AN ABSTRACT OF THE THESIS OF

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Title: POTTERY MANUFACTURE ANALYSIS: AN EXPERIMENTAL MEANS FOR ASSESSING TECHNOLOGICAL CONTINUITY IN THE ALTAMONT REGION.

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Thomas Clark Hogg

Pottery manufacture analysis, an aspect of experimental archeology, is developed and used to compare and test through experimental reconstruction, data on pottery from the Altamont region (southern Alberta, Canada and northcentral Montana, U.S.). The analysis uses major variables of (1) manufacturing process and (2) product characteristics to formulate models of the technologies tested. The results indicate both technological continuity and discontinuity between pottery complexes of the prehistoric archeological record (A.D. 1500-1700) and the historic ethnographic accounts (A.D. 1800-1900).

Three ethnographically described pottery traditions (Handbuilt, Rawhide Mould, and Ground Mould) of the Blackfoot Tribe are compared to three prehistoric complexes (Cluny, Intermountain, and Saskatchewan Basin). Pottery manufacture analysis indicated: technological discontinuity

between historic Handbuilt Tradition and prehistoric Cluny Complex; technological continuity between historic Rawhide Mould Tradition and prehistoric Intermountain Ware; and technological continuity between historic Ground Mould Tradition and prehistoric Saskatchewan Basin Complex.

Using the technique of experimental replication, it has been shown that pottery may be manufactured successfully using rawhide and ground moulds and that moulded pottery traditions are of greater antiquity than has been previously accepted. Blackfoot ethnographic accounts of pottery manufacture are shown to be usable and useful sources of information. The pottery described in these accounts is of traditions represented in prehistoric complexes. These traditions were sophisticated adaptations to the life-ways of nomadic bison hunters of the Altamont region. Experimental replication with pottery manufacture analysis allows reasonable hypotheses to be advanced concerning the spatial and temporal relationships between cultural groups inhabiting the Great Plains.

Pottery Manufacture Analysis: An Experimental Means for Assessing Technological Continuity in the Altamont Region

by

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This continuation of "The Case for Blackfoot Pottery" began in a seminar on prehistoric ceramics held at MSU (Bozeman, MT) in 1973, taught by Les Davis and Tom Roll. At that time, I became interested in the accounts of pottery manufacture collected from tribes in the Northwestern Great Plains. I was amazed that these accounts were generally recognized as 'inaccurate and unusable information' in most of the literature when the technologies had never actually been tested. That reaction resulted in the present research as a means of testing these technologies. The pottery manufacturing methods described are unlike any previously recognized and at first seem to be unworkable. But as this research has shown, the ingenuity of the Plains Indians should not be underestimated.

In completing this research, I would like to acknowledge the following people and thank them for their interest and assistance: the Anthropology staff at OSU, particularly Thomas Hogg, for encouragement and much constructive criticism; Marian Bowman, for understanding that art and science can be combined in a creative and systematic endeavor; Henry TenPas, for insight into the philosophy that motivates modern scientific and educational thought.

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A.W.S.

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POTTERY MANUFACTURE ANALYSIS: AN EXPERIMENTAL MEANS FOR ASSESSING TECHNOLOGICAL CONTINUITY IN THE ALTAMONT REGION.

I. INTRODUCTION AND METHOD

> "Let us suppose that the idea of art can be extended to embrace the whole range of man-made things, including all tools and writings in addition to the useless, and poetic things of the world. By this view, the universe of man-made things simply coincides with the history of art. It then becomes an urgent requirement to devise better ways of considering everything man has made."
>
> - George Kubler
> The Shape of Time, 1962

INTRODUCTION

The primary concern of this research is developing the method of pottery manufacture analysis, applying it to the Altamont region of the northwestern Great Plains, and through that application, testing the usefulness of the method as an indicator of technological continuity or discontinuity. Through pottery manufacture analysis the pottery technologies of the prehistoric archeological record (A.D. 1500-1700) and the historic ethnographic record (Blackfoot Tribe A.D. 1800-1900) are reconstructed through experimentation. This allows comparison of the two records and a resulting indication of similarity/continuity or dissimilarity/discontinuity over the intervening period (approximately A.D. 1700-1850).

The Altamont encompasses the plains of southern Alberta, Canada, and northcentral Montana, United States, hence the name. The region

extends from the foot hills of the Rocky Mountains; from the Sun River north to the drainage of the Red Deer River. The Altamont is a geographic unit of the Northern High Plains in vegetation and wildlife as well as climate and general topography. As a means of bridging the gap between the prehistoric and historic records, the Altamont region was chosen to be the subject of a concentrated study for the development and testing of pottery manufacture analysis.

A gap between the prehistoric and historic records is a common problem throughout the northwestern Great Plains. This gap in the record is complicated by several other factors. The intervening time period (A.D. 1700-1800) was marked by cultural groups being displaced by the expanding white culture, which in turn forced other groups to the west to be displaced. The introduction of the horse resulted in increased mobility. The use of the gun changed hunting and raiding patterns. Epidemics of European diseases spread through the tribes. These factors contributed to shifts in the populations and their geographical locations (Secoy 1953; Lewis 1942). The problem of determining geographic shifts of populations through the region in pre-white-contact days is presently a major concern of anthropologists and archeologists working in the region.

To develop a comprehensive hypothesis of what happened in this area during the intervening period, it may be necessary in the future to apply pottery manufacture analysis to pottery technologies of many groups thought to have been in the area (Cree, Chippewa, Kutenai, Shoshoni, Crow, Assiniboine and Gros Ventre). It will also be of

utmost importance to establish a more complete chronology for the region based on archeological data. Cultural components defined within this chronology should be as complete as possible; including pottery, projectile points, features, and other relevant data. Inferences may then be made about the diffusion of cultural traits and technologies, migrations of cultural groups, and possible links may be indicated between historical groups and archeological sites. This study is concerned with developing the method of pottery manufacture analysis and applying it to the Altamont region. The method is not restricted to possible use in the Plains area. The content to which it may be applied is highly variable. Conceivably, the method would be applicable to any area of ceramic manufacture and cultural group that has manufactured pottery. As such, it promises to be a highly useful tool for archeologists.

> "Experimental archaeology then cannot and does not pretend to prove anything. It provides a tool by which some of the basic economic activities of ancient man, those concerned primarily with subsistance and technology, can be assessed for their development and their competence. As such it can and should lead on to further considerations of patterns of human behavior, the concern of archeology as a science and as a humanity" (Coles 1973:18).

Ethnographic data (A.D. 1800-1900) from the Blackfoot Tribe, historic inhabitants of the region, indicates knowledge of pottery manufacturing technologies in use prior to the mid-1800's. Presently, no products of these Blackfoot technologies have been identified. In "The Case for Blackfoot Pottery", (1945), Ewers summarized accounts given by Blackfoot informants and early travelers to the Altamont.

The contents of the accounts are diverse. The primary methods of manufacture were moulding - either using a rawhide mould or a hollow in the ground. Mention is made of holes punched in the sides of the pots through which a handle was passed. The pots were rubbed with grease and fired. Ewers concludes that probably very little pottery was made after 1825, due to the introduction of metal kettles through trade (1945:296);

> "While we need no longer doubt the existance of Blackfoot pottery, we would wish for better knowledge of some of its implications" (1945:298).

Until recently, ceramic remains in the archeological record had been largely ignored. W. J. Byrne discusses this situation in "The Archeology and Prehistory of Southern Alberta as Reflected by Ceramics" (1973). Byrne points out that the often quoted scarcity of pottery is relative. When compared to the Middle Missouri and Eastern Woodland regions, the pottery numbers did look trivial, but, in the pottery bearing sites in southern Alberta, the pottery remains constitute a high percentage of the total artifact inventory (1973:iv).

Byrne uses pottery trait analysis as a means of determining cultural complexes and chronology for the region from A.D. 200 through A.D. 1700. He nevertheless recognizes that,

> ". . .for the interval between A.D. 1700 and A.D. 1800, it is almost impossible to determine just what tribal groups were present in southern Alberta and adjacent territories, and to what extent their respective territories reached" (1973:513).

The works of Ewers (ethnographic data, A.D. 1800-1900) and Byrne (archeological data, A.D. 1000-1700) are key sources of background

information for this study. The presence of excavated pottery remains and ethnographic reports of pottery manufacturing technologies led to the development of the pottery manufacture analysis method as the means of bridging the time gap (A.D. 1700-1800) that separates the two sources of information.

The results of pottery manufacture analysis bring about the reinterpretation of some problematic features that have been found in late prehistoric sites. One feature commonly called a "postmould" may be reinterpreted to be a pottery mould. This feature usually consists of a hollowed, round hole in the ground, approximately 5 to 40 centimeters deep and about 10 to 90 centimeters in diameter (rough average dimensions), (Byrne 1973:18). Postmoulds sometimes contain pieces of bone pushed vertically into the hole (Byrne 1973:23). It is thought that these were supports for poles used for drying racks or corrals. Often, however, the postmoulds are U-shaped, filled with a mixture of loose dirt, ash, charcoal and the edges show fire-reddened areas (Byrne 1973:22-23, Fig. 8). This may correlate with an account mentioned by Ewers which states that Blackfoot pottery was moulded in a hollow in the ground and then a fire built on top of it (1945:293-4). This is a moulding and firing method that will be tested in this project.

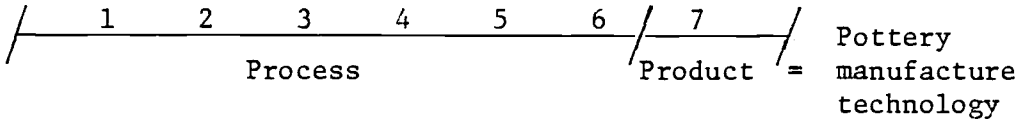
By reconstructing the pottery manufacture technology, it can be determined whether or not it was once a viable form and it is possible to test features and find alternative explanations for them. These new explanations in turn can allow the features to be used as an indicator of that particular technology within a larger cultural component.

The occurrence of the technology may be traced through time and space by the occurrence of the pottery and the U-shaped pit features. The results of the pottery manufacture analysis will, in all cases, have to be compared to other data from archeological and ethnographic sources to correlate the experimental results' relevance and validity. Although pottery manufacture analysis does not provide conclusive evidence, the inferences drawn from it can provide a working hypothesis with which the archeologist can further investigation.

METHOD

Pottery manufacture analysis is just what the name implies. Technology is made up of a process and a product (Dewey 1964:141-159). For a study of a technology to be complete it must include study of both the process and the product. By studying both of these aspects of ceramic technology, we develop a more complete picture than if only one or the other were studied. In pottery manufacture analysis, the two groups of data, archeological and ethnographic, are analyzed within the same framework of variables. These variables are the procedures of pottery manufacture (the process) and the characteristics of the pottery (the product): (1) the materials used (clays and tempers), (2) preparation of materials, (3) pottery forming methods, (4) decorating methods, (5) firing methods, (6) utilization of the pottery, and (7) physical characteristics of the pottery; material composition (clay, temper, color, hardness) and style (surface finish, vessel form and decoration).

A pottery manufacture technology is defined as a process and a product. The seven variables are arranged in the following way: (Variables one through six describe the process of making pottery, variable seven describes the product - the finished pottery).

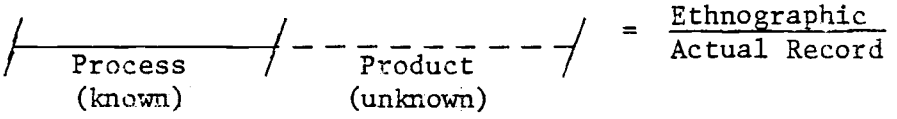


In light of Osgood's concept of techniculture, the process/product definition of pottery manufacture technology takes on added meaning.

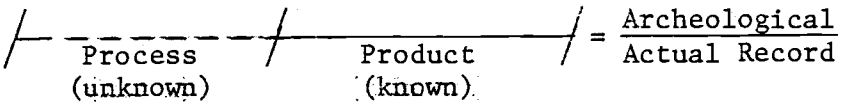
> In defining techniculture, Osgood says, "To begin with, it is significant that we can distinguish the behavior which results directly in the manufacture of material objects. This segment of social culture has significance because it is inseparable from the description of the material which is confined to the use of a single manufactured object" (1957:211-212).

The study of technology is more complete when the behavioral process and the physical product both are considered, than when only the physical product is considered.

The ethnographic record (A.D. 1800-1900) of pottery manufacture for the Blackfoot culture in the Altamont region is incomplete. Accounts from informants and travelers to the region tell us what the process of manufacturing pottery was like. The pottery itself has not been identified or found. In this case we have accounts of what the process was, but do not have the product:

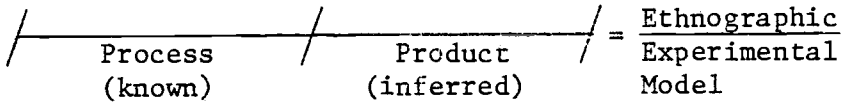


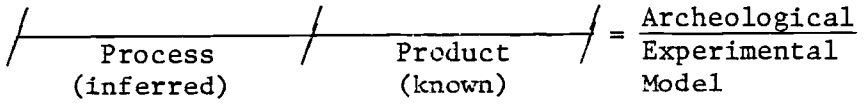
The archeological record (A.D. 1000-1700) of the same region contains pottery remains. There is no ethnographic information to accompany the pottery. With this data set, we have the product of the technology, but no account of this process(es):



As shown above, both the actual records of the ethnographic and the archeological data are incomplete and in opposite ways. This is what has made comparison of the two data sets virtually impossible.

An experimental model of each technology may be formed by inferring the unknown from what is known. These experimental models are then complete models of the technologies, containing both the process and the product of the technology:





Through reconstruction using materials native to the area under study, the experimental models are formed. Each experimental model is then checked against itself and the data from which it is formed. If the inferences were made correctly and the experiment was carried out properly, the results (the product) should correlate with the methods used (the process). When the reconstruction of the experimental models has been completed, then the archeological model and the ethnographic model can be compared on the basis of the seven variables with which the models were defined.

The comparison is made in terms of similarities and differences between the two sets. The final result is one of overall similarity or difference between the two technologies. A result of similarity should indicate technological continuity in pottery manufacture between the two sets and across the intervening time period. A result of dissimilarity should indicate technological discontinuity between the two sets. Inferences of technological continuity or discontinuity made through pottery manufacture analysis will aid anthropologists in forming hypotheses about the movements of different prehistoric cultures through the plains area and about their persistence through time.

II. REVIEW OF THE ARCHEOLOGICAL AND ETHNOGRAPHIC DATA

Ceramic material is one of the most enduring material manifestations of human culture. The study of ceramic items has often been used by anthropologists in reconstructing past cultures. This reconstruction is done to further our understanding of human experience - to recapture and record past adaptations and cultures.

Until recently, archeologists studying the northwestern Great Plains had largely ignored the presence of pottery in Late Prehistoric sites.

> "The popular image of the Plains Indian is of a hard-riding hunter who scorned the softness of civilized settlements. Such a people obviously could never be bothered with a luxury as fragile as an earthenware vessel! Yet more and more Prehistorians are coming to realize that even the nomads on the High Plains manufactured pottery before they became able to obtain trade kettles" (A. Kehoe 1959:2).

The increased excavation and documentation of pottery bearing sites has brought about this change in attitude. The majority of pottery finds in northcentral Montana date from the Late Prehistoric (A.D. 1000) to the Proto-Historic (A.D. 1800) (A. Kehoe 1959:2; Davis 1968:49). In southern Alberta, ceramic finds have been documented for the Late Prehistoric. A few specimens are dated as early as A.D. 200 (Byrne 1973:322, 701 - Fig. 42). There have been numerous attempts to classify the pottery remains found in this region into traditions. Mulloy cites seven major traditions for the northwestern Great Plains region as a whole: Mandan-Hidatsa, Upper Republican, Dismal River, Promontory, Woodland, Pueblo, and Intermountain (Mulloy 1958:191).

Of these traditions, two are applicable to the Altamont: Mandan-Hidatsa and Intermountain. A third tradition was defined by Byrne (1973) as Saskatchewan Basin. These three traditions will be briefly described and their significance in the Altamont region discussed. To reassess these pottery traditions and attempt to determine their methods of manufacture, it is necessary to review both the archeological and ethnographic data pertaining to pottery in the Altamont. This will be the topic of the following discussion.

ARCHEOLOGICAL DATA

The ceramic tradition most commonly recognized for the Upper Missouri is referred to as Mandan-Hidatsa. The major occurance of this style is in the western Dakotas. The geographical distribution of Mandan-Hidatsa ware has yet to be well defined. It has been suggested that ceramics in eastern Montana along the Yellowstone River (notably the Hagen Site) and in northeastern Wyoming are of Mandan-Hidatsa tradition and were made by the prehistoric Crow in their westward migration (Mulloy 1942:101; A. Kehoe 1959:3; Frison 1976:44). It is presently not known when the Mandan and neighboring groups of Hidatsa and Arikara began to manufacture pottery. There were still a few potters producing serviceable wares as late as A.D. 1860. There appears to have been a degeneration of the craft in the 19th century brought about by the introduction of trade kettles and movement to the reservations (Wedel 1951:110-111).

A summary of Mandan-Hidatsa pottery manufacturing techniques pieced together from ethnographic and archeological data (Wedel 1951) indicates

that this tradition made use of the paddle-and-anvil technique of forming the pot from a large lump of plastic clay which has been mixed with pounded granite or flint as temper. The paddle-and-anvil technique was used not only to form the vessel, but also to thin, shape and finish it. Decorative incisings were added to the pots. They were set aside to dry and then fired. Most reports indicate that the firing procedure was carried out by placing the pot in a prepared bed of hot coals, heaping it inside and out with the coals, then adding more wood over and around the pot. It was heated red hot, then the fire was allowed to die down and cool before the pot was removed. The finished vessel was greased with fat and rubbed. It was then ready for use as a cooking pot which could be suspended over the fire and used to boil meat and other foods. Pots ranged in size from one quart to five gallons (1951:93-96).

Pottery from the Hagen Site is reportedly of the Mandan-Hidatsa tradition but of somewhat simplified form (Mulloy 1948:38). The pottery still has the typical Mandan form - globular body with a slight "S" shaped neck in cross-section (Mulloy 1942:36) (see Figure 1).

Byrne states that pottery recovered from the Cluny site (EePf-1) in southern Alberta is highly similar to the pottery from the Hagen Site (1973:407). The so-named Cluny complex dates after A.D. 1700, and is thus believed to be a recent intrusion into the area (1973: 366-367, 438). Both the Cluny village site and the Hagen Site were characterized by features such as house and storage pits. Hearths are mentioned and these are very shallow in construction. No other

features are reported (Byrne 1973:473-476; Mulloy 1942:9-11). The Cluny site is an unusual occupation site for this area as it was a fortified village. This may be another similarity to the Middle Missouri sites. Reconstructed Cluny complex vessel forms do appear highly similar to those presented by Mulloy from the Hagen Site.

Pottery similar to Mandan-Hidatsa tradition does occur in the Altamont region. Byrne has identified pottery from sites in north-central Montana on the Milk River drainage near the Bearpaw Mountains and Fresno reservoir as being closely related to Cluny complex ceramics found in southern Alberta on the South Saskatchewan River drainage (1973:413-414). The limited distribution of Cluny complex ceramics and its recent occurrence in the Altamont region would seem to indicate an intrusion into the area. The debate over who these intruders were will not be entered into here. What is significant to this research is that pottery similar to Mandan-Hidatsa pottery was made in the Altamont region in recent times (ca. A.D. 1700-1800). From that data it may be inferred that manufacturing methods used to produce the pottery were similar to those used in the Mandan-Hidatsa tradition. Since the pottery tradition in the Altamont is not strictly Mandan-Hidatsa, but is similar to that tradition, it will be referred to here as Cluny. This represents one pottery tradition of the Altamont.

Intermountain ware was defined by Mulloy as a possible indigenous tradition to the intermountain region (1958:196-203). Examples of this particular ware are distinctive in form, often described as flower pot-like vessels with flanged bases (see Figure 3). Geographical distribution of the pottery type in archeological finds extends from northcentral

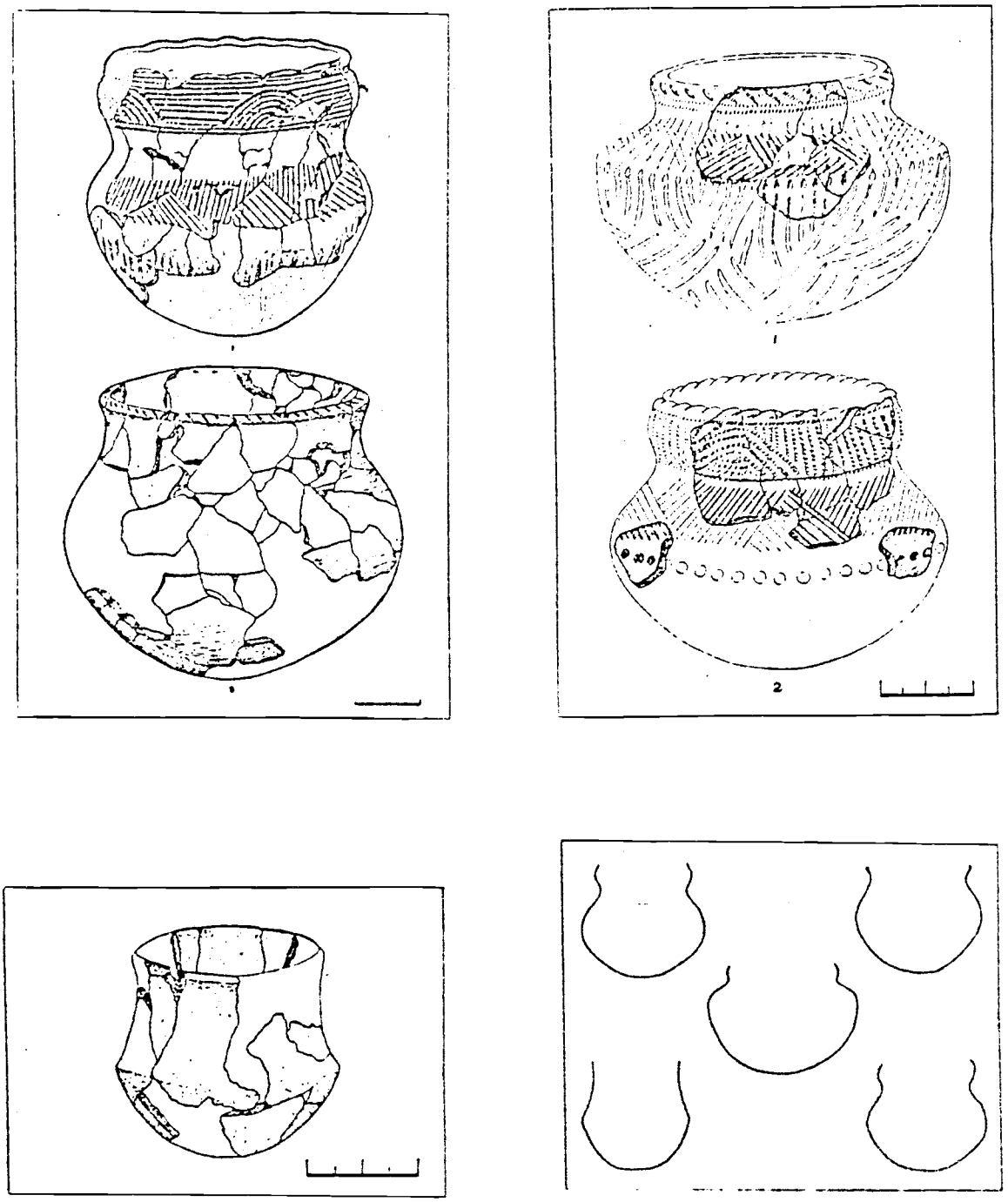


Figure 1. Reconstructed Vessels from the Hagen Site (Mulloy 1948:17, Fig. 6-9).

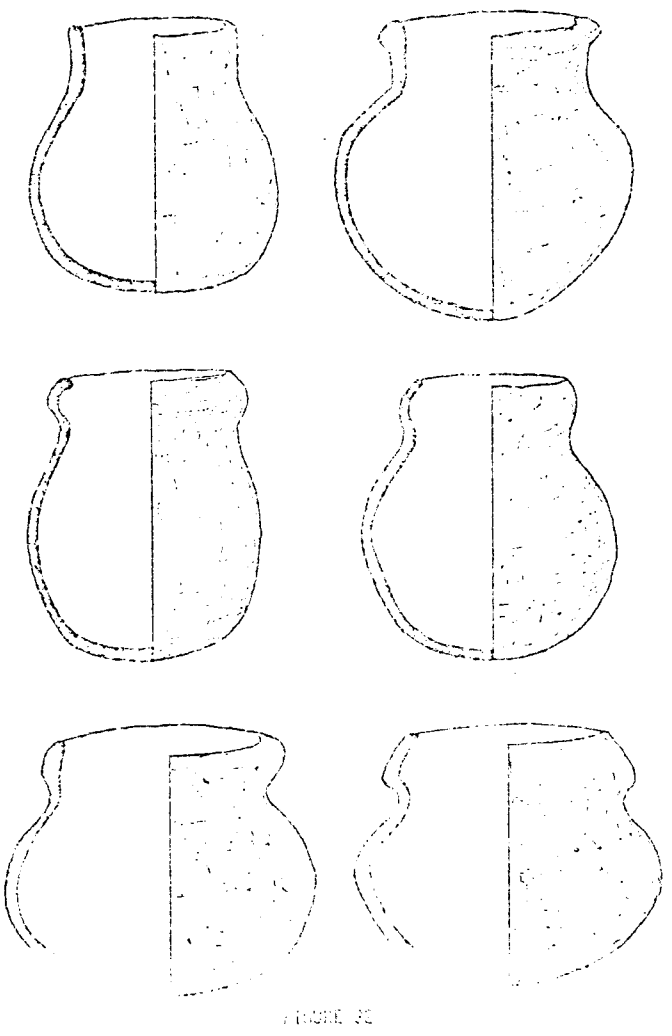


Figure 2. Reconstructed Vessels of the Cluny Complex (Byrne 1973:691, Fig. 32).

Montana, south into the Wyoming Basin and west to the northeastern part of the Great Basin. Intermountain ware has been found in sites bearing other ceramic traditions in Montana and Wyoming. Two sites in northern Montana - 24CH202 in the Missouri Breaks and another west of Great Falls - yielded Intermountain ware:

> "The ceramic affiliations of the Upper Missouri Valley flat bottom sherds are particularly well known. That is, they are obviously representative of the Intermountain ware or complex, a ceramic tradition which was defined by Mulloy (1958:196-203) as being characterized by vessels which are flat bottomed, generally with a flight exterior flange at the base. Straight, outflaring sides usually bend inward very slightly towards the rim, sometimes resulting in a somewhat globular appearance, but more often the appearance is that of a flower pot. The paste tends to be coarse (with lumpy grit temper), both inner and outer surfaces are irregularly smooth, and wall thicknesses vary considerably. Colour varies from grey to buff, often with firing clouds (Arthur 1966:152) and 'no handles, holes, or decorations are known'" (Mulloy 1958:198).

Much of the Intermountain ware that has been collected in Montana and Wyoming has been from surface finds. This makes the pottery difficult to date, although rough estimates made from associations to other artifacts can be made (Mulloy 1958:198). Byrne has suggested a temporal span of A.D. 1100 to historic times (1973:389). Intermountain ware is still rather inadequately documented in the Altamont region. There is mention of its occurrence at only two sites in northern Montana - one near Virgelle and one near Great Falls. A more dense distribution of Intermountain ware has been documented in the southcentral part of the state and in northern Wyoming (Brown 1968:70; Frison 1976:29; Mulloy 1958:199).

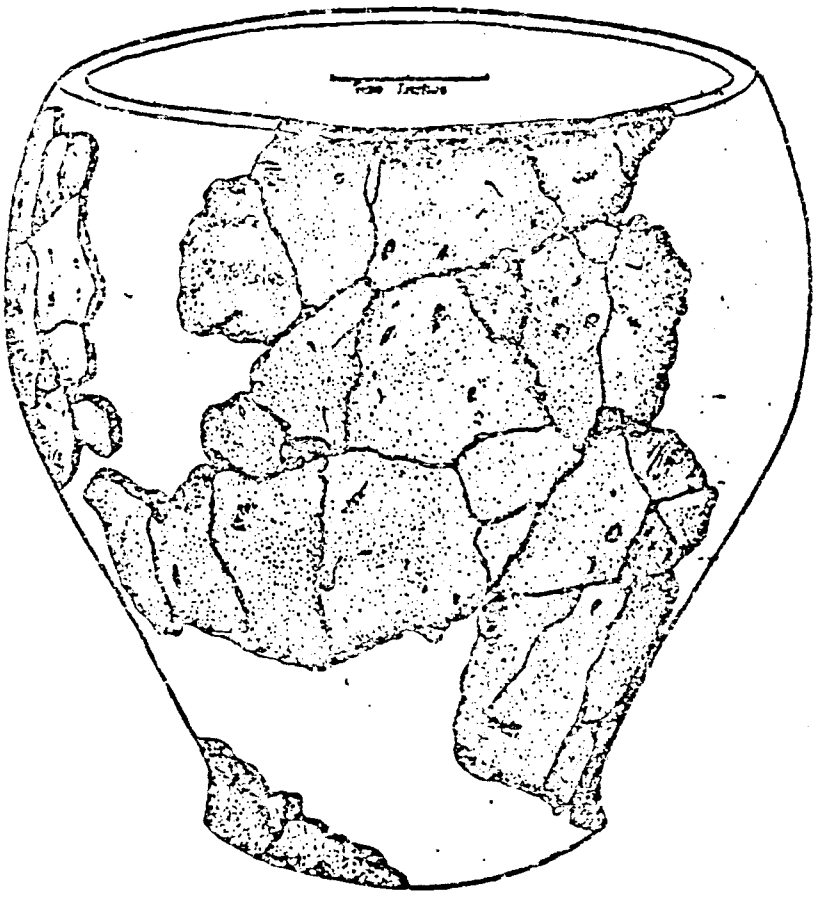


Figure 3. Intermountain Tradition Pot (Mulloy 1958:197, Fig. 71).

Intermountain ware is often credited with Shoshoni origins (1973: 389; Mulloy 1958:199-200). However, Mulloy emphasized that although the Shoshoni may indeed have been responsible for some of the ware, Intermountain pottery more than likely was a regional style which was made by several tribal groups. Ethnographic accounts collected from the Sarcee, Blackfoot, Kutenai, Sanpoil, Lemhi and Bannock show strong similarities to Shoshoni accounts. There is also a strong suggestion that a mould of bark or rawhide was used as the method of manufacture (1958:200-201).

> "The former manufacture of flat bottomed vessels by the Kutenai has been noted by Schaeffer. The pottery appears to be a crude, undecorated utility ware employed largely for food preparation and for water carrying. Vessel types include pots, bowls, and trays. The cooking pot would appear to have had a flat bottom and straight or flaring sides. The descriptions are quite similar to those of the Blackfoot and Sarcee. Paste was clay and tempering appears to have included crushed rock and/or sand, wood ashes, and unidentified adhesives. Vessels were molded within bark forms or in holes in the ground. Some were sun dired and others fired. Opposed rim lugs or a wooden bail set in holes served for carrying" (Mulloy 1958:200-201).

Intermountain ware is represented in the archeological record of the Altamont region, but only in the southern part. Pottery of this tradition was present during the Proto-Historic and may date to the Late Prehistoric. It appears to be a unique tradition, quite different from the Cluny complex in both method of manufacture and finished vessel form. Vessels are characterized by flat bottoms, a basal flange, straight to sloping sides, wider at the top than the bottom. The use of a mould in construction of the vessels is strongly indicated from ethnographic comparison. Mulloy's hypothesis that the tradition was

shared by several tribal groups seems quite reasonable based on the different groups similar descriptions of these vessels. Therefore, it will not be stated that the Intermountain ware present in the Altamont is of exclusive Shoshoni manufacture. Intermountain ware constitutes a second ceramic tradition of the Altamont region.

A third pottery tradition is represented in the archeological records of the Altamont. Wares of this tradition have been excavated at the Ethridge Site and Galata Site in northcentral Montana and at numerous sites in Alberta, notably the Morkin Site. This pottery tradition was as yet unidentified when Mulloy wrote his article on pottery in the Northwestern Plains (1958:202).

> "The wrapped rod impressions and grooved paddle impressions may suggest something related to the Mandan-Hidatsa tradition, but the other features do not" (1958:202).

A. Kehoe has identified this tradition as Algonkian and believes it to have been made by the Blackfoot and the Cree who resided to the east. "Algonkian pots were shaped like old-fashioned kettles, with rounded bottoms, globular bodies, and narrowed necks" (1959:2). Byrne has given this pottery tradition another name, Saskatchewan Basin Complex. Much of the pottery found in southern Alberta and northcentral Montana along the Marias River is of this tradition (Byrne 1973:386).

> "From the region south and west of the Missouri Coteau there are some pottery collections which contain sherds reflecting at least superficial similarities to representative materials of the Late Variant of the Saskatchewan Basin Complex. For example, some quite comparable material was recovered from the Ethridge site, situated about eight miles northwest of the town of Ethridge in the drainage basin of the Marias River, a tributary of the Missouri River in northern Montana. This site yielded approximately 100 sherds from a buried camp-

> site which also contained Side Notched Arrow points and other artifacts indicative of a Late Prehistoric period occupation; several brass fragments were also recovered, but it is possible that they came from the soil level above the ceramics (Wedel 1951)" (Byrne 1973:385).

The Saskatchewan Basin complex was so named because of strong comparative similarity to pottery found in southern Saskatchewan. Reconstructed vessels and trait analysis of the pottery shows it to be a separate tradition from both Mandan-Hidatsa and Intermountain. Bodies are globular but with a tendency for elongation. Most decoration, which is simple and not always present, occurs above the shoulder of the pot (see Figure 4). Saskatchewan Basin ceramics are divided into an early and late variant (Byrne 1973:333-335). The late variant, Old Women's, is in association with Late Plains projectile points and dates from A.D. 1000 to the Proto-Historic A.D. 1800. This would predate Upper Missouri pottery by not quite 1000 years (Byrne 1973:701 - Fig. 42).

Only the late variant will be dealt with in this research since it is within the time space under study. The method of manufacture of this pottery has not been established. Since it does not bear resemblance to Cluny or Intermountain ware, it may be assumed that a different method of construction was employed. Given the forms of the vessels and that decorative finishing was applied, if at all, above the shoulder, it would seem feasible, it not probable, that these pots were formed in ground moulds. This hypothesis is supported by the frequent occurrence of U-shaped pits in sites bearing pottery of this type (Cooper 1955:26-27; Byrne 1973:18, 22-23).

The literature concerning these features in the Altamont abounds with terms such as "refuse pits", "post moulds", "stone lined pits", and "prepared hearths". Such terminology is often accompanied by little description of the actual feature, even fewer illustrations, and decidely inadequate or absent explanations of the use and/or purpose of the feature in association with surrounding artifacts (Cooper 1955; Miller 1963; Frison 1976; Byrne 1973). Byrne does give adequate description of "refuse pits" and "prepared hearths" complete with illustration (1973), however, all features are dealt with under the topic "Stratigraphic Problems", which decidely does not elucidate their significance to their respective cultural components (1973:26).

The problem is one of lumping pit-type features. Granted, many of the features may actually be "post moulds". It does not seem practical that pits were dug to bury small amounts of trash that was more often than not left strewn about on the ground (Byrne 1973:18). A more likely explanation is that the pits were dug for a specific purpose (such as pottery moulding) and were later filled with trash. The pit hearths (Byrne 1973:22-23, Fig. 8) and refuse pits described from the Morkin Site show a striking similarity to features which would result from moulding pottery in the ground (see Appendix D, Account #7). This possibility will be discussed in more depth in the following chapter.

Saskatchewan Basin pottery would appear to be the oldest tradition of pottery manufacturing in the Altamont region. The pottery is globular in form with a tendency to elongation. Decoration is simple and

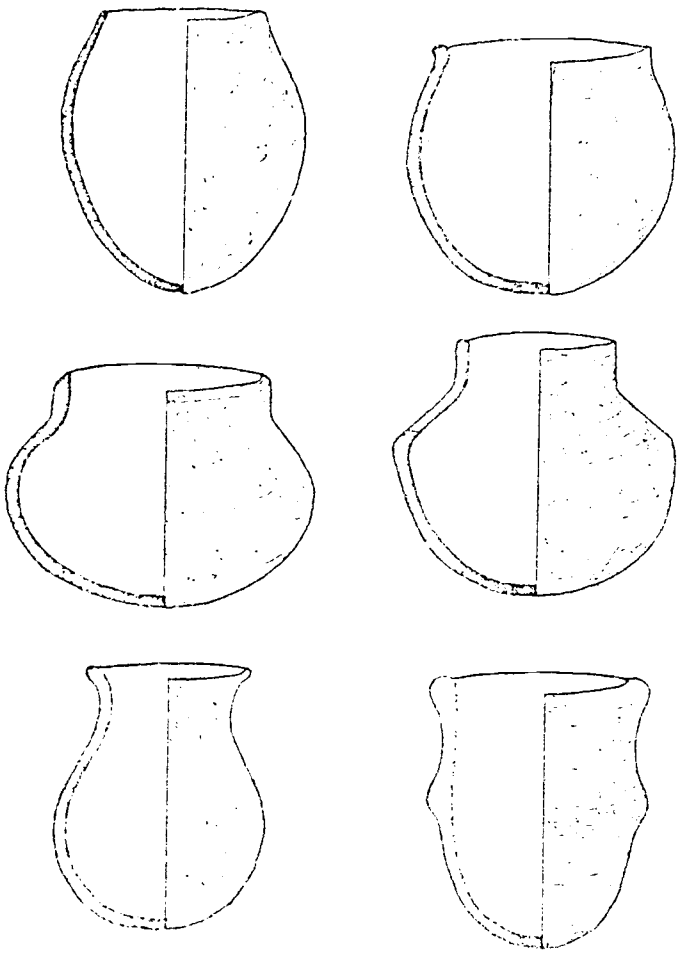


Figure 4. Reconstructed Vessels of the Saskatchewan Basin Complex (Byrne 1973:689, Fig. 30).

occurs above the shoulder of the pots if at all. There is some likelihood that the manufacturing method may have been through the use of ground moulds. This, then, is the third pottery tradition of the Altamont region.

This concludes a brief overview of the archeological evidence for the three ceramic traditions: Cluny; Intermountain; and Saskatchewan Basin. The discussion will now proceed with a review of the ethnographic evidence for pottery manufacture among the Blackfoot Indians.

ETHNOGRAPHIC DATA

In 1945, Ewers summarized "The Case for Blackfoot Pottery" with a wish for better understanding of the implications of the existance of Blackfoot pottery (1945:298). He posed three significant questions:

> "Is it possible that the use of a mould in the manufacture of pottery is a trait of some antiquity and breadth of distribution in the Northern Great Plains? Is the Blackfoot pottery that has been described a survival of a simple and crude pottery tradition, or is it a terminal, decadent form of an earlier, better made, decorated pottery? What are the historical relationships among the several nomadic tribes north and west of the Mandan in the matter of ceramics?" (1945:298).

At present, the implications of the existence of Blackfoot pottery are not known. The questions posed by Ewers have yet to be adequately answered. This research is a continuation of the search for answers. To arrive at answers, one must first examine the evidence upon which the questions were based.

> "Direct evidence in the case for Blackfoot pottery now rests upon Bradley's brief account of about 70 years ago, a statement in a myth, and traditions of Blackfoot pottery making obtained by three field investigators from some eleven Indians representing all three tribal divisions (Piegan, Blood and North Blackfoot), over the past four decades" (Ewers 1945:296). (See Appendix D for a detailed listing of these accounts.)

Two notable discussions of Ewers' article were done by James B. Griffin and W. J. Byrne. In "Prehistoric Pottery from Southern Alberta" (1965), Griffin makes the following statement:

> "In the various stories reported by Ewers, there is a recurring theme of pottery made by improbable methods such as coating the inside of a buffalo bag, or coating the outside of a rawhide bag filled with sand, or of clay lining a basketry mold. It is even reported that pottery was made by digging a hole in the ground, coating this hole with clay, and then putting a fire over the hole to bake the vessel. The net result of the various accounts given is that there is not a single one, or indeed any combination, which gives a very clear or believable account of the manufacture of Blackfoot pottery" (1965:241).

Griffin is highly skeptical of any moulding technique being workable and faults Hunter's (1823) and Kiniet's (1938) "fabrication" of these procedures with causing "mischief" in subsequent accounts of the manufacture of Plains pottery (1965:241). Although Griffin agrees that it is probable the Blackfeet produced pottery because they were bordered by people who made Woodland type pottery (1965:242), he feels that it cannot be indicated from the literature whether the Blackfeet made "good northern Plains pottery" prior to the 17th century (1965:241).

Byrne cites a portion of Ewers' description as his summary of the pottery manufacturing technique given by the Blackfeet informants (Byrne 1973:509-10).

> "For example, by combining explorers' journals, informants' statements, and ethnographic observation, Ewers (1945) has convincingly demonstrated that the Blackfoot were manufacturing some sort of pottery as late as the nineteenth century. The problem is, the descriptions consistently indicate that this pottery: Was made of a moist, sticky clay tempered with sand; shaped with the hands (there is not mention of any tools); dried in the sun; rubbed all over inside and out with animal fat and hardened over a fire. The finished vessel was cylindrical in shape (i.e., flat bottomed with nearly perpendicular sides), broader than deep, and of considerable thickness. It had two holes in the side, opposite one another for the insertion of a rawhide handle by which the pot was suspended, apparently for a tripod, over the fire. There is not mention of any surface decoration (Ewers 1945:295-6)."

Byrne concludes that the accounts are unreliable because similar accounts occur in the data collected from other Plains tribes, making the Blackfoot accounts indistinguishable from the others. Similar accounts have been recorded for the Arapaho (Kroeber 1902:25), Assiniboine (Lowie 1910:12), Cheyenne (Grinnell 1923:236-9), Plains Cree (Mandelbaum 1940:12; Skinner 1914:79-82), Gros Ventre (Kroeber 1908: 50), Kutenai (Schaeffer 1952; Turney-High 1941:77-8), Sanpoil (Ray 1932:39-40; Schaeffer 1952:8), Sarsi (Sapir 1923), and the Northern Shoshoni (Lowie 1909:177) (Byrne 1973:510). The historical data may indicate remembrance of pottery as an earlier part of the material culture, but the content of the accounts is inaccurate and unusable (1945:511). Byrne also faults early explorers with failing to make accurate records of the locations of the encampments they visited.

> "Therefore the early chronicles rarely record routes of passage in sufficient detail to permit accurate location of early historic native communities, and so there are virtually no known Indian campsites in southern Alberta and adjacent Saskatchewan which can actually be definitely affiliated with a historic tribe.

> About the only useful information which can be derived from the early records concerns the recent distribution of major tribal and linguistic groups on the Northwestern Plains" (1973:511-12).

The discussions of Griffin and Byrne have several conclusions in common. Both authors are doubtful that mould pottery could be produced; Griffin states that these methods are results of influences from fabrications of early authors, Byrne ignores the possibility of mould-made pottery and states that the accounts are inaccurate due to "faulty tribal remembrances" (1973:514). Ewers had stated that the evidence for mould-made pottery could not be ignored.

> "Although there is little consistency in the description of the mould and its use, the testimony is too persistent to be ignored lightly" (Ewers 1945:296).

A second conclusion is that any one account, or combination thereof, does not produce a believable or complete explanation of the Blackfoot pottery manufacturing technology. Griffin and Byrne were looking for "the" method of pottery manufacture. Ewers had stated that there may have been variations in the vessel forms and also in the methods of manufacture.

> "That there may have been some variation in the form of the vessel and its method of manufacture is suggested by the minority testimony. Pulverized sand rock may have been used quite commonly for tempering material. There is some testimony from all three divisions that a mould of some description was used in shaping the vessel" (Ewers 1945:296).

Accounts from earlier explorers are used tentatively to locate distributions of the Plains Indian populations in recent times (Griffin 1965:238; Byrne 1973:513). However, native accounts of pottery manufacturing techniques are not deemed useful for even tentative conclusions.

> "It may be doubted that the 'mold' method of construction given to various recorders of Indian customs will hold water as a serious description of aboriginal pottery manufacture" (Griffin 1965:241).
>
> ". . .with the possible exception of the Shoshone materials, none of these reputed pottery industries can be effectively demonstrated to be related to archeologically known ceramics from anywhere in North America" (Byrne 1973:511).

An obvious paradox of these discussions is that the early historical accounts from explorers and natives are not given equal consideration. Both groups of accounts have a margin of accuracy and inaccuracy. It seems incongruous that the native accounts of pottery manufacture are dismissed as unusable, while explorers accounts are used as the basis of speculations into the history and prehistory of the region. Either the accounts, both native and explorer, should be dismissed due to incompleteness and inaccuracy, or both should be given similar consideration while recognizing that there is a margin for error. Since the former approach would be totally unproductive, it is with the latter thought in mind that this discussion continues.

SUMMARY

A reassessment of "The Case for Blackfoot Pottery", both archeological and ethnographic, is in order. (1) It must be recognized that native accounts of pottery manufacture may be correct. It should not be stated that a technological method is unproductive until the method has been tested through experimental reconstruction. Only through testing can it be shown whether or not a method was once a viable means

of production. (2) There may have been several methods of pottery manufacture and variations in the vessels produced. The accounts and archeological data must be considered together but allow for diversity of technologies. The possibility of mould-made pottery should be seriously considered. (3) The ethnographic and archeological evidence for pottery manufacture may be more readily compared after experimental reconstruction of the technologies. (4) The occurrence of similar accounts of pottery manufacture among other Plains Indian groups does not negate the possibility of Blackfoot pottery, it more importantly indicates that these manufacturing methods were not exclusively Blackfoot. There may have been wide spread use of these technologies within the Plains. (5) Experimental reconstruction of the pottery technologies will give archeologists a more complete understanding of these traditions. Both the process and the product of the pottery technology will be known. Subsequently, more complete interpretations of archeological and ethnographic data may be made.

With the foregoing reassessment of archeological and ethnographic date and resultant changes of interpretation, it is possible to reconstruct through experimentation, the pottery technologies of the Altamont region. In so doing, it will be possible to test whether mould-made pottery was once a viable form of pottery manufacture. These experiments will be the subject of the following chapter.

III. EXPERIMENTAL RECONSTRUCTION

The reconstruction through experimentation of the pottery traditions of the Altamont region is the subject of this chapter. The experiments were performed in accordance with the method and theoretical framework explained in Chapter I. Suggested rules for experimental archeology outlined by Coles (1973:15-18) were followed in carrying out these experiments.

> "All (experiments) begin with reconstruction, and all go on to tests for function or for suitability. All represent a series of steps: problem -- idea -- procedure -- result -- assessment" (1973:14).

Materials native to the study area were used in the experiments (see Appendix E). The techniques used to produce the pottery were based on inferences from the archeological and ethnographic data (Appendices A, B, C, and D) and did not exceed the technological capacity of the cultures involved. Due to allotted research time and focus of the research project, the scope of the experiments was limited to the following objective: to test whether or not mould-made pottery was a viable form of pottery manufacturing in the prehistoric Northwestern Great Plains. Focus was on the process of the manufacture (pottery manufacture analysis) not on the product of the process (trait analysis). It was recognized that the tests could show whether or not mould-made pottery was a viable form of pottery production, but that in the allotted time, the methods could not be perfected. In each series of experiments a variety of approaches and alternatives were used to test the range of possibilities. By this trial-and-error repetition of manufacturing

techniques, valuable information and insight on why certain techniques worked or did not work was obtained. Results were checked against the archeological and ethnographic data before conclusions were formed.

The results of the experiments are illustrated and explained in the context of the archeological tradition (Cluny, Intermountain and Saskatchewan Basin) to which they show the strongest resemblance. The similarities and differences of the pottery technologies and corresponding traditions are compared. Each of the three traditions is treated under a separated section. Each section contains a summary of the ethnographic accounts and the archeological record with inferences drawn from each. The pottery technologies are explained in this setting and conclusions suggested.

> (Note: Appendix D; accounts #5 and #3 are ambiguous and incomplete and will not be used as evidence for any particular method of manufacturing even though they do support the suggestion that the Blackfeet did manufacture pottery. Specifically, account #5 states that pottery was "moulded" into shape. The use of the word "moulded" without further explanation is ambiguous. This may mean that a definite type of mould was used, or it may be a figure of speech meaning the pot was "moulded" with the hands, i.e., shaped. Account #3 states that pottery was made of clay and pulverized rock, but does not given any comment as to the method of manufacture. Because of these factors, the two above mentioned accounts cannot be used as supporting evidence for any particular pottery tradition or technology.)

COMPARISON OF CLUNY COMPLEX AND HANDBUILT TRADITION

Archeological Summary

The Cluny complex ceramics bears close resemblance to that of the Mandan-Hidatsa tradition of the Upper Missouri Region. Archeological

evidence cited by Mulloy and Byrne (see Chapter II:12-16) indicates the use of paddle-and-anvil in the manufacture of this pottery. Gifford's (1928) research on paddle-and-anvil techniques clarified the physical traits resulting from this form of pottery manufacture (1928:354-355).

Cluny Complex ceramics were made of clay and crushed granite which was mixed with water to form a paste. The vessel was shaped by using the paddle-and-anvil technique. Decoration was most commonly dentate stamping. The pot was fired on a surface hearth and was utilized as a cooking vessel. The physical characteristics of the pottery were a globular body with rounded base and a short sharply curved neck. The interior walls were smoothed and outer walls showed evidence of paddling. The color was medium gray/black to tan, with gray to black cores (Comparison Chart #1, Appendix A).

Ethnographic Summary

Several Blackfoot accounts tell of pottery being made with the hands. There is no mention of a paddle-and-anvil or mould. Accounts #2, 8, and 12 (Appendix D) may be summarized as follows:

The pottery was made from moistened clay mixed with sand. The pot was shaped with the hands and put in the sun to dry. It was greased all over, inside and out, to prevent it from cracking. The final drying was accomplished by placing the pot near the fire or possibly by suspending the pot over the fire. The dry pots were placed in the fire until they were red hot. Then they were taken out and allowed to

cool. They were used for boiling food.[1]

One description of the pottery is of a cooking pot with a constriction around the neck and a flat dish (Account #8).

Experiments

The paddle-and-anvil method of producing pottery was not reconstructed since it had already been well defined and tested (Gifford 1928). The handbuilt method of manufacturing pottery was tested. It does produce pottery which can be used for cooking. The form of this pottery is loosely defined. It is possible to make virtually any shape of pottery by hand building clay. The method in no way restricts the form of the vessel that could have been made. Because the form of these pots cannot be well defined, this method will not be illustrated here. The steps used to make the pottery are described below:

(1). A paste of sand and clay was made by mixing these with water.

(2). The pot was mass modeled from the clay paste.

(3). The pot was greased all over and placed in the sun to dry.

(4). The pot was placed near the fire and turned periodically so that all the moisture evaporated out of it.

(5). The pot was then placed in the fire, heated until it was red hot, and allowed to cool before it was removed.

The unusual procedure in this method of making pottery is step 3 -- the greasing of the pot. The use of grease on pottery is an excellent

way to reduce cracking from sun-drying. For the best results the grease is applied immediately after the pot has been formed and is firm enough to hold its shape, then the pot may be placed in direct sunlight to dry without cracking. Beef fat was used as a substitute for bison fat in these experiments. The fat had been cooked down to liquid and allowed to cool before it was used.

When the greased pot is placed in the sun, the grease soon liquifies and soaks into the clay while the water "sweats" out of the pot. A light white powder remains on the surface of the pot (see Figure 5). A cross-section of a fired pot that had been greased in this manner shows a core of black to dark gray color and exterior walls of medium gray/black to tan. The pots do not always fire an even color in the core or walls. There is some variation. It is significant to note that grease treatment of the pottery will produce a black core even when the pot has been oxidization fired. A reduced atmosphere is not necessary to produce this effect (see Figure 5).

Comparison

Cluny Complex ceramics and ceramic reconstruction of handbuilt ceramics are noted on Comparison Chart I. From the accounts given and the archeological evidence compiled, it presently cannot be stated that there is a connection between these two technologies. Without ethnographic descriptions to more specifically detail the form of the pottery, or a specific reference to the use of paddle-and-anvil, it is impossible to indicate a positive relationship. The two data sets

differ on pottery forming method, and (due to insufficient data) vessel form and surface finish. Considering what data are available, it would seem that a conclusion of technological dissimilarity is in order. The manufacture of Cluny pottery is sufficiently dissimilar to the manufacture of handbuilt ceramics to indicate technological discontinuity between the Cluny complex and the handbuilt tradition of ceramic manufacture.

COMPARISON OF INTERMOUNTAIN WARE AND RAWHIDE MOULD TRADITION

Archeological Summary

Intermountain ware has been defined by Mulloy as a distinctive pottery tradition that has been found in the southern part of the Altamont (see Chapter II:16-19). The flower-pot like shape of this pottery is it distinguishing feature. The method of its manufacture has not been well explained. The pots appear to have been mass moulded or formed in sections. There is no real evidence for paddle-and-anvil techniques (Frison 1971:276).

The following inferences about the manufacture of this pottery can be drawn from the archeological record: Intermountain ware was formed from a paste of clay and fine sand or quartzite which had been mixed with water. The pots were (possibly) moulded over a cylindrical form. A mould of this shape would give them their distinctive flower-pot form. Handle holes were made opposite one another near the rim. The pot was dried and fired in an open hearth. Residue on the pottery

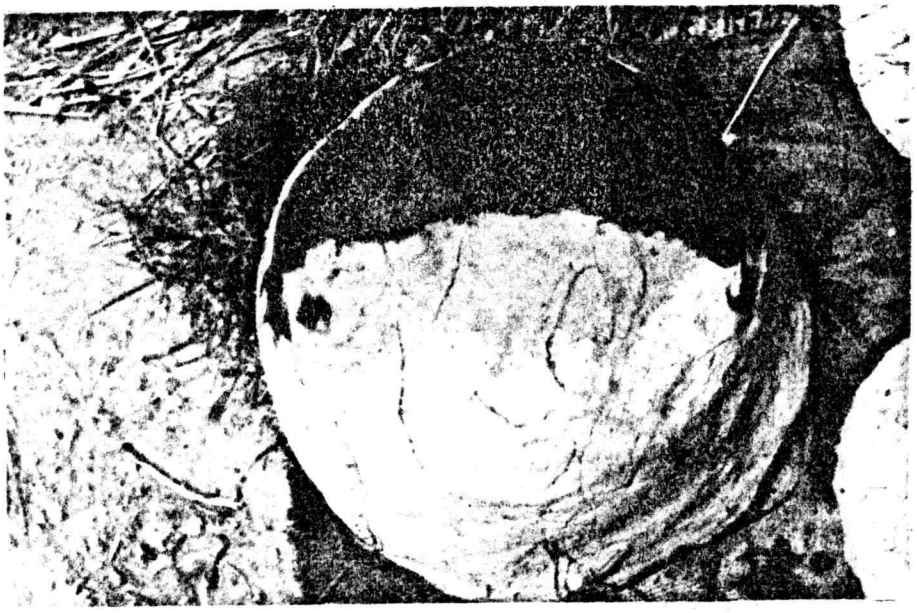


Figure 5. Unfired pot showing effects of grease during sun-drying.

Figure 6. Cross-section view of fired potsherd showing effects of grease treatment.

		Ethnographic Data (Accounts #2, #8, #12)	Archeological Data (Cluny Complex)	
PROCESS	(1) Materials used	Clay temper (granite or sandrock)	Clay temper (Crushed granite)	Dissimilar (?)
	(2) Preparation of Materials	Clay and sand mixed with water into a paste	Clay and sand mixed with water into a paste	Similar
	(3) Pottery forming method	Handbuilt (no tools or moulds), greased to prevent cracking	Formed with the hands and paddle-and-anvil tools	Dissimilar
	(4) Decorating techniques	(Undefined)	Linear dentate stamping is most common. Some cord wrapped impressions	Dissimilar (?)
	(5) Firing methods	Fired on an open surface hearth	Fired on an open surface hearth	Similar
	(6) Utilization of vessel	Used as a cooking pot	Used as a cooking pot	Similar
PRODUCT	(7) Material Composition	Clay and sand tempered paste, exterior walls are medium gray/black, hardness was undetermined	Clay and crushed granite tempered paste, exterior walls are medium gray/black, cores are gray to black, hardness averages 3.0 to 3.5 (Moh scale)	Similar
	Style	Cooking pot (form undefined) with a constriction around the neck for a handle hold, smoothed surface. No decoration mentioned. A flat dish was also made	Vessel form is globular, with a short sharply curved neck, interior smoothed, exterior paddled and decorated, dentate stamping used most commonly	Dissimilar

Figure 7. Comparison Chart I. Comparison of Cluny Complex and Handbuilt Tradition.

is an indication of use as cooking vessels. Physical characteristics of the pottery show a brown to black color in the cores and exterior walls. This dark color may be an indication of grease burned onto the pottery during firing and when in use as cooking vessels. The pottery is fairly soft, averaging 2.5 on the Moh scale (Comparison Chart II, Appendix B).

Ethnographic Summary

There are three ethnographic accounts (#4, #6, and #9) which describe methods of using rawhide moulds to produce pottery. Accounts #10 and #11 describe pottery vessels which may have been formed by these techniques. The physical descriptions of these pots are similar to a physical description of Intermountain ware. The pots are described as being wider than tall, 12" by 8" and 15" by 12". The sides slope out from the bottom toward the top. The walls are fairly thick. One of the pots is said to have had a flat bottom and two holes near the rim for a handle.

Ethnographic inference was used to determine the form of the rawhide moulds used in the experiments. The Blackfeet made several types of carrying vessels from hide and paunch. Cylindrical cups and buckets were made from pauch that had been stretched and sewn over willow hoops (Grinnell 1962:201-202). A "double bag" was made of hide and used for general carrying purposes. It was similar to a saddle bag (Wissler 1910:741). A folding rectangular box was used to store food and belongings. This was called a parfleche (Wissler

1910:79). Cylindrical rawhide cases were made and used for ceremonial objects (Wissler 1910:78). It would seem likely that the Blackfeet made other cylindrical cases of rawhide for general purposes, one of which may have been for use as a mould for pottery (Figure 8). Two rawhide cylinders were made for use in the experiments for this section (see Figure 9; Appendix E, Figures 57 and 58).

Experiments

The data in the ethnographic accounts dealing with the use of rawhide moulds in the manufacture of pottery show two different approaches to using the moulds. Account #4 describes the forming of a cooking pot over the exterior of a rawhide mould. Account #9 is of a ceremonial vessel that was formed inside a rawhide mould, painted with red earth paint, and sun dried. Account #6 may be a simplified version of Account #9. These methods were tested by making pottery with the rawhide moulds described in the ethnographic summary. Each method is explained and illustrated in the following discussion.

Cooking pots were formed over the outside of a rawhide mould (based on Account #4). The steps used to make a pottery vessel by this method are outlined below:

(1). The rawhide mould is well greased with fat that had been cooked down and allowed to cool (Figure 10).

(Note: During the experiments the mould was not filled with sand. It is thought that the sand would help the mould hold its shape while the pot was formed over it. Having the mould filled with sand would not hamper the moulding process.)

(2). The clay and sand paste has been mixed thoroughly and is slightly sticky in consistency. A large piece of the paste is pressed out over the bottom of the mould which has been set upside down. The clay mixture is patted out with the flat of the hand until it covers the base of the pot and extends over the edge to the sides. An extra amount of clay is left where the bottom and sides join to reinforce the edge (Figure 11).

(3). More clay is added to the sides of the mould until it is covered. Each addition of clay is pressed out to an even thickness on the mould and rubbed into the other clay that had been previously added so that a strong bond is formed. The mould and pot are allowed to stand in the sun for about an hour. The outside of the clay has been smoothed and rubbed with grease to prevent it from cracking (Figure 12).

(4). When the clay has become somewhat firm but not leather hard, the mould is turned right side up. (If sand had been put in the mould, the cover would be removed and the sand dumped out before the mould was turned over.) Edges of the mould are pulled into the center to loosen the clay around the upper edge. While this is done, one hand, fingers extended, is slipped most of the way down between the pot and the clay wall to loosen the mould. When this has been done around the pot, the

mould can be removed (Figure 13).

(5). With both hands holding the upper edge of the mould, the rawhide and clay pot are lifted a couple inches off the surface. The mould is given a few up and down shakes and the clay pot falls free. Seams from patching of clay onto the mould will be present on the interior of the pot. These must be smoothed out at this time. Additional grease is added if necessary (Figure 14).

(6). The form of the pot can be adjusted at this time. Holes for a handle are poked through the clay wall near the rim. Any decorations are applied to the clay while it is still damp. The pot is then set in the sun to dry (Figure 15).

(7). The pot is turned upside down during the drying process. This is necessary to prevent the bottom from cracking away from the walls. The bottom and sides must dry at the same rate. The pot is set next to the fire or suspended above a low fire to drive the remaining moisture from the pot. The vessel is kept well greased during this process (Figure 16).

(Note: it is doubtful that a pot "filled" with grease would remain intact when it had been been previously fired.)

(8). The completely dried and warmed pot is placed in an open hearth and the fire built over and around it. The pot

Fig. 43 (50–4511). A Medicine Case. Length, 60 cm.

Figure 8. Blackfoot Rawhide Case (Wissler 1910:78, Fig. 43).

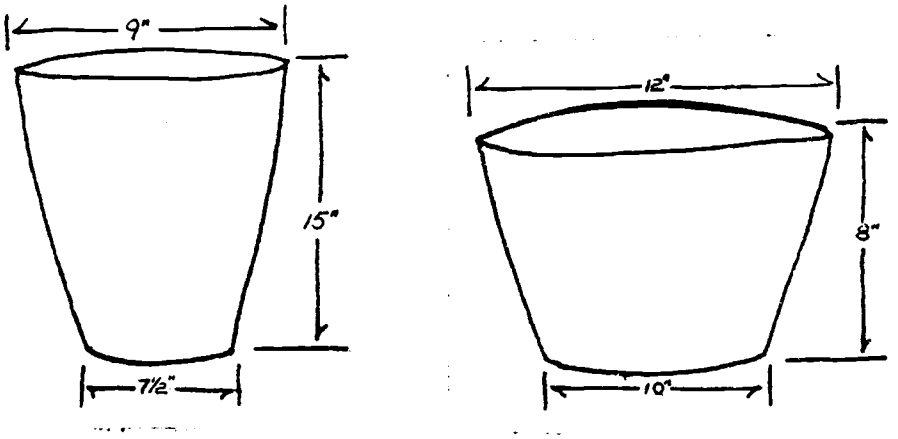


Figure 9. Rawhide Moulds Used in the Experiments.

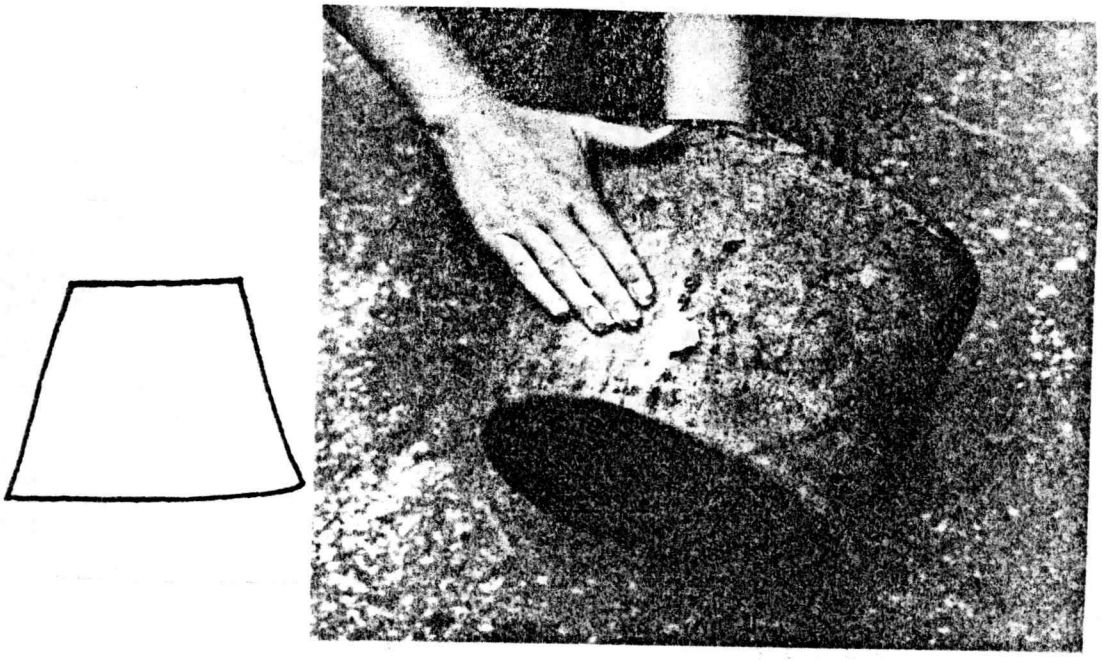


Figure 10. Left, Cross-Section Drawing of Rawhide Mould. Right, Rawhide Mould Being Greased with Fat.

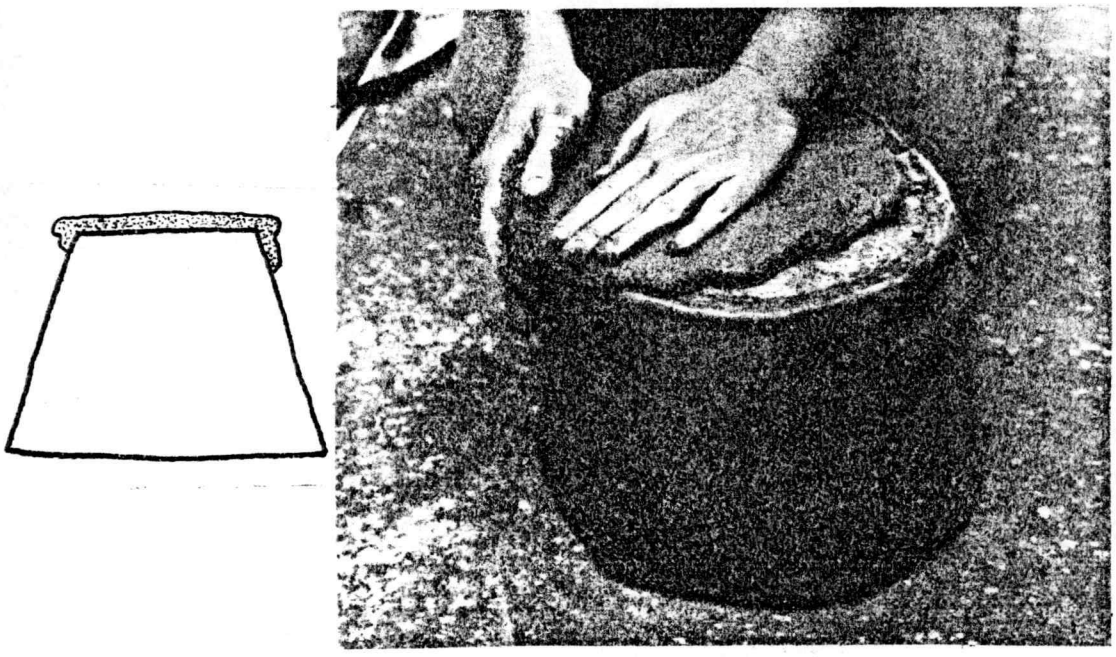


Figure 11. Left, Cross-Section of Rawhide Mould with Clay Pressed Over Base. Right, Photo of Same.

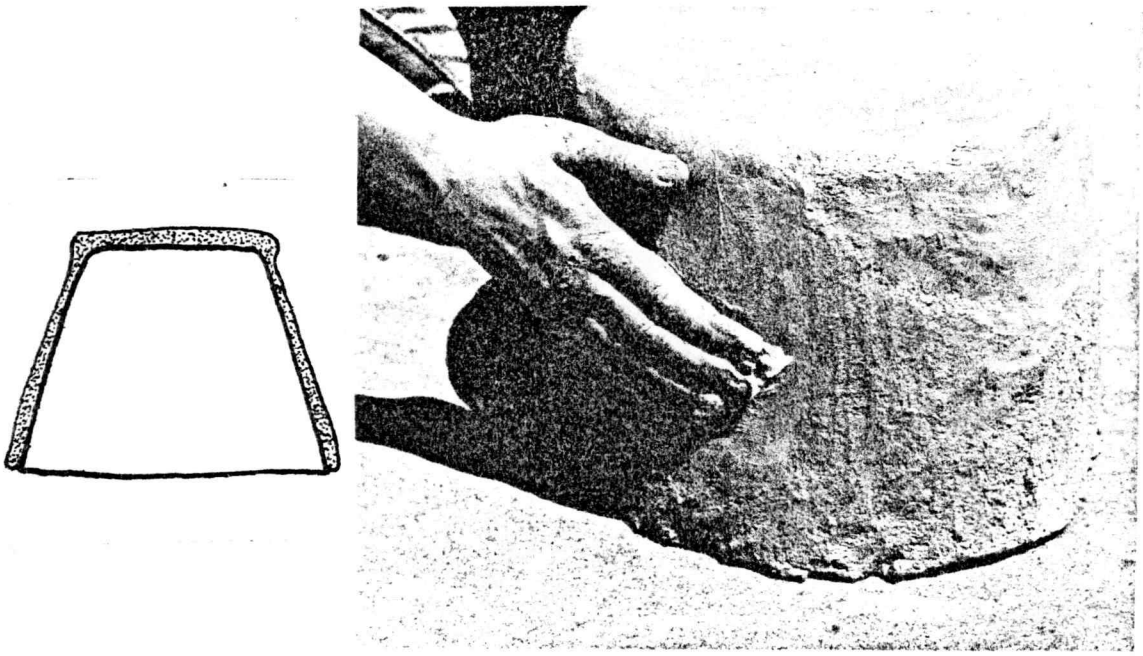


Figure 12, Left, Cross-Section of Pot Formed Over Rawhide Mould. Right, Photo for Formed Pot Being Greased.

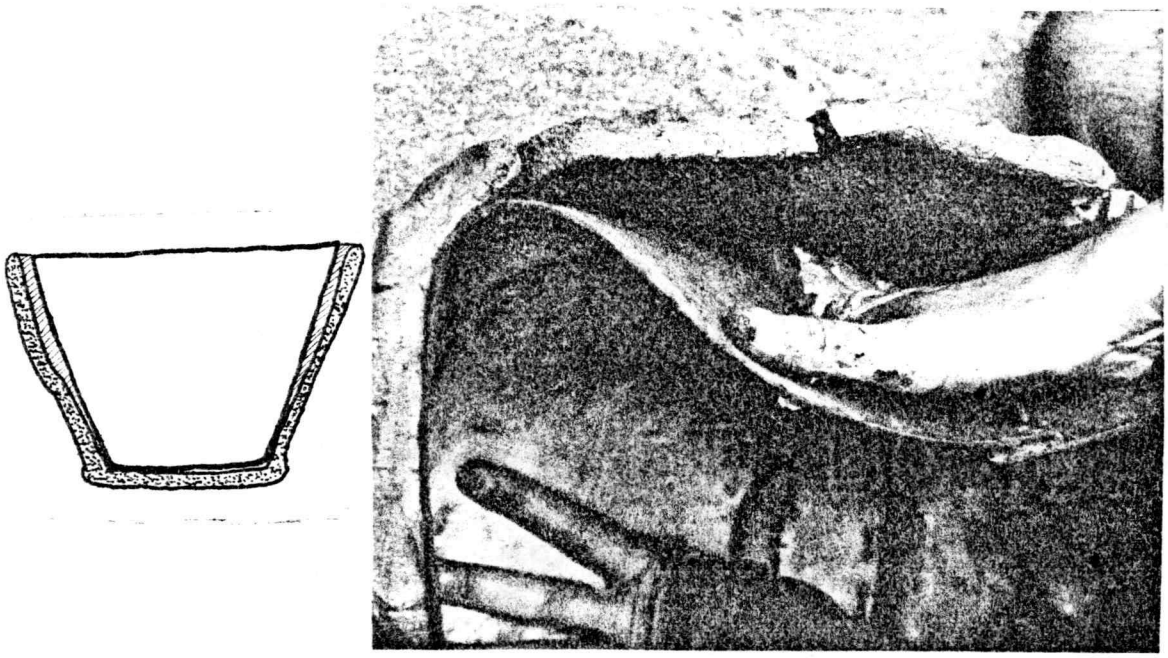


Figure 13. Left, Cross-Section of Pot Being Loosened From Mould. Right, Photo of Same.

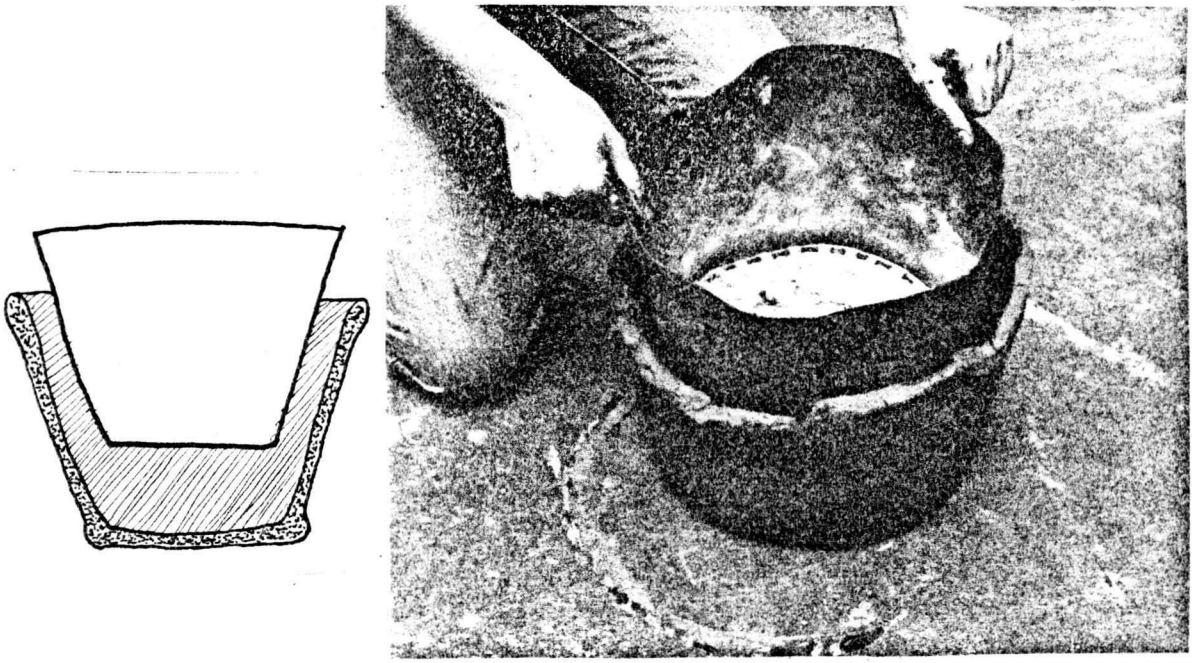


Figure 14. Left, Cross-Section of Rawhide Mould Being Lifted From Pot. Right, Photo of Mould Being Removed From Pot.

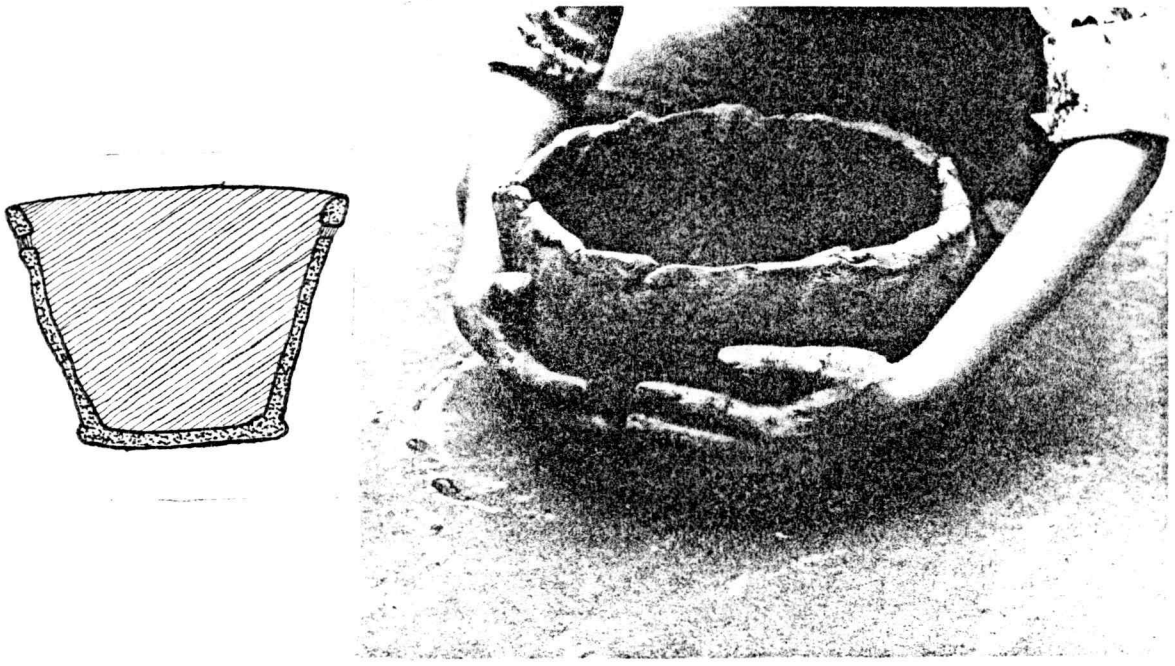


Figure 15. Left, Cross-Section of Formed Pot With Handle Holes. Right, Photo of Pot Being Smoothed and Shaped.

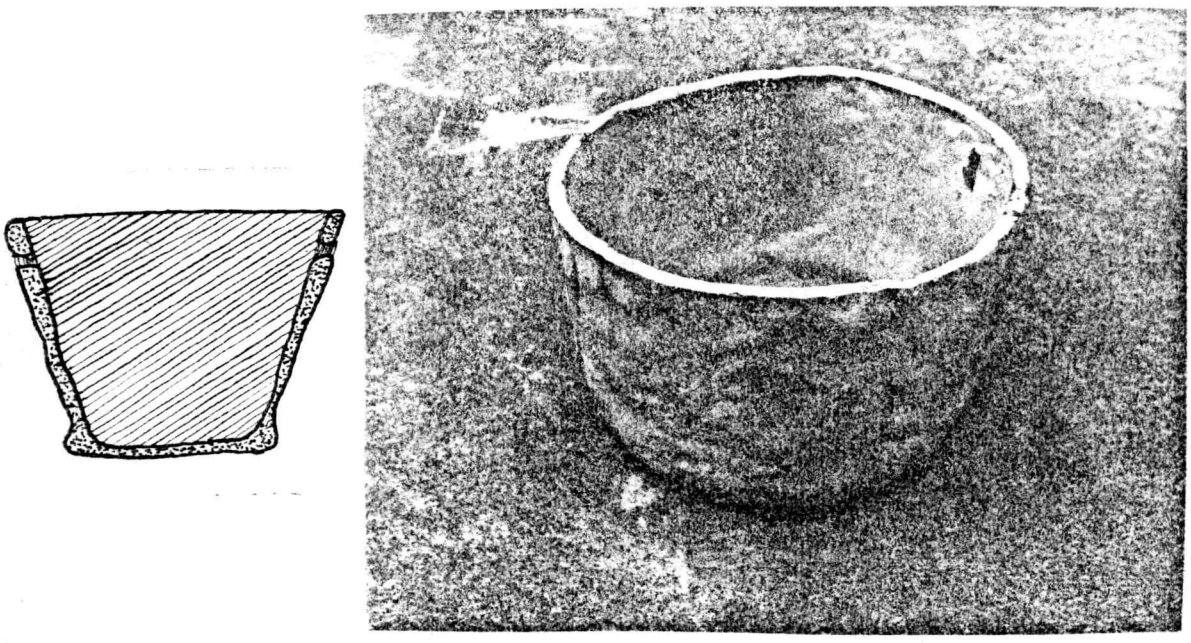


Figure 16. Left, Cross-Section of Dry Pot. Right, Photo of Sun Dried Pot. Note White Powder Left From Grease Treatment.

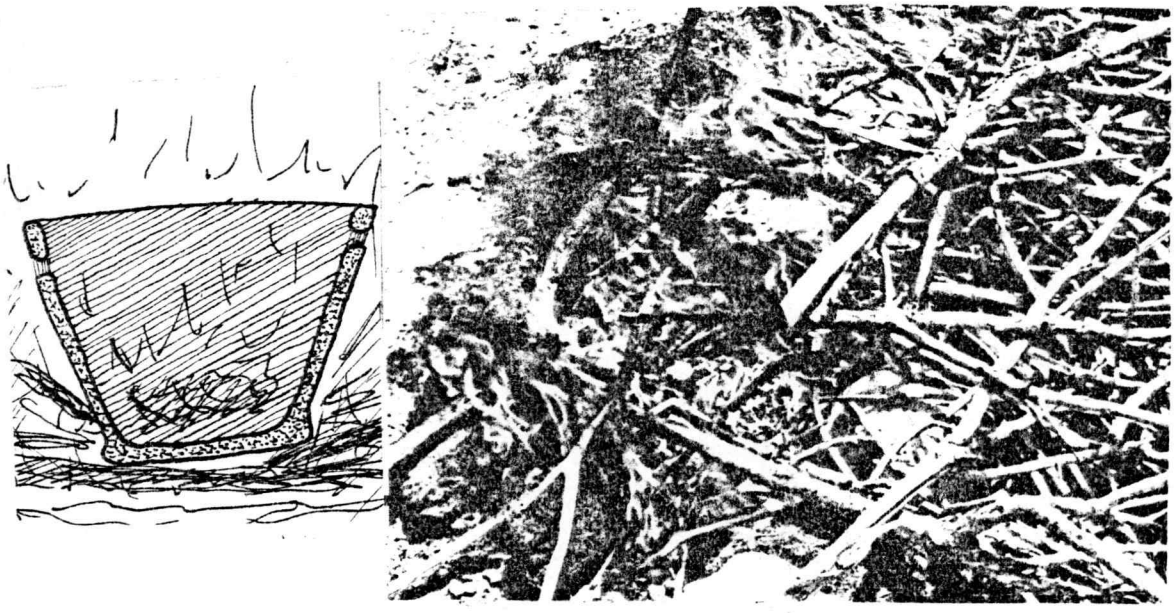


Figure 17. Left, Cross-Section of Pot Being Fired. Right, Photo of Pots Being Fired in Surface Hearth.

would be heated red hot and then allowed to cool before it was taken out. Pots were kept well greased when in use. Since there was no glaze, this probably provided a measure of water proofing (Figure 17).

Account #9 tells of a ceremonial dish which was made and used by the men. The process of making a pot by this method is similar to, although more detailed than the one given in Account #6.

(1). An ungreased rawhide container is used as the mould. This would have to be a long narrow one as the finished dimensions of the pot are given as 8" in diameter and 12" high (Figure 18).

(Note: it is not necessary to grease the rawhide when the inside of the container is used as a mould. The clay will shrink away from the rawhide as it dries. In the previous method, grease was used on the outside of the mould to prevent the clay from shrinking and cracking.)

(2). A sticky paste of sand and clay mixed with water is prepared. This is pressed and smoothed over the interior of the mould to an inch thickness. Care is taken to make sure it is even and smooth (Figure 19).

(3). The mould and pot are set in the sun to dry. When the pot has become firm (one to two hours) the clay will pull away from the mould walls. A space may be seen between the clay wall and the rawhide (Figure 20).

(4). At this point, the mould is turned upside down and the pot is slid out of it. Marks from the lacing in the mould may then be removed and the surface of the pot

smoothed off (Figure 22).

(5). The outside surface is further smoothed by rubbing it with a stone. This would result in a polished effect (Figure 23).

(6). The exterior of the pot is painted with a "red earth paint".[2] If this were a clay slip it would have to be painted onto the vessel while it was still damp, otherwise it would crack off. A thin red stain could be successfully painted onto a drier pot and would soak in without peeling off. There is no mention of this red paint being polished (Figure 24).

(7). The pot was completely sun dired. It was never greased or put near a fire. These ceremonial vessels were only used to hold dried meat and foods, never liquids. They were kept in rawhide cases that were hung in the lodges (Figure 25).

The procedure for making a pot on the inside of a rawhide mould was developed from Account #6. As this technique is similar to the one derived from Account #9, it will be briefly explained but not illustrated. The steps in this pottery method are listed below:

(1). A rawhide mould of the desired proportion is used. The mould is not greased.

(2). Clay and sand or quartzite river sand is mixed together with water to form a paste. The clay paste, of a sticky consistency, is pressed and smeared over the inside of

the rawhide mould to about a 5/16" thickness. Care is taken that the mould is covered evenly.

(3). The mould and pot formed inside it are set in the sun until firm. This will take about an hour on a warm day. The clay will pull away from the rawhide mould. A small space can be seen between the mould and the pot. When this occurs, the pot is ready to be removed from the mould.

(4). The mould is carefully turned upside down and the pot will slip right out. The mould is then set aside. Marks from the lacing in the mould are removed and the surface of the pot smoothed.

(5). Handle holes are pressed through the clay wall. Decorations may be added at this time and additional smoothing done.

(6). Before the pot has become stiff, the form may have been modified. It would be advantageous to press the clay above the base of the pot in a small amount to help support the weight of the walls. If this is not done, the walls have a tendency to sag out at the bottom, making a weaker vessel.

(7). The pots were dried in the sun. It is not stated whether grease was used with this method. It would seem reasonable to infer that grease was used to prevent cracking from sun drying if this vessel were a

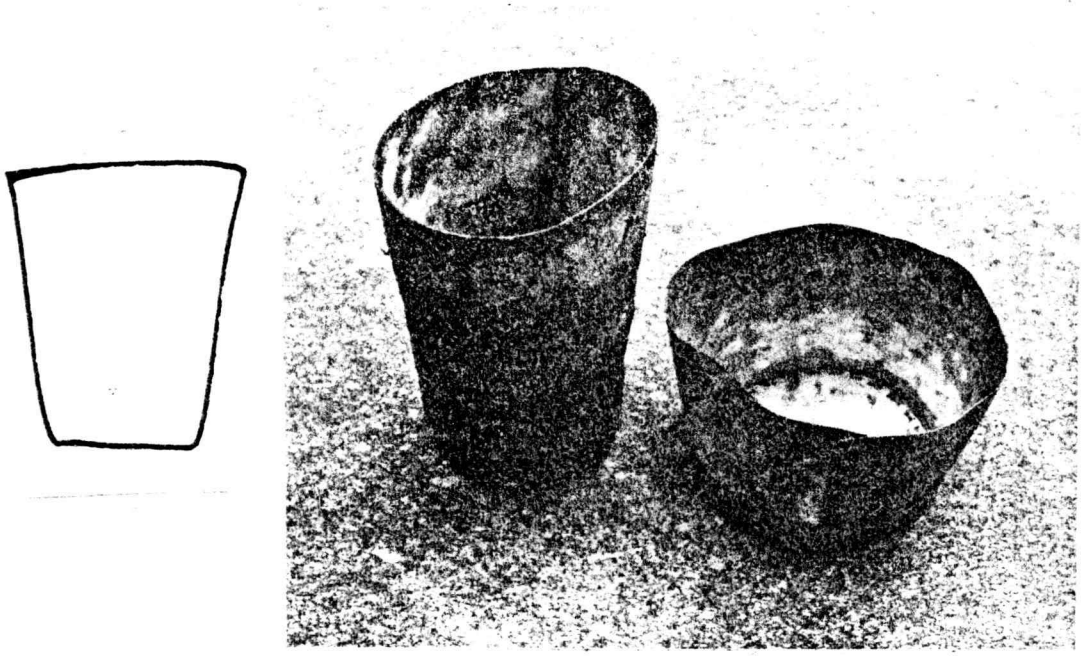


Figure 18. Left, Cross-Section of Rawhide Mould. Right, View of Inside of Rawhide Mould.

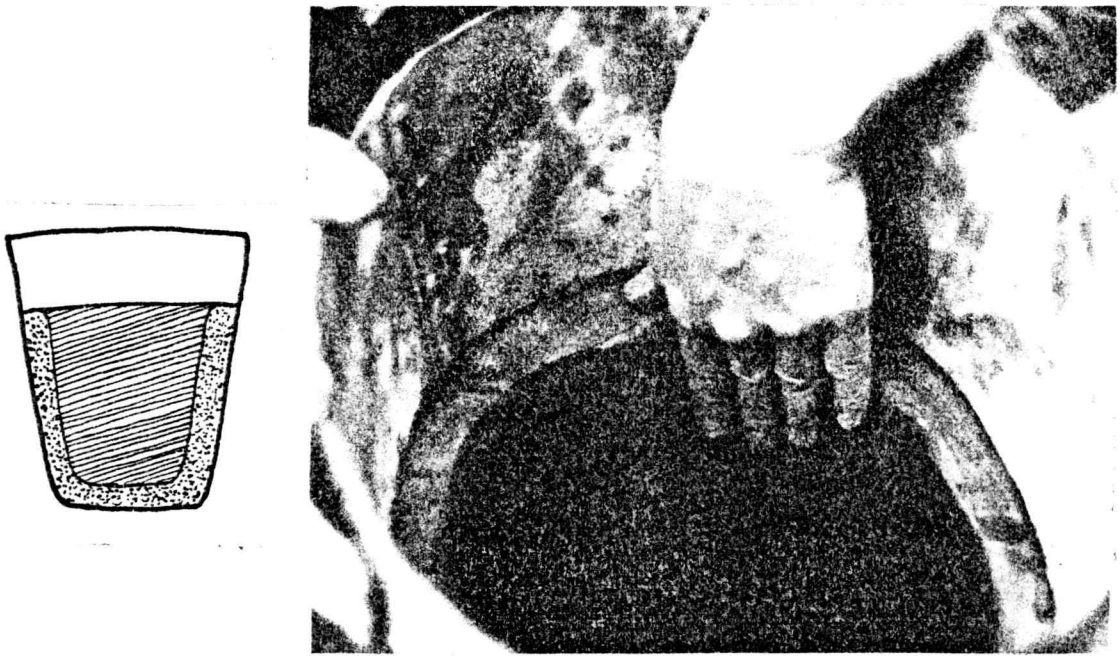


Figure 19. Left, Cross-Section of Pot Formed Inside Mould. Right, Pot Being Formed Inside the Rawhide Mould.

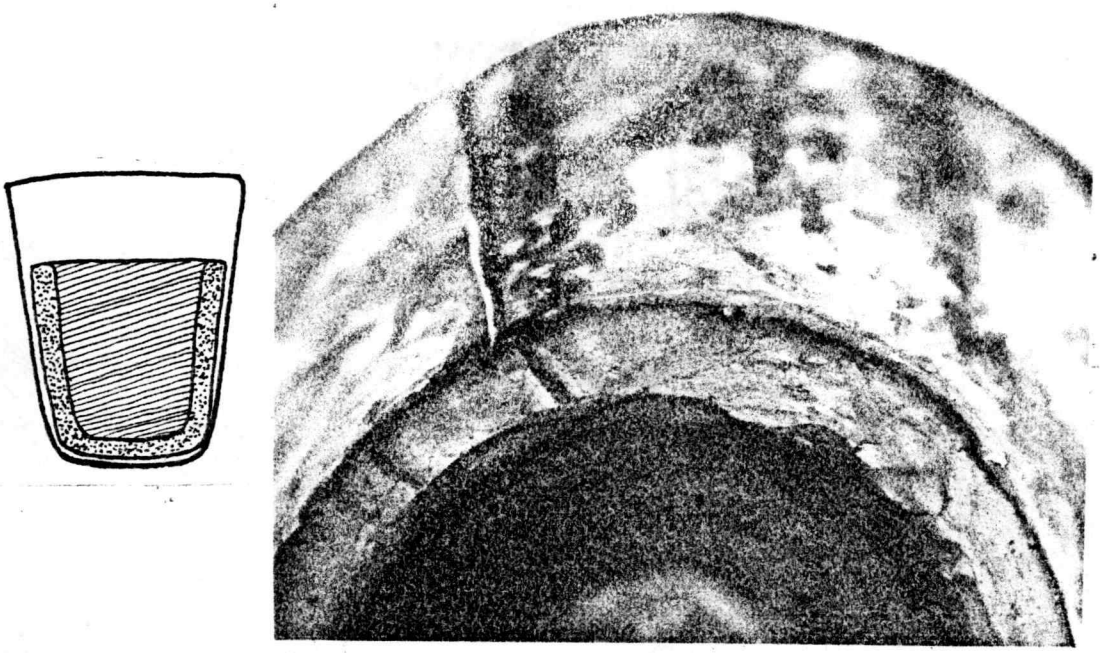


Figure 20. Left, Cross-Section of Pot Pulled Away From Mould Walls Because of Shrinkage During the Drying Process. Right, Photo of Same.

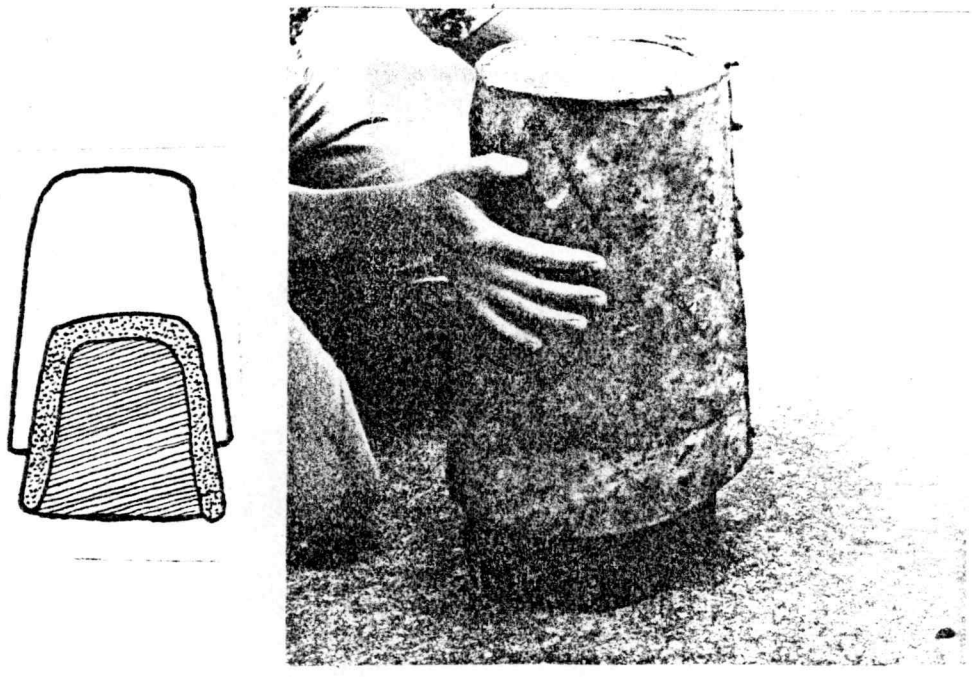


Figure 21. Left, Cross-Section of Pot Being Slid Out of Mould. Right, Photo of Same.

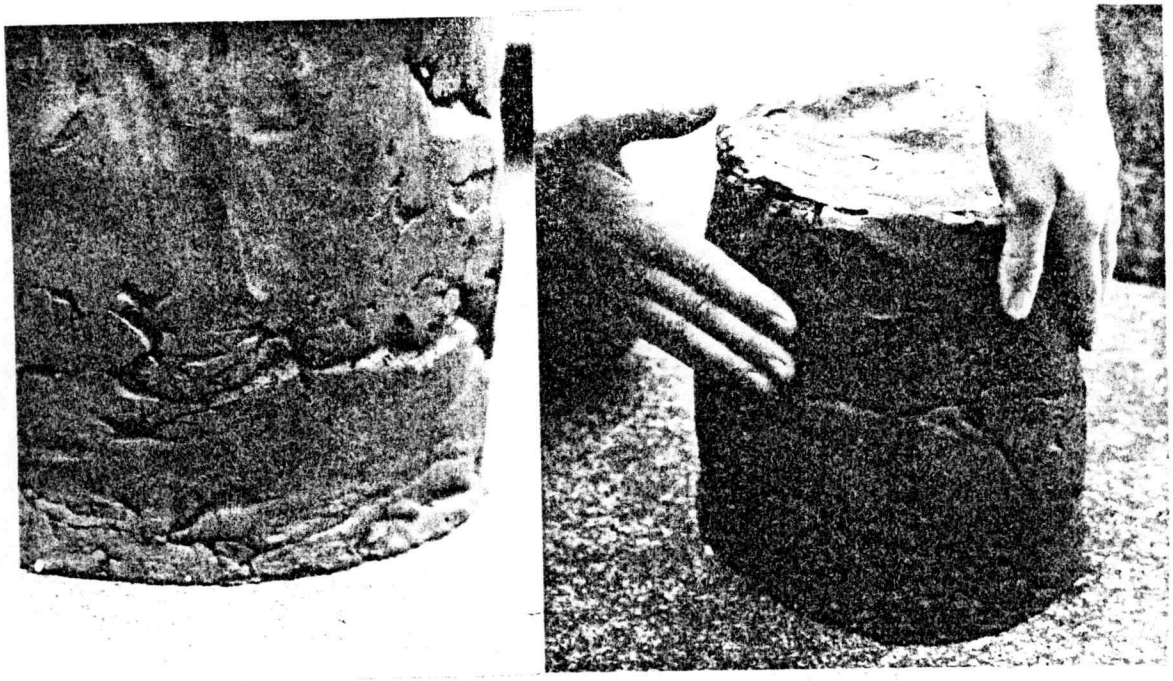


Figure 22. Left, Pot Showing Patch Marks From Forming Method. Right, Patch Marks Being Smoothed Out.

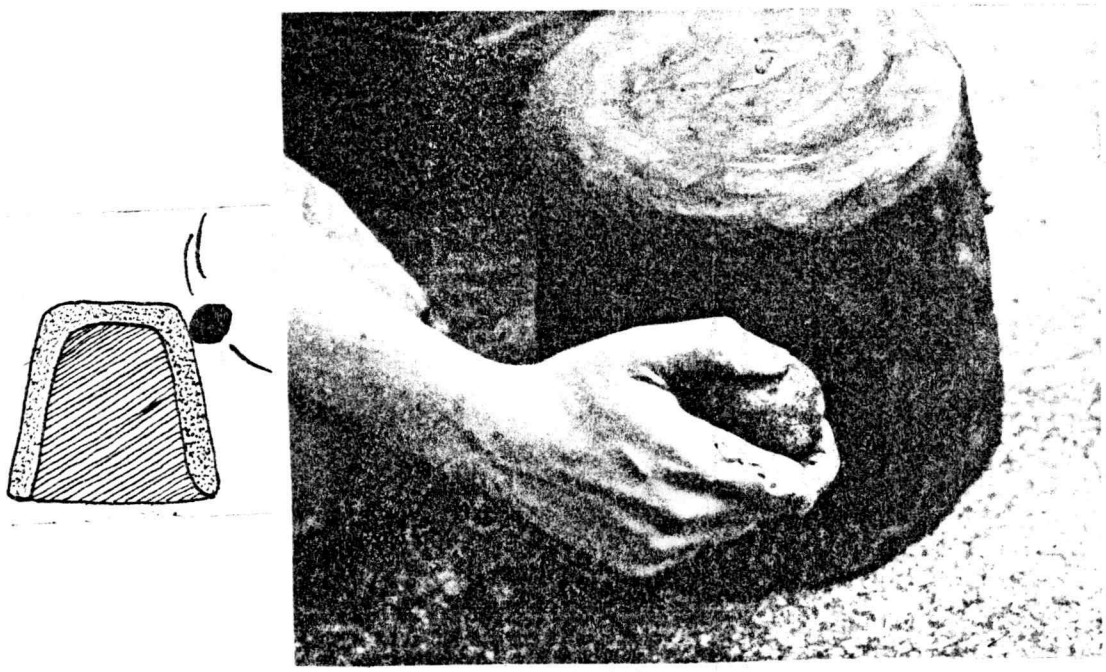


Figure 23. Left, Cross-Section of Pot Being Smoothed With Pebble. Right, Photo of Same.

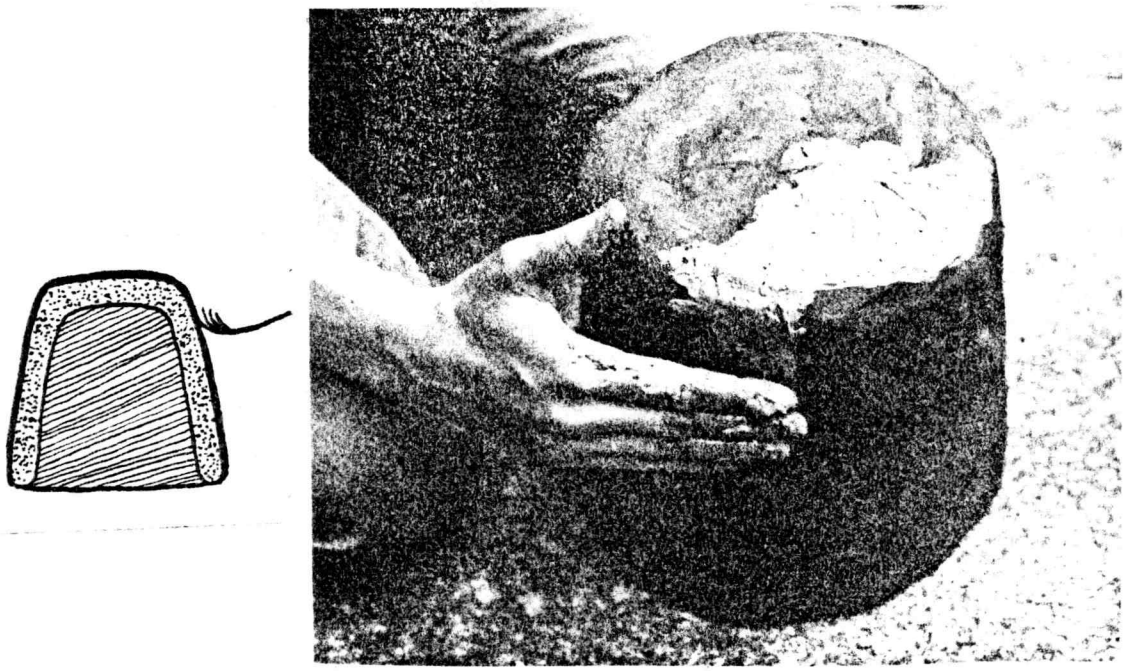


Figure 24. Left, Cross-Section Showing Pot Being Painted With Red Earth Paint. Right, Red Slip Being Smoothed Over Damp Pot.

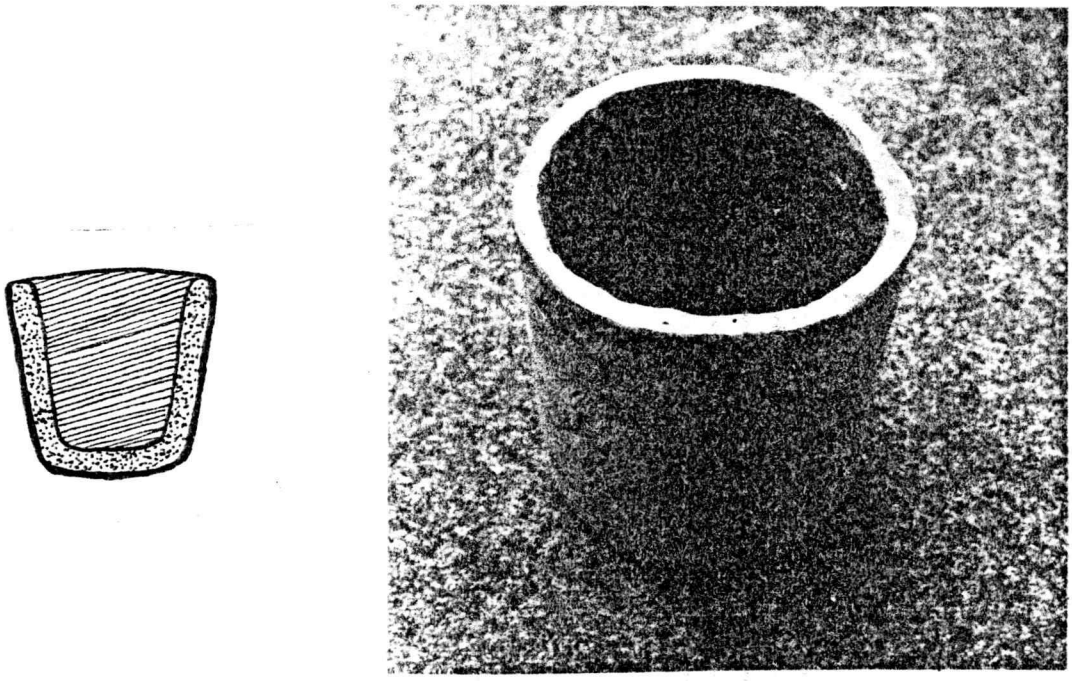


Figure 25. Left, Cross-Section of Finished Pot. Right, Sun Dried Pot With Red Painted Exterior.

cooking pot. If it were a ceremonial pot, it may have been sun dried without the use of grease.

(8). The (cooking) pot would have been fired, possibly in an open hearth. Again, it is reasonable to infer that if this was a cooking pot, it would be fired in a method similar to that described for the other moulded cooking pots. If it were a cermonial pot, this step would be omitted.

Comparison

The three described methods of making pottery with rawhide moulds may be summarized as follows. The first is definitely a cooking pot and was fired to a ceramic state.[3] Pottery produced from this method is strongly suggestive of Intermountain ware. The second method is a ceremonial vessel, unfired. Pots of this type would not show up in the archeological record as they would disintegrate when they became wet. The third method is more similar to the ceremonial vessel in method of construction than to the cooking pot in the first method. It does state that a handle was sometimes attached -- this would be a similarity to the cooking pot. It is difficult to categorize this third method, it will be left open to question.

There were at least two methods of manufacturing pottery using rawhide moulds. One, a fired cooking vessel, formed on the outside of the mould with grease used to prevent cracking, and two, an unfired painted, cermonial vessel formed on the inside of the mould. It is

doubtful whether the latter would appear in the archeological record.

A comparison of the rawhide cooking pot technology and the technology of Intermountain ware is shown in Comparison Chart II. There is a degree of similarity in all categories of comparison. Pottery of a flower-pot like form is quite easily produced through this rawhide mold method. The pottery becomes brown/black after firing due to the grease applied during the moulding and drying process.

The two technologies, rawhide mould and Intermountain, are sufficiently similar in all categories of comparison including the forming method, style, and material composition to indicate technological similarity. It is therefore suggested that there is a technological continuity between the ethnographic accounts of rawhide mould made pottery and the archeological record of Intermountain ware (Figure 26 and 27).

COMPARISON OF SASKATCHEWAN BASIN COMPLEX AND GROUND MOULD TRADITION

Archeological Summary

Saskatchewan Basin pottery appears to be the oldest pottery tradition of the Altamont and has the widest distribution extending through southern Alberta and into northern Montana along the Marias River drainage. It is a separate tradition from Cluny and Intermountain ware (see Chapter II:12-19). The pottery (late variant) is globular in form although somewhat elongated. The pots sometimes have a short neck, but are often lacking this feature. Decoration is simple and occurs above the shoulder if at all. The shapes of the pots could

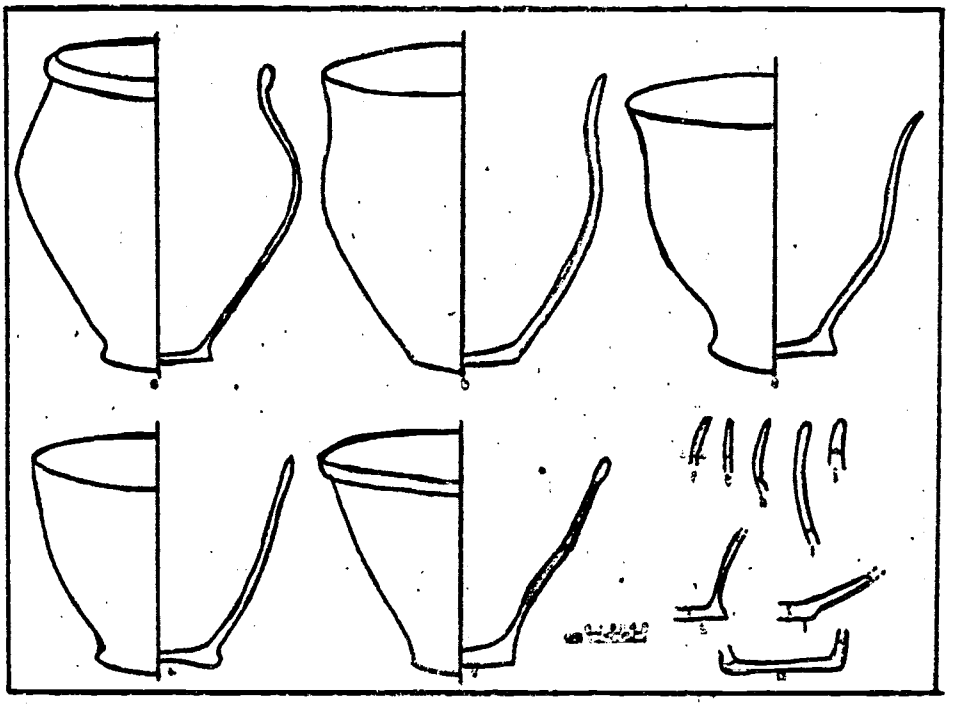


Figure 26. Reconstructed Intermountain Ware Vessels From the Eden-Farson Site (Frison 1971:277, Fig. 9).

		Ethnographic Data (Accounts #1, #4, #6, #9, #10, #11)	Archeological Data (Intermountain Ware)	
PROCESS	(1) Materials used	Clay temper (sand/quartzite)	Clay temper (fine sand/quartzite)	Similar (?)
	(2) Preparation of materials	Clay and temper mixed with water into a paste	Clay and temper mixed with water into a paste	Similar
	(3) Pottery forming method	Rawhide mould: - outer surface (cooking pot) - inner surface (ceremonial pot)	Use of mould possible	Similar (?)
	(4) Decorating technique	Handle holes, surface smoothed	Handle holes. surface smoothed, some incised lines	Similar (?)
	(5) Firing method	Fired in open surface hearth (cooking pot)	Fired in open surface hearth (?)	Similar
	(6) Utilization of vessel	Cooking pot (unfired ceremonial pot)	Cooking pot	Similar
PRODUCT	(7) Material Composition	Clay and fine sand or quartzite tempered paste, brown/black color on interior and exterior walls and core, fairly soft, 2.5 (?) Moh scale	Clay and fine sand or quartzite tempered paste, brown/black color on interior and core, 2.5 Moh scale	Similar
	Style	Cooking pot of flower-pot like form, flat bottom, basal flange, smooth surface, handle holes near rim, no decoration mentioned	Cooking pot of flower-pot like form, flat bottom, basal flange, smooth surface, handle near rim, some incised lines as decoration	Similar (?)

Figure 27. Comparison Chart II. Comparison of Intermountain Ware and Rawhide Mould Tradition.

easily have been produced in ground moulds. There is also a high occurrence of problematic U-shaped pits in these pottery bearing sites which may have been ground moulds (see Appendix C).

Ethnographic Summary

Of the ethnographic accounts from the Blackfoot Tribe dealing with the manufacture of pottery, there is only one which tells of pottery made in a mould in the ground. It is a very complete account with a large degree of detail (Appendix D, Account #7).

Briefly, the pottery was made by digging a hole in the ground of the right shape, placing a stone in the bottom, and lining this with mud. Then clay and temper mixed together with water were plastered over the lining to form the pot. This was allowed to dry and a stone was placed inside the pot. A fire was kindled over the top and the pot was fired in the ground.

This account also gives the most detailed description of the clay preparation process. The clay (and temper?) were pounded with a stone, heated, and then pounded again to a fine texture before they were mixed with water to form a "dough" or clay body.

Experiments

The procedure for making pottery in a ground mould was the test subject in this section of experiments. By working out the process, it is possible to take the resulting features (ground moulds and U-shaped pits) and pottery into comparison. The process of making pottery in ground pits was worked out through these experiments. It

was found that this method does produce pottery which can be used as cooking vessels. The process involved in making pottery in a ground mould is outlined as follows:

(1). A hole is dug in the ground slightly larger than the size of the finished pot. The sides of this pit are made as smooth and round as possible (Figure 28).

(2). A flat stone a few inches thick is placed in the bottom of the pit. This will act as a heat reflector during the firing. Sandstone was often used. It is possible to make pottery in this manner without a stone in the bottom of the pit, although the heat would not be reflected as well (Figure 29).

(3). The walls of the pit are splashed with water so that the mud lining will stick to them. The dirt that was dug out of the pit was mixed with water to a thick mud. This was used as the lining for the pit. The lining was put on in a thick coat, one to three inches thick. It was smoothed out and then allowed to dry for one or two days (Figures 30 and 31).

(4). The pot was formed in the mould by placing a large clump of clay (sufficient to make the pot) into the mould cavity. The cavity had been well greased before the clay was placed in the mould. By using the hands and a small stone, the clay is pressed and spread to cover the mould evenly. The clay was

spread up to the top of the mould and then formed into a rim by pulling the clay away from the mould walls. Two holes were punched for handle holes (Figures 32-38).

(Note: experiments were tried in which the mould was not greased. Greasing is not mentioned in the account. It is difficult to get the clay pot to dry and pull away from the mould without the grease. The clay has a tendency to stick to the mould walls. It is then split apart by the shrinkage from the drying. This method will work without the grease, but the chances of successful completion of pottery vessels is lower. If the use of grease to prevent cracking of sun dried pottery was known, it would be fairly accurate to infer that grease was used in this method.) (Figures 39-41.)

(5). The pot was allowed to dry and a large stone was placed inside it. A fire was built over the top of the pit and kept burning until the pot was dried. In the experiments, pots were fired for eight hours and then allowed to cool off. The rims and top, 3 to 4 inches of the pots, were fired to a ceramic state. The bottoms were heated but not sufficiently fired. If the firing had lasted for a longer time period (16 to 24 hours) the pots probably would have been fired to a complete ceramic state (Figure 42).

(6). An alternative firing may have been to fire the pot as stated in Step 5 (long enough to turn the rim ceramic and dry the rest of the pot thoroughly) then the pot could be cooled, lifted from the pit, the stone

turned out, and the pot placed on an open hearth to complete the firing of the vessel. Either firing procedure would result in a finished ceramic vessel (Figure 43). The pit fired pottery had a very high survival rate. This method of firing has as good, if not better, survival rate as open hearth firing. Pit firing is not adversely affected by wind gusts as is open hearth firing.

(7). The finished pottery is the major result of this process. Another result is the feature left by the ground mould. This is significant in that it is an indicator of this method of pottery manufacture. The feature would be characterized by a U-shaped pit filled with dirt and charcoal, perhaps refuse that was dumped into it. There would be large deposits of charcoal around the surface and some heat-reddened areas. The soil surrounding the walls of the pit would show as more compact from the heat concentration. There may be a flat stone in the bottom of the pit and/or ones around the upper edge (Figures 44-46).

Comparison

The Saskatchewan Basin complex and pottery from the ground mould Account #7 are compared on Comparison Chart III. The reconstruction of these technologies based on inferences drawn from the data has been

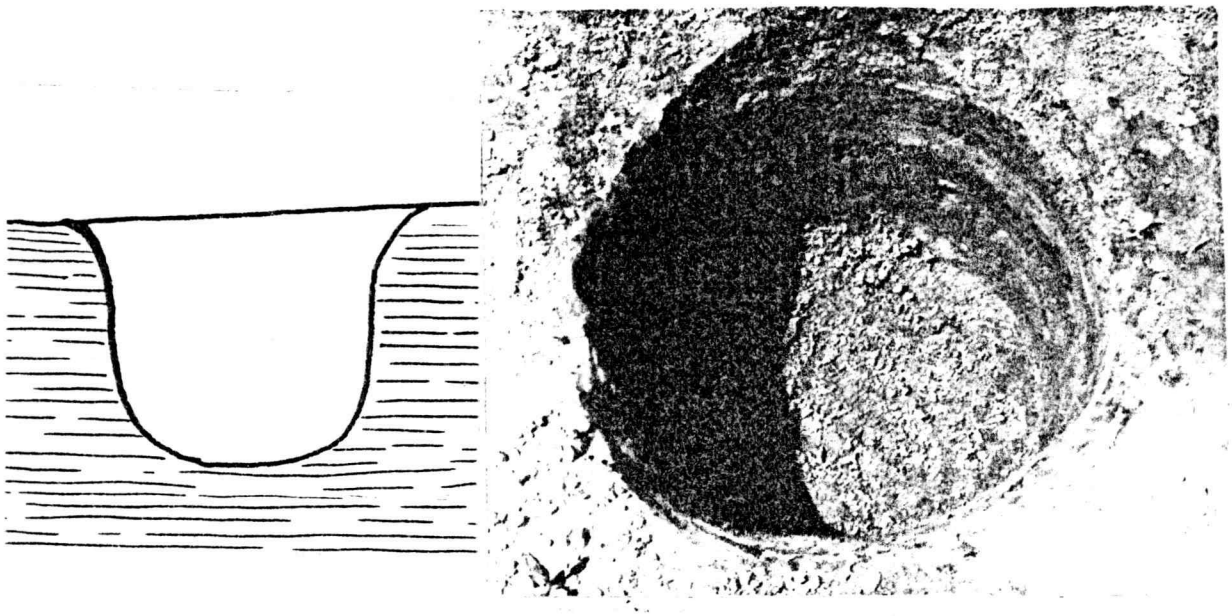


Figure 28. Left, Cross-Section of U-Shaped Pit. Right, Top View of U-Shaped Pit Used for Ground Mould Method.

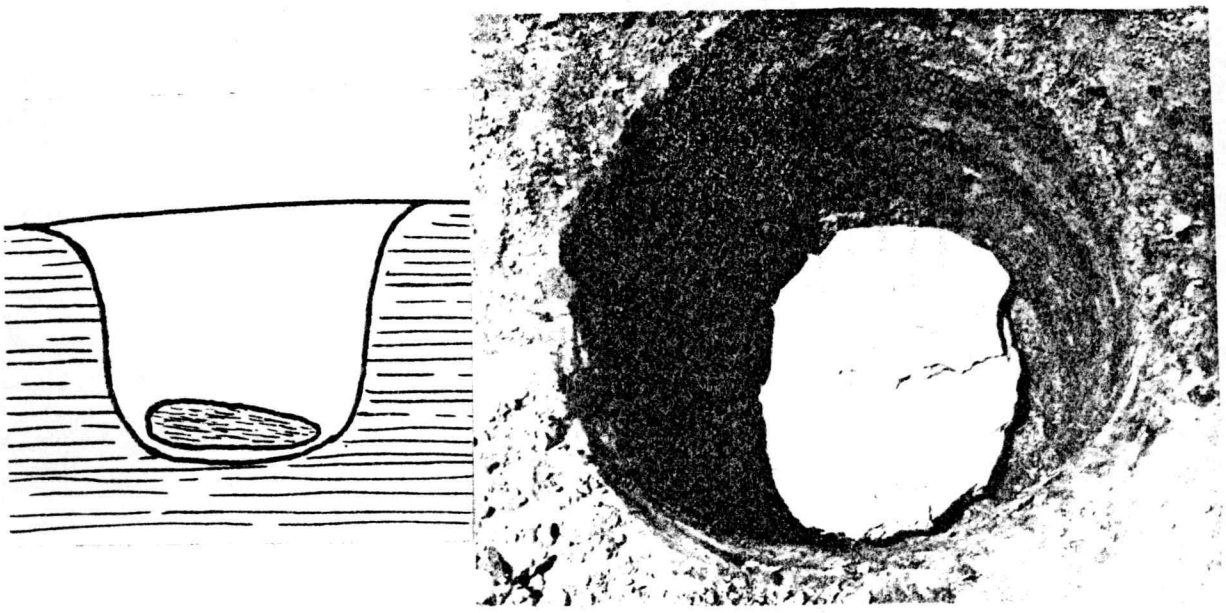


Figure 29. Left, Cross-Section of Flat Sandstone Placed in Bottom of Pit. Right, Top View of Sandstone in Pit.

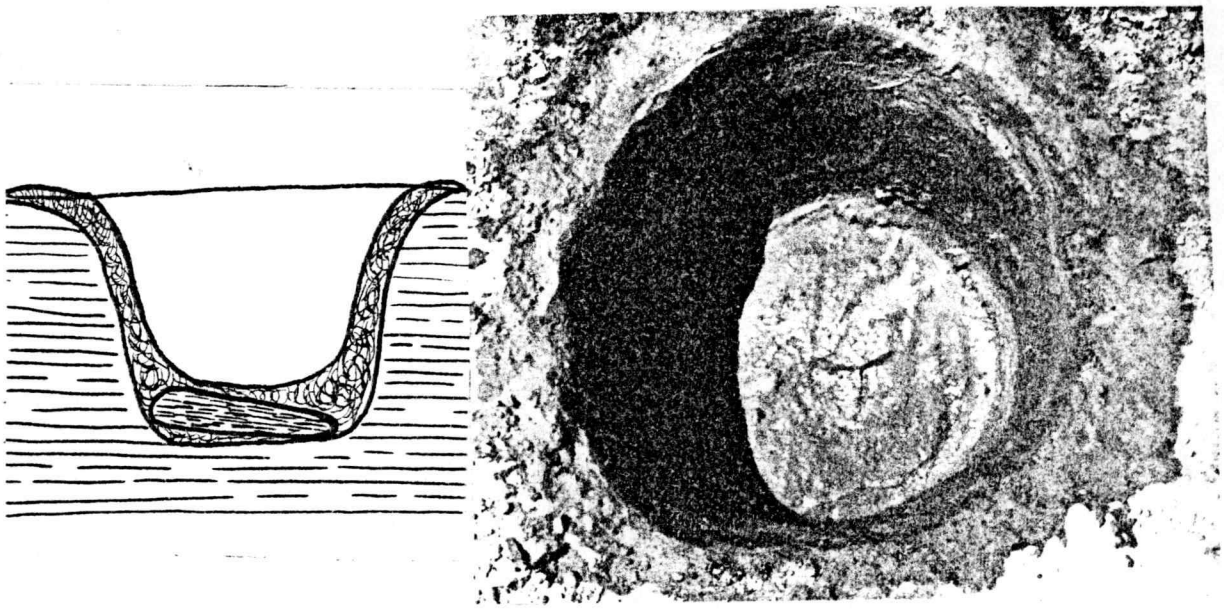


Figure 30. Left, Cross-Section of Mud Lined Pit. Right, Top View of Pit Wet Down in Preparation for Lining.

Figure 31. Left, Wet Lining Being Smoothed. Right, Dry Lining Being Greased.

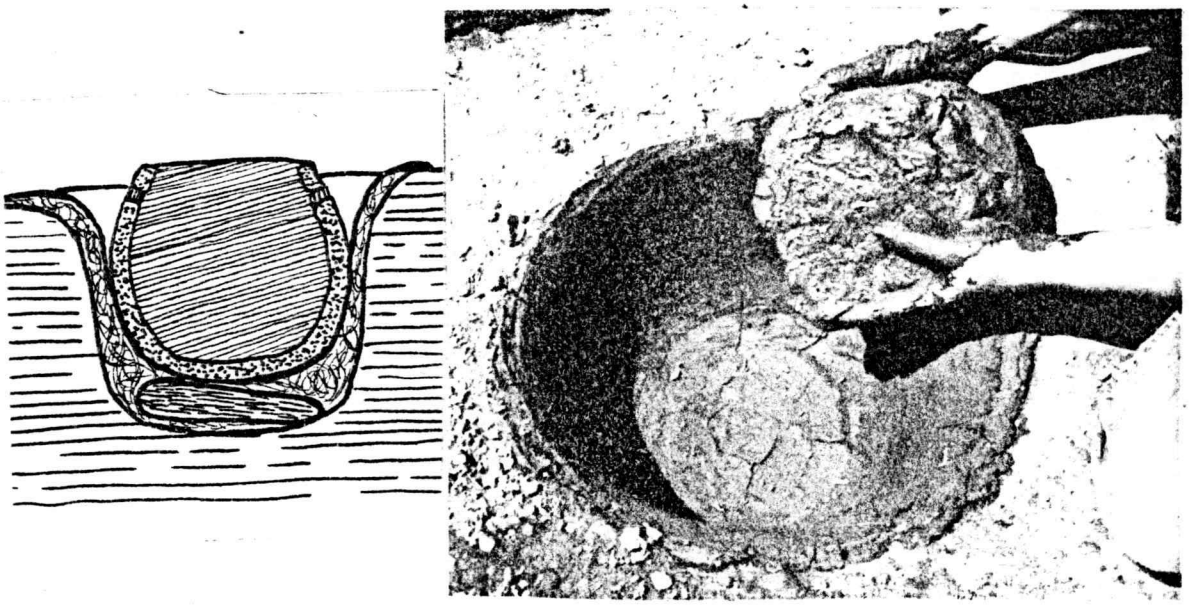


Figure 32. Left, Cross-Section Showing Formed Pot in Ground Mould. Right, Large Piece of Clay Being Placed Into Prepared Mould.

Figure 33. Left, Clay Being Hollowed Out and Pressed Against Sides of Mould. Right, Clay Being Pulled Up Side of Mould to Form Walls of Pot.

Figure 34. Hand Held Stone Being Used to Thin and Push Up Clay Walls of Pot.

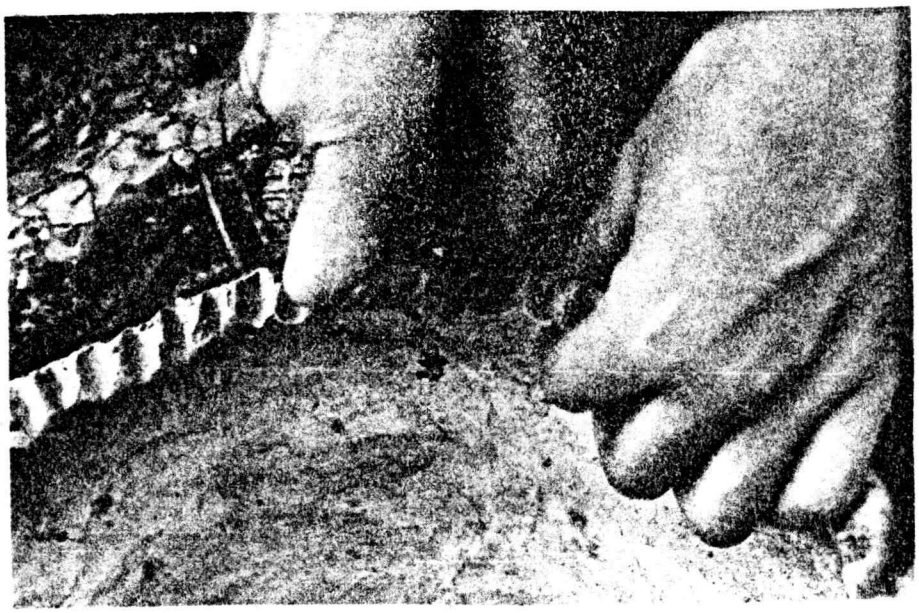


Figure 35. Detail, Showing Small Pebble Used as Edge Finishing Tool.

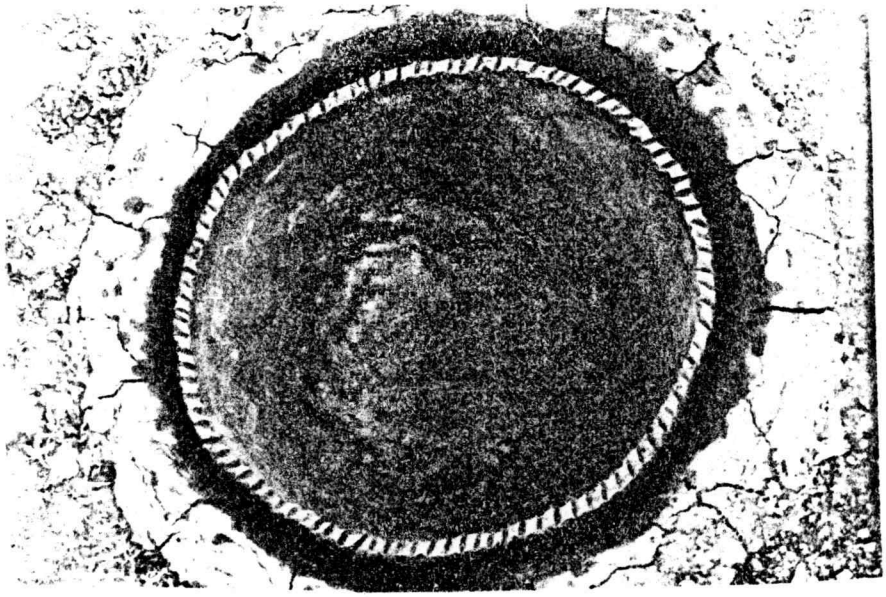


Figure 36. Formed Pot Drying in Mould. Pot has been Greased to Help Prevent Cracking.

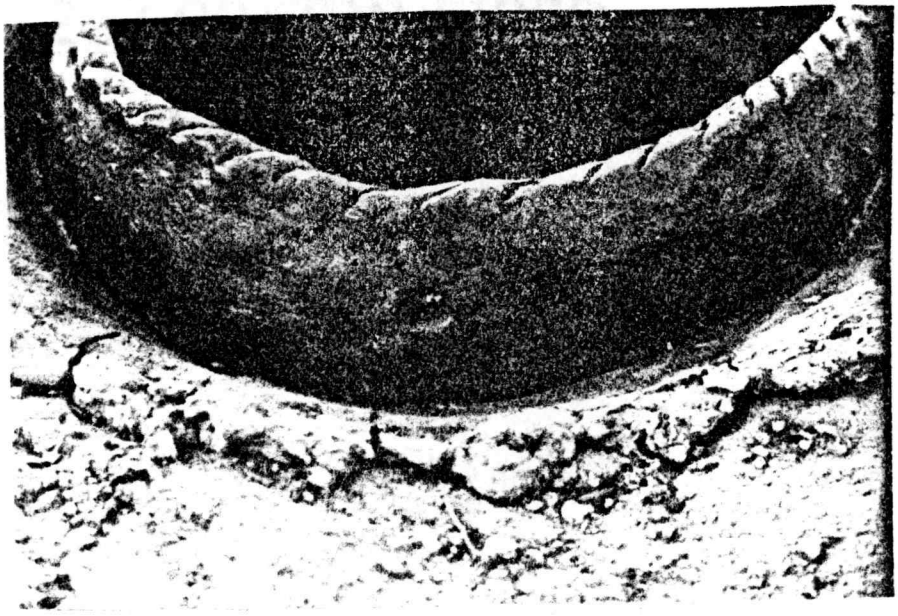


Figure 37. Detail, Showing Neck and Rim of Pot Formed Above Ground Mould. Note Rim Edge and Handle Hole.

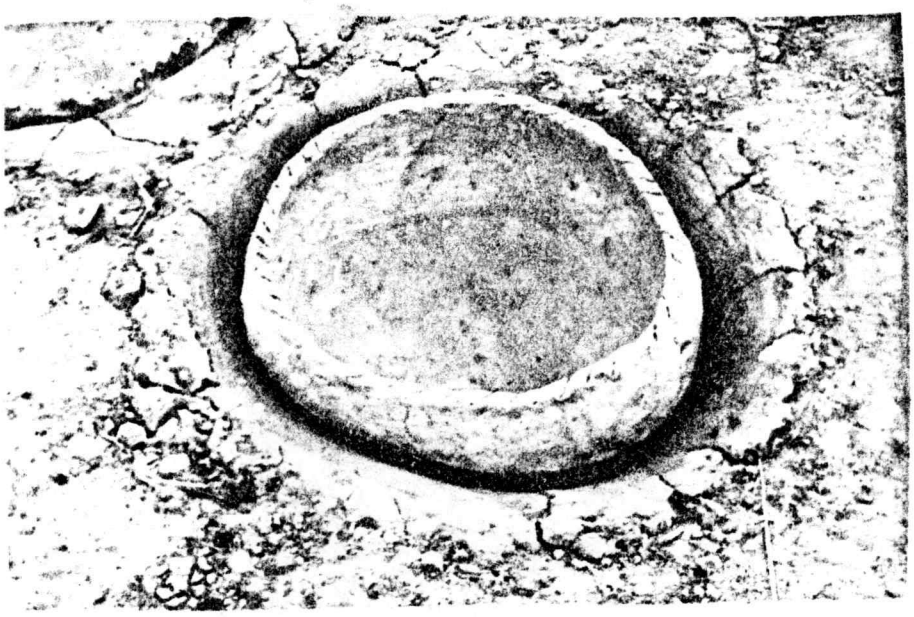


Figure 38. Dried Pot in Ground Mould. Note Shrinkage of Pot Away from Mould, also Shoulder Formed on Pot Where Neck was Drawn Away from Mould.

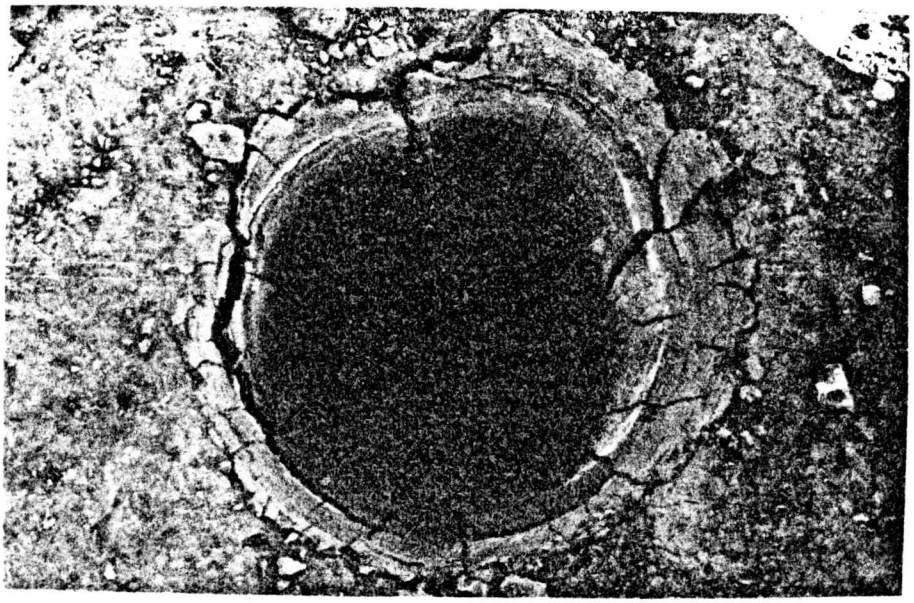


Figure 39. Formed Pot in Ungreased Ground Mould Showing Cracking Due to Shrinkage.

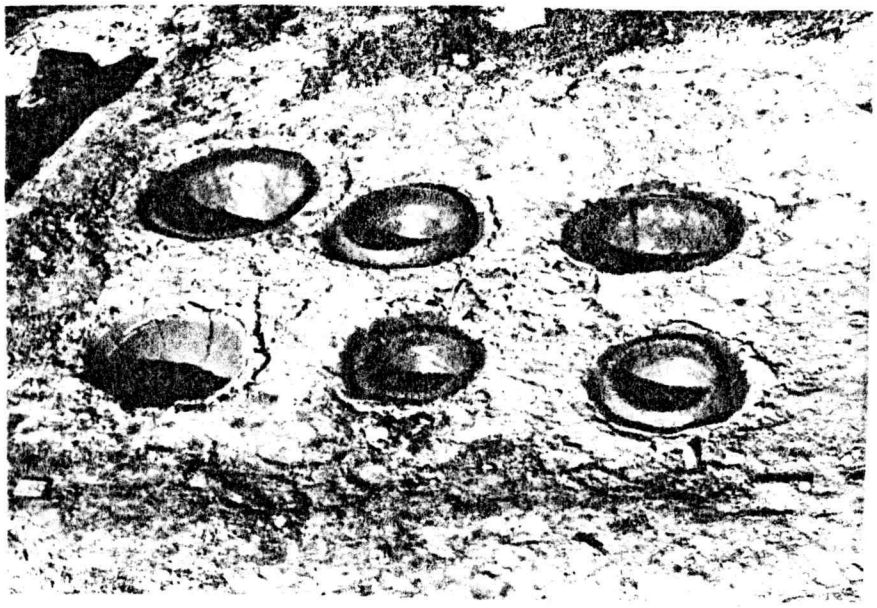


Figure 40. Formed Pots in Ground Moulds. (Lower Left Pot is Shown in Detail, Fig. 39.)

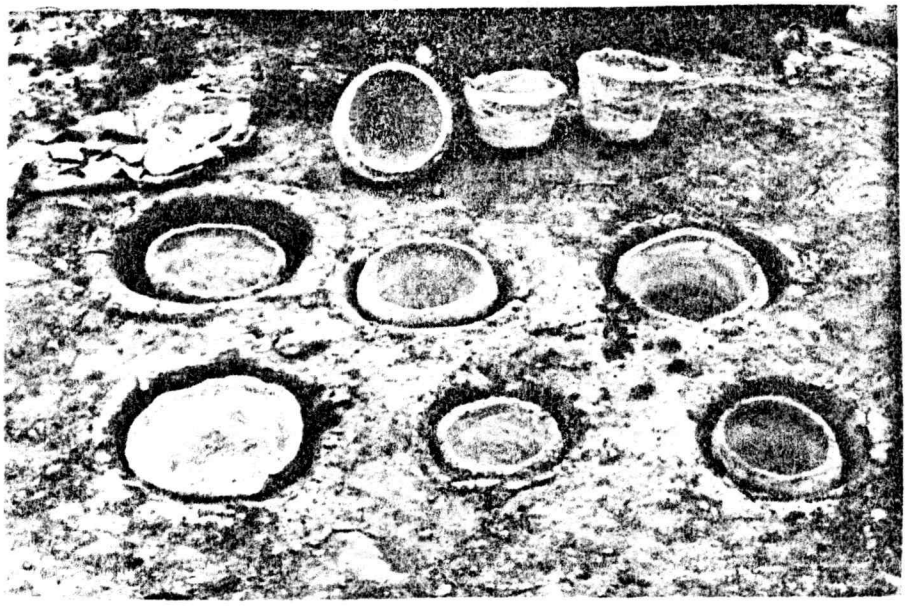


Figure 41. Dried Pots in Ground Moulds and on Surface.

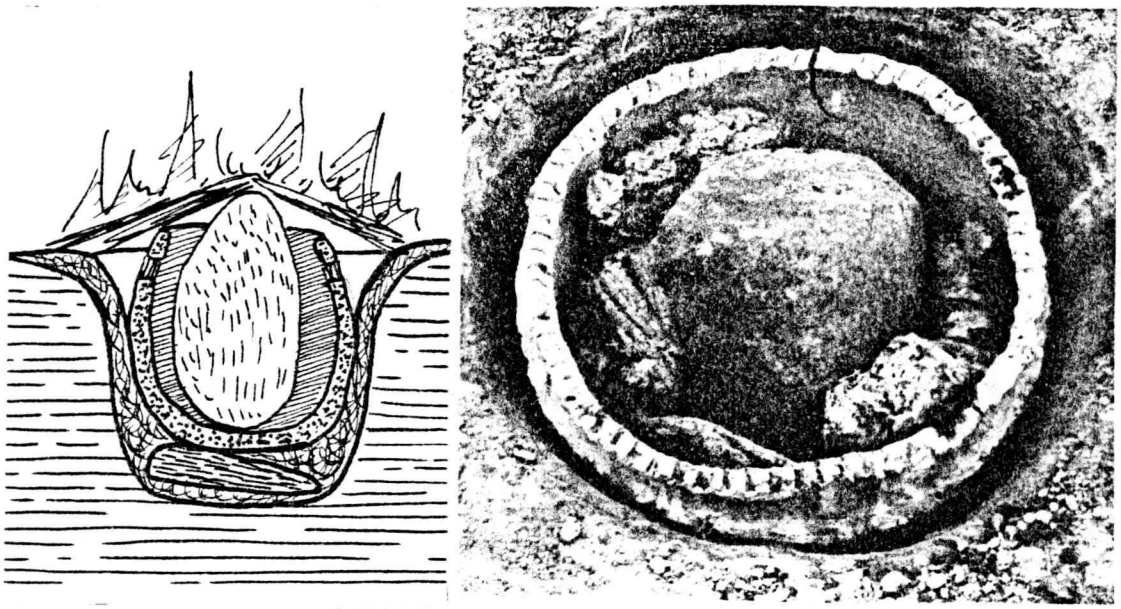


Figure 42. Left, Cross-Section of Pot Being Fired in Ground Mould. Right, Pot Prepared for Firing, Stone and Cow Chips in Place.

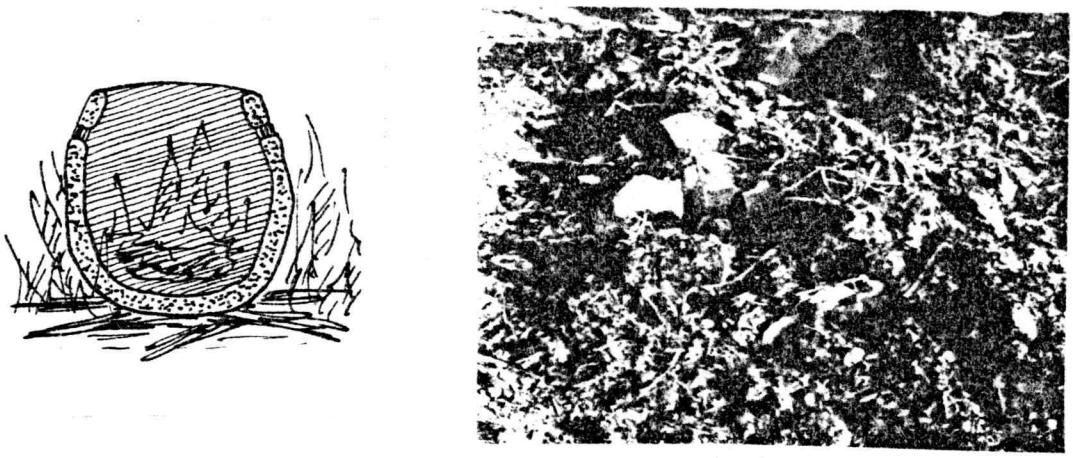


Figure 43. Left, Cross-Section of Pot Being Fired in Open Hearth. Right, Firing of Pots.

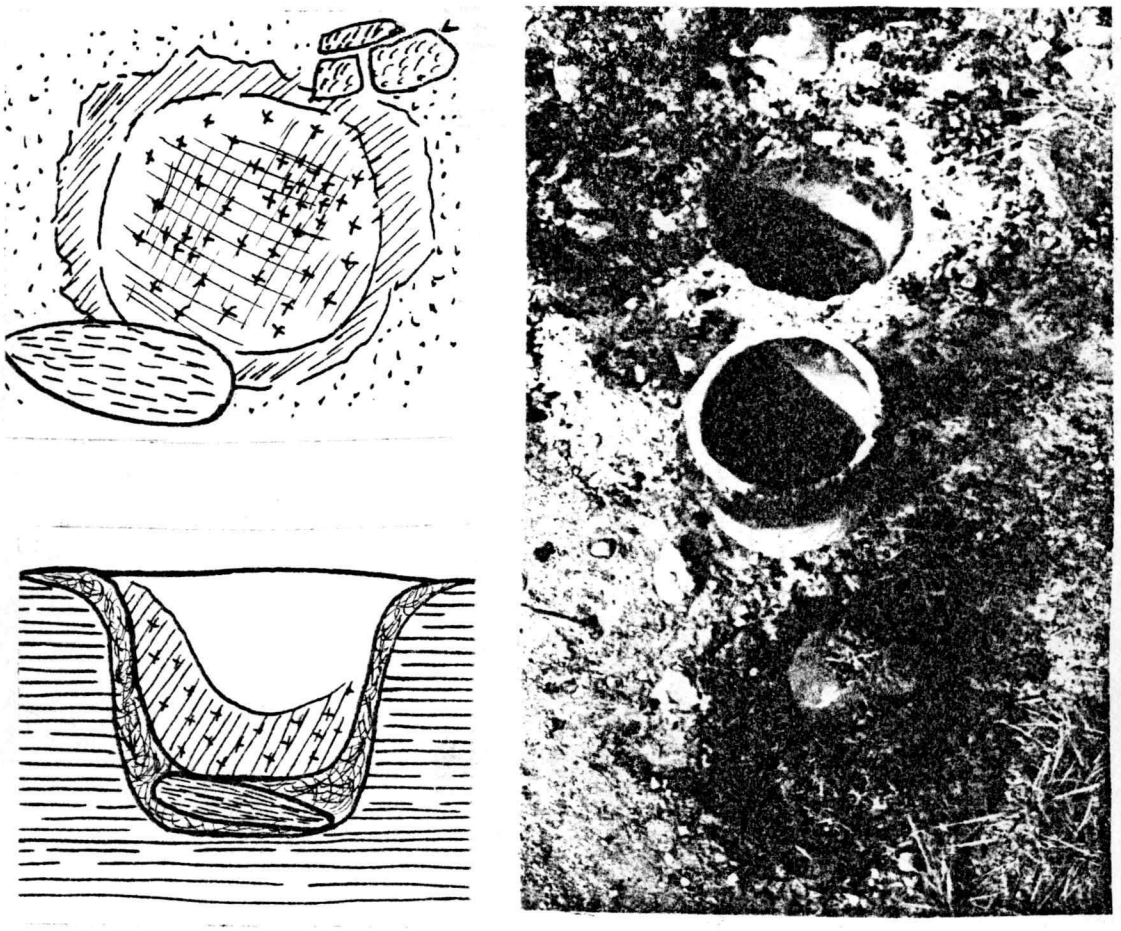


Figure 44. Ground Mould Feature, Upper Left, Top View of Pit. Lower Left, Cross-Section. Right, Pot Pulled from Pit, Stone and Ashes in Foreground, Mould in Background.

Figure 45. Ground Mould (Pot Removed) Filled With Dirt, Ashes, and Charcoal. Fire Cracked Rock, Upper Right.

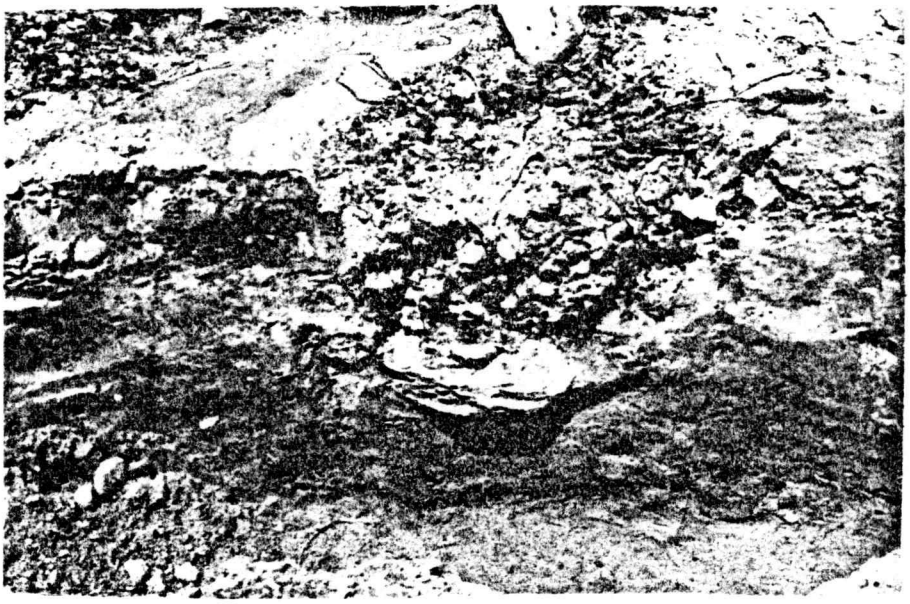


Figure 46. Cross-Section of Ground Mould Showing Sandstone in Bottom of Pit. Note Fill of Dirt, Ashes and Charcoal. Darkened Soil Around Pit is Indication of Heat Concentration.

explained in the foregoing discussion. The two technologies have many characteristics in common. The most significant point is the method of manufacture -- ground moulds. The presence of U-shaped pits in the archeological record in association with Saskatchewan Basin pottery supports this idea (Figure 47). The experiments have shown that pottery can be successfully produced in ground moulds (Figure 48). The occurrence of decorations above the shoulder on Saskatchewan Basin pottery can be explained in terms of this method of manufacture. When the pot is formed in the ground mould the shoulder and area above are the only exposed portions of the pot other than the interior. This exterior portion would be the only available space to decorate. Further, these decorations may serve a purpose. The rim and upper portion of the pot are exposed to the air and have a faster drying rate than the portion of the pot that is in the mould. This same area is also exposed to direct heat concentration during the firing process, while the bottom of the pot has a delayed and/or indirect exposure to firing. The decorative incisings may have been added to help prevent the rim from cracking while drying and shattering during the firing process.

Many of the Saskatchewan Basin pots were smooth on the exterior body below the shoulder. This would have resulted from forming the pot in a smooth mould. Some of the pots show evidence of texturing on the exterior body of the pot. During the experiments, it was found that when pots over one and a half gallon capacity were formed, it was difficult for the clay in the base of the mould to dry as rapidly

as the walls. The base of the pot would form cracks because of this irregular shrinkage. This problem could be remedied by placing strips of loosely woven fabric in the mould before the pot was formed. (Burlap was used in the experiments. Strips of hide, woven fabric, or net may have been used by the prehistoric culture.) The strips of woven cloth loosened the bottom of the pot from the mould sufficiently to allow more even drying. These strips were held in place by small stones placed around the surface edge of the moulds. The pots, when leather hard, could be lifted from the pits by these strips (Figures 49-51). The smaller pots could be lifted out by their rims. The exterior surfaces of these pots could then be rubbed, scraped, smoothed or textured. The pottery would be too dry at this point to decorate to any great extent. The pottery could be left on the surface to dry before returning to the ground mould for firing.

Shoulders on this type of pottery are common and show thickening along the shoulder ridge. This may be a characteristic of ground mould ceramics. When the clay is bent in away from the mould to form a neck on the vessel, a shoulder ridge of thickened clay is naturally formed. It requires effort and much working of the clay to avoid this effect. Pots with shallow necks, or no necks, are the easiest to form in ground moulds. This may explain why these forms are more common.

The ground moulds, once formed, could be re-used many times, Possibly from season to season. The pits would have to be re-lined with mud as this would have quickly weathered away. A pit feature formed from the experiments was compared to a "prepared hearth" from the

Morkin Site and found to be greatly similar. Both are U-shaped pits, filled with charcoal and dirt. A flat stone is in the bottom and a few stones are found around the surface. There is evidence of fire and heat-reddening in the soil deposits surrounding the features.

On the basis of these comparisons, it is suggested that Saskatchewan Basin ceramics were manufactured in ground moulds. There is a high degree of similarity in all categories of the two technologies compared. Additional similarities in U-shaped pit features resulting from the pottery manufacture adds strength to the case. An indication of technological continuity between the ethnographic ground mould account and the Saskatchewan Basin complex is concluded.

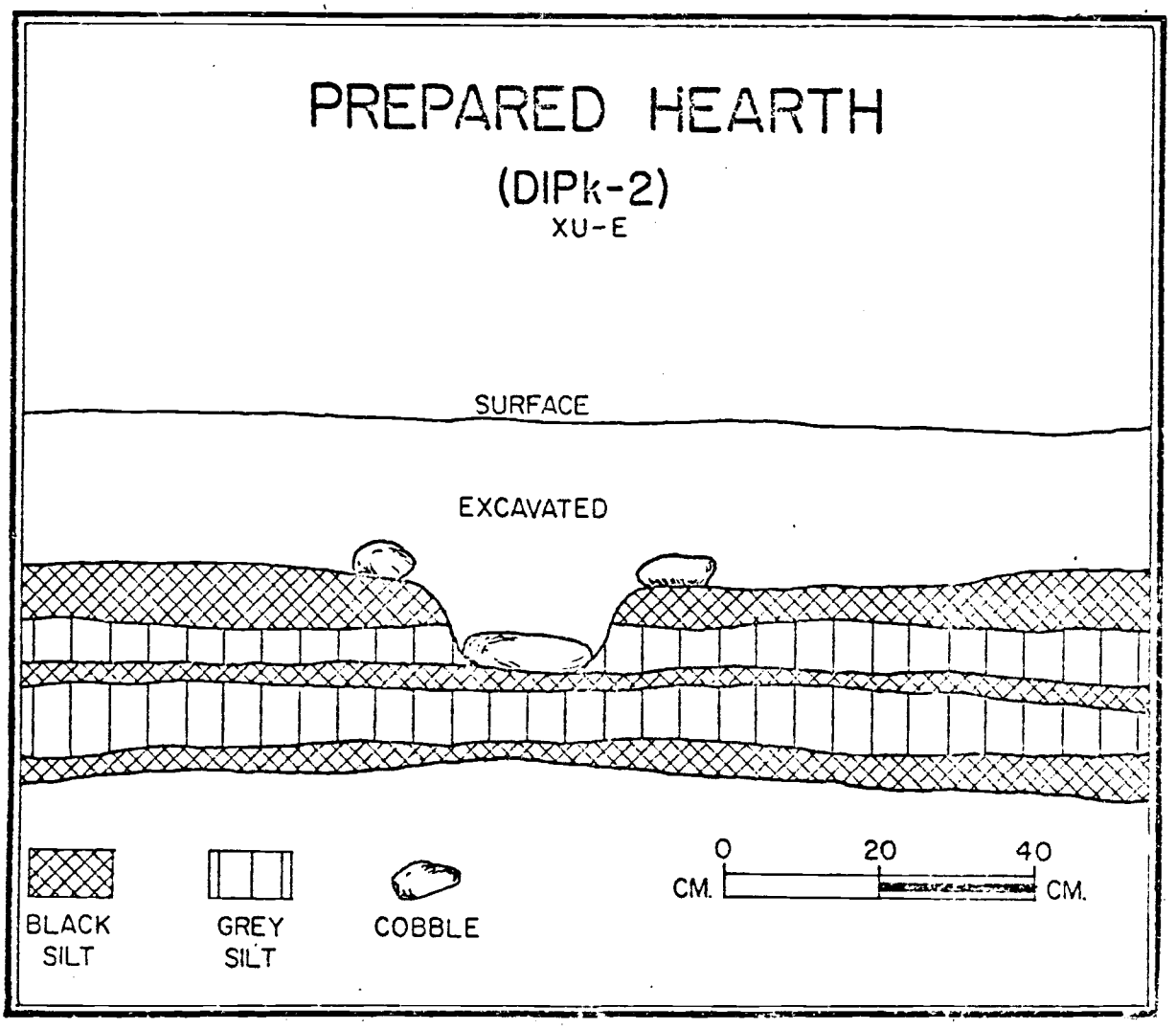


Figure 47. Cross-Section of "Prepared Hearth" or U-Shaped Pit from the Morkin Site (Byrne 1973:672, Fig. 8).

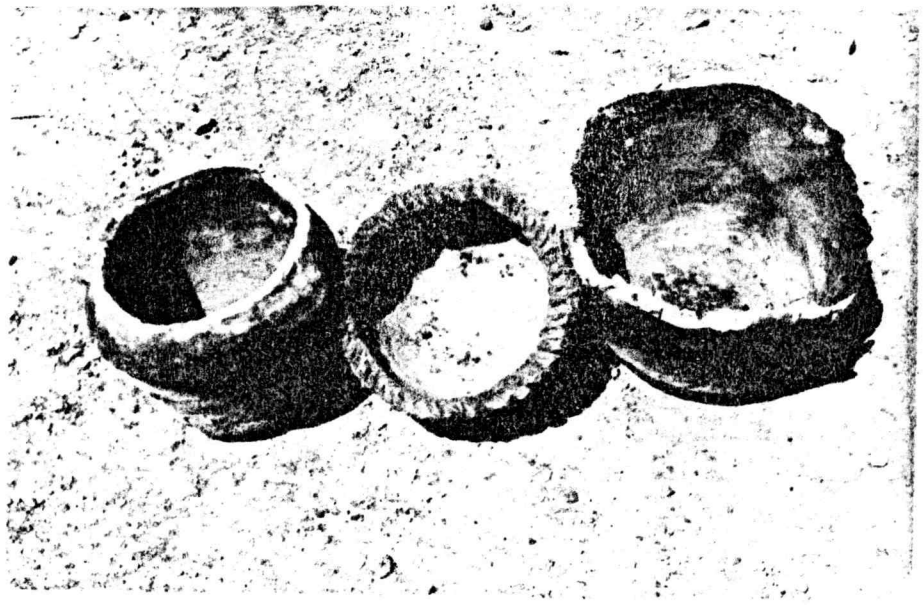


Figure 48. Fired Ground Moulded Pottery.

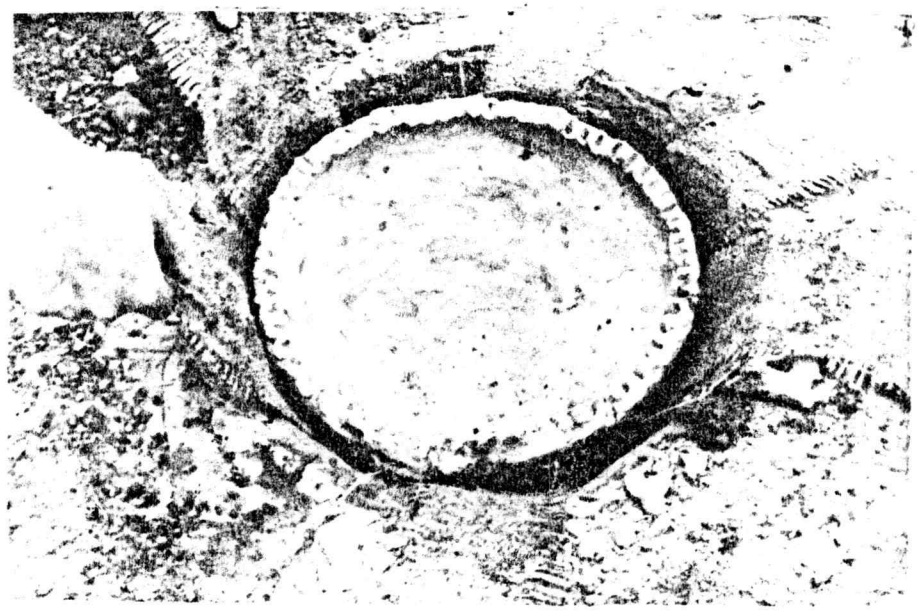


Figure 49. Dried Pot Being Lifted from Ground Mould by Fabric Strips. Strips were Placed in Mould Prior to Formation of Large Pot to Help it Pull Away from Mould While Drying.

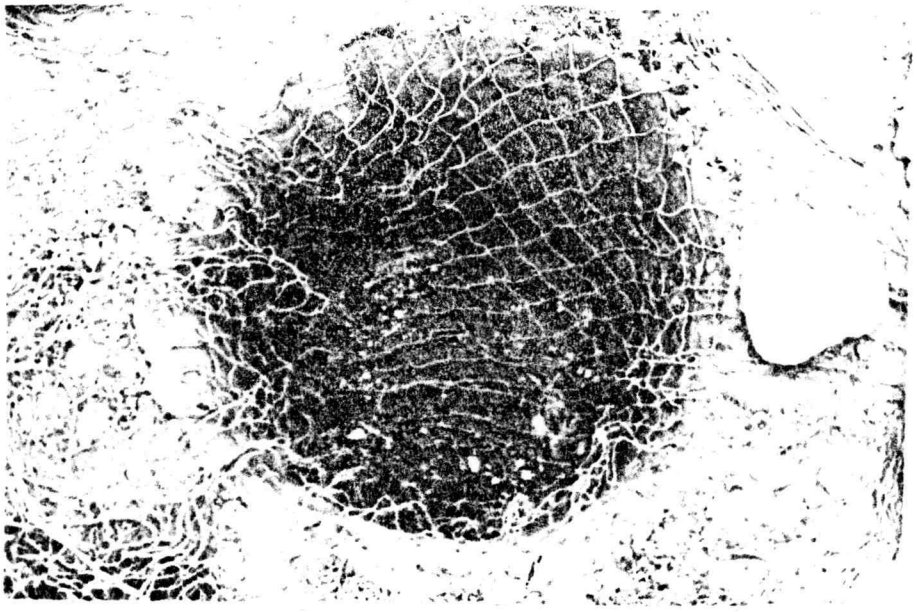


Figure 50. Netting Placed in Ground Mould Prior to Formation of Large Pot. Netting Served Same Purpose as Fabric Strips (Figure 40).

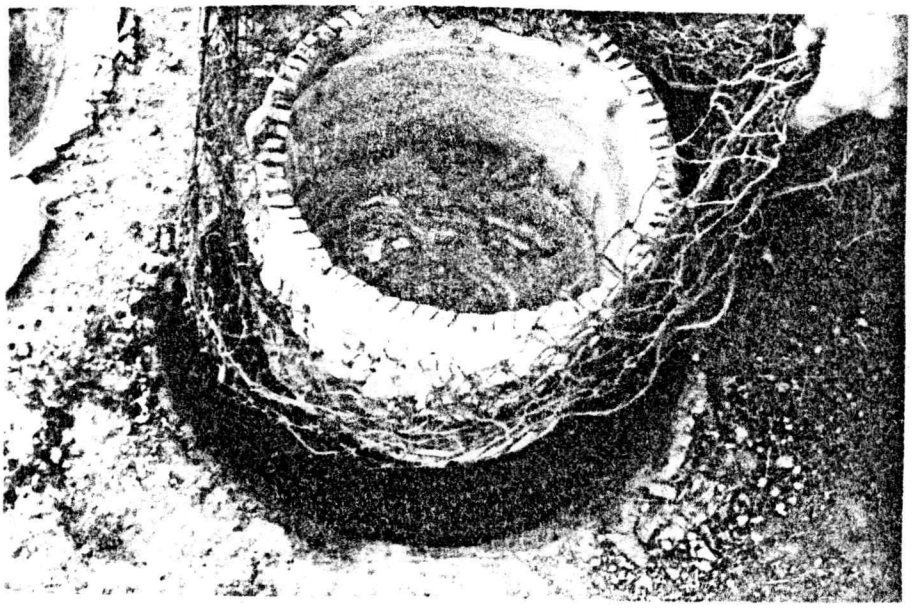


Figure 51. Dried Pot Being Lifted from Ground Mould With Netting. Netting Could be Removed and Pot Returned to Pit for Firing.

		Ethnographic Data (Account #7)	Archeological Data (Saskatchewan Basin Complex)	
PROCESS	(1) Materials used	Clay temper (sand/granite?)	Clay temper (crushed granite)	Similar (?)
	(2) Preparation of materials	Clay and temper mixed with water to form dough	Clay and temper mixed with water to form dough	Similar
	(3) Pottery forming method	Ground mould, U-shaped pits	Ground mould (?), U-shaped pits	Similar
	(4) Decorating techniques	Undefined (above shoulder?)	Occurs above shoulder of pot	Similar (?)
	(5) Firing method	Fired in ground mould, U-shaped pits	Fired in ground mould (?), U-shaped pits	Similar
	(6) Utilization of Vessel	Cooking pot	Cooking pot	Similar
PRODUCT	(7) Material composition	Clay and sand/granite tempered paste, tan to brown exterior and interior walls, cores darker in color	Clay and granite tempered paste, exterior walls are tan to brown in color, cores are black to gray, hardness 3.0 to 4.5 on Moh scale	Similar (?)
	Style	Pot forms are globular with pronounced shoulders (when present), smooth finish on surface	Globular pot forms, pronounced shoulders when present, surface finish smoothed, decoration occurs above shoulders	Similar

Figure 52. Comparison Chart III. Comparison of Saskatchewan Basin Complex and Ground Mould Tradition.

IV. CONCLUSIONS

EVALUATION OF EXPERIMENTS

The experiments that were conducted to test the pottery manufacturing methods are reliable in that they could be repeated from the data available and would return the same results. The procedures for manufacturing pottery that have been previously explained are the results of the experimental process. Each method has been explained in terms of the results from the experiments and comparison to the original ethnographic and archeological data. Throughout the experiments the procedures of making pottery and related inferences were checked against that data base. New interpretations and revised inferences resulted from this constant re-checking of the data and experimental content.

Each method of ceramic manufacture was tried a number of times with a variety of approaches until the process was successfully worked out. Each step of the methods was questioned and tested through trial and error to determine why that step worked and was a necessary part of the procedure. The attempt was made throughout the experiments to test aspects of the processes and not assume that something would or would not work.

The experiments were done using native materials (see Appendix E). Clays and sands acquired in the Altamont region were used as vessel paste. A variety of these materials was tested. The ground mould experiments were done in northern Montana. This approximated

the typical summer conditions under which such pottery would have been made in prehistoric times -- soil, humidity, sun, thunderstorms, and wind.

It is important to note that through the experiments, the methods of pottery manufacture were worked out to the point that pottery could be produced successfully. The methods were not by any means perfected. This would be possible given much repetition as is true of any method of pottery manufacture.

It is recognized that the results indicated are an interpretation of the experimentation. The pottery manufacturing methods described are defined to the extent the present research will allow. There are variations within each method and modifications are possible. The results of these experiments are indications of what may have been viable methods of pottery manufacture in prehistoric times.

SUMMARY OF RESULTS

The pottery traditions of the Altamont region have been reconstructed and the technologies compared in the previous chapters. The results of the experiments may now be summarized:

(1). Comparison of the Cluny Complex and the Handbuilt Tradition gave an indication of technological discontinuity. Given the present data and test results, these two technologies are different in method of manufacture. The Cluny Complex is a late Protohistoric Period intrusion into the area from the East. As such, it is the most recent of the pottery traditions of the

Altamont. The Handbuilt Tradition does not correlate with any of the other technologies compared. Its closest resemblance is to the Cluny Complex even though a correlation is not indicated. This comparison is left open to further research.

(2). Comparison of Intermountain Ware and the Rawhide Mould Tradition resulted in an indication of technological continuity. The two technologies are similar in manufacture based on the archeological and ethnographic data tested through reconstruction. There are a variety of ways in which rawhide moulds can be used to make pottery. Two defined methods are; a cooking pot formed over the outside of a greased rawhide mould and fired to a ceramic state, and a ceremonial pot formed in the inside of an ungreased rawhide mould, polished, painted with red earth paint, and sun dried. A third possibility is that of a cooking pot formed in the inside of an ungreased rawhide mould. On the other hand, this account may be a brief version of the ceremonial pot method. The Intermountain Tradition appeared at an earlier time than the Cluny Complex, possibly dating as early as A.D. 1100. Most Intermountain Ware is found in the southern part of the Altamont.

(3). Comparison of the Saskatchewan Basin Complex and the Ground Mould Tradition yielded an indication of technological continuity. Based on the reconstruction of the technologies and comparison of the resultant pottery and U-shaped pit features, it was determined that these two ceramic traditions were similar.

The Saskatchewan Basin Complex is the earliest recognized pottery tradition in the Altamont region. The late variant dates to A.D. 1000, and early variants of the complex may be as old as A.D. 200. The pottery was made in pits that had been excavated out of the ground. A stone was placed in the bottom and a pot formed in the cavity after it had been lined with mud and greased (optional). Stones were placed inside the pots while they remained in the ground moulds and a fire was built over the surface. This pottery manufacturing technology leaves two archeologically significant products -- the pottery and the ground moulds.

The Handbuilt Tradition will be set aside at this point in the discussion. Perhaps at some future time, a pottery tradition will be recognized in the archeological record that will show a correlation to it. Additional ethnographic information may turn up that would indicate the use of a mould or paddle-and-anvil, in which case, it could be linked to one of the other pottery traditions.

The three pottery traditions that are now recognized for the Altamont region are:

(1). The Cluny Tradition -- a paddle-and-anvil method of pottery manufacture. The most recent entry into the Altamont, arriving during the Protohistoric Period from the East (possibly Upper Missouri).

(2). The Intermountain Tradition -- a rawhide mould method of pottery manufacture. An earlier tradition brought into the southern Altamont during the Late Prehistoric.

(3). The Saskatchewan Basin Tradition -- a ground mould method of pottery manufacture. The earliest pottery tradition, present during the Late Prehistoric and possibly dating into the Middle Prehistoric.

The results of the experiments stated here are indications made from the presently available archeological and ethnographic data and experimental reconstructions of the pottery technologies.

IMPLICATIONS

It will be useful and appropriate to discuss the implications that arise from the results of these pottery technology experiments in the context of Ewer's three questions. These questions were first posed thirty years ago and are still relevant today:

(1). "Is it possible that the use of a mould in the manufacture of pottery is a trait of some antiquity and breadth of distribution in the northern Great Plains?"

A point of primary importance needs to be made before this question can be addressed. It is possible to make pottery from moulds as described in ethnographic accounts! There are several methods of using moulds in pottery manufacture. In the Great Plains in general, and the Blackfoot Tribe in particular, there were several methods of pottery manufacture known contemporaneously. Variation and multiplicity of pottery technologies must be recognized.

The likelihood that rawhide moulds were used as the method of manufacture for Intermountain Ware would indicate that moulds were

used in pottery production in the Altamont during the Late Prehistoric. The Saskatchewan Basin Tradition of ground moulded pottery may date as early as the Middle Prehistoric. These dates are indicative of a pottery moulding tradition in use for over a thousand years. The occurrence of similar ethnographic accounts among other Plains tribes indicates a wide distribution of these technologies. Further archeological research will be needed to accurately map the distribution of these traditions through the Great Plains and the prehistoric chronology of the region.

Yes, it is possible that the use of a mould in the manufacture of pottery is a trait of some antiquity and breadth of distribution in the Northern Great Plains.

(2). "Is the Blackfoot pottery that has been described a survival of a simple and crude pottery tradition, or is it a terminal, decadent form of an earlier, better made, decorated pottery?"

After examining the archeological record of Saskatchewan Basin ceramics (Byrne 1973) and Intermountain Ware (Mulloy 1958), it is evident that these two pottery technologies are not terminal, decadent forms of an earlier, better made, decorated pottery. Intermountain Ware has a large distribution over the states of Montana and Wyoming and contains some local variations. It is a unique tradition and is not a degeneration of a more complex tradition. Saskatchewan Basin Ware is divided into early and late variants. This tradition has variations within its distribution and form also. It, too, is a

unique tradition and is not a simplified terminal form of a different technology.

The Blackfoot accounts described several pottery technologies that were workable. These pottery manufacturing technologies incorporated the use of materials and methods suited to a lifestyle of nomadic bison hunting in a Plains environment. Simplicity is often the pragmatic answer to need and often more successful than more elaborate answers.

> "Then it is shown that thinking falls within the scope of this principle (affective thought); reasoning is a phase of the generic function of bringing about a new relationship between organisms and the conditions of life, and like other phases of the function, is controlled by need, desire, and progressive satisfactions" (Dewey 1964:144).

When compared to the highly decorative pottery of the Upper Missouri groups, this pottery would seem crude. However, when considered within the region's cultural setting and natural environment, these pottery technologies are simple, yet elegant in a pragmatic sense, because they are totally appropriate answers to the needs they fulfill. It can then be stated that the pottery methods described by the Blackfeet are survivals of earlier simple and well adapted pottery technologies.

(3). "What are the historical relationships among the several tribes north and west of the Mandan in the manner of ceramics?"

The occurrence of similar accounts of pottery manufacture among many other northwestern Plains tribes would indicate a wide distribution of these pottery technologies. These accounts and related

archeological data will have to be analyzed through pottery manufacture analysis before theories of trait dispersal and area distribution can be formed. Regional variations in the technologies will need to be defined and a more complete chronology determined from the archeological data. It is hoped that the indications of technological continuity arrived at from pottery manufacture analysis will aid archeologists in forming hypotheses about the prehistory and history of the northwestern Great Plains.

CONCLUSION

Pottery manufacture analysis as applied to the archeological and ethnographic data of the Altamont region has been a useful tool. Through the use of this method, ethnographic information previously dismissed as invalid has been tested in the context of the archeological setting with experimental reconstruction of the pottery technologies. The results of these experiments has shown that the ethnographic material is valid and can be used to develop hypotheses concerning prehistoric technologies in the region. In carrying out this research the method of pottery manufacture analysis was developed and tested as a tool of experimental archeology.

This method has provided a new insight into the prehistory of the Altamont region. Beyond that, several issues have been raised that deserve comment.

The question of the validity of native accounts of pottery manufacturing technologies has been raised. Through experimentation

based on these accounts and the archeological data it was found that the technologies described do produce viable forms of pottery. With the knowledge that the information contained in these accounts is valid, accounts of this type from other Plains tribes can be reassessed and valuable data gained from the inquiry.

It has often been assumed that there is no way that ethnographic and archeological data could be compared. This problem is especially relevant to the northwestern Great Plains where a time gap exists between the two records. Although no method of direct comparison has been found, through pottery manufacture analysis the archeological and ethnographic records may be compared by the indirect means of experimental reconstruction.

Over-emphasis on trait analysis in the study of Plains ceramics has led to ignorance of manufacturing processes. By analyzing the decorative markings on prehistoric pottery, archeologists seek to define pottery traditions and their distributions. This has been partially successful in the Plains. However, with this approach the major problem facing these studies is that most of Plains pottery is undecorated. What is needed in the study of Plains pottery is an approach adapted to the characteristics of the pottery. Since the pottery is not highly decorated it is logical to turn to other data: methods of manufacture, traits and features associated with these technologies, and vessel form as a function of the pottery technologies. Pottery manufacture analysis provides an approach adapted to Plains pottery. It incorporates trait analysis to deal with physical

characteristics of the pottery product, and experimental reconstruction of the technologies to analyze the process of pottery manufacture. By understanding both the process and the product of manufacturing pottery, the archeologist is better able to incorporate data of ceramic technologies into the total cultural context of which it is a part. In doing this we gain a more complete picture of the prehistory of the Northern Great Plains. In this region, a new perspective for interpreting ceramic data has been needed. Pottery manufacture analysis should provide such a perspective, a more complete way of studying the techniculture called ceramics.

EXPLANATORY NOTES

1. The pottery vessels were used for boiling food. Cooking pots were not glazed and had to be kept greased to waterproof them. Unglazed, unpolished pottery is very porous. Boiling may have been done by placing the pot containing food on a fire, or suspending it from a tripod over the fire. Another possible method of boiling food is similar to stone boiling in a paunch described by Wissler (1910). Small stones, heated in a fire, would have been placed inside the pot causing the contents to boil.

2. "Red earth paint" as used in the ethnographic account describes the colorant used on these cermonial pots. The colorant is not specified. The red color may have come from red clays or from red ochre (commonly found, though in small quantities, in archeological sites in the Altamont). This colorant would have been applied as a stain, rather than as a "paint".

3. The clay body (i.e., paste, dough) is dried and then fired, (i.e., baked, cooked) to a "ceramic state". During the firing process a chemical change occurs in the clay body. Alumina and silica and other minerals are melted and reform during the firing and following cooling process. The clay body has been changed to a glass-like ceramic. The clay is said to have matured at this temperature during firing. Ceramic vessels and fragments that have matured will not return to raw clay (clay body) form again. If the vessel has not matured it will disintegrate in water and return to a clay body (see Nelson 1966:311-322, Glossary of Ceramic Terms).

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APPENDICES

APPENDIX A

Description of the Cluny Complex (Byrne 1973:336-338).

Total of 37 vessels, all dated prior to period III, five components, four sites.

Paste

- Compact, fine laminations and light to moderate blockiness.
- Temper relatively fine, sparse to moderate, crushed granite main component, no larger than 4mm.
- Cores black to medium gray, interiors also, exteriors medium gray/black to light tan, negligible firing rims.
- Hardness 2.5 to 4.0 Moh, average 3.0 to 3.5.

Surface Finish

- Interiors quite smooth, plastic formed stria running parallel to and just below the inner lip edge.
- Exteriors most commonly paddled with grooved implement, check and simple stamps marks, outer surface then completely smoothed, clay had dried somewhat prior to smoothing -- done by combination of wiping with a dampened pad, perhaps a piece of wet hide, and pebble polishing. Additional -- brushing of the wet clay and woven fabric impressing without the exterior having been smoothed were done but not as common as first.

Vessel Form

- See Figure 32, reconstructed vessel forms.
- Bases are always rounded, never flat.
- Bodies are globular and squat; walls range 4 to 8mm, average 6mm.
- Shoulders not demarcated feature, if apparent no wall thickening.
- Necks are frequently (1) short and very sharply curved (external concave vertical profile arcs of 90 to 139 degrees); or, (2) long and shallow vertical to slightly flaring section.
- Rims are often collared or braced, "S" vertical profile, direct to vertical.
- Lips are usually flat and unthickened, generally formed to inslope occasionally horizontal, rounded and ridged forms are known but are rare (Byrne p. 336,7).

Decoration

- Most vessels show decoration, majority have considerable amount.
- Linear dentate stamping most common.
- Fine cord wrapped stick or cord wrapped cord impressions next common.

- Punctate decorations seen occasionally -- finger tip depressions, very shallow fine-line incision and plain impressions used in motifs.
- Motifs -- fairly complex in composition, oblique located below outer lip edge, on collar, and/or in neck region, frequently seen in combination.
- Triangular or chevron patterns are also evident, formed either from incised lines or linear dentate stampings, found in neck region.
- Shoulders that are evident, punctation along the ridge has been observed.
- Exterior edge of lip decoration is rare.
- Common design motifs illustrated in Figure 33 (Byrne p. 337,8).

APPENDIX B

Description of the Intermountain Tradition (Mulloy 1958:197-198; Kehoe 1959:2; Frison 1971:271-280; Hoffman 1960:3-7).

Paste

- Fine sand or quartzite used as temper.
- Brown to black in color.

Surface Finish

- Somewhat unevenly smoothed, interior and exterior, few instances of paddling.

Vessel Form

- Flat bottomed.
- Flower pot-like, circular.
- Dimensions, as wide as it is tall.
- Constriction forming flange around base.
- Incurve at mouth.

Decoration

- Some incised lines.
- Rim slightly thickened and flat on top surface.
- Some vessels may have had holes for handles (Frison 1976).

APPENDIX C

Description of Saskatchewan Basin Complex (Byrne 1973:333-335)

Total of 144 vessels from 19 dated sites; period III — 46, period II — 85, and period I — 13.

Paste

- Texture compact to very blocky, variable bonding, temper = minute to 15mm, crushed granite most common, temper concentration moderate to considerable. Black to medium cores (gray), exteriors usually lighter gray to tan, firing rims measuring as much as 3mm in depth. Hardness varies 3.0 to 4.5 on the Moh scale, most pieces relatively well fired.

Surface Finish

- Interior -- uniformly smooth, fine stria running parallel to lip, formed when clay was in plastic state or when partially dry.
- Exterior -- most appear to have been paddled with either cord wrapped or a fabric/net wrapped instrument, characteristic external texture.
- One-third shows no post paddling treatment.
- One-third all surface texture smoothed out, by dragging the finger tips across the surface horizontally, or polishing, occasional exposure of temper.
- One-third "Truncation" clay was allowed to harden somewhat and then the exterior was scraped and polished to remove some of the original surface texture: (1) never completely obliterates the paddle impressions, and (2) no evidence of clay being worked this way when it was wet, had to be pretty dry.

Vessel Form

- See Figure 30, reconstructed vessel profiles.
- Bases are usually rounded but occasionally flat, bodies globular with a tendecy to tallness or elongation.
- Wall thickness 6 to 15mm.
- Shoulders common and pronounced, internal or external thickening of ridge.
- Necks, when present, are short and shallow.
- Rims frequent insloping, concave vertical profile more common than convex: (1) concave -- shoulders and necks, vessel mouth flares; (2) convex -- to necks or shoulders, coconut outline.
- Lips are flat and thickened, usually in horizontal plane, sometimes everted, round and ridged lips are rare (Byrne p. 333,4).

Decoration

- Low decorative frequency, many vessels have none at all.
- Of the decorated: punctate most common, both tool and fingertips; tool — rectangular, circular, with central cone (hollow instrument); and, fingertip — oblong, form bands of finger pinching.
- Marks are deep, sometimes going through interior wall,
- Incision cord marks suggestive of fiber loosely wrapped around tool.
- Impressions.
- Motifs, simple and restricted to area, shoulder, sub-lip and lip. See Figure 31 for illustration (Byrne, p. 334,5).

APPENDIX D

Accounts

Account #1: Lt. James H. Bradley (mid-1800's);

"They had in early times, a sort of rude kettle of moistened clay, shaped with the hands, dried in the sun, and then burned in the fire. These kettles ordinarily held about two (2) gallons and were of cylindrical shape and usually of greater breadth than depth. They were replaced by vessels of tin, brass, copper, and iron as fast as they were able to buy them of the traders and they are no longer manufactured. It is doubtful whether a single specimen has been preserved to the present day" (Ewers 1945:292).

Account #2: The myth of the Twin Brothers, collected by C. Wissler and D. C. Duvall:

"Now at this time, the people cooked pots of clay. These were shaped out of mud by the hands, and put in the sun to dry; then the kettle was rubbed all over with fat, inside and out, and placed in the fire. When it was red hot, it was taken out, and allowed to cool. Such a pot was good for boiling" (1945:291).

Account #3: Collected by Clark Wissler:

"An old woman had heard that cooking pots were made of pulverized rock and some sticky material. She never heard of pots hollowed out of stone" (1945:291).

Account #4: Collected by Clark Wissler:

"A man had heard that pots were made a long time ago. They were fashioned of mud and sand. A bag of rawhide was filled with sand, greased on the outside and the pot shaped over it. The sand was then poured out and the bag withdrawn. The pot was filled with fat and hung over the fire to harden. When finished, it was tested by boiling water in it. Such pots grew gradually harder with use. They were supported by a rawhide cord passing around the rim. The cord had to be changed often. During this operation they were always kept rubbed with fat" (1945:291).

Account #5: Summary of accounts from six Blackfoot informants, collected in the summer of 1935, by Kenneth Kidd.

"According to some informants, the pots were made of a white sticky clay, found in rocky places, which was moulded into shape and stood beside the fire to dry. . .Such pots were used for boiling' (1945:293).

Account #6: Pretty Young Man, collected by Kenneth Kidd, summer of 1935:

"The other tradition relates that a bag of the required size was made from buffalo skin. Sand (evidently clay and sand) mixed with water was plastered on the inner surface of the bag and allowed to dry in the sun. The skin cover was then removed. Sometimes a handle made from the neck gristle of a bison was attached through holes made in the rim: (1945:293).

Account #7: Weasel Tail told this account of his grandmother (Victory All Over Woman) and how she said they made pottery in the early 19th century:

"She said that to make a cooking pot, they first dug a hole in the ground, making the sides round and smooth as possible. Then they took a flat stone and placed it in the bottom of the hole. Then they lined the hole with a thick layer of clay. Next they took a mixture of a certain red rock which had been broken into small pieces with a stone hammer, heated and again pounded fine, mixed with water into a dough. After the clay lining was smoothed and shaped with an elk-horn, this dough was put in the cavity and roughly plastered over the clay layer. When it began to dry out, two holes were punched in this inner layer opposite each other and near the top edges of the sides. Then a large stone, just the right size and shape to fill and form the inside wall of the pot, was placed in the cavity. Next a fire was built over the hole. It heated the stone very hot. After this firing had dried out the pot, it was removed from the hole by (1) digging away the top portion of the outer clay lining, (2) lifting the pot by the handle holes with the rock inside it, and (3) turning the pot over carefully and extracting the rock" (1945:293-4).

Account #8: Mrs. Frank Racine gave this account of her great grandmother's time, the early 19th century:

"The vessel was built up by hand. No mould was used. Then it was greased inside and out and placed over a fire to dry. This fire must not be too hot or the pot would crack. The vessels were quite thick and fragile. They were easily broken, so people had to be very careful with them. Two shapes of vessels were made. One was a cooking pot with a constriction near the top around which the handle was wrapped. The other was a flat dish" (1945:294).

Account #9: How pottery was made by Chief Lodge Pole (Piegan) told to Short Face;

"A sticky clay was obtained from around elk licks. The clay was mixed with a much smaller amount of sand rock pounded fine. The two were mixed with water into a dough. The dough was then put into a

form made out of rawhide the exact shape desired for the outside of the dish. The clay was smoothed over the inside of the mould with the hands, to about an inch thickness. Then the whole thing was placed in the sun to dry. After it was dried, the dish was loosened from the rawhide, and the outside surface of the dish was smoothed with a stone. Finally the outside was painted with red earth paint. These dishes were flat on the bottom. The sides were almost straight. Bottom and sides were about an inch thick. They were about 8" across and about a foot high. These dishes were never placed on the fire, nor were they ceremonial feasts. These dishes were not strong. They would fall apart in time. But they were much admired. Because they were so fragile much care was taken to preserve them from harm. For storage they were hung up in the lodge inside a rawhide slip cover gathered over the top with a drawstring. These dishes were always used by men: (1945:294).

Account #10: Told by Weasel Tail:

"There used to be a shop keeper in McLoud (Alberta), who kept a store on the south side of the street, at the east end of town. He bought up a lot of old Indian relics and kept them on view in his store. One of those relics was an old clay pot, found on the plains in the Blackfoot country. The last time I saw it was when I was about 28 years old. (ca. 1885).

I saw that relic many times in company with other Indians. We used to look it over carefully and talk about it. I remember it clearly. It was about 12" broad and about 8" high. The sides sloped out a little from the bottom. It had two holes in the sides near the rim, but no handle in it when I saw it. The sides were a little thicker than the pencil you hold in your hand. (This was 5/16" thick.) It was the color of cement" (1945:295).

Account #11: Collected from Richard Sanderville (born 1866) Blackfoot:

"I saw a cooking pot when I was a boy. It belonged to one of the wives of Many Horses, the Piegan chief, who was killed by the Gros Ventre in 1866. It was thick, flat-bottomed with straight sides, about 15 inches in diameter and about a foot high. It had two holes near the rim for a handle. When she moved camp she carried it in a laced rawhide container which was packed on the top of a packhorse's load" (1945:295).

Account #12: Told by Richard Sanderville:

"I have been told that Piegan pottery was made of clay mixed with sand. It was shaped with the hand. The pot was kept greased all over to prevent it from cracking, and hardened over a fire" (1945:295).

APPENDIX E

Materials used in the Pottery Experiments

Clays

Clays in the Altamont region are from soils formed from calcareous sediments that are high in smectite and mica. Smectite is a high swelling or bentonite clay that has weathered down from volcanic materials deposited in Cretaceous times (Klages: person communication). Bentonite type clays are used by modern ceramists as a pasticizer in small amounts. Bentonite was formed from airblown volcanic dust and has the finest particle size of any clay (Nelson 1977:122-123). Mica, in large pieces, can cause problems in fired clay. When fired it becomes opaque white and powdered causing defects in the vessel walls. If present in small specks, this does not damage the vessel (Figure 53).

Despite these drawbacks, usable ceramic clay can be found virtually anywhere in the Altamont region. The soils are commonly a clay-type and so are easy to locate. Of the eight soil samples tested for use in these experiments, only three were unsuitable. (One was pure bentonite and would not mature during firing. It was collected from a bank of the Marias River. A second clay type collected near Ulm, Montana, did fire properly. However, this clay cracked extensively and consistently during the drying process and so was unsuitable for pottery manufacture. A third soil type was collected near the Sweetgrass Hills and proved to be nonplastic and non-firing.) Known clay sources in northern Montana and southern Alberta are listed below (Figure 54):

(1). Clays located on the Blackfoot Reservation are numerous. An excellent quality red earthenware was obtained along the Two Medicine River. Ceramic clays are abundant throughout Glacier County and are used by local ceramists. One report was given of a good quality ball clay located north of Browning.

(2). A brick factory was located in Great Falls for many years. It manufactured drainage tiles and other bricks. There are several locations in this vicinity where contemporary potters dig for clay supplies. No clay from this area was used in the experiments.

(3). Havre, Montana, is another source of a variety of clays. A brick factory was in business here until the 1950's. The source of clay used by this factory is a hillside on the west edge of the town not over a mile from the Wahkpa Chu-gn Site (24HL101). The hill appears to be very similar in composition to others along the

Milk River breaks. Three samples of clays were taken from the Havre Brickyard site and were used in the experiments. One of these was the brick clay type that had been used by the factory. The others were a clay with natural fine sand tempering and a type of "gumbo". All three were usable ceramic clays.

(4). Another source of suitable ceramic clays is near the town of Medicine Hat, Alberta, located on the South Saskatchewan River, west of the Sand Hills. A brick factory is in business here today and supplies brick to that area of Alberta and north central Montana. A brickyard is also located in Lethbridge, Alberta.

(5). Two clay types that are very common along Willow Creek, a tributary of the Marias River in Toole County, were dug for use in the experiments. The source of these clays is southwest of the Sweetgrass Hills.

These clays all varied in plastic quality and working characteristics. The five kinds of clay that were used in the experiments were found to be workable ceramic clays, although not by contemporary standards. It is important to note that these clays did provide the qualities needed for use in the prehistoric ceramic technologies.

Samples of the clays were test fired at a low temperature (approximately Cone 018). This temperature can be reached by open hearth firing, without any particular type of fuel requirements. The clays reached maturity at this temperature in which they became ceramic and did not become muddy when placed in water.

Clay samples were also fired at Cone 06, and became thoroughly ceramic at this temperature. Cone 06 is the common firing temperature for modern earthenware ceramics. This test was fired in an electric kiln.

The color scale shown in Figure 55 for temperatures was used for estimating the temperatures of firings during the experiments.

Tempers

Two kinds of sand were used for temper in the experiments. Sand weathered down from sandstone was used in some of the pottery. The other type of sand used was river sand from the Marias River that contained large amounts of weathered granite particles. The granitic sand used as temper provides the strongest pot -- resistant to cracking and temperature shock. However, it makes the clay paste gritty and lowers its plasticity. The sand rock sand is much finer grained and does not affect the plasticity of the clay. It is not

as resistant to cracking. It was found that a ratio of one part temper to two or three parts clay provided a paste of good strength and working characteristics (Figure 56).

Fuels

Wood from willows was the major source of fuel used in firing the pottery. Some wood from other trees was also used (cottonwood, ash, brush). Some dried cow manure was also used as fuel. It is known that the Indians used buffalo chips quite extensively for fuels. Chips burn quickly with a hot flame and build up a good bed of coals.

Rawhide Moulds

The rawhide moulds were made from a beef hide that had been treated with a lime and water solution to remove the hair. The lime was neutralized with vinegar and the hide rinsed before it was stretched to dry. Although this is not the same process of making rawhide that the Blackfeet used, the difference in hide treating chemicals would not affect the rawhide in a way that would change the results of the experiments. Drawings detailing the construction of the rawhide moulds are shown in Figures 57 and 58.

Miscellaneous

Sandstones were used in the bottom of the ground moulds. Other stones were used as tools in the shaping of the pots and to hold the burlap strips in place, were chosen for their shape and size. The large stones that were placed inside the ground moulded pots during the firing process were different kinds of granite and quartzite. The very fine grained quartzite stones worked the best as these did not break as often during firing (Figure 59). The holes that were used for ground moulds were dug with a modern shovel. This saved time during the experiments and would not affect the process of pottery manufacture.

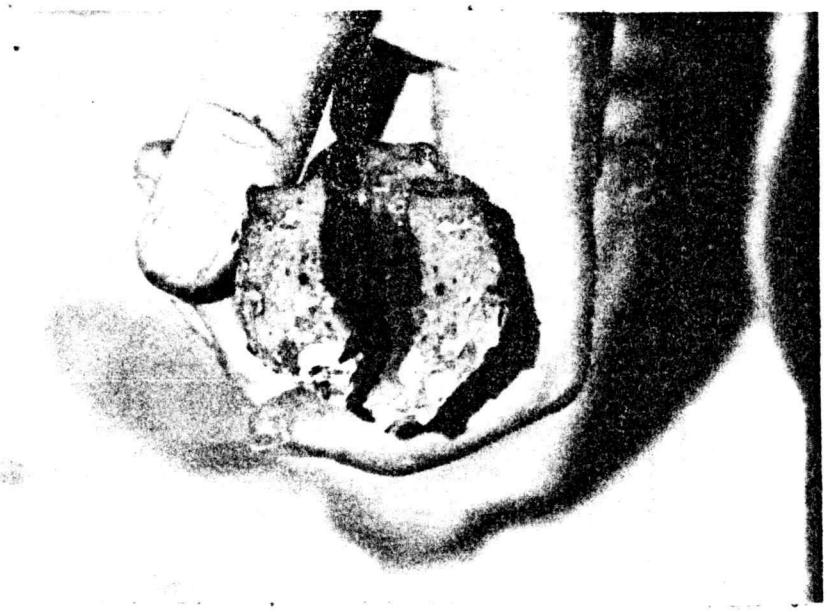

Figure 53. Fired Sherds Showing Inclusions of Fired Mica (White Spots).

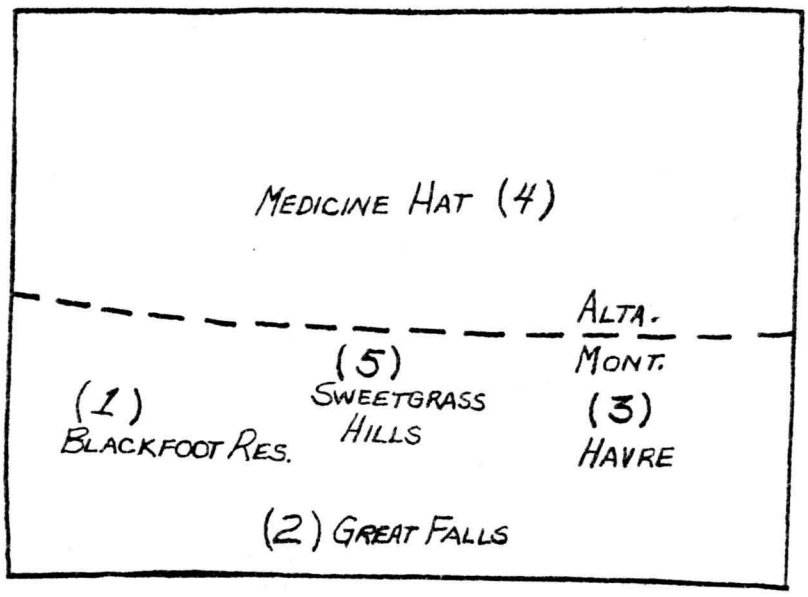

Figure 54. Map of Clay Locations.

COLOR SCALE FOR TEMPERATURES

Color	Degrees C	Degrees F
Lowest visible red	475	885
Lowest visible red to dark red	475–650	885–1200
Dark red to cherry red	650–750	1200–1380
Cherry red to bright cherry red	750–815	1380–1500
Bright cherry red to orange	815–900	1500–1650
Orange to yellow	900–1090	1650–2000
Yellow to light yellow	1090–1315	2000–2400
Light yellow to white	1315–1540	2400–2800
White to dazzling white	1540 and higher	2800 and higher

Figure 55. Color Scale for Temperatures (Nelson 1966:288).

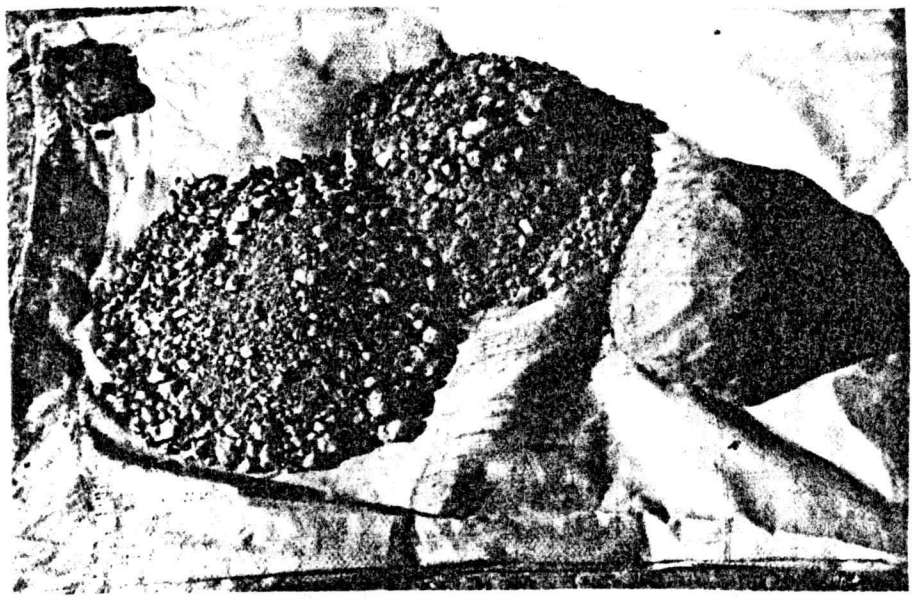

Figure 56. Left to Right: Red Earthenware Clay, Sand Weathered From Sandrocks, and the Two Mixed With Water into Ceramic Paste.

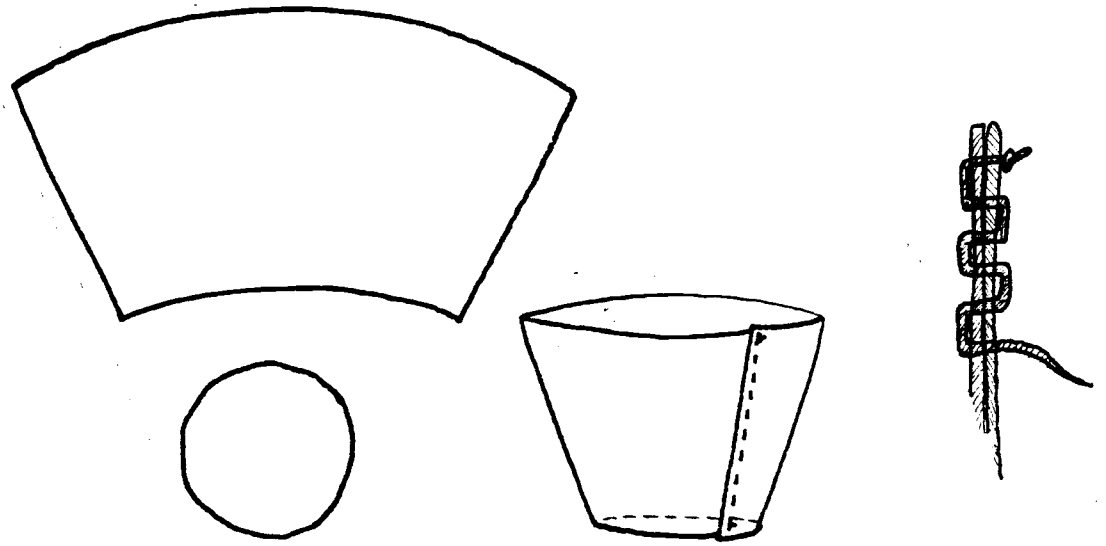

Figure 57. Construction of Rawhide Mould. Left, Flat Rawhide Pieces Cut for Mould and Sides and Base. Center, Side Piece Laced Together to Form Cylinder. Right, Detail Cross-Section of Lacing on Cylinder Seam. Rawhide Lacing was Put in Wet and Allowed to Dry.

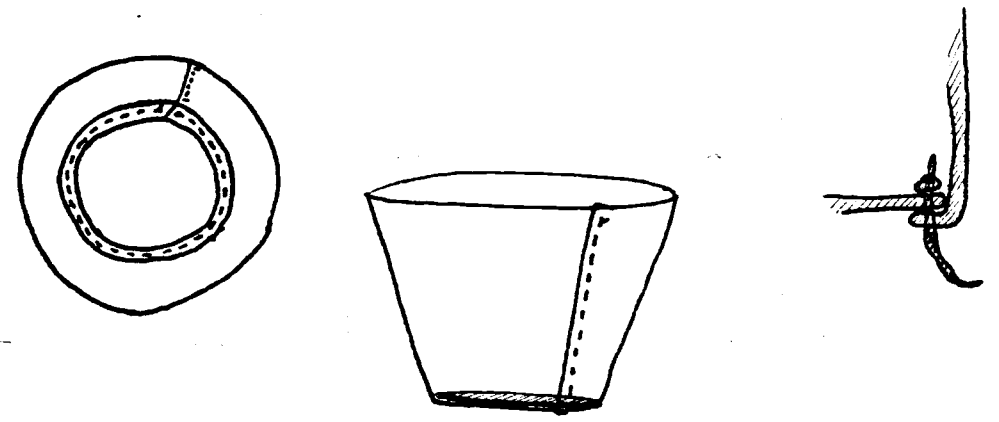

Figure 58. Construction of Rawhide Mould, Continued. Left, Exterior Bottom of Mould with Base in Place. Center, Completed Rawhide Mould with Base Laced Into Place. Right, Detail Cross-Section of Lacing on Base of Mould. Base Piece is Horizontal, Wall of Cylinder Vertical. It is Necessary to Soak the Lower One Half to One Inch of the Cylinder Wall in Water to Make it Pliable. Then This can be Bent to Form the Overlap at the Seam Line.

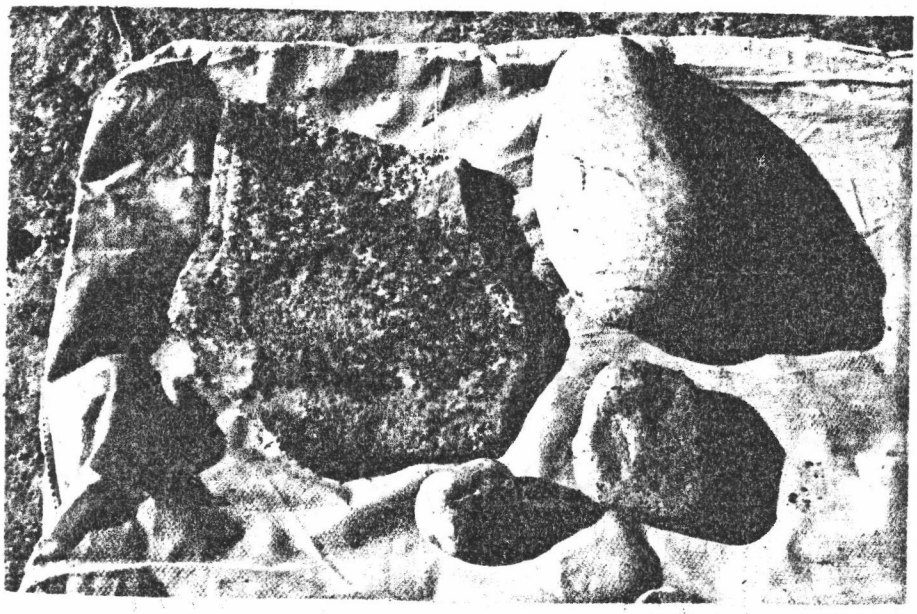

Figure 59. Flat Sandstone Used in Bottom of Ground Mould. Large Stone Fired Inside Pot, and Small Hand-Held Stones Used in Forming the Pottery. All Used in Ground Mould Method.