MOCHE CERAMIC TECHNOLOGY

Christopher B. Donnan

Introduction

This report is a description of Moche ceramic technology as it could be reconstructed from a study of the ceramics from Site F at Moche. Thirty-one graves at this site were excavated by Max Uhle in 1899; these graves yielded a total of 528 ceramic objects which are now in the Robert H. Lowie Museum of Anthropology at the University of California at Berkeley.

Since the ceramics from Site F consist entirely of grave offerings, they do not necessarily represent the entire range of Moche ceramic objects. For the most part, they are finely-made pieces which may have been produced specifically for burial purposes. Only one vessel in the entire collection shows any signs of use. A number of forms of utility ware which are not represented in the collection also must have been made by Moche potters, and their production may have involved other techniques in addition to those used to make the finer pieces. It should be realized, therefore, that this report is affected by the limitations of the sample being studied and does not necessarily include the entire range of the potter's techniques.

In discussing Moche ceramic technology, changes in techniques will be discussed in terms of the sequence of five phases first suggested by Rafael Larco Hoyle.[1] These phases were based on specific characteristics of the stirrup spouts, and were arranged by seriation into a chronological sequence. In 1950, J. H. Rowe confirmed the validity of these phases, as well as their sequence, on the basis of the thirty-one grave lots from Site F.

It should be noted that this five-part division was arbitrarily imposed on the gradual development of the Moche style, which in actuality was probably without sharp breaks. Thus, grave lots containing ceramics belonging to two consecutive phases are found and represent a phase transitional between the two. Moreover, since the collection contains fourteen grave lots belonging to Phase III, it has been possible to divide this phase further into two subphases: IIIa and IIIb. The Uhle collection from Site F does not contain any grave lots which were purely Phase I or Phase V, nor is there a grave lot representing the transitional Phase IV-V. All other phases are represented, however. They are listed in Table I along with the graves assigned to each and the ceramic objects found in the respective graves.

It is often difficult to reconstruct details of ceramic technology from observation of the finished product, because there are too few direct correlations between a specific technique of manufacture and an observable characteristic produced by the technique. Instead, any one feature, such as the color or hardness of the object, can generally be the result of a number of combinations of factors. Because of the limitations inherent in the observation of finished objects, the information derived from observation has been supplemented by direct experimentation in several techniques by the author and, to a lesser degree, by certain ideas presented in the literature. I should like to express my appreciation to J. H. Rowe and Lawrence E. Dawson for their assistance in this project, and to Winifred Lambrecht and Alex Apolestides for their help with the illustrations.

Forms of the Objects

Many vessel forms were made by Moche potters, and the technology often varied according to the form being produced. The forms of Moche pottery can be divided into two main categories: those with stirrup spouts and those without stirrup spouts. The vessel forms belonging to the latter category are shown in figs. 1-10.

Vessels with stirrup spouts have a wide variety of forms. The majority of stirrup spout vessels have symmetrical chambers (fig. 29).[2] The symmetrical chambers were sometimes elaborated by stamping the outer surface (fig. 30) or adding a ring base.[3] More major elaborations were made by adding a closed jar neck (fig. 31) or some type of figure.[4]

Stirrup spout vessels with nonsymmetrical chambers include human heads, seated figures, and vessels with chambers in the form of plants or animals.[5] These forms are frequently unique and very complex. In this report, the forms with nonsymmetrical chambers will be referred to as elaborate forms, whereas those with symmetrical chambers will be referred to as plain forms.

There are a few ceramic objects from Site F which are not vessel forms. These include 16 spindle whorls, 5 figurines (two of which are shown in figs. 33, 34), a whistle (fig. 35), and a rattle (fig. 36).

Antecedents of Techniques

It should be noted at the outset that Moche ceramic technology was not without local antecedents. Indeed, pottery had been known on the north coast for over 1500 years before the Moche style began, and many of the style's distinctive features are found in the styles that preceded it. The following list illustrates the features found in the three styles immediately preceding Moche which were utilized in the Moche style. The styles are listed in chronological order.

Cupisnique
- stirrup spout vessel form
- relief modeling
- decoration with representational elements
- blackware
- design and incision techniques on redware
- brush painting
- painting within incised outlines

Salinar
- shapes later used by Moche
- modeling
- spouted, incised, white on red painted ware
- geometric design motifs (e.g., "step")
- high grade oxidized paste
- whistling bottles
- representational depiction of humans in half round relief

Gallinazo
- organic black pigment
- bands of linear rectangles, parallel wavy lines, "spiral rosette" motifs
- dipper vessel form

From the above list, it can be seen that many important features which were later to become part of the Moche ceramic tradition had already appeared on the north coast before the Moche style began. Actually, there are very few features which can be attributed to the inventiveness of the Moche potters. Instead, the distinctiveness of Moche ceramics derives from their characteristic combination of inherited features and the great skill with which these features were utilized.

Forming and Shaping

The building-up process in Moche ceramics involved a utilization of four basic techniques: coiling, molding, modeling, and stamping. Nearly all vessels required at least two of these techniques, and well over half used three or more for their production. Unfortunately, in

many instances all traces of fabrication were removed in the finishing process, and we can only speculate how they may have been formed. This situation obtains most notably in the case of open vessels, but even the closed forms frequently offer few clues to their manufacture. The instances about which we are not certain will be pointed out in the discussion that follows.

Molding

Molding might well be called the basic technique of Moche ceramics. It played a part in the production of almost all ceramic objects. Moche molds are rare, since they were never a burial item. Nevertheless, several have been reported in the literature.[6] The molds were made of fired clay which had been formed over an actual object such as an ear of corn, a squash, etc., or over a pottery matrix. The mold illustrated in fig. 11 was made by the author from the bottom portion of a stirrup spout bottle by simply pressing clay around the latter, sectioning it, and removing the two halves as they began to dry. It is quite possible that Moche molds were frequently made from existing vessels in this way.

All Moche molding involved pressing moist clay into the molds rather than pouring in a liquid clay slip. As the clay began to dry, it shrank away from the inside of the mold, and was easily removed. This point deserves emphasis, because there has been considerable confusion in the literature about the problem of preventing the clay from sticking to the mold.[8] Experimentation has shown that the removal of the clay presents no difficulty whatsoever, and the inside of the molds need not be artificially treated in any way.

Two-piece molds were the most common form, although one-piece molds were also used. When a vessel was too complex to be produced in a single two-piece mold, as was frequently the case with highly elaborate forms, it was made in sections which were later joined together. The molds themselves never became more complex than two-piece molds.

Among the objects formed in two-piece molds were the chamber portion of bottles, including the chambers of the stirrup spout, spout and handle, and double-chambered whistling varieties. The chambers of jars and dippers were also formed in this way. Indented jars, collared bowls, ring base bowls, and cooking bowls may have been formed in two-piece molds, although it seems equally probable that they were formed entirely by a coiling technique, as has been suggested by Linné and Tello.[9] Additional objects formed in two-piece molds include the mouths of jars, handles of dippers, and various forms of heads, figures, and other small objects which were added to the vessels for ornamentation. Three of the five figurines in the Uhle collection were also made in two-piece molds (e.g., fig. 33), as well as a small, crudely made rattle (fig. 36).

Two-piece molding is found in all phases represented in the collection from Site F and does not show any significant changes in technique, frequency of use, or the vessel forms on which it was employed.

One-piece molding is less common in Moche ceramics. Only a few instances of it are demonstrable in the collection from Site F.

One-piece molding appears in the Uhle collection in Phase I-II, the earliest phase represented, where it was utilized in the manufacture of two of the five figurines (e.g., fig. 34) and a whistle (fig. 17). The front of the figurines was formed in a one-piece mold, while the back is merely a slab of clay, added to the molded front and subsequently trimmed. The front of the whistle was a solid piece of clay which had been formed in a one-piece mold. The whistle mechanism was a separate piece, added later.

One-piece molds may also have been used in the production of the flaring bowl form which began in Phase IIIb and continued through Phase IV. This vessel form could conceivably have been coiled, although adding the coils of clay onto the flaring rim when the clay was still soft would have presented serious difficulties. A much more probable means of production would have been to press the clay into a mold similar in shape to the flaring bowl itself. As it dried it would have shrunk away from the mold and, when firm, could have been removed easily, thus facilitating the finishing of the outside surface and the bottom. Whatever the method of manufacture of the flaring bowl may have been, the rattle base bowl must have been produced in much the same way, and the rattle base added later.

A final use of one-piece molds was to produce both halves of a vessel chamber or of the neck of a jar. A one-piece mold can always be used in this way when the two halves of an object are identical. It is, however, to the potter's advantage to use a two-piece mold instead, since the two halves of an object can then be joined while still in their molds, thus making it easier to fix and smooth the seams on the inside without warping the vessel. When a one-piece mold is used, the sides must be removed from the mold to be joined, and the seams are subsequently very difficult to make. The seams are quite evident on vessels made in this way, thus giving them a rather crude, sloppy appearance which is rarely seen on Moche ceramics (fig. 32b). Why, then, was this technique employed? It might be thought that it resulted from the breaking or misplacement of one-half of a two-piece mold. The vessels, however, indicate that the use was not accidental. All vessels produced in this way have a relief design on the two halves which was made in the mold. Furthermore, the mold was constructed in such a way that a wide, raised vertical band was formed on the sides of the vessel paralleling the seam (fig. 32). This made the walls thicker along the seam and helped counteract the disadvantage of having to join the two halves without the support of the mold. The only apparent functional value of this technique over a technique utilizing a two-piece mold was that it allowed for a detailed relief design to be reproduced exactly on both halves of the vessel.

The molding of vessel chambers in a one-piece mold has been observed only in pieces corresponding to Phase IIIb.

Coiling

Moche potters generally used the coiling technique in conjunction with molding to produce a particular vessel form. Whether or not

it was used exclusively to form certain vessels (cooking vessels, collared bowls, and ring base bowls) is difficult to determine. As noted above, these three forms may well have been made in molds.

Used in conjunction with molding, the coiling technique was important in forming the chambers of bottles (see fig. 14d). It was used in much the same manner to form the base on rattle base bowls and was the means of forming the ring base on stirrup spout bottles (fig. 31c), and ring base bowls (fig. 3). On spout and handle bottles (fig. 7), and stirrup bottle/jars (fig. 31), a coil of clay was placed around the neck where it joins the vessel. In a similar manner, a coil of clay must have been applied to stirrup spouts where they join the chamber on stirrup spout bottles, although it was smoothed into the junctures and is more difficult to detect. Finally, the coiling technique appears to have been employed to form the collar on collared bowls (fig. 6) and cooking vessels (fig. 5).

Stamping

Stamping differs from molding in that it is a method of ornamentation rather than a means of forming the object itself. Stamps from the northern Peruvian coast have been illustrated in the literature, as well as the type of matrix over which they were made.[10] Furthermore, the Robert H. Lowie Museum of Anthropology at Berkeley contains several examples of Moche stamps, although they are not part of the collection from Site F. Stamps were made of fired clay which had been formed over fired clay matrices, or over the objects to be represented, such as sea shells, ears of corn, etc. The stamps made over clay matrices were generally depictive, representing animal or human forms.

Two general rules which governed the use of stamps by Moche potters can be formulated. First, never more than one stamp was used on any one vessel. Though certain graves from Site F contain several vessels each marked with a different stamp, no single vessel was ever stamped with two different stamps. Second, there was an attempt at symmetry or balance. If one side of a vessel is stamped, the other side should be stamped also; or, if the vessel is spherical, an odd number of stamped impressions can be produced on it, but they must be evenly distributed. Only in the case of jars which have had a face stamped on the neck is there an exception to this rule.

Stamps were used only on jars, collared bowls, and stirrup spout bottles. There are no examples of stamped vessels in Phases I-II and IV, but they are found in all other phases represented in the collection (II to III-IV). Phase IIIb has the greatest number of stamped vessels, as well as the greatest variation in stamp designs.

Stamping was done in two ways. The most common way was to place the stamp against the outside of a vessel while the clay forming the side was still soft and malleable. The potter then reached inside the vessel and pushed the side outward into the stamp. When the stamp was taken away from the outside, the impression was left in relief on the vessel wall. Since this method necessitates reaching inside the vessel, when it is applied to vessel forms with constricted openings (e.g., stirrup spout bottles and

jars) it must be done before the vessel is completed. More discussion of this point will be given in the section concerning the production of stirrup spout bottles. When this method of stamping is applied to other forms (e.g., bowls), it can be done at a later stage of manufacture.

The second way of stamping vessels was to press moist clay into a stamp and then press the stamp against the outside of the vessel. The clay inside the stamp sticks to the vessel wall and remains attached to it when the mold is taken away. This method obviates the need to reach inside the vessel, and thus the stamping can be done at a late stage of manufacture, even on vessels with constricted openings. Furthermore, it leaves no outward bulge on the inside of the vessel. There were two major problems with this method of stamping which made it inferior to the method described previously. First, it was difficult to make the clay impression adhere well to the side of the vessel. Once the mold was removed, any additional effort to make the impression attach more firmly to the vessel would alter the relief newly made in soft clay. The second problem was that air pockets might be formed between the clay impression and the wall of the vessel, producing an explosion when the vessel was fired. To meet this problem, deep holes were punched into the clay impression to prevent air pockets from forming. Only one example of this method of stamping is found in the collection from Site F, though the Lowie Museum of Anthropology has other examples of it from Moche. The one example from Site F is from Phase IIIb (Museum no. 4-3101).

Modeling

Modeling, i.e., direct shaping, was always used as a secondary technique. That is to say, no object of Moche ceramics has been found which was made exclusively, or even primarily, by the modeling technique.[11] Instead, it was used as a means of elaborating, ornamenting, or giving detail to an object, and thus should be viewed primarily as a technique of artistic expression. The one instance when modeling was more functional than aesthetic in nature was in the production of solid handles which were added to certain vessel forms.

Modeling can be divided into two categories for purposes of discussion: the shaping of clay which is added to an object and the reshaping of clay which is already a part of the object. The first of these techniques is the most easily identified, since it often results in appendages depicted in the full round. Handles were made in this manner, as were the arms, legs, ears and earspools, and elaborate headdresses of molded figures. In fact, all three-dimensional representation which could not be built into a two-piece mold or stamped onto a molded object was done by this modeling technique.

Modeling by reshaping clay which was already a part of the object was used as an alternative to the stamping technique and is often seen in the case of low relief faces depicted on jar necks.

Both categories of modeling were frequently used by Moche potters. They were, however, used only in the production of certain items. These include double-chambered whistling bottles, jars, elaborate

stirrup spout bottles, and, as mentioned above, the handles of spout and handle bottles and cooking vessels. Modeling was also used to make the whistling mechanism of the whistle.

The two forms of modeling were used in all Moche phases represented in the ceramics from Site F. Modeling tends to increase in importance from Phase I-II until Phase IIIb, when it is most abundant. In Phase IIIb its abundance is due primarily to the great number of very elaborate, unique forms of stirrup spout bottles found in that phase. After Phase IIIb, its importance waned as the proportion of stirrup spout bottles decreased and bowls, jars, and spout and handle vessels became more abundant.

Making a stirrup spout bottle

In the discussion of molding, coiling, modeling, and stamping which is given above, it is apparent that the four techniques were often used in conjunction with one another to construct a particular vessel form. The section which follows is a detailed description of the way these techniques were employed by Moche potters to produce a particularly complex vessel, a stirrup spout bottle. This particular shape was chosen as an example, since it illustrates the use of all four techniques and its method of manufacture is perhaps the most difficult of all to understand. Furthermore, although much has been written about this vessel form, a plausible explanation of its production has never been given in detail.

The method explained here is derived from direct experimentation with various techniques by the author. It can only be suggested that this method was the one utilized by the Moche potters. Nevertheless, the suggestion is plausible in the light of what is known of Moche ceramic technology, and it accounts for all the features of stirrup spout bottles which resulted from their manufacture and which can be observed on the specimens which have survived.

The production of stirrup spout bottles followed a basic pattern which will be explained in terms of the production of the simplest type.--the plain, spherical shape. More complex stirrup spout vessels are merely elaborations of this basic method. Their elaborations will be explained later.

Making the chamber

The chamber of the stirrup spout bottle was partially formed in a two-piece mold which produced the bottom and all but the upper portion of the sides (see figs. 11, 12, 13). The opening left at the top made it possible to reach inside the chamber and carefully smooth the inner surface, thus removing all traces of the seam. Since the walls of these vessels are remarkably thin, and the clay shows evidence of having been moist at this stage of production, a major technical difficulty would have been to prevent the chamber from warping. It is quite probable that this difficulty was overcome by leaving the chamber in the mold while smoothing it on the inside. Only later, when it began to dry and become firm, would it be removed from the mold.

Once the lower portions of the chamber were made and had begun to dry, the upper part was carefully closed by means of the coiling technique (fig. 14). Complete loops seem to have been added rather than a continuous coil, each loop being smoothed both on the outside and inside as it was added. When only a small opening remained in the top, the vessel was sealed by a technique shown in fig. 15. This technique accounts for the lump of clay at the top of the vessel (fig. 29b). The chamber was then complete and ready for the addition of the spout.

Making the spout

The spout was made as follows. A thin sheet of clay was formed (fig. 17) and cut into wide strips which were wrapped around three tapered wooden rods (figs. 18, 19). The seams were sealed and the two long rods were joined together at their small ends. A disc of clay was removed at the junction point, and the short wooden rod, with clay around it, was added (fig. 20). The seams at the junction were smoothed and reinforced by a small ring of clay which was added and subsequently smoothed into the joint. The wooden rods were then withdrawn, and the two long tubes of clay were bent to form the hoop of the stirrup spout (figs. 21, 22). Caution must have been employed to prevent the shoulders from crimping or tearing during the process, and undoubtedly very moist clay was used.[12] Once the desired shape was achieved, the spout was allowed to become firm, though not dry.

Joining the spout to the chamber

Joining the stirrup spout to the chamber was done by first punching two holes in the chamber where the stirrup spout was to be added. The stirrup spout was then attached in its correct position and a small coil of clay was wrapped around each of the joints (fig. 23). The coils were subsequently smoothed into the joints and served to reinforce them. At this stage, the vessel appeared as is shown in the cutaway view of fig. 24. A small vertical slit was then made in the shoulder of the stirrup spout and was opened (fig. 25). A swab on a stick, similar to that shown in fig. 26, was inserted into this opening and was used to ream out the inside of the passageway of the spout where it joins the chamber. This operation fully cleared the passageway at the juncture of the spout and the chamber, as can be seen in fig. 29c. The swab was removed and the spout was pressed back to its original shape (fig. 27). This process was then repeated on the other shoulder of the stirrup spout. All traces of the vertical slits were removed from the outside of the stirrup spouts, but a ridge of clay resulting from the operation can still be seen on the inside of the shoulders (fig. 29a).

More complex stirrup spout bottles require slight variations in the pattern described. As an example we can consider the making of stamp-marked stirrup spout bottles (fig. 30). When stamping is to be done on the chamber walls, the mold changed form. Rather than molding the bottom and all but the upper portions of the sides, the entire top and sides were molded and the bottom was left to be finished by the coiling method. Thus, the lump of clay resulting from closing off the chamber is

found on the inside of the bottom on stamped vessels, rather than in its more usual position on the inside of the top (fig. 30b). Molding the top and sides of the chamber rather than the bottom and sides allowed the Moche potter to reach into the vessel through the bottom and press the sides and top outward into whatever stamp pattern he desired to produce.

Since it is somewhat easier to coil the top of the chamber than it is to coil the bottom, molds for making the top and sides were used only when the vessel was to be stamped or some figure was to be added to the top, an operation which would necessitate reaching into the chamber to join the seams.

Stirrup spout bottles with closed jar necks and spout and handle bottles were made in a manner similar to that of the basic pattern as outlined above. Instead of the chamber being completely sealed, however, the top was merely constricted by coiling until it reached the diameter of the spout or jar neck which was to be attached. This spout or neck was inserted into the hole in the top of the chamber, and a thick coil of clay was looped around it at the juncture to reinforce the joint (fig. 31b).

Through similar combinations of the four basic techniques (molding, coiling, stamping, and modeling) the process of building up all the objects in the collection can be explained. Even the most elaborate vessel forms were made by combinations of these simple techniques.

Finishing the Surface

Smoothing

At this stage the vessel was fully formed and shaped, and was nearly ready for the next stage of painting and incising. Slight ripples would have been left on its surfaces by the building up processes. The finished products almost never show such ripples, and the irregularities must have been removed at this time. Several methods of smoothing pottery were utilized in the Andean area, but it is not known which, if any, were used by the Moche potters.[13] Essentially, these methods involved some means of abrading the vessel surfaces and later rubbing them to regain a smooth surface texture.

Materials commonly used to abrade the surfaces of vessels, and which would have been available to Moche potters, include corncobs, pieces of gourd, mussel shells, bits of bone, and rough stones. Using these or similar materials, the pots were probably smoothed of all surface ripples and subsequently rubbed with either a cloth or piece of leather.

Painting

Slip paint (a suspension of fine clay in water) was used extensively by Moche potters to decorate and improve the surface texture of their ceramics. Only two basic colors of slip pigment were used: red and white. The desired effect in painting seems to have been a contrast between these two colors. The colors were always flat, with no deliberate attempts

at shading, although shading sometimes occurred through inconsistencies of firing, polishing, etc. Furthermore, no vessel in the collection from Site F was painted with more than one shade of each color. On some bottles and jars (primarily from Phase IIIb), part of the outer surface was left unpigmented and was later polished like the pigmented areas. Since the clay of which the vessel was made was a different shade of red than the red pigment which was applied, the resulting color scheme involved two shades of red and one of white.

A great many shades of red and white pigment can be seen in the collection from Site F. To some extent this variety is due to the extent of burnishing and to the specific conditions of firing. On the other hand, variations in color also reflect differences in the pigment itself.

Red pigments were made from a clay similar to, if not identical with, that from which the vessels were made. Nevertheless, due to its finer texture and lack of impurities, the pigment can nearly always be distinguished from the clay of the vessel. White pigments were made from a very pure, white clay.

Both red and white slip pigments were used in all phases represented in the collection from Site F. They are used both as background for designs and for the designs themselves. They were also used merely to cover broad areas which were left in only one color. Pigments of good quality can be seen on some vessels in Phase I-II. There was a slight improvement in the quality of the slips, however, and those of Phase IIIb showed the greatest perfection. In Phases III-IV and IV the slips were often of poorer quality, particularly those applied to vessels other than stirrup spout bottles. The bowls and jars, for example, were often painted with a coarse, white slip which not only did not cover well but also was allowed to run down the sides of the vessels.

Some development can be noted in the technique of figure painting. In Phase I-II the lines are generally quite wide and uneven in comparison to those of later periods. The finest lines in the collection from Site F are found on the figure painted vessels of Phase IV. In all instances, the paint was applied with a freehand technique. Stencils were not used, nor does there appear to have been any preliminary sketching.

Polishing

Since glazes were not used by Moche potters, polishing or rubbing the vessel surface to give it luster was the most important means of obtaining a fine finish. A smooth, hard stone was probably the standard polishing tool, as it was throughout much of South America.[14] Since stroke marks can rarely be seen on the vessel surfaces, polishing was probably done when the vessels were nearly dry. Perhaps, as has been reported for the San Ildefonso potters, the vessel was allowed to dry thoroughly, and the surface was redampened to facilitate polishing.[15] Rubbing the vessel with the hand or a soft cloth while polishing it will also tend to remove the stroke marks.

Nearly all the specimens from Site F show some signs of polishing. In general, the amount of polishing on a vessel is directly proportional to the elaboration of the decoration and to the degree of care shown in the other techniques of manufacture. The highest luster is normally found on stirrup spout bottles. As a general rule, only the pigmented areas of the vessel were polished. The only exceptions to this rule are the stirrup spout bottles and jars mentioned above which had polished areas that were unpigmented.

Many very highly polished vessels were made in Phase IIIb. This fact is related to the presence of numerous elaborate stirrup spout vessels in that phase. In Phases III-IV and IV polishing is less abundant and, particularly in Phase IV, many painted vessels were left unpolished. Collared bowls were always unpolished except in Phase IIIa. The one cooking vessel and the small objects, including figurines, spindle worls, the rattle and the whistle, were also unpolished.

Incising

Incising is common on objects from all phases represented in the collection from Site F. It is most frequently found on stirrup spout bottles and on jars with figures or faces depicted on the neck and/or chamber.

Incision was almost always done before firing when the clay was quite soft. Three instruments for producing incision can be distinguished from the evidence of their use on the ceramic objects. These are: the serrated edge of a small cockleshell for making a punctate line, a small circular tube (perhaps a bird bone or a hollow plant stem) for making a circle, and a pointed object for making lines and dots. The use of a cockleshell occurs only on some of the spindle whorls found in Grave 14 (Phase I-II). The small circular tube was also used only on objects from Phase I-II. It was used on the spindle whorls for decoration and on a miniature figure jar to define the eyes. A pointed object for making lines and dots was used in all periods represented in the collection. It was frequently used in conjunction with stamping and modeling for elaboration, emphasis, or to define certain features such as ornaments and details of dress.

Incision after firing is found on only four objects in the collection. Each of these was a stirrup spout bottle. Three were from Phase IIIb (4-2677, 4-2693, 4-3258) and one from Phase IV (4-3100). In each case the incision cut through a layer of red slip which had been applied over a white slip and thus left a narrow line of white showing through. In this manner, fine details were added to designs that had previously been drawn in the red slip.

Firing

It is difficult to reconstruct details of the firing techniques used by Moche potters. Tello suggested that the firing techniques were similar to those of the present-day native potters of Ancash, the pots

being stacked one on top of another and surrounded by fuel in an open pit.[16] This explanation seems probable, since a large proportion of the vessels from Site F have localized discolorations or fire clouds, a result of contact with fuel during firing.

Nearly all Moche ceramics were fired in an oxidizing atmosphere which produced the reddish color. Considerable sophistication in firing technique is demonstrated by the fact that the ceramics are almost invariably evenly colored throughout a cross section of their walls. Thus the combination of temperature, time, and draft was adequate for full oxidation. For the most part, only on an occasional jar or large bowl is there any evidence of fire streak to indicate that one of these three factors was not adequately controlled. It is interesting to note that the inner surfaces of some of the stirrup spout vessels and, less frequently, other vessels with constricted openings, are gray in color. This gray color is the result of insufficient circulation of air within the vessel to oxidize the clay during the firing process, the clay being reduced as a result. This effect, however, appears to have been accidental, and very likely was not even realized by the Moche potters.

Four vessels in the collection, all stirrup spout bottles, are basically grey in color (4-2711, 4-2914, 4-2916, 4-3118). These vessels were slip-painted prior to firing and are of shapes and vessel types that are generally red and white. The grey coloration may therefore be the accidental result of a lack of sufficient air circulating around these vessels while they were being fired.

Three vessels in the collection from Site F show signs of overfiring, that is, firing at such a high temperature that the vessels were deformed, the body being softened by too rapid vitrification. In each case the vessels showed signs of warping, and the slips which had been applied to them were slightly crazed. Two of the vessels were stirrup spout bottles of Phase II-III (4-2675, 4-2685), and one was a collared bowl of Phase IV (4-3042). In each instance the overfiring appears to have been accidental.

The collection from Site F contains eighteen vessels of blackware. These vessels were the products of a special firing process. Furthermore, it is apparent that this process was deliberately employed rather than accidental, since (1) it occurs only on stirrup spout vessels and is never found on other forms, and (2) the vessels of blackware were not slip-painted as was almost every other stirrup spout vessel in the collection.

If the production of blackware was deliberate, certain inferences can be made about how its firing differed from the method explained above. The black vessels were very likely fired first in an oxidizing atmosphere. Once the temperature was sufficient for sintering to occur, however, additional fuel was added, and the fire covered over with sand. The additional fuel would produce smoke, thereby depositing carbon on the surface of the vessel and giving it its characteristic black sheen. Meanwhile, the smothering of the fire would create a scarcity of oxygen and an increase of carbon monoxide, thus causing reduction of the paste, making the interior of the vessel wall gray.

Blackware vessels are found in all phases represented in the collection from Site F except Phases I-II, III-IV, and IV. The greatest number (12 out of 18) of blackware vessels is found in Phase IIIb.

Firing techniques seem to have remained constant throughout the phases represented in the collection. The vessels from Phase IIIb have the finest appearance, but it is impossible to say to what extent this effect is a result of improved firing techniques.

Organic Black Pigment

Black pigment was added to some of the vessels for decoration. This pigment appears to have been an organic liquid which was painted on the vessels after they were fired. These vessels were then heated in order to scorch the substance onto the surface. The application of this pigment was always done positively; no examples of negative painting were found.

As previously noted, the basic color scheme of Moche ceramics was created with red and white slip pigments. Organic black was only applied to vessels which already had both of these colors and was never used to produce a black and red or a black and white vessel. Black was merely a secondary feature used by Moche potters to produce increased elaboration and detail.

In the collection from Site F, less than five per cent of the vessels show signs of having black pigment added. It should be noted, however, that the black is fugitive and may well have been applied to a greater number of vessels than those on which it is now found. All phases except Phase IV include vessels with black pigment. It is generally found on jars and stirrup spout bottles, though it also occurs on collared bowls, dippers, indented jars, and whistling bottles. It apparently was not used on other ceramic objects.

Conclusions

A certain amount of development can be noted in Moche ceramic technology. Although the vast majority of techniques and forms were present in Phase I-II, both underwent an elaboration and refinement in Phases II and II-III. In Phase IIIa, the peak of technological excellence was reached. This peak was maintained in Phase IIIb, during which time many extremely elaborate forms were produced. New techniques of molding and stamping were experimented with, although nothing which influences later periods was developed. Phase III-IV shows the beginning of a decline in craftsmanship which continued into the next phase. By Phase IV, technical excellence is noticeably lacking in the majority of the ceramic objects. Several new vessel forms appeared but, in general, are quite simple and frequently appear to have been mass produced. Nevertheless, figure painting continued to be skillfully done, and the sculptured head form of stirrup spout bottle, which was developed in Phase IV, is the form most highly prized by modern collectors.

Notes

[1]Larco, 1948.

[2]Kroeber, 1925, pl. 57d-g; i; pl. 58b-e, g, j-l.

[3]Kroeber, 1925, pl. 57h.

[4]Kroeber, 1925, pl. 54a-f; pl. 67b.

[5]Human heads: Kroeber, 1925, pl. 54k, pl. 55c; seated figures: Kroeber, 1925, pl. 53d-f, h-k; pl. 54h, i; plants or animals: Kroeber, 1925, pl. 55e, j; pl. 56d-f.

[6]Tello, 1938, pp. xxxv, xxxvii; Hébert, 1902, p. 4.

[7]Thompson, 1963.

[8]Linné, 1925, p. 85, and others.

[9]Linné, 1925, pp. 80-81; Tello, 1938, pp. xiv-xvii.

[10]Stamps: Tello, 1938, pp. xxviii, xxxiv, xxxv; matrix: Tello, 1938, p. xxxvii.

[11]With the possible exception of lids for indented jars, although these lids are just as likely to have been made in a shallow mold or formed over the bottom of a bowl.

[12]Junius B. Bird of the American Museum of Natural History kindly furnished me with information regarding the experiments of Robert Sonin, New York City, who has also succeeded in reproducing Peruvian stirrup spouts. Bird reports that Sonin found it helpful to pinch the ends of the tubes to seal them before bending. The air trapped within the tubes helps to prevent crimping when the tubes are bent. I tried this technique and found that it did facilitate the bending process somewhat. Satisfactory stirrup spouts can also be produced without pinching the ends of the tubes, however.

[13]Linné, 1925, pp. 104-108.

[14]Linné, 1925, pp. 106-107.

[15]Guthe, 1925, p. 56.

[16]Tello, 1938, pp. xvi, xvii.

Bibliography

Guthe, Carl Eugen
1925 Pueblo pottery making; a study at the village of San Ildefonso. Papers of the Southwestern Expedition, no. 2. Published for the Department of Archaeology, Phillips Academy, Andover, by the Yale University Press, New Haven.

Hébert, Jules
1902 Quelques mots sur la technique des céramistes péruviens. Journal de la Société des Américanistes de Paris, tome IV, no. 1, pp. 1-7. Paris.

Kroeber, Alfred Louis
1925 The Uhle pottery collections from Moche. University of California Publications in American Archaeology and Ethnology, vol. 21, no. 5, pp. [i-ii], 191-234. Berkeley.

Larco Hoyle, Rafael
1948 Cronología arqueológica del norte del Perú. Biblioteca del Museo de Arqueología "Rafael Larco Herrera," Hacienda Chiclín, Trujillo. Sociedad Geográfica Americana, Buenos Aires.

Linné, Sigvald
1925 The technique of South American ceramics. Göteborgs Kungl. Vetenskaps- och Vitterhets-Samhälles Handlingar, fjärde följden, band 29, no. 5. Göteborg.

Tello, Julio César
1938 Arte antiguo peruano; album fotográfico de las principales especies arqueológicas de cerámica Muchik existentes en los museos de Lima. Primera parte, tecnología y morfología. Inca, vol. II. Lima.

Thompson, Donald E.
1963 A mold matrix from Peru. American Antiquity, vol. 28, no. 4, April, pp. 545-547. Salt Lake City.

Table I

Quantitative Summary of the Uhle Collection from Site F, Moche

Phase	Grave*	Stirrup Spout Vessels	Non-Stirrup Spout Vessels	Other	Total
I-II	14	7	11	16	34
II	13	4	4	-	8
	20	1	1	-	2
	30	4	-	-	4
II-III	33	17	5	-	22
	16	18	13	-	31
IIIa	32	8	4	-	12
	2	8	1	-	9
	10	14	22	-	36
	11	9	6	-	15
IIIb	3	10	1	-	11
	29	3	6	-	9
	28	1	2	-	3
	26	23	11	-	34
	22	2	2	-	4
	21	3	2	-	5
	27	2	1	-	3
	12	43	11	-	54
	4	3	6	-	9
	5	2	-	-	2
III-IV	6	4	13	-	17
	19	7	8	-	15
IV	9	5	18	-	23
	8	1	9	6	16
	7	4	7	-	11
	23	8	74	1	83
	25	2	10	-	12
	18	2	-	-	2
	15	8	34	-	42
				Total	528

*Graves are numbered 1-23, 25-30, 32-33, according to the numbers assigned to them by A. L. Kroeber. There are no graves corresponding to the numbers 24 and 31.

Table II

Division of Non-Stirrup Spout Vessels by Phase

	Phase							
Type of Vessel	I-II	II	II-III	IIIa	IIIb	III-IV	IV	Total
Cooking vessel	1	-	-	-	-	-	-	1
Indented jar	2	-	1	-	-	-	-	3
Collared bowl	1	-	-	3	-	1	12	17
Dipper	-	3	-	4	-	1	2	10
Double chambered whistling bottle	-	-	-	-	2	-	-	2
Flaring bowl	-	-	-	-	2	1	20	23
Ring base bowl	-	-	-	-	-	1	-	1
Rattle base bowl	-	-	-	-	-	-	10	10
Spout and handle bottle	-	-	-	-	-	-	14	14
Jar	7	2	17	26	38	17	94	201
Total								282

Key to Illustrations

All specimens illustrated were excavated by Max Uhle at Site F, Moche, in 1899 and are now in the Robert H. Lowie Museum of Anthropology, University of California, Berkeley. Numbers with the prefix 4- are museum catalogue numbers.

Plate I

Fig. 1. Dipper, 4-3355, Grave 33, Phase II-III. Height of chamber, 10.5 cm.

Fig. 2. Flaring bowl, 4-2753, Grave 6, Phase III-IV. Height, 10 cm.

Fig. 3. Ring base bowl, 4-2749, Grave 6, Phase III-IV. Height, 12 cm.

Fig. 4. Indented jar, 4-2996, Grave 14, Phase I-II. Height, 12.5 cm. See also Kroeber, 1925, pl. 59f.

Fig. 5. Cooking vessel, 4-2997, Grave 14, Phase I-II. Height, 10.5 cm.

Fig. 6. Collared bowl, 4-3015, Grave 14, Phase I-II. Height, 10.5 cm. See also Kroeber, 1925, pl. 67c.

Fig. 7. Spout and handle bottle, 4-3031, Grave 15, Phase IV. Height, 20 cm.

Fig. 8. Rattle base bowl, 4-3179, Grave 23, Phase IV. Height, 11.5 cm.

Fig. 9. Jar, 4-3119, Grave 20, Phase II. Height, 24 cm.

Fig. 10. Double-chambered whistling bottle, 4-3262, Grave 26, Phase IIIb. Height, 16 cm. See also Kroeber, 1925, pl. 56l.

Plate II

Figs. 11-16. Making the chamber of a stirrup spout bottle. 11, two-piece mold; 12, clay pressed into both halves of the mold; 13, the mold removed, leaving the lower portion of the chamber; 14, coiling the remainder of the chamber; 15, sealing the chamber; 16, the completed chamber.

Figs. 17-19. Making the stirrup spout. 17, slab of clay from which the spout is made; 18, wooden rods over which the spout is formed; 19, rolling the clay onto the wooden rods. Sequence continued on Plate III.

Plate III

Figs. 20-22. Making the stirrup spout (continued from Plate II). 20, joining the three sections; 21, spout with the rods removed prior to bending into stirrup form; 22, completed spout.

Figs. 23-28. Joining the spout and the chamber. 23, holes punched in chamber, coils of clay used to reinforce the spout; 24, cutaway view showing chamber and spout; 25, vessel with vertical slit made in the shoulder and opened; 26, cutaway view showing swab being used to ream out the passageway where the spout joins the chamber; 27, shoulder of spout being pressed back into its original shape; stirrup spout bottle completely formed.

Plate IV

Fig. 29. Cross section of a stirrup spout bottle. a, ridge of clay resulting from the slit made in the shoulder of the stirrup in joining the spout to the chamber; b, lump of clay resulting from the closing of the chamber; c, fully cleared passageway between the spout and the chamber. Specimen 4-3301, Grave 26, Phase IIIb. Height, 20 cm.

Fig. 30. Cutaway view of stamp-marked stirrup spout bottle. a, wall of chamber pushed outward, forming a relief design on the outer surface; b, lump of clay on bottom of chamber. Specimen 4-3078, Grave 16, Phase II-III. Height, 17 cm.

Fig. 31. Cutaway view of stirrup spout bottle with a closed jar neck. a, end of jar neck inserted into the chamber; b, coil of clay used to reinforce the junction between the jar neck and the chamber; c, ring base formed by adding a coil of clay to the bottom. Specimen 4-3138, Grave 23, Phase IV. Height, 23 cm.

Fig. 32. Front and side view of a stirrup spout bottle of which both chamber halves were made in the same mold. Note matching relief design on both sides, wide raised band along the vertical seam, and uneven finish where the two halves join. Specimen 4-2958, Grave 12, Phase IIIb. Height, 21 cm.

Fig. 33. Front and side view of a figurine made in a two-piece mold. Specimen 4-3249, Grave 25, Phase IV. Height, 7.5 cm.

Fig. 34. Front and side view of a figurine made in a one-piece mold. Specimen 4-3248, Grave 25, Phase IV. Height, 8.5 cm.

Fig. 35. Front and side view of a whistle made in a one-piece mold with the whistle mechanism added on the back side. Specimen 4-3185, Grave 23, Phase IV. Height, 12.2 cm.

Fig. 36. Front and side view of a rattle made in a two-piece mold. Specimen 4-3253, Grave 25, Phase IV. Height, 10 cm.

Plate I. Shapes of Mochе pottery, except stirrup spout bottle (figs. 1-10). See key to illustrations for identification.

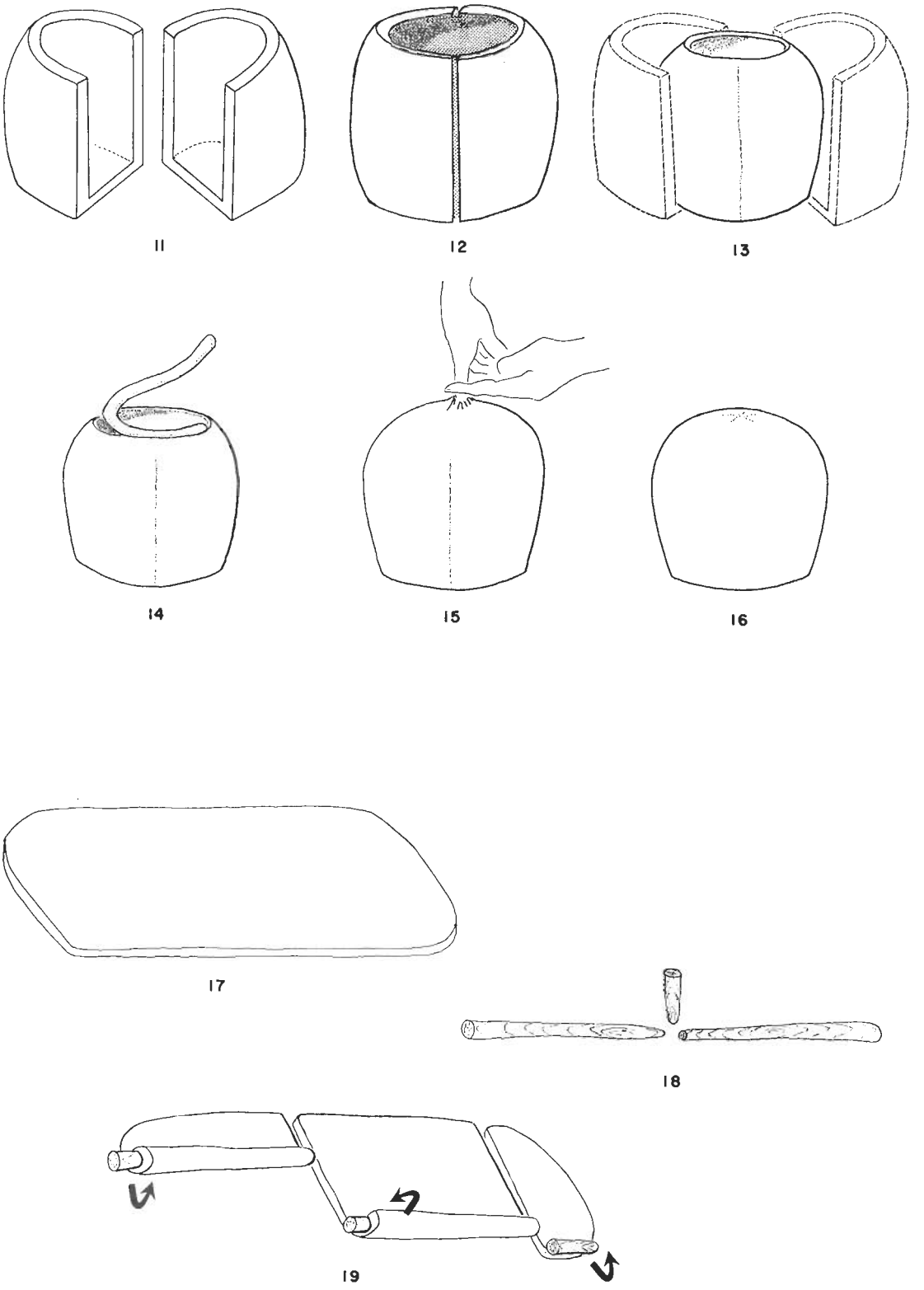

Plate II. Making the chamber of a stirrup-spout bottle (figs. 11-16); making the stirrup spout, first steps (figs. 17-19). See Plate III for continuation of this sequence and see key to illustrations for explanation.

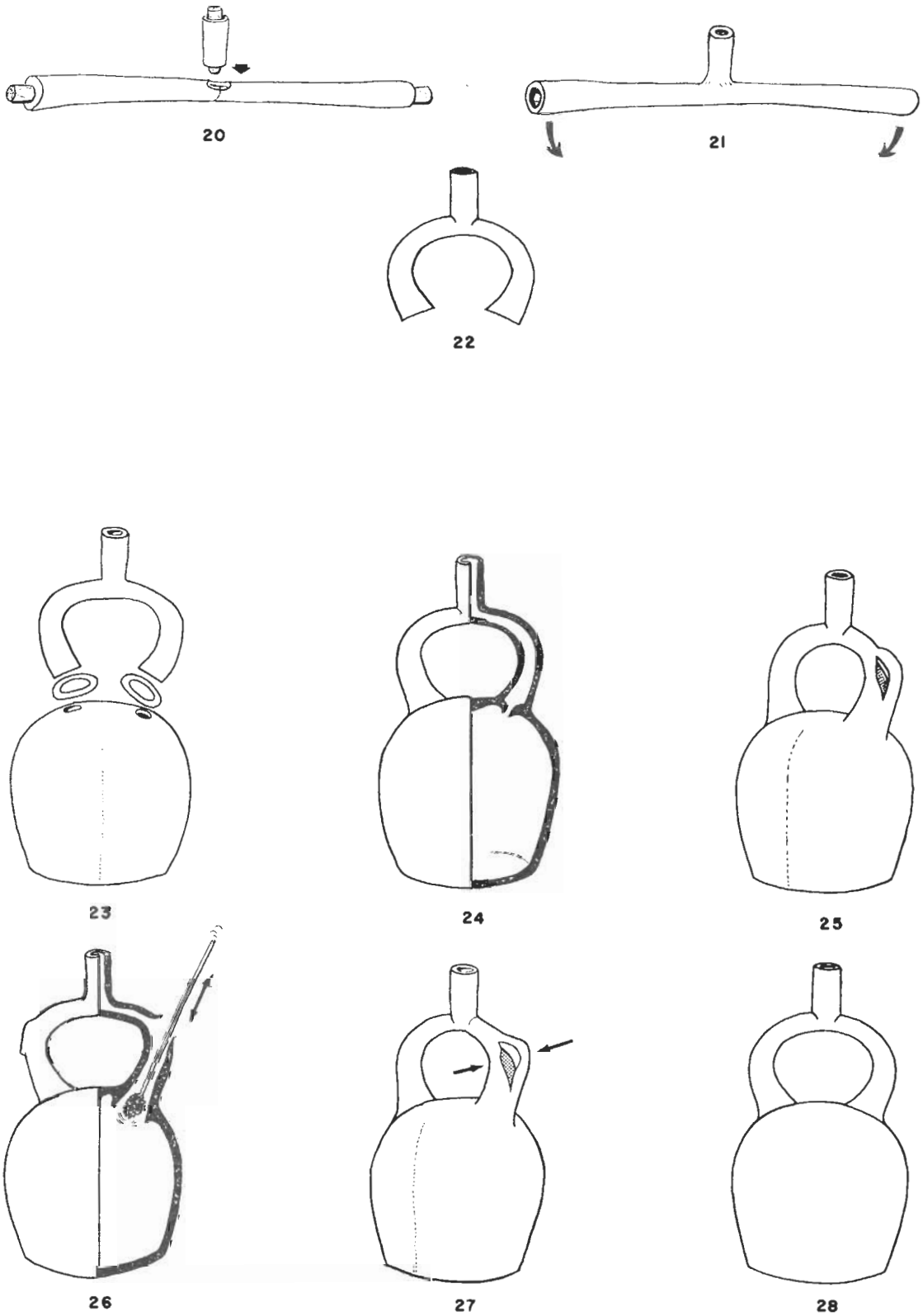

Plate III. Making the stirrup spout; sequence continued from Plate II (figs. 20-22); joining the spout and the chamber (figs. 22-28). See key to illustrations for explanation.

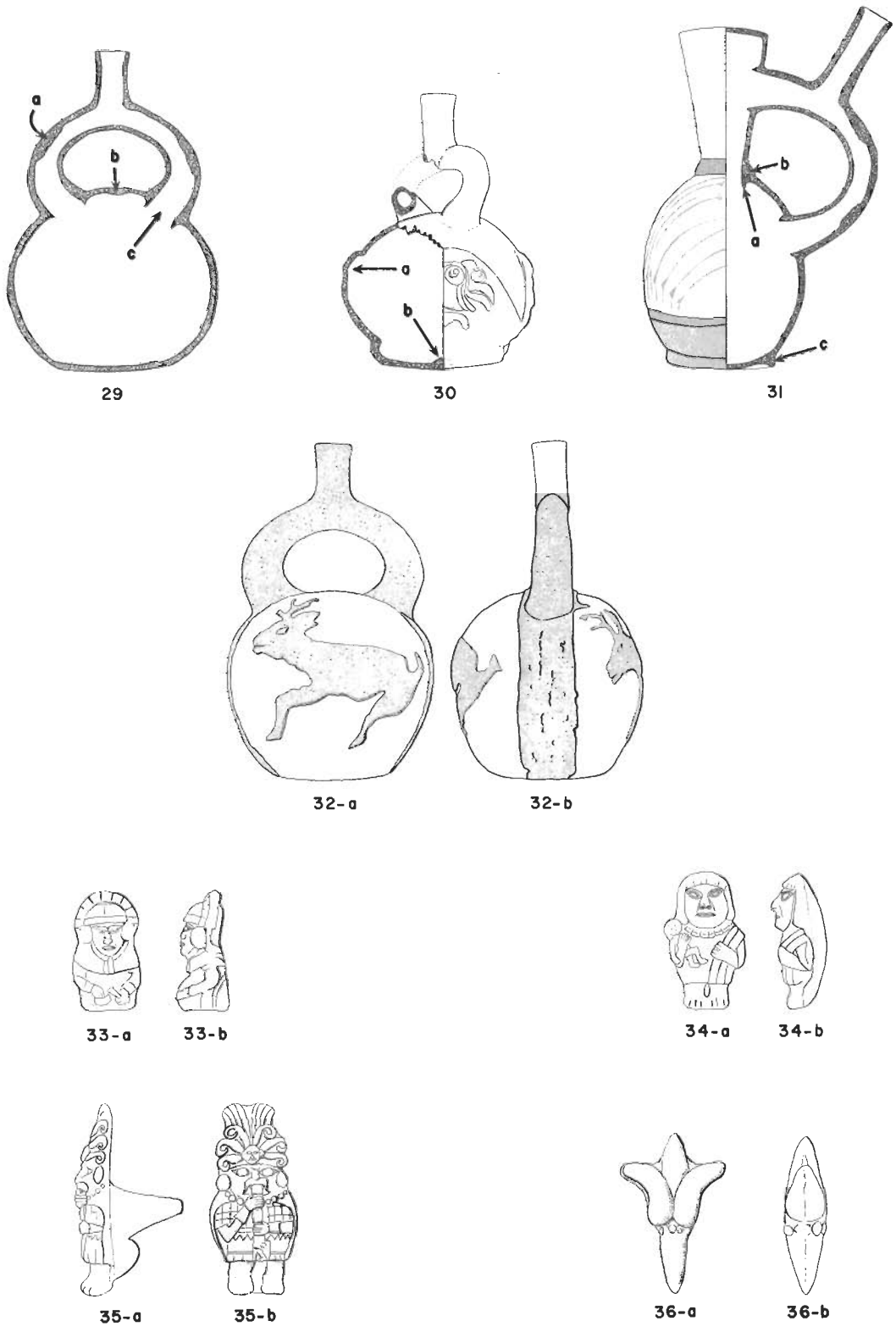

Plate IV. Examples of stirrup spout bottles illustrating methods of manufacture (figs. 29-32); figurines (figs. 33-34), whistle (fig. 35), and rattle (fig. 36). See key to illustrations for explanation.