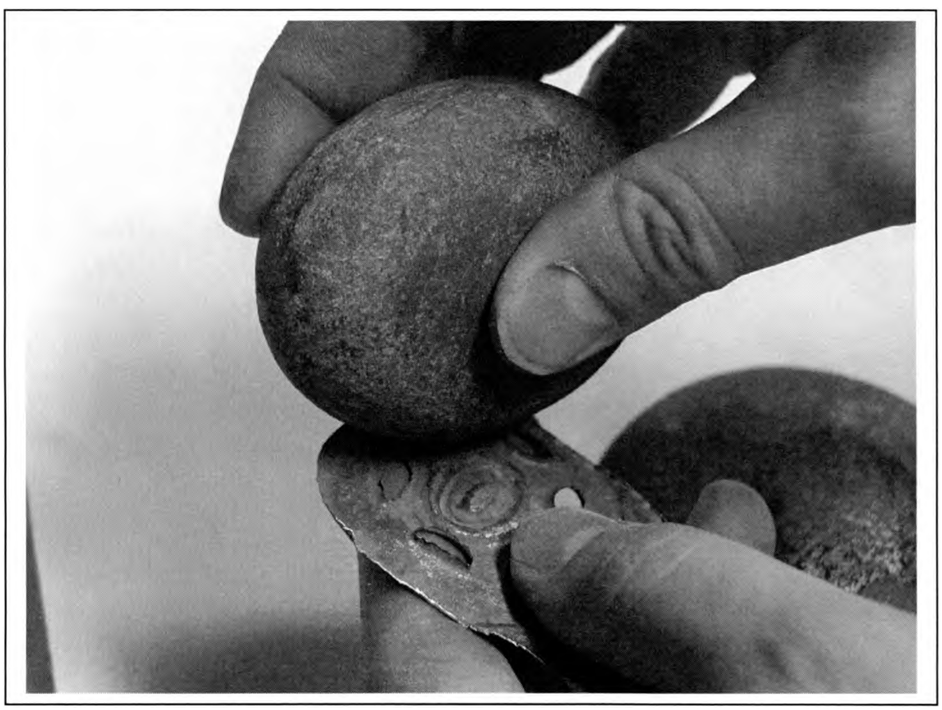

Illustration 8.16 Grinding the Backside of the Scallops

Illustration 8.17 Completed Free Hand Badge

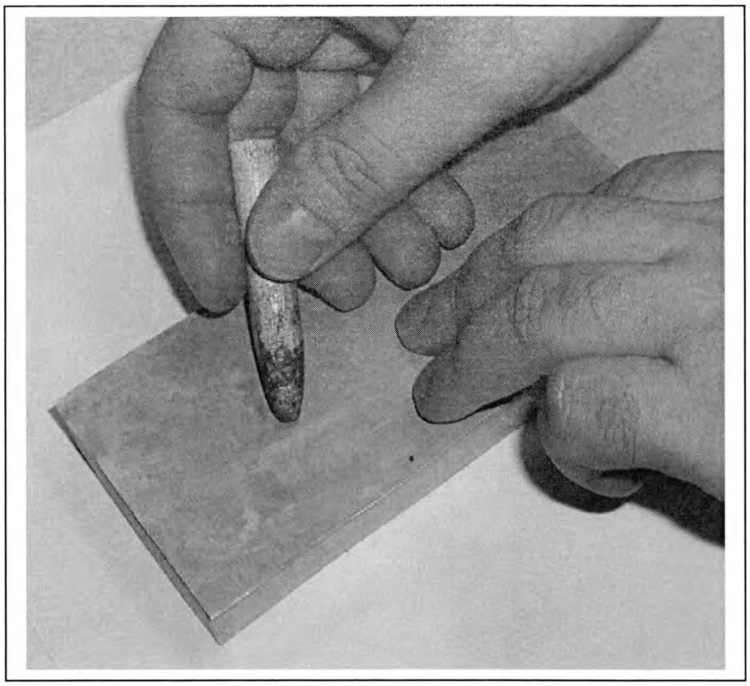

Illustration 8.18 Burnishing

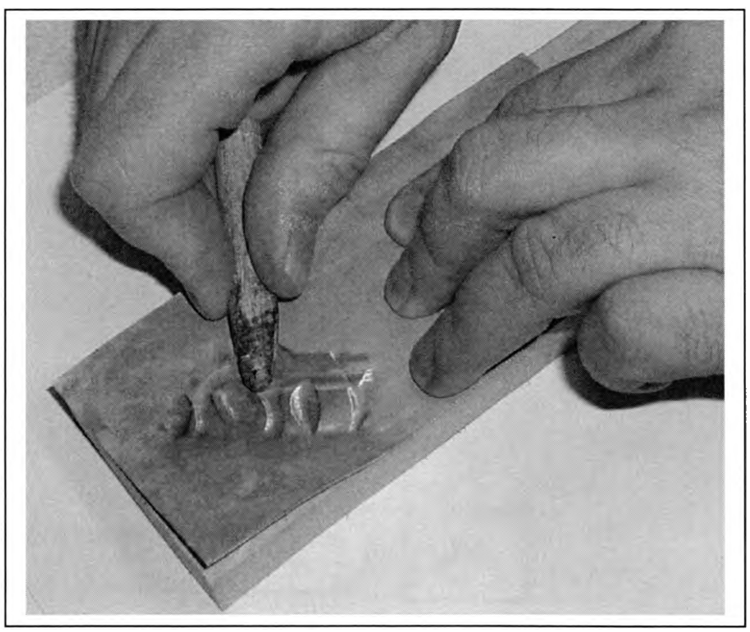

Illustration 8.19 Burnishing

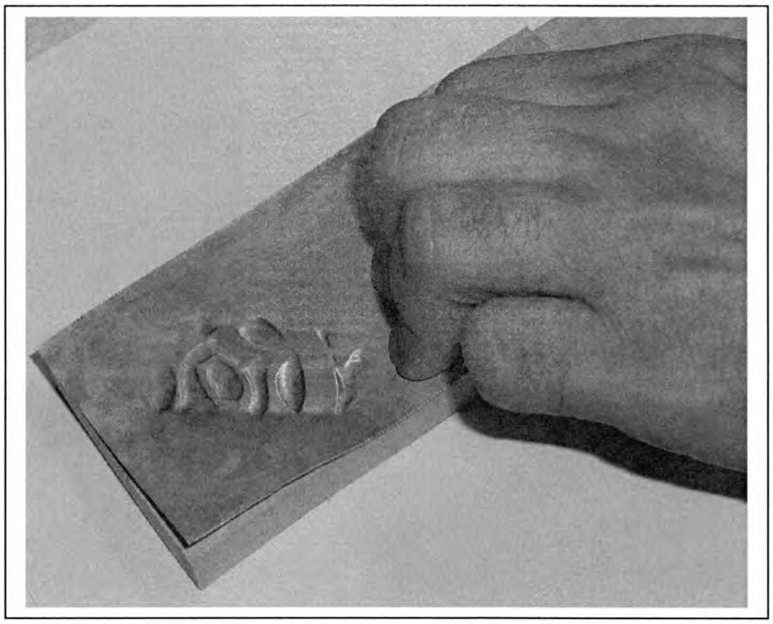

Illustration 8.20 Burnishing

Illustration 8.21 Burnishing

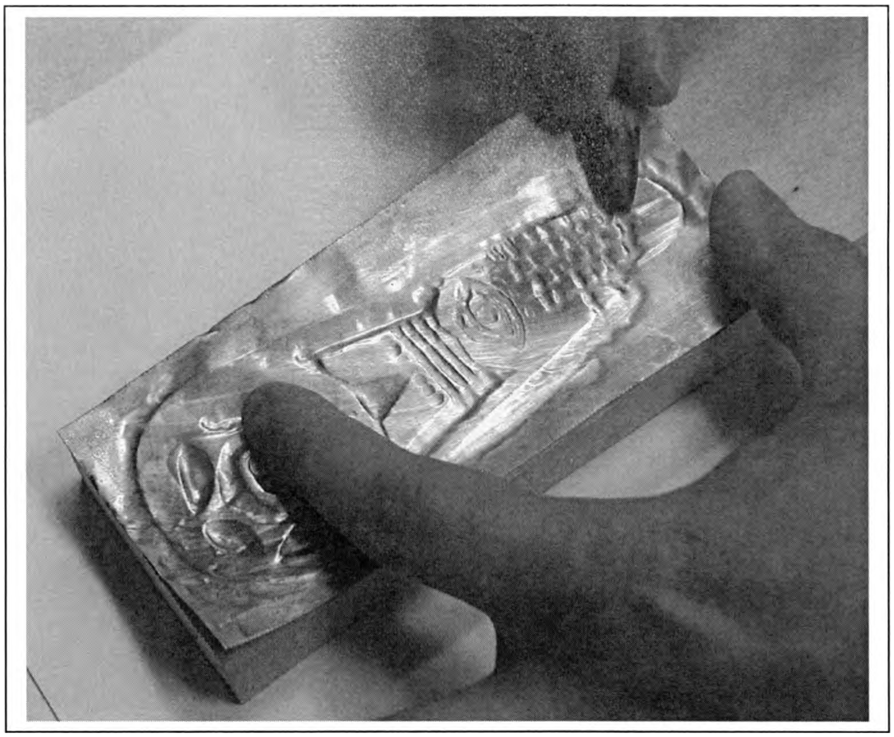

Illustration 8.22 Burnishing

Illustration 8.23 Complete Burnished Badge

Illustration 8.24 Securing Badge in Clay

Illustration 8.25 Defining Image in Clay

Illustration 8.26 Finished Badge Utilizing Template and Clay

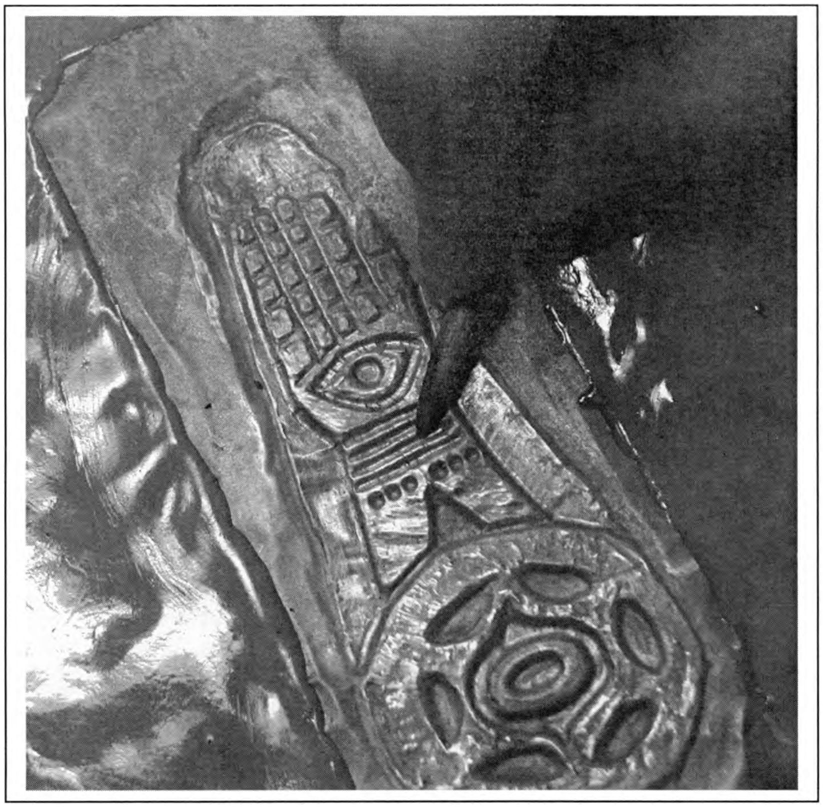

Illustration 8.27 Chasing the Front Side

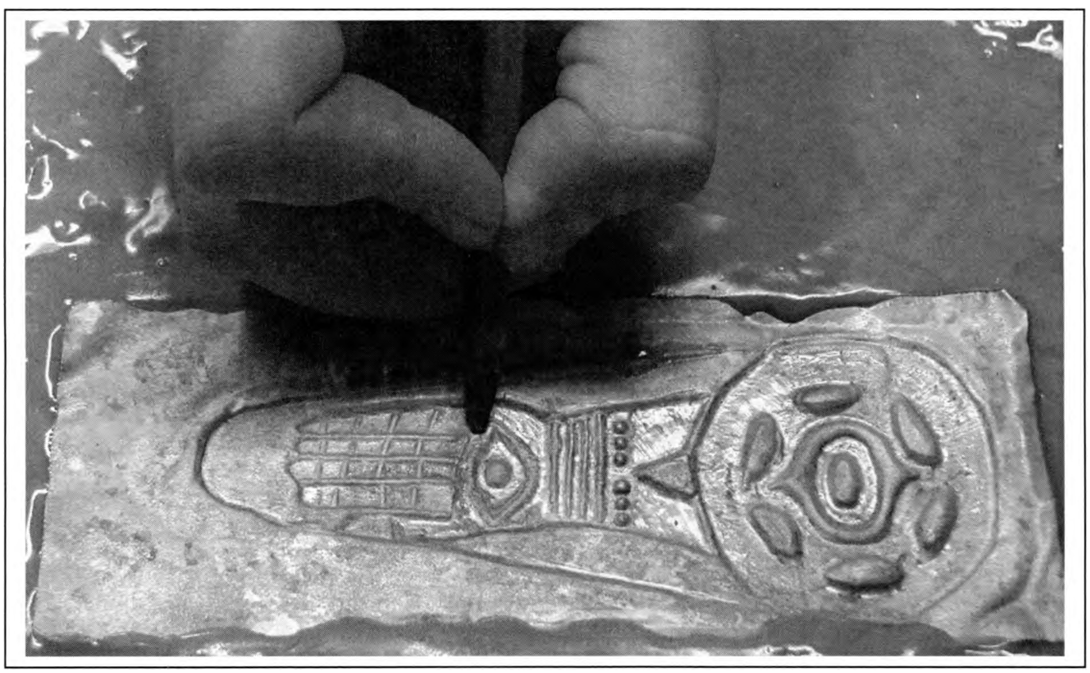

Illustration 8.28 Chasing the Backside

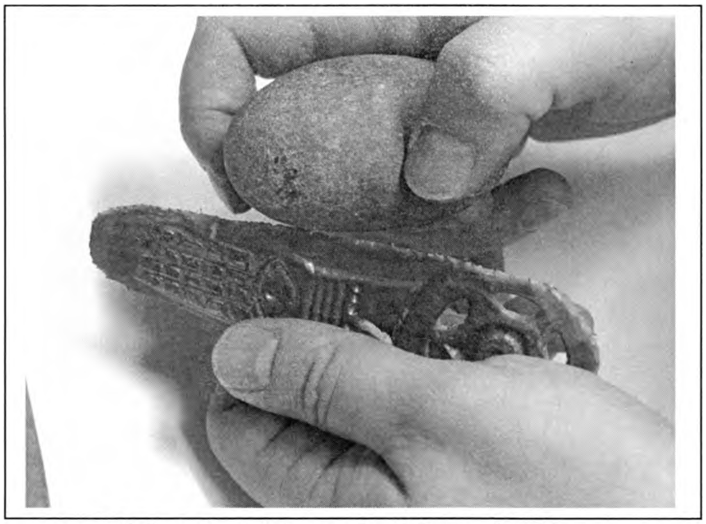

Illustration 8.29 Grinding

Illustration 8.30 Finished Badge Utilizing Template and Pitch

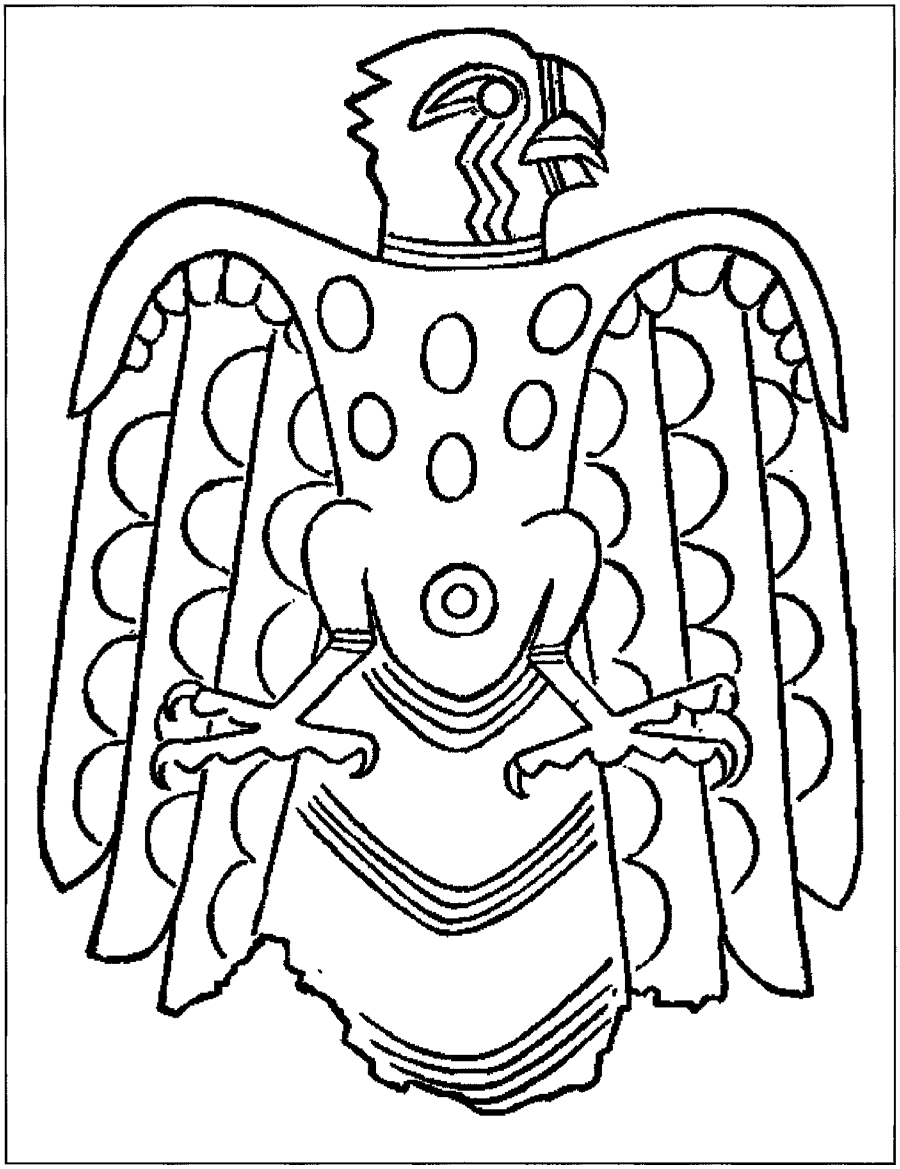

Illustration 8.31 Cushing's Peoria Plate

Illustration 8.32 Transferring the Image

Illustration 8.33 Transferred Image

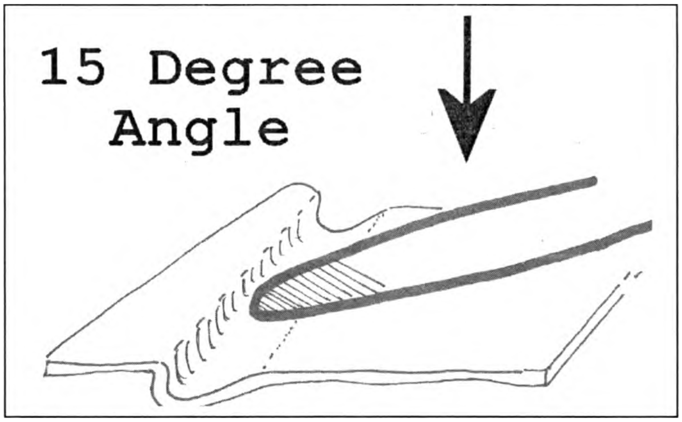

Illustration 8.34 Punch Held at 15 Degree Angle

Illustration 8.35 Freehand

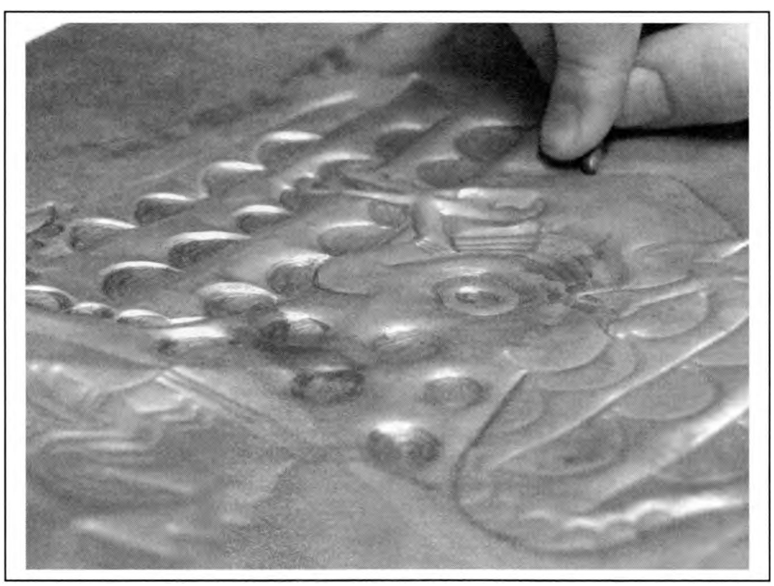

Illustration 8.36 Freehand

Illustration 8.37 Freehand

Illustration 8.38 Chasing Repeated on Backside of Plate

Illustration 8.39 Cutting the Free Hand Plate

Illustration 8.40 Cutting over Hardwood Surface

Illustration 8.41 Finished Free Hand Plate

Illustration 8.42 Carved Wooden Template

Illustration 8.43 Distorted Rubbing

Illustration 8.44 Plate Secured with Nails

Illustration 8.45 Burnishing the Plate

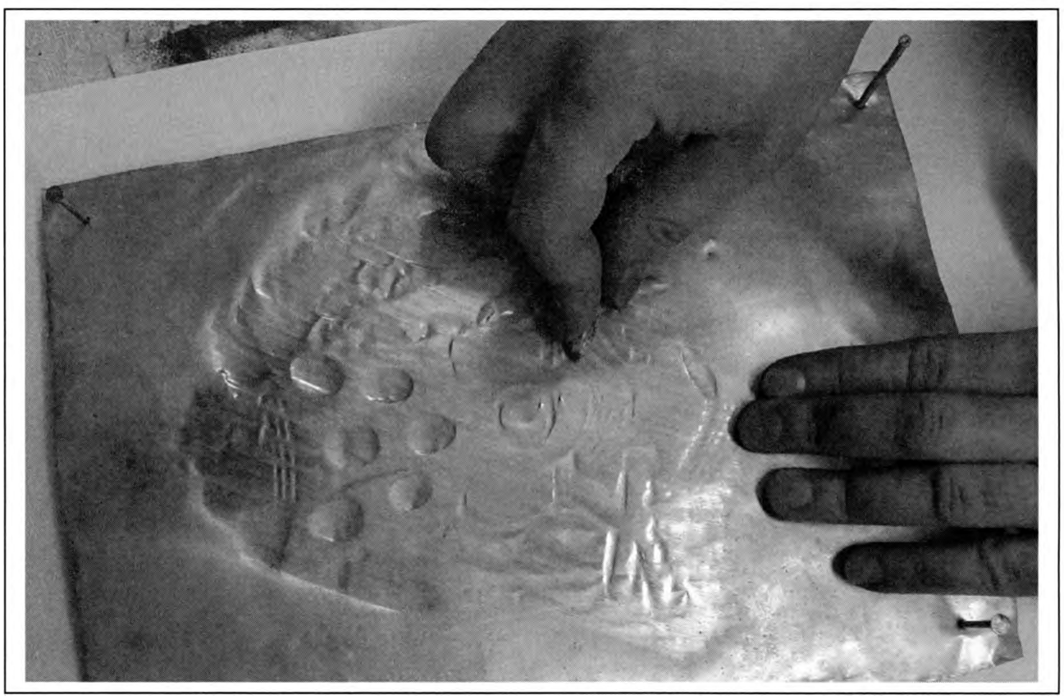

Illustration 8.46 Burnishing the Plate

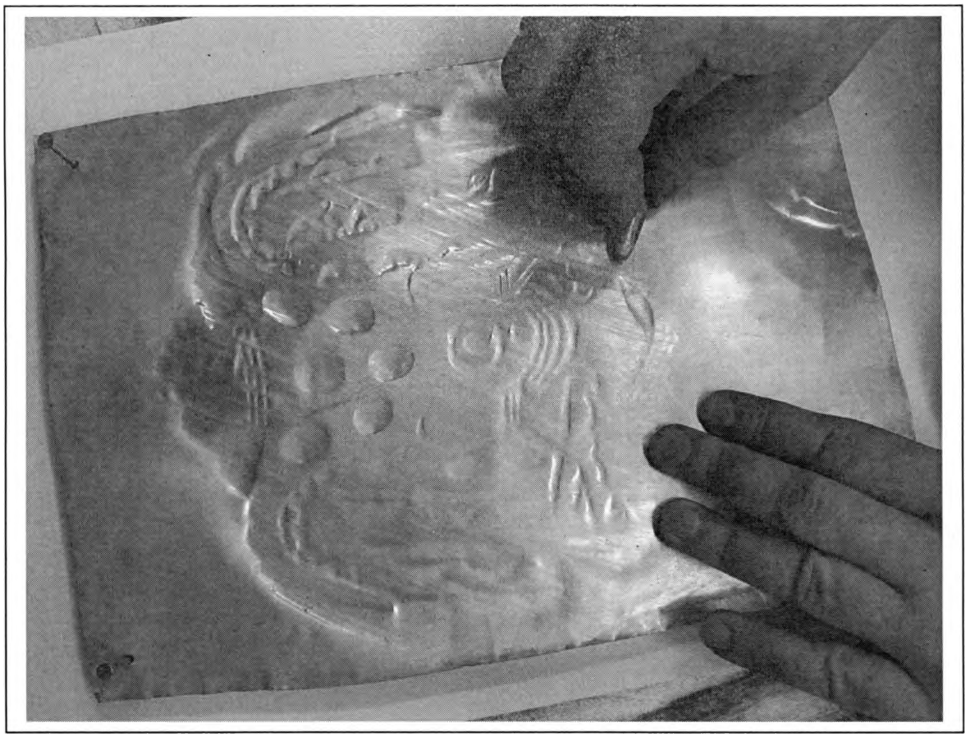

Illustration 8.47 Burnishing the Plate

Illustration 8.48 Burnishing the Plate

Illustration 8.49 Burnishing the Plate

Illustration 8.50 Plate Burnished

Illustration 8.51 Raptor in Pine Pitch

Illustration 8.52 Partial Work in Pitch

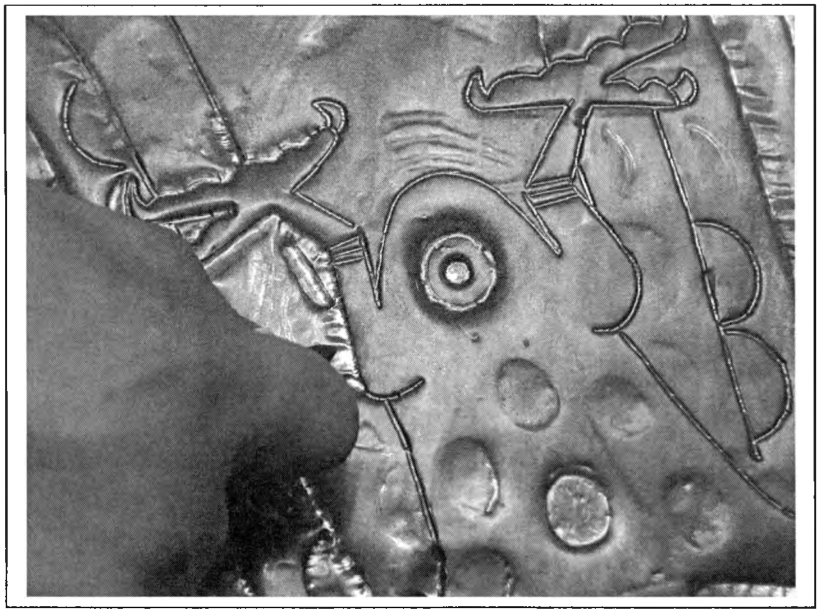

Illustration 8.53 Work Continued

Illustration 8.54 Work Continued

Illustration 8.55 Work Continued

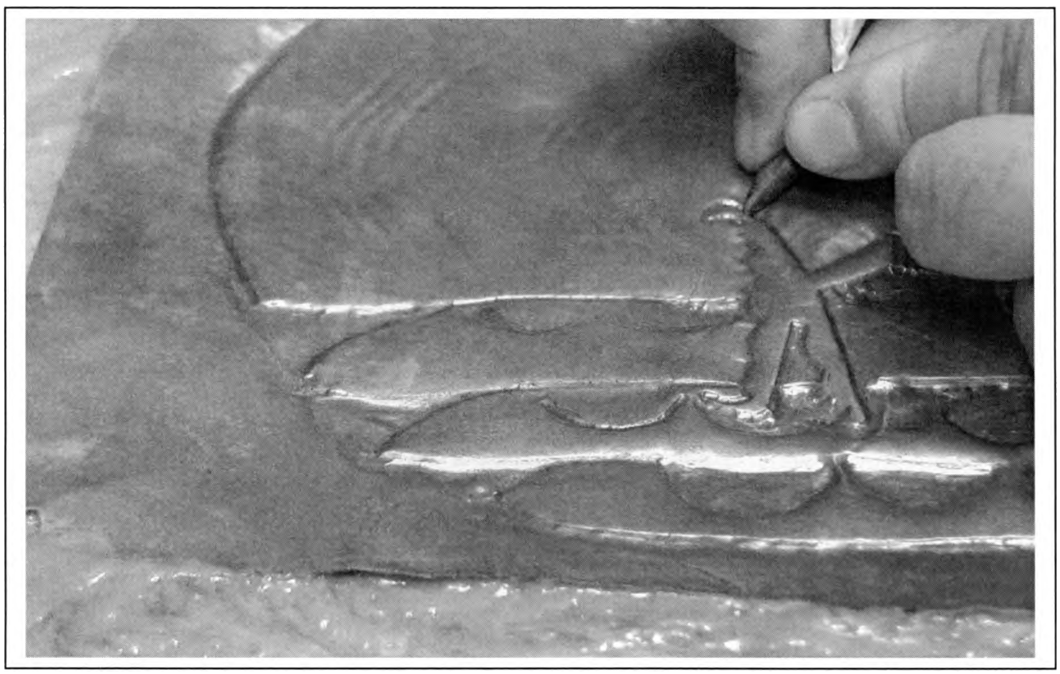

Illustration 8.56 Work Continued

Illustration 8.57 Final Stage Before Cutting Out and Cleaning

Illustration 8.58 Finished Plate Utilizing Template and Pitch

Illustration 8.59 Spiro Embossed Head Plate

Illustration 8.60 Completed Free Hand Plate

Illustration 8.61 Carved Wooden Template

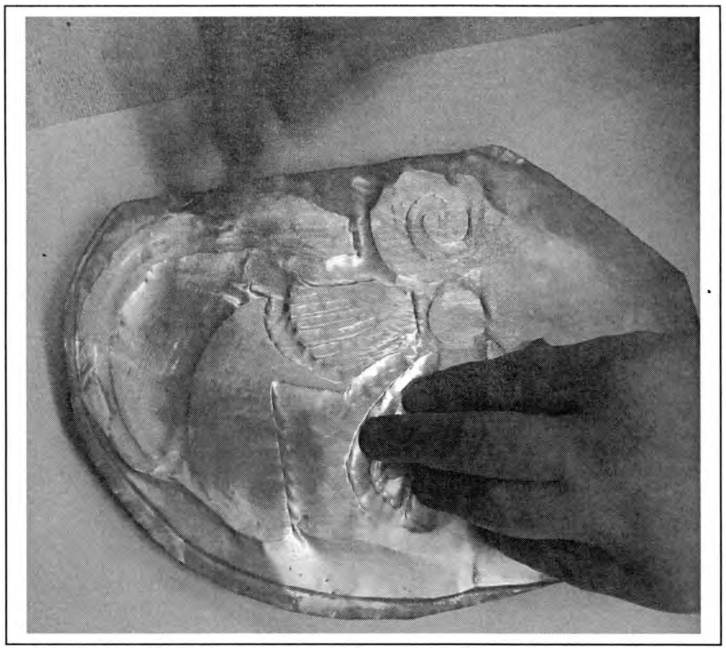

Illustration 8.62 Burnishing

Illustration 8.63 Burnishing

Illustration 8.64 Burnishing

Illustration 8.65 Finished Burnishing

Illustration 8.66 Completed Plate Utilizing Template Only Showing Area of Cutting

Illustration 8.67 Secured in Pitch

Illustration 8.68 Working Plate in Pitch

Illustration 8.69 Working Plate in Pitch

Illustration 8.70 Working Plate in Pitch

Illustration 8.71 Working Plate in Pitch

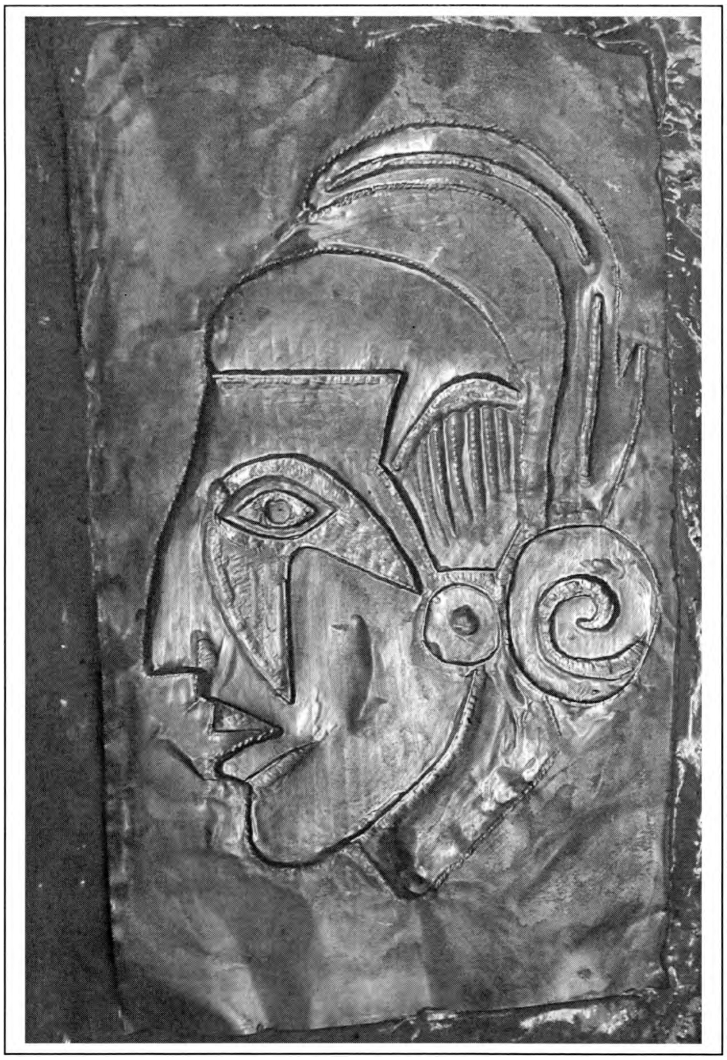

Illustration 8.72 Front Side Completed

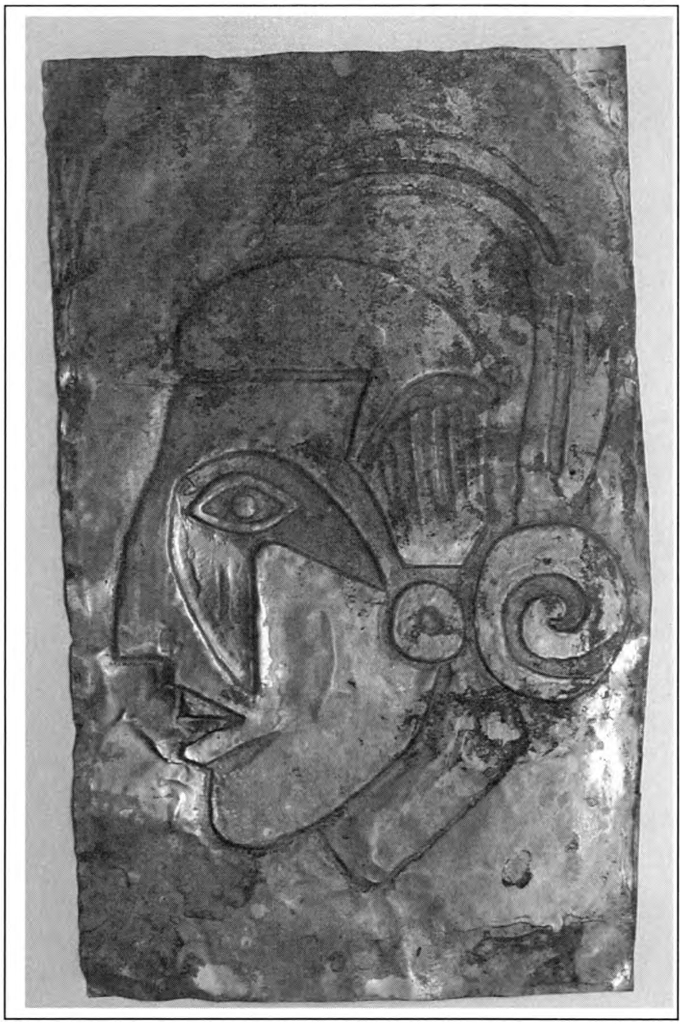

Illustration 8.73 Finished Plate Before Cutting Out and Cleaning

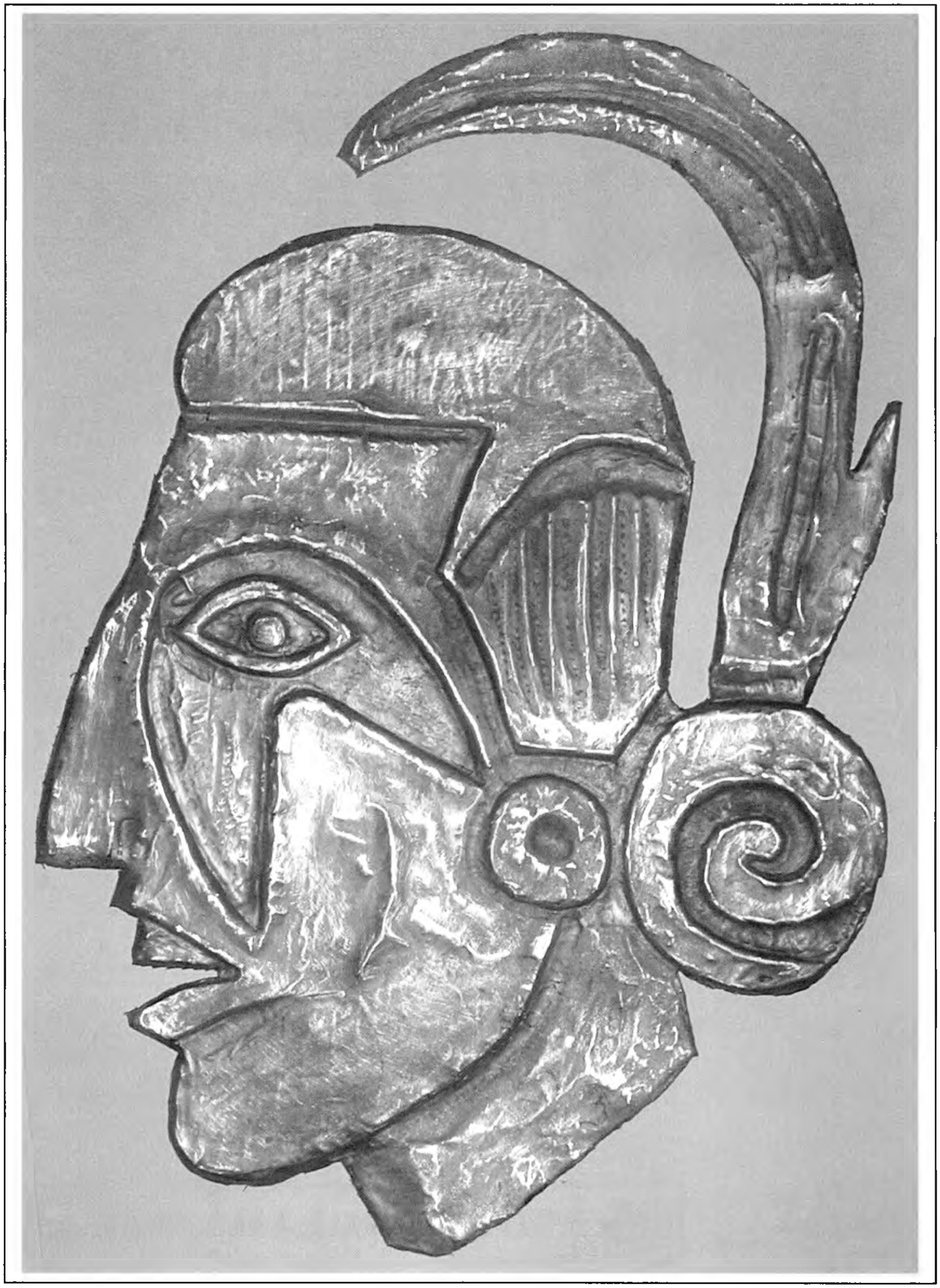

Illustration 8.74 Finished Plate Utilizing Template and Pitch

Illustration 8.75 Smaller of the Two Rogan Plates

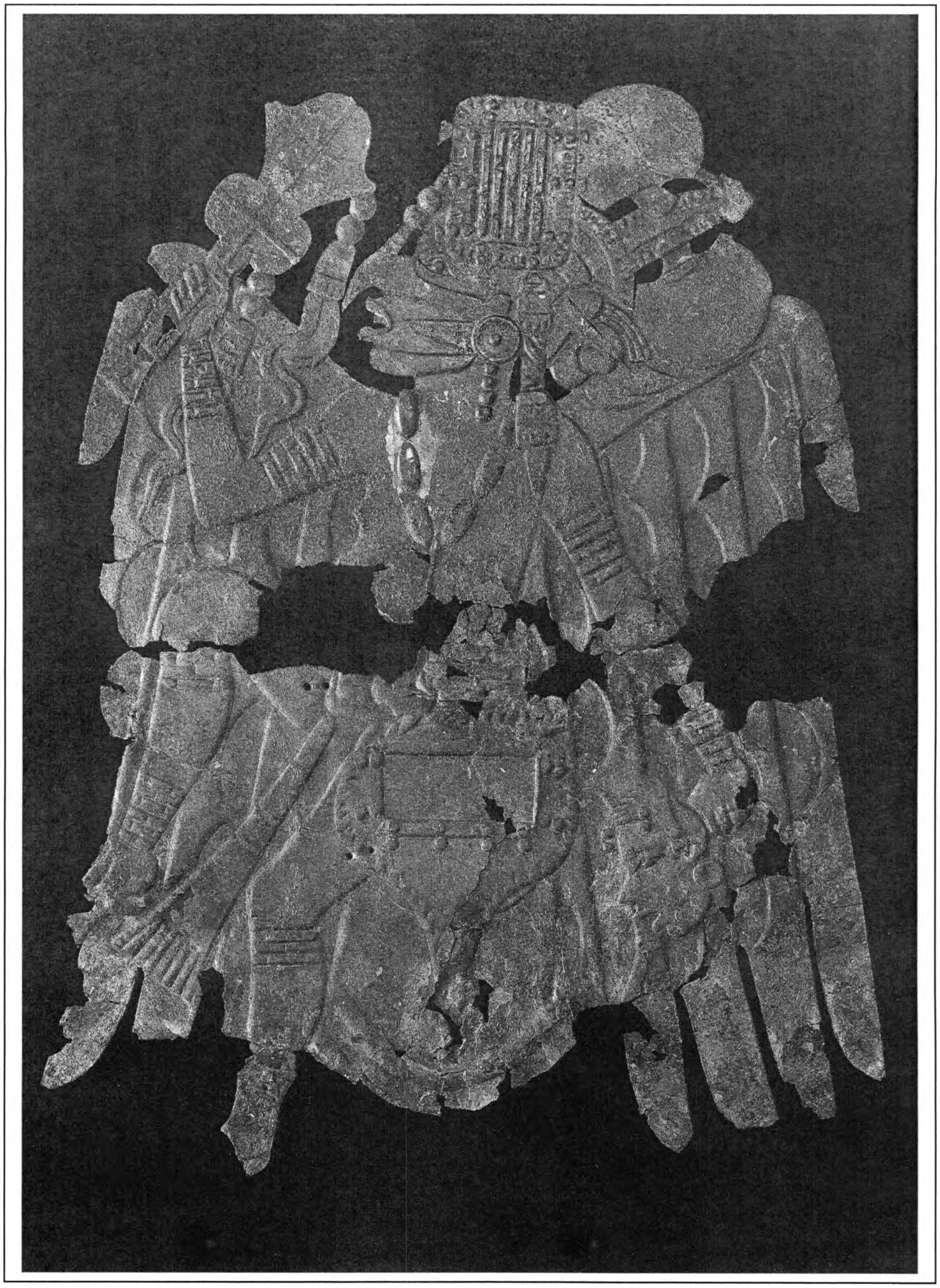

Illustration 8.76 Larger Rogan Plate

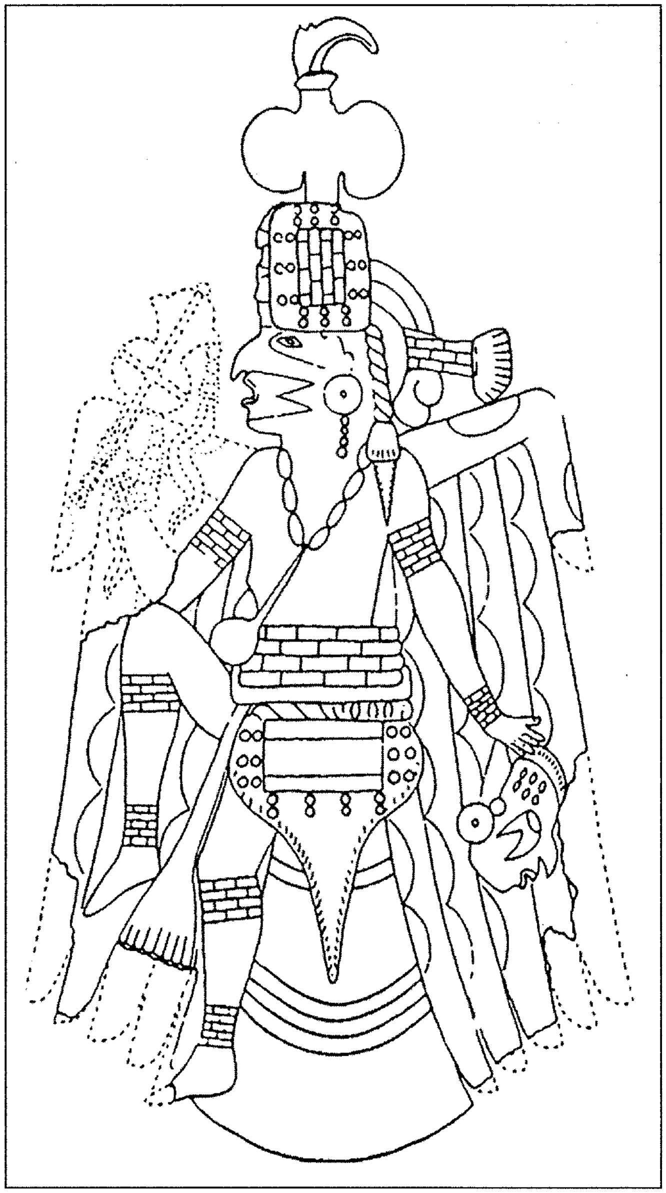

Illustration 8.77 Illustration of Smaller Plate

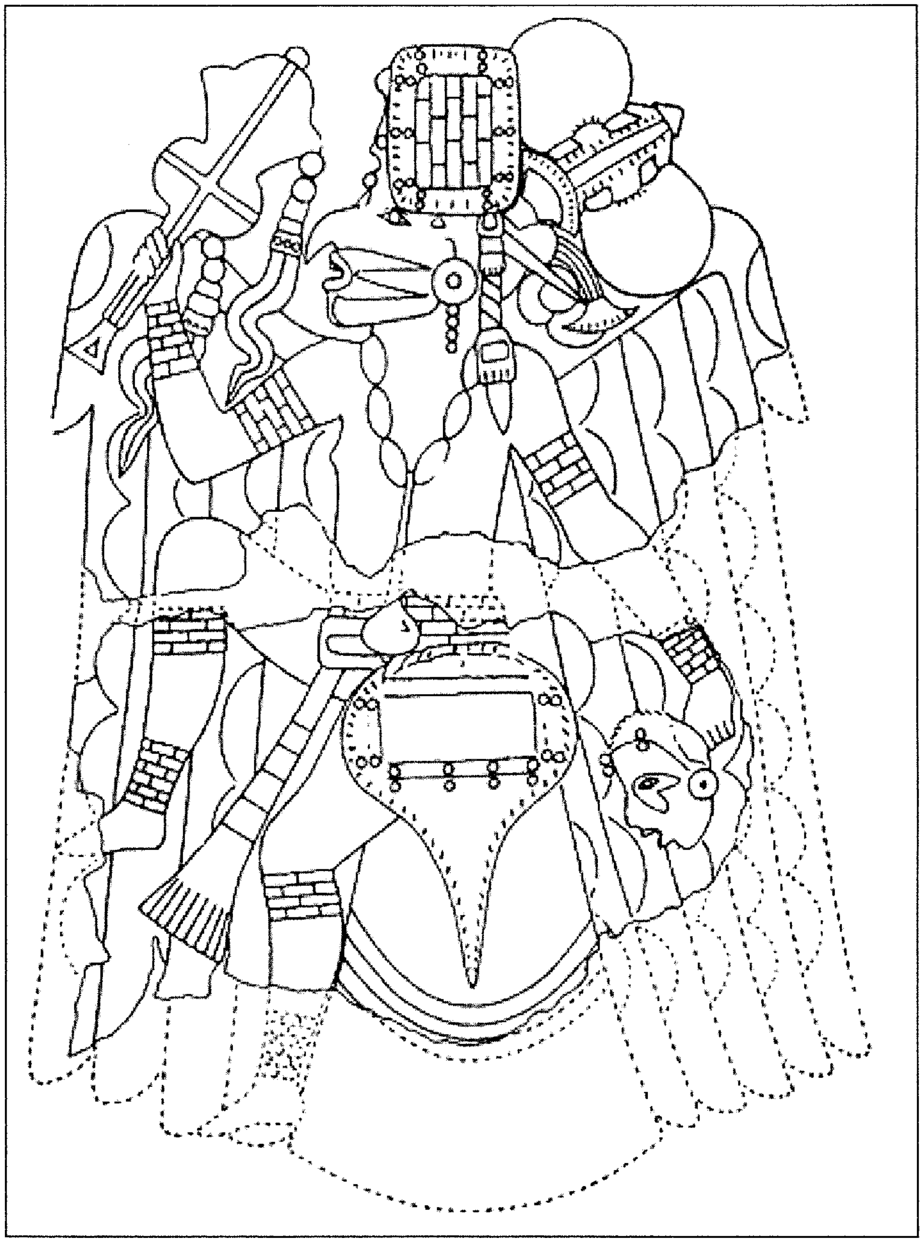

Illustration 8.78 Illustration of Larger Plate

Illustration 8.79 Free Hand Partial Cut Out But Not Completely Chased

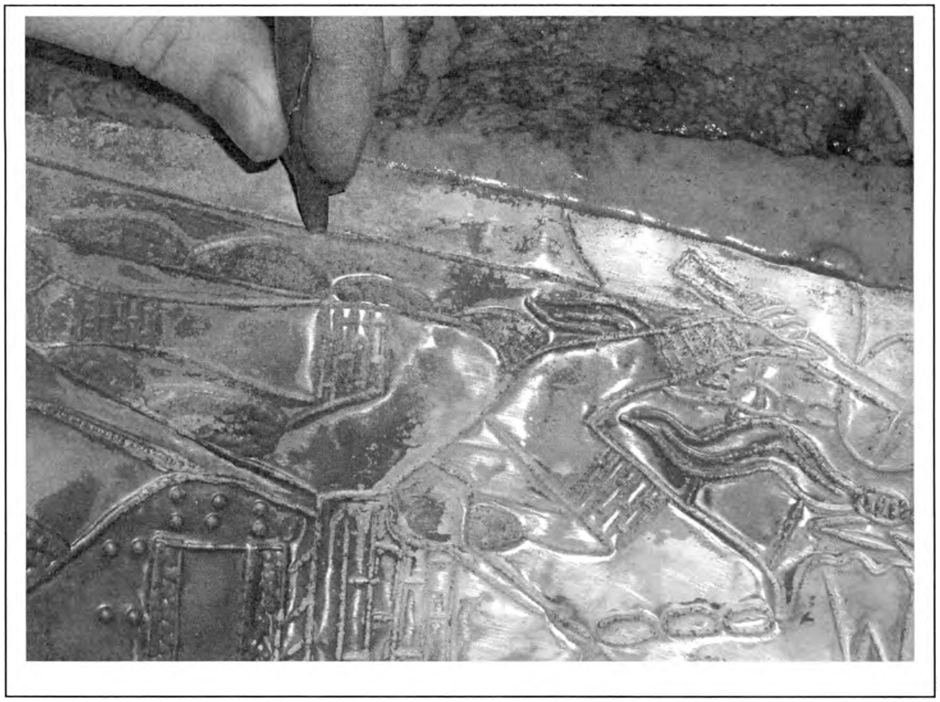

Illustration 8.80 Cutting the Plate While Embedded in Pitch

Illustration 8.81 Cutting While Embedded in Pitch

Illustration 8.82 Rogan Plate Cut Out

Illustration 8.83 Chasing in Pitch

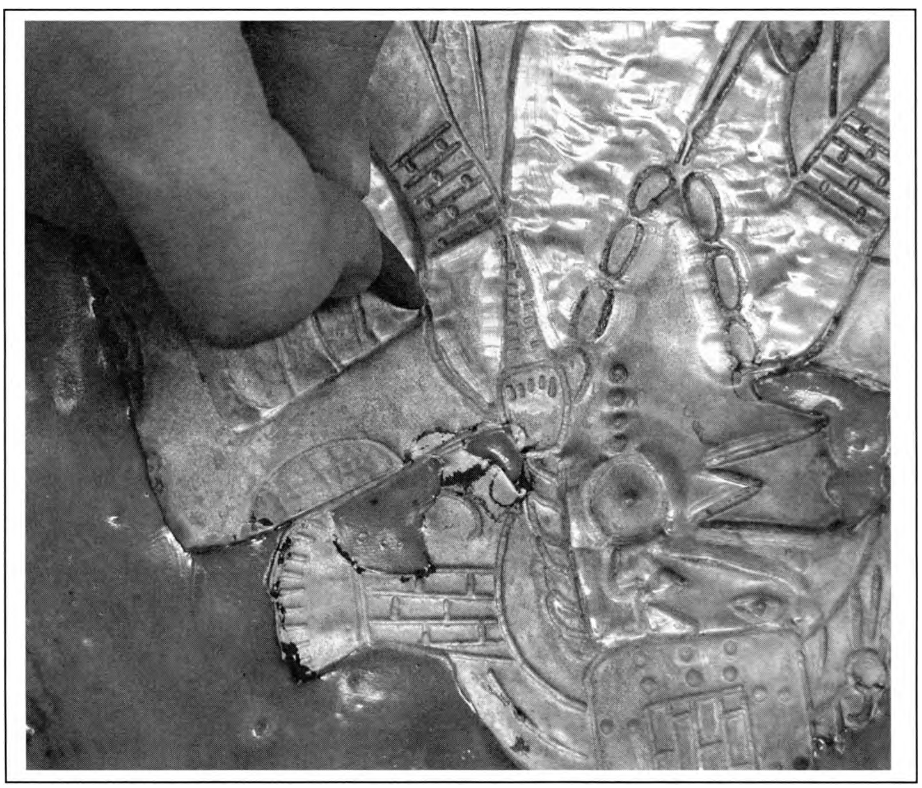

Illustration 8.84 Chasing in Pitch

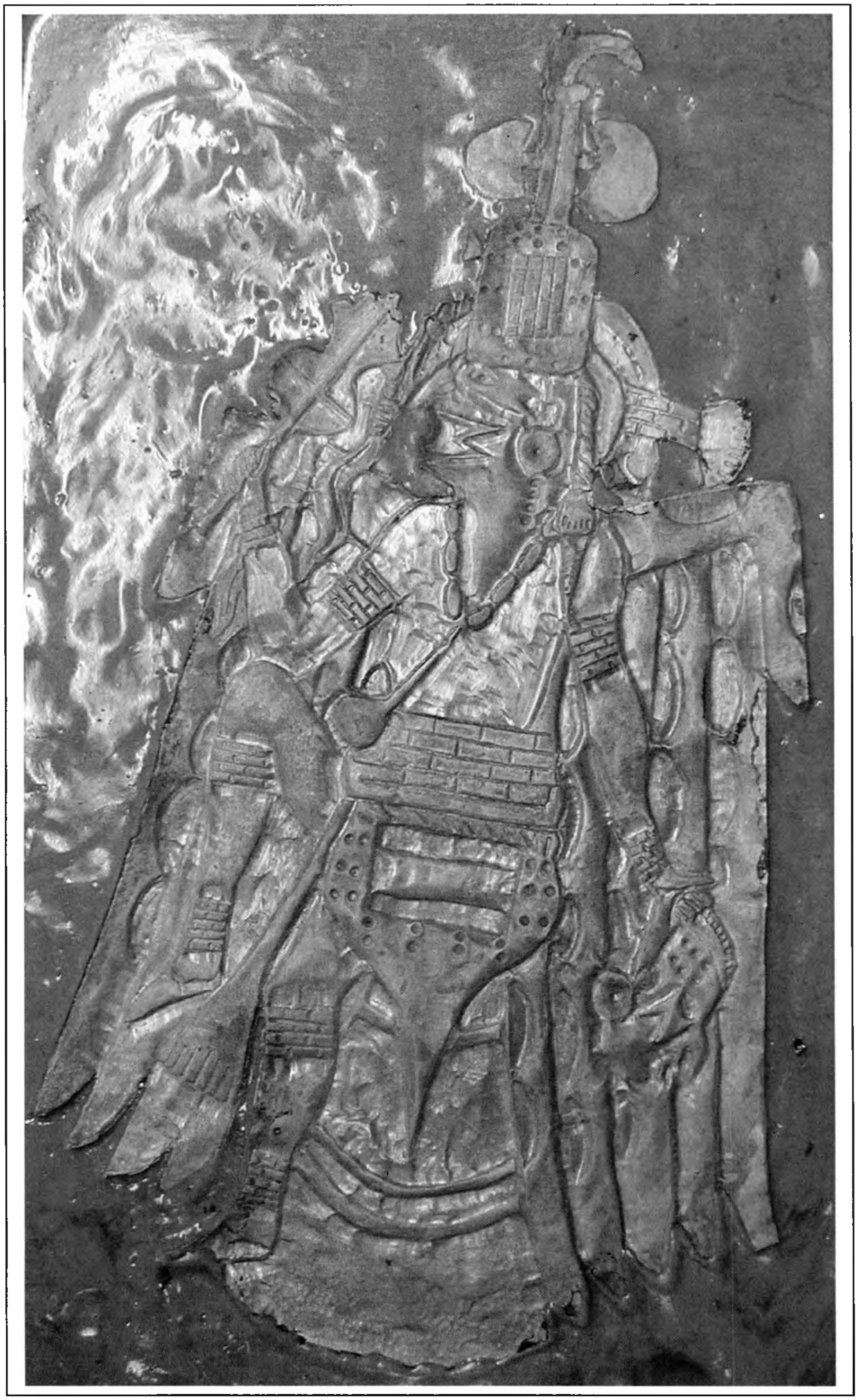

Illustration 8.85 Completed Free Hand in Pitch

Illustration 8.86 Completed Free Hand

Illustration 8.87 Carved Rogan Plate Template

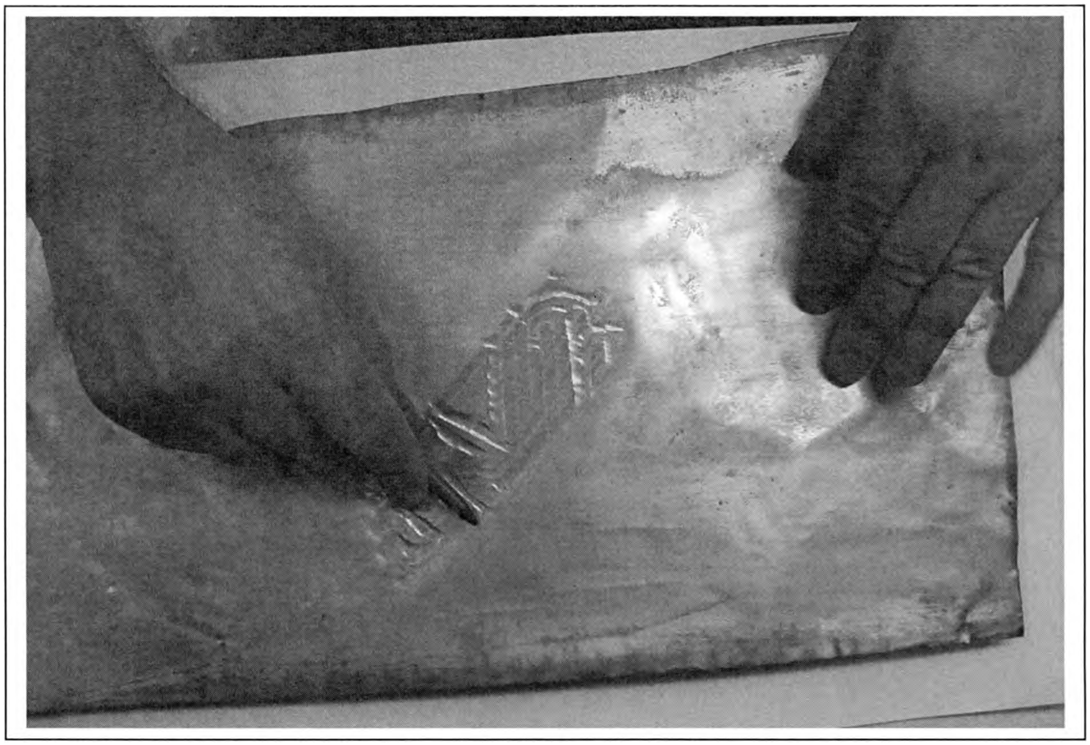

Illustration 8.88 Burnishing the Plate

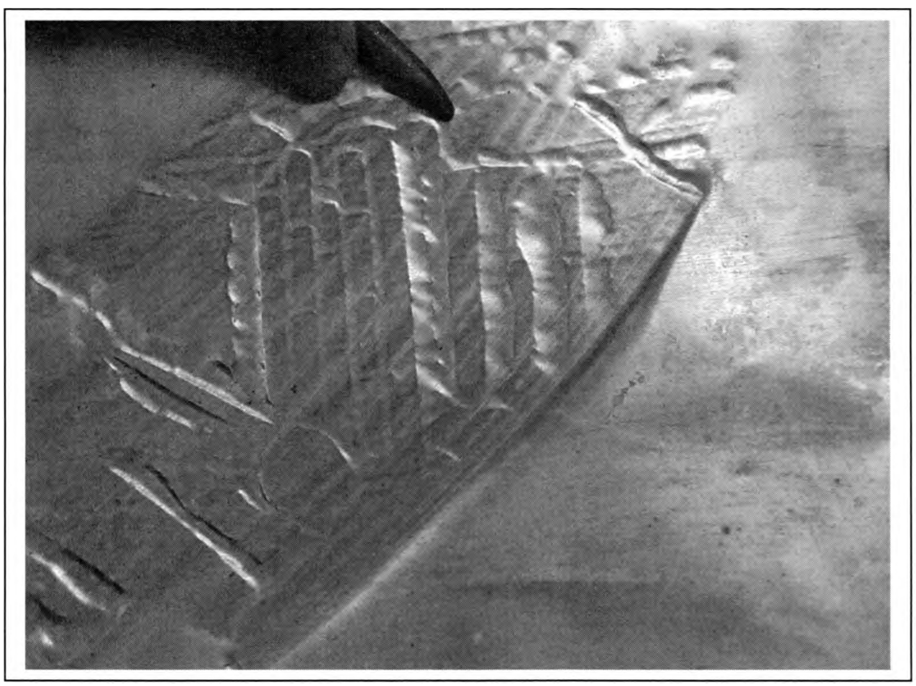

Illustration 8.89 Burnishing the Plate

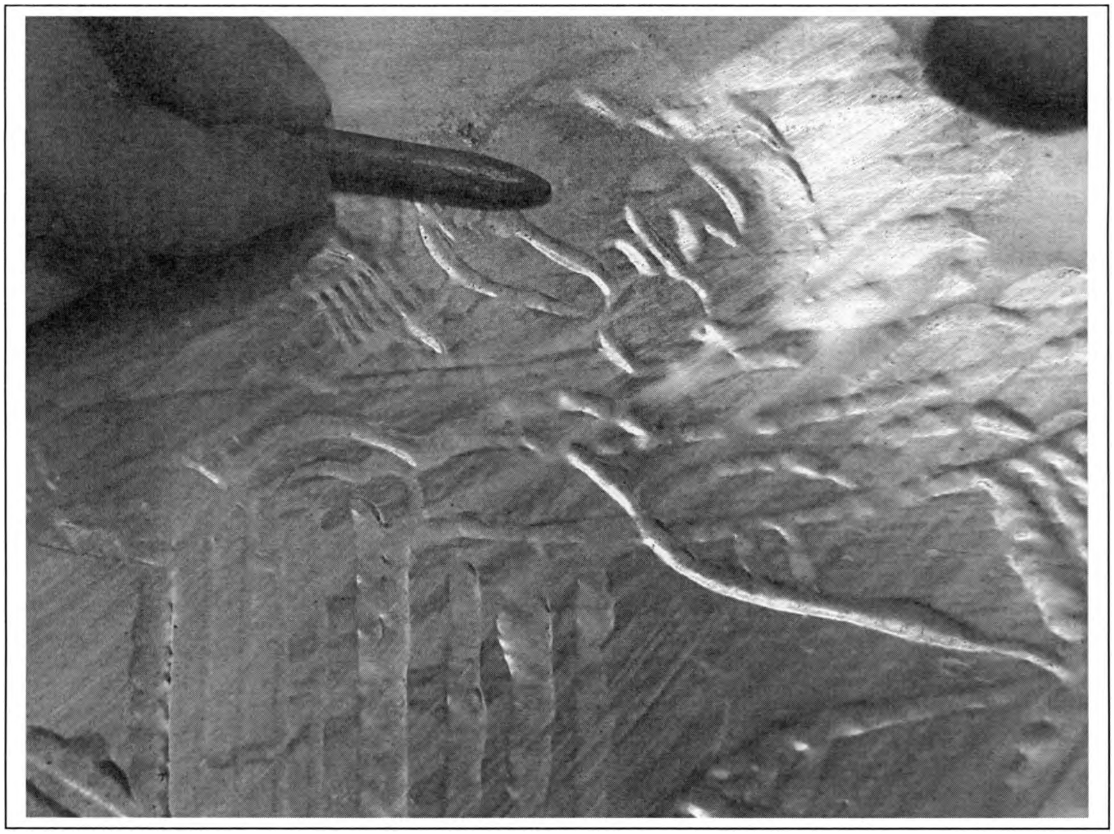

Illustration 8.90 Burnishing the Plate

Illustration 8.91 Burnishing the Plate

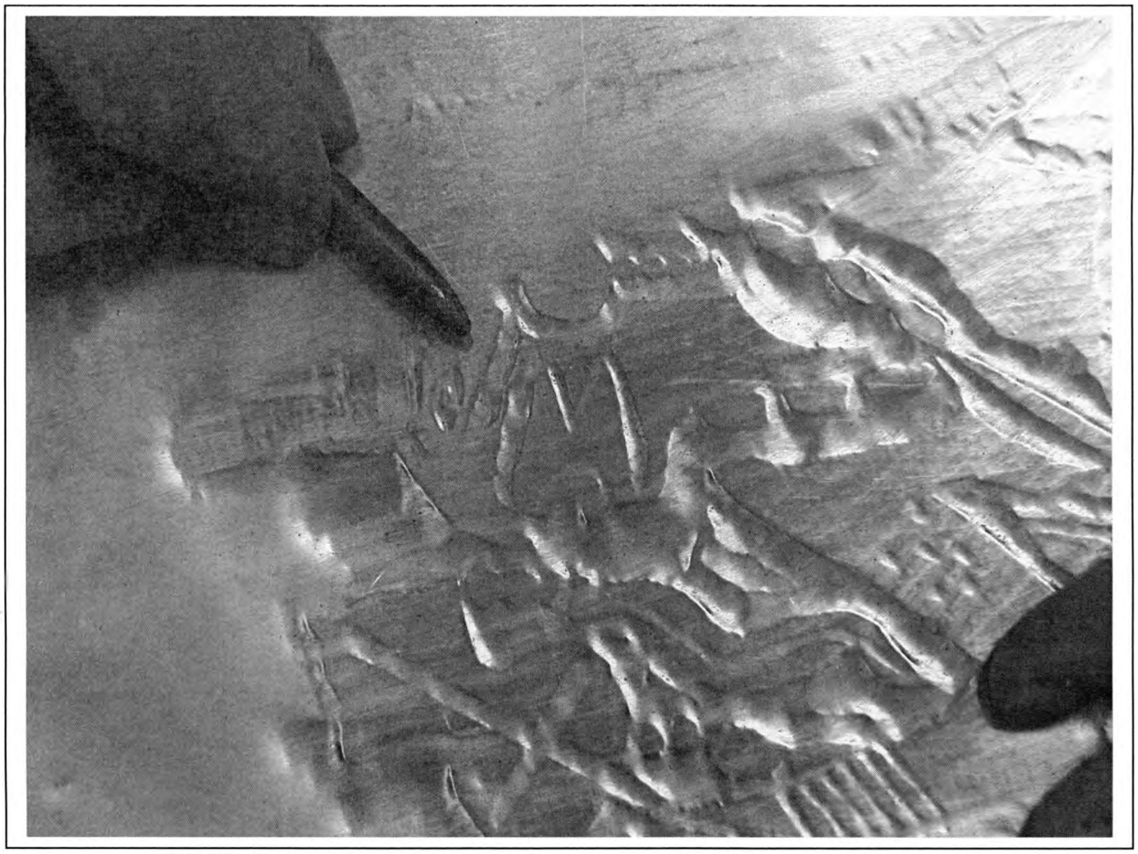

Illustration 8.92 Burnishing the Plate

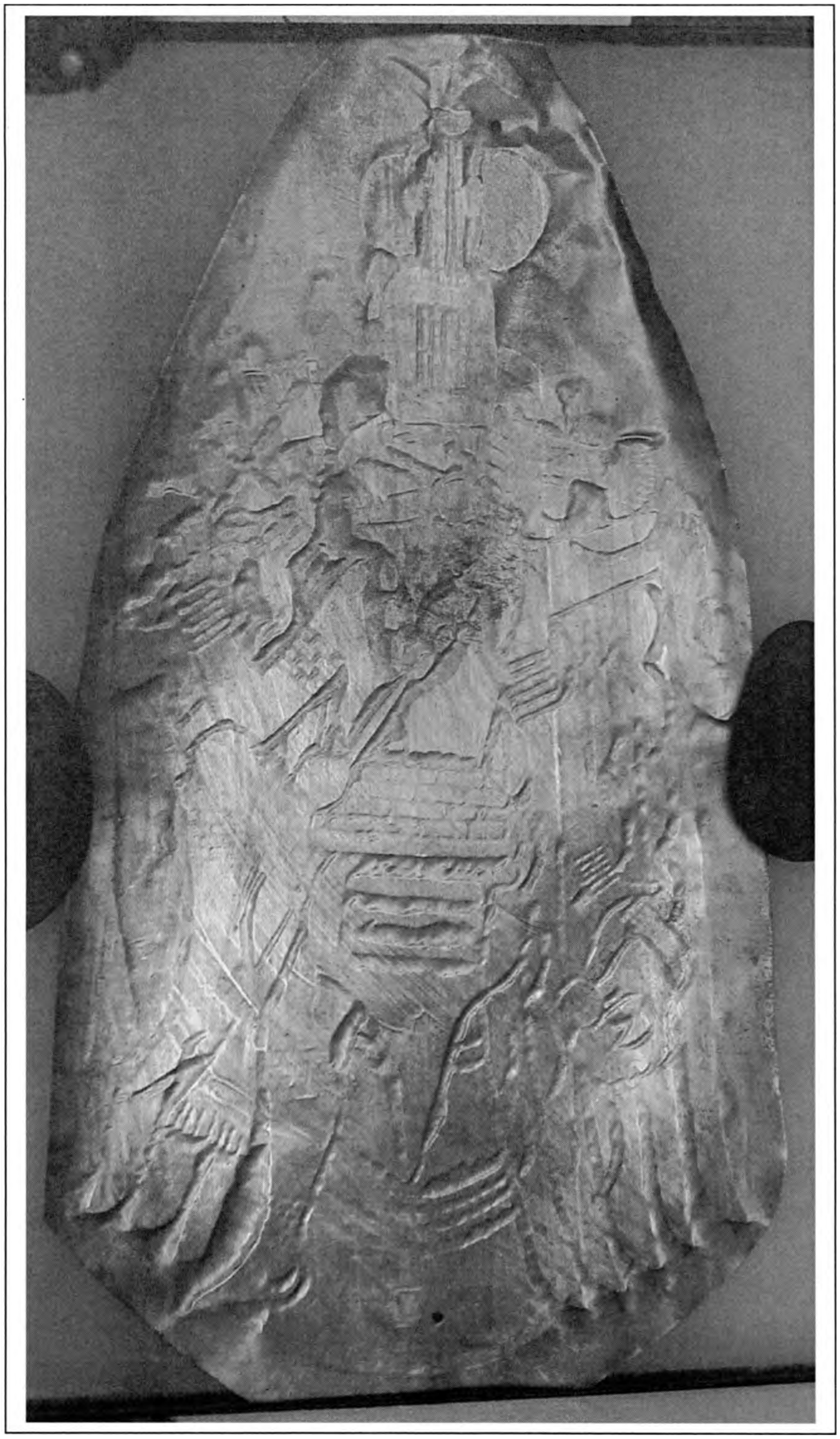

Illustration 8.93 Final Burnished Rogan Plate

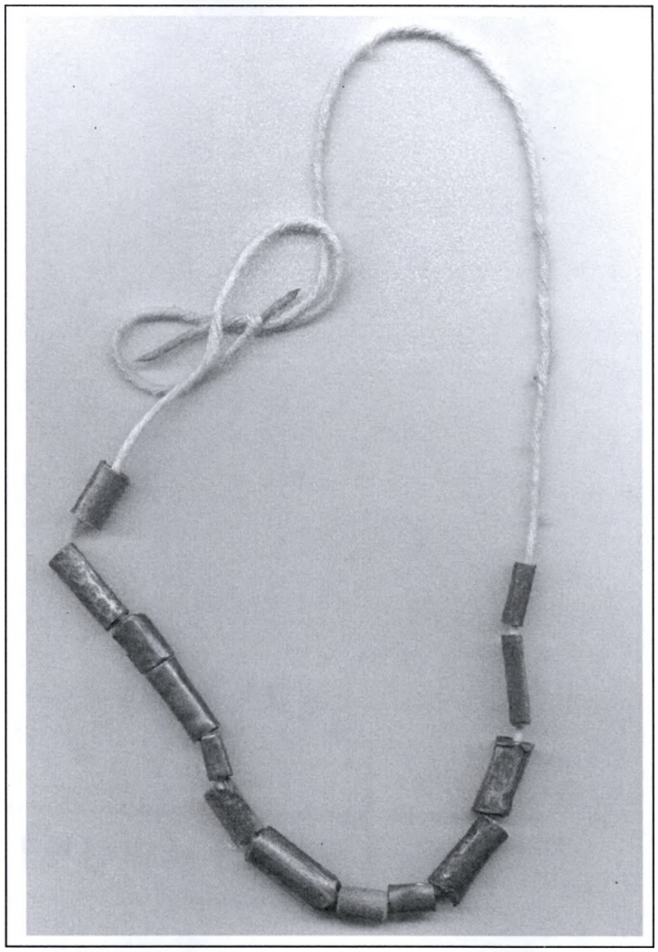

Illustration 9.1 Beads Constructed from Copper Fragments

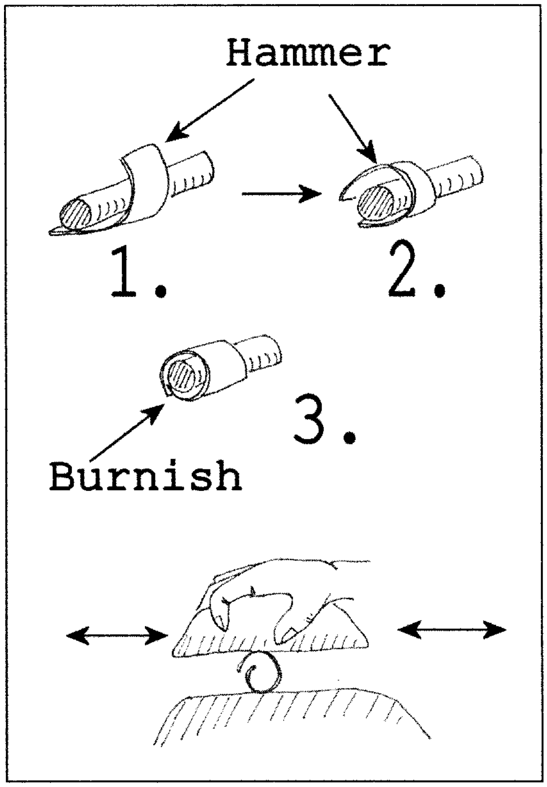

Illustration 9.2 Methods of Bead Manufacture

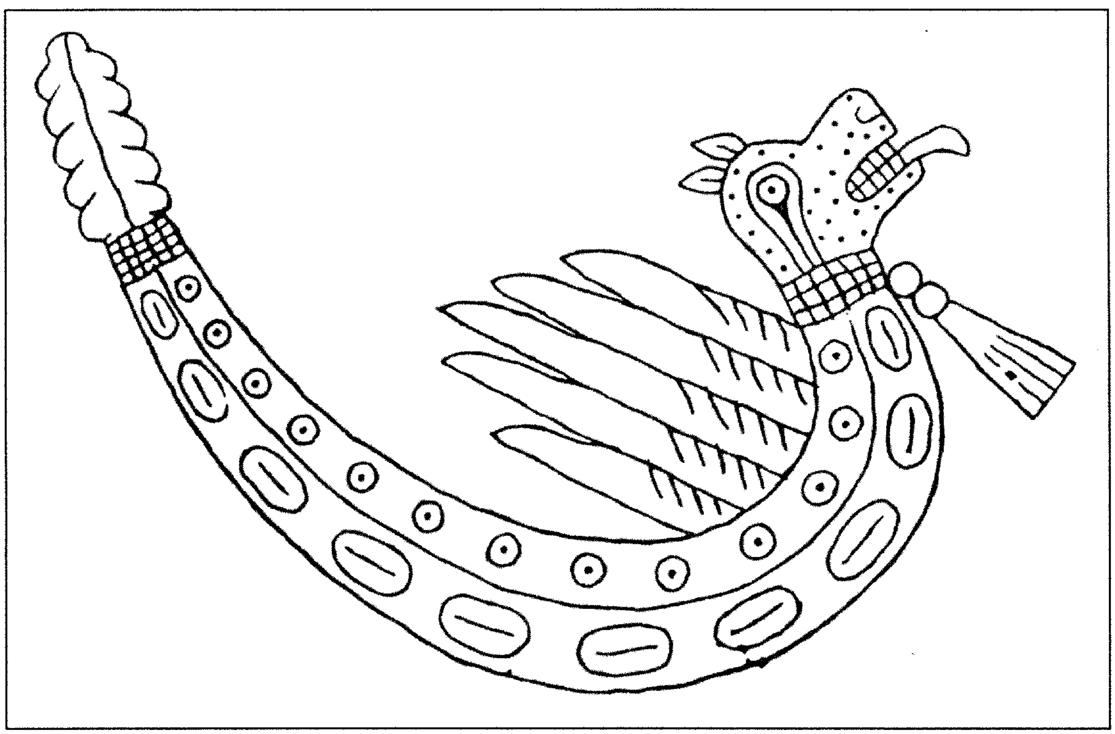

Illustration 10.1 Piasa from an Engraved Shell Exhibiting Serpent, Avian, and Mammal Attributes

Illustration 10.2 Hopewell Shaman with Copper Antlered Head Piece

Illustration 10.3 French Paleo-cave art from Les Trois Frères

Illustration 10.4 Copper Axes with Carved Wood Bird Effigy Handles from Spiro, Oklahoma

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