Anasazi Pottery
Evolution of a Technology

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Pottery is ubiquitous on Anasazi archaeological sites (Figs. 1 and 2), and it is both one of the aesthetic joys and most powerful tools of the archaeologist. The beauty of Anasazi pottery was one of the primary motivations behind the early archaeological expeditions to the Southwest, as the sherds of masons are stocked with exquisite display specimens. But as this motivation was satisfied, and as knowledge about the inner workings of ancient cultures became more important, pottery was seen in a different light. Consistent progressions of decorative style were discovered across the region with the help of stratigraphy and tree-ring dating, and these styles in turn became the basis for one of the most precise ceramic chronologies in the world. Simultaneously, geographic variations in raw materials were documented and became the basis for studies of prehistoric exchange networks. These two aspects of Anasazi pottery are now nearly taken for granted in Southwestern archaeological research, and attention is once more being directed toward pottery itself. However, instead of its beauty, archaeologists are now studying pottery technology: its origins, changes within the craft, and the organization of pottery production within Anasazi society.

Origins of Anasazi Pottery

Anasazi pottery is distinguished from that of other Southwestern culture areas by its predominant colors (gray, brown), and a coiled-slip manufacturing technique, and a relatively independent stylistic trajectory. Speculation about its origin has centered around diffusion from Mogollon and ultimately from Mesoamerican cultures to the south, but the stark contrasts between Mogollon brown and Anasazi gray and white pottery have also raised the possibility of independent invention through accidental burning of clay-lined baskets (Morris 1927). However, the contrasts are usually drawn between fully developed examples of both Mogollon and Anasazi pottery traditions (Fig. 4). Recent research by Dean Wilson and colleagues has pointed to underlying similarities of the earliest pottery throughout the upland Southwest (Wilson and Blinman 1991; Skibo et al. 1992).

Pottery occurs as early as A.D. 200 in the Anasazi region, and most of this pottery appears to have been made of floodplain or soil clays. These alluvial clays are often usable as they come from the ground, and the high iron content of the clay resulted in a brown surface color. An open fire on the ground surface would have proved adequate for firing. The best known of these early pottery sites are in the Petrified Forest National Park and the Navajo Reservoir area of northern New Mexico, where a crude brown ware is present on sites dating within the A.D. 200-500 period. By A.D. 500, the durability of the brown ware improved, and it was joined by a gray ware pottery. By A.D. 600, Anasazi potters focused their attention on the gray ware technology and brown wares were no longer manufactured.

The transition to Anasazi gray wares appears to have resulted from the adoption of a more refined production technique to new raw materials. As the brown ware technology moved northward the Mogollon area, potters continued to seek out floodplain or soil clays, ignoring for a time the geologic clays that were abundant as shale layers within the sandstone cliffs of the Four Corners landscape. Most of these geologic clays have high shrinkage ratios, and potters would have had to modify the clays before use. Also, unlike the alluvial clays, the geologic clays appear to perform best when fired under neutral rather than the oxidizing conditions of an open fire. Experimentation with the geologic clays began in the 10th century, and by the beginning of the 14th century the technology had been fine-tuned, setting the stage for the next 600 years of Anasazi pottery production.

The Gray Ware

Foundation of the Anasazi ceramic tradition was the cooking pot. As maize became a significant part of the Anasazi diet, boiling became increasingly necessary as a food preparation technique. Although food can be boiled in batches, pottery vessels have a number of advantages—pots are less time-consuming to produce, fuel use is more efficient, and the same container can serve for dry storage, wet storage, and cooking. Pots are brittle, however, and better suited to sedentary rather than mobile lifestyles. The Four Corners environment was perfect for feedback among agriculture, sedentism, and pottery technology, and pottery rapidly became an integral component of Southwestern culture (LeBlanc 1982).
The formula for Anasazi cooking pot clays was achieved by A.D. 700 and remained stable for the subsequent six centuries of occupation in the Four Corners area. However, there were dramatic changes in the appearance of cooking vessels throughout this period (Fig. 5). Initially, the coils of clay that made up the pot were carefully shaped on both interior and exterior surfaces, welding coils together and creating plain surfaces. Prior to A.D. 700, and especially during the brown ware phase of Anasazi pottery development, these finished vessel results from the permanent alteration of clay minerals by the heat of firing. This alteration follows a continuum from the initial physical destruction of the clay mineral structure (earthenware) to complete sintering or fusion of the clay minerals into a glass-like material (such as porcelain). The strongest pots are those where sintering has progressed the furthest, but those pots are also the most brittle.

Strength alone is not a good measure of cooking pot performance (wit- ness the catastrophic result of placing a porcelain bowl on top of a gas burner). The most important selection pressure on cooking pot design is the contrast between the heat of the cooking fire (as much as 900°C) and the relatively cool, insoluble vessel contents (usually less than 100°C). This difference places tremendous stress on the clay body, and success in dealing with this stress was the goal of early Anasazi potters.

The Anasazi compromise appears to have been to give, relatively angular rock or sand tempers, coupled with firing regimes that achieved only low levels of sintering. These mineral tempers tend to expand more than the surrounding clay during firing, creating voids around the temper particles when the vessel cools, and the lower-fired clay creates a relatively soft vessel wall. Our understanding of why this combination works better than others is only now being tested in the laboratory, but the likely explanation is that the voids and highly feldspar clay accommodate small fibers in a means of relieving stress, as opposed to allowing stress to build up to the point of catastrophic failure.

Modern ceramic technology can be extremely intricate, producing products as diverse as building brick, porcelain, and space shuttle heat shields. In Anasazi culture, the initial goal was to produce a durable cooking pot. Although outwardly simple, the cooking pot is a delicate compromise between conflicting technological and functional demands. Anasazi geologic clays swell and shrink so much on wetting and drying that vessels of pure clay crack prior to firing. Non-wetting material (temper) can be added to the clay to reduce and control shrinkage, but temper reduces the strength of the vessel wall. The potter can control the effect of temper on strength by altering the shape, size, and material of the temper particles. Angular tempers form stronger bonds with the surrounding clay, finer tempers distribute weaknesses more evenly and, and tempers that have a similar coefficient of thermal ex- pansion to that of the surrounding clay create fewer flaws during the heat of firing and subsequent cooling.

Given a particular clay and temper combination, the strength of the

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Figure 7: Comparison of white and red ware designs in the Four Corners area. At the time of their introduction, San Juan Red Ware designs detented significantly from contemporaneous white wares. Wavy lines, broad lines, large painted areas, and onerous design fields were much more common in red wares, adding to the symbolic contrast created by the background color. The differences remained strong through the mid-5th century, but gradually diminished thereafter.

White Ware

Red Ware

A.D. 500 and only in the Animas River area of southeastern Colorado. The third class of pigments is organic or carbon-based. These consist simply of a plant sap that soaks into the clay and carbonizes within the vessel surface during firing. Successful use of this pigment requires careful control of firing and may also be dependent on the type of clay used. Organic paints occur throughout the Anasazi sequence in some areas, but they become the most popular paint after about A.D. 1100. Mineral and glass pigments are relatively insensitive to firing conditions, but if too much oxygen is present, the vessel surface during firing, organic paint will burn out (oxidize), effectively erasing the design.

Red Ware Production

Although the Anasazi culture area is defined in large measure by gray and white ware pottery, red ware technologies were also developed (Fig. 9). Early Mogollon potters produced red-slipped brown wares, and a few unpainted, red-slipped bowls occur in Anasazi sites dating to the late-7th century. These bowls were manufactured by coating a gray clay body with a red clay slip, and firing them to a low temperature in an atmosphere to preserve the red color. Although made throughout the Anasazi

Figure 8: Diagrammatic representation of changing Anasazi pottery production organization in the Four Corners area. Small open circles represent nonpottery producing households, small filled circles represent gray ware producing households, concentric circles represent white (and gray) ware potters, and concentric squares represent red (and gray) ware potters. Larger symbols represent the greater volume associated with specialized production.

- The second class of pigments is a subset of redware with enough iron to serve as a glazing agent, producing a glassy paint. These were never applied as an overall surface coat in the sense of our modern glaze pottery but only as a pigment for the limited areas of painted designs. Mineral paints were used through the duration of Anasazi pottery production; glassy paints were used only until about

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Figure 9. Changing wave frequencies through time. These frequencies represent changes as seen at sites in southeastern Colorado. Gray wave vessels decrease in abundance as white and red waves increase. The early popularity of red waves (A.D. 900) gave way to a surge in white wave production that continued to increase until the abandonment of the Four Corners area.

area, these slipped red vessels were so rare that most of the early Anasazi pottery was made with chinking on the inside of some of their fired vessels with powdered hematite, giving the pots a temporary or "fugitive red" finish.

A more elaborate red ware technology was developed by potters in southeastern Utah around A.D. 750, marking the start of the San Juan Red Ware tradition. This ware shared tempering and vessel forms with contemporary white ware technology, but red wares were an extreme departure in both firing regime and decorative style (Fig. 7).

Figure 10. Examinations of an Anasazi trench kiln in southeastern Colorado. The dark charcoal-rich fill and abundant stones are characteristic of these shallow features.

Figure 11. Replicas Anasazi vessels. Archaeologists and potters have experimented with replicas of Anasazi trench kilns in ongoing research sponsored by the Crow Canyon Archaeological Center and the Museum of New Mexico. Temperature measurement equipment is thermocouple wire coiled in the center left of the photo has been loaned by Los Alamos National Laboratory.

Throughout the early 1970s, reports of Anasazi kilns had been limited to occasional specialization on the functions of unusual features on a handful of archaeological sites (e.g., Morris 1974). This situation changed rapidly in the past two decades, with the recognition of trench kilns by the hundreds across the Four Corners area. The first of these was reported by Claudia Helm and coworkers while describing archaeological remains in the path of highway improvements in southeastern Utah (1973). They had encountered a shallow stone-lined trench, not unlike the footings for an Anasazi room block, but its shape and size were just unusual enough to raise doubts about an architectural interpretation. While preparing their report, they reached the conclusion that it could not be a room foundation, and they suggested that it might have been a kiln.

This report languished in the "gray literature" of contract archaeology until the early 1980s, when a set of five similar features were uncovered by the construction of a well pad in southwestern Colorado (Fig. 10; Hibberts and Harden 1982). This time, one of the features included abundant warped and overfired pottery—"the wasters and cover sherds of pottery firing. The report of this find spread rapidly among Four Corners archaeologists (Fulcher 1984), and in the intervening years hundreds of these trench kilns have been recognized and recorded in Utah, Colorado, and New Mexico.

These features range from 80 to 120 centimeters in width and 10 to 30 centimeters in depth, but they can be anywhere from 1.5 to 8 meters long. They are located away from residential sites, often several kilometers from the nearest settlement, and this great distance probably reflects a voluntary exclusion of these features from any formal interpretive program. The vast majority of these kilns postdate A.D. 1100, but one may date as early as A.D. 800, while another may date shortly after A.D. 1000. By and large, the date of this kiln tradition is dominated by white ware vessels, and this type of kiln may have been designed specifically (but not necessarily exclusively) for the production of that ware.

Enough trench kilns have been excavated for us to be confident of their form and function, but we do not as yet know how they were being used to produce pottery. In an effort to resolve this question, Crow Canyon Archaeological Center (Cortez, Colorado) and the Museum of New Mexico (Santa Fe) have been sponsoring a series of workshops and experiments. These experiments have illuminated the archaeological and pottery making processes and the production techniques that could have been used by the Anasazi potters. Results of these studies are being published and presented at the biennial conference of the Society for American Archaeology (Fig. 11), but they still lack the consistency and clarity of color that was achieved by the Anasazi potters.
temporarily suppressed over much of the Mesa Verde region through the early decades of the 9th century. Production and exchange continued at a slower pace through the end of the 9th century, waxing and waning with regional cycles of village formation and abandonment (Orcutt et al. 1990). White ware production slowly returned to prominence in the 10th century as red ware production declined, and there was a slow stylistic convergence between the two wares. After the shift of the red ware production to the Kayenta region, red ware exchange into the Mesa Verde region declined, becoming insignificant after specialized white ware production reached its peak.

Conclusion

Our perception of Anasazi pottery has changed over the past century. Aesthetic appreciation of pottery has been augmented by its use as a research tool, allowing us to date sites with tremendous precision, and forming the basis for elaborate reconstructions of trade and exchange. Now the attention of the archaeologist is also focusing on pottery as a technology, and we are beginning to understand the sophistication of the Anasazi potter, as scientist, artisan, and entrepreneur. In this context, pottery becomes a physical record of the changing economic and social forces that shaped the fabric of Anasazi life, adding another dimension to our understanding of the past.

Acknowledgments

Research today is of necessity a collaborative process, bringing together the skills and ideas of many people, and this article is no exception. Dean Wilson of the Museum of New Mexico has seen and handled a wide range of Southwestern ceramics, with a keen eye for variation in materials and techniques, and with a limitless curiosity. Meg Hunt and the staff of the Crow Canyon Archaeological Center, together with Dean, organized the first symposium on Anasazi trench kilns. Clint Swink, a replicator of Anasazi pottery in Bayfield, Colorado, has shared his skill and the results of painstaking experimentation, and Larry Stine of the Museum of New Mexico has patiently supervised our temperature measurements. Mike Schiffer, Jim Skibo, and Mark Nepom of the University of Arizona have elevated the breaking of pots to a science, and they and Dean are spearheading research on the early brown wares of the Southwest. Janet Orcutt has watched and encouraged my technological experiments, and her suggestions for the manuscript have improved its clarity.

Bibliography

An explosion of Anasazi archaeological research has occurred in the past 15 years as the result of large and small salvage archaeology projects. Research reports resulting from these projects tend to receive limited distribution, and syntheses of their contents lag well behind the pace of the work itself. Because of this, many of the reports and data on which this summary is based are not readily available. As an alternative, the interested reader can consult several broad treatments of Anasazi pottery. More recent discussions include:


Peckham, Stewart 1990. From This Earth: The Ancient Art of Pueblo Pottery. Santa Fe: Museum of New Mexico Press.

Technical discussions of pottery technology and use experiments are included in the following books and articles:


