# POTTERY SOUTHWEST

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## DEDICATION

Perhaps it is provident that a publication that saw its launch from the basement of an airport is now in cyberspace. In 1972 when William Sundt agreed on behalf of the Albuquerque Archaeological Society to undertake the publication of *Pottery Southwest* he did so with the limited resources of a small band of dedicated professional and avocational archaeologists. The Albuquerque Archaeological Society had just been founded a few short years when Helene Warren of the Museum of New Mexico's Laboratory approached AAS asking for help in creating a periodical devoted to pottery studies. Since the Museum had no funds, it was to be a volunteer effort.

Bill Sundt accepted the challenge of being co-editor in charge of publishing *Pottery Southwest* while the Museum was to provide the other editor in charge of technical content, i.e. rounding up and editing articles for publication. Kathleen B. Angle was co-editor for the first seven years and Regge Wiseman served another seven. Following Regge, Wolcott Toll and Eric Blinman took turns as technical editors. Certainly, Bill Sundt did his share of rounding up articles and writing some as well. (Dolores Sundt in Clues to the Past: Papers in Honor of William M. Sundt, eds. Meliha S. Duran and David T. Kirkpatrick, The Archaeological Society of New Mexico: 16, 1990.)

For almost 2 decades, Bill Sundt was the engine behind *Pottery Southwest.* Ably assisted by folks like Dick Bice, who magically managed to keep the antiquated printing press in the basement of the former Albuquerque Airport churning out copies and Dolores Sundt who maintained the records and kept up with subscribers, Bill Sundt managed to produce one of the Southwest's foremost publications on ceramics. Dedicated volunteers spent dozens of hours collating, folding, stamping, and mailing each issue on a quarterly basis. Filled with articles, letters, requests for information, and sundry tidbits, back issues of *Pottery Southwest* read like a who's who in Southwestern ceramics.

This first cyberspace issue is dedicated to the memory of Bill Sundt, his love of Southwestern archaeology, and his dedication to keeping *Pottery Southwest* viable. We owe him a debt of gratitude and a commitment to preserving the excellence he strove to achieve.

Patricia Lee, Chair, Pottery Southwest Publications
Albuquerque Archaeological Society

CONTENTS



## The Return of *Pottery Southwest*

Early in the Fall of 2004 the board of the Albuquerque Archaeological Society was made aware of the lapse in publication of *Pottery Southwest.* We owe a debt of gratitude to Lori Reed for bringing this to our attention. For the next several months the regeneration of *Pottery Southwest* became a labor of love culminating in the production of a searchable archival CD of all of the past issues of *Pottery Southwest* from 1974 to 1996.

Information technology has changed since 1996, and *Pottery Southwest* is changing as well. Going forward, *Pottery Southwest* will be published electronically on the World Wide Web. Future issues will also be available annually on CDs. This will increase the accessibility of the journal, as well as keep the production costs manageable. Individuals interested in print issues are encouraged to purchase the CDs which can easily be read and printed at most libraries as well as on home computers.

*Pottery Southwest* has been a great source of information on southwestern ceramics. In the past, short reports, information on current research, book reviews, and ceramic questions and discussions have been published. Many of these have proven important in the study of Southwestern archaeology. For example, since 1996 when *Pottery Southwest* temporarily suspended publication, there have been 24 citations of a total of 18 different articles documented by the Social Science Citation Index. On 24 different occasions, prominent archaeologists writing in the leading anthropological journals found the information presented in *Pottery Southwest* significant.

AAS and the editors of *Pottery Southwest* plan to continue this tradition. In this vein, we have compiled this "renewal" issue containing three articles we believe are representative of the high quality of the articles and reports published in *Pottery Southwest.* It was difficult to choose only three articles because so many great insights have been published over the years. See for yourself by ordering a copy of the archival CD containing over 670 pages. The CD is now available for $5.00 for AAS members and students and $7.50 for non-members from the Albuquerque Archaeological Society, P. O. Box 4029, Albuquerque, NM 87196. You will find an order form for the CD on the last page of this issue.

As the new editors of *Pottery Southwest,* we'd like to take this opportunity to introduce ourselves:

> *Patricia Lee*, Chair, Pottery Southwest Publications, holds a BA/MA in anthropology from Hunter College and is ABD in archaeology at the City University of New York. Her research interests include the international four corners region of Sonora, Chihuahua, Arizona, and New Mexico as well as pre-contact ceramics and iconography. She is currently a candidate for the Graduate Certificate in Historic Preservation and Regionalism at the School of Architecture, University of New Mexico.
>
> *David Phillips* has been involved in Southwest archaeology since 1970 and is currently the Curator of Archaeology at the Maxwell Museum, University of New Mexico. He is also an adjunct Associate Professor of anthropology at UNM. He received his Ph.D. from the University of Arizona.
>
> *Christine S. VanPool* received her doctorate from the University of New Mexico and is now a visiting Assistant Professor at the University of Missouri-Columbia. Her research focuses on Casas Grandes archaeology, ceramics, and iconography, along with general questions concerning archaeological method and theory, and shamanic and gender practices throughout northern Mexico and the American Southwest.

We are excited to be working together to make .*Pottery Southwest* available once again.

Now we are ready to publish your short reports, comments, and queries pertaining to Southwestern pottery. With all of this in mind, we encourage you to send your short pottery-related reports, articles, and queries to us. In the words of William Sundt, founder and editor of PSW for the first 20 years, "***Don't be bashful, if you are working on a project involving Southwestern pottery problems, make time to tell us about it***." We look forward to working with you.

Submissions should be sent in MS Word or compatible software either to: psw@unm.edu or to pottery_southwest@comcast.net. Please use 1 inch margins on the top, bottom, and sides of each page; a 12 pt. font is preferred. CD's can be mailed to *Pottery Southwest,* c/o Albuquerque Archaeological Society, P. O. Box 4029, Albuquerque, NM 87196. If you want your CD returned, please send a prepaid, return address envelope.

# Description of a Tewa-Ute Vessel from near Cripple Creek, Colorado

Michael P. Marshall
Corrales, New Mexico
(from *Pottery Southwest*, Vol. 1, No. 4, October, 1974)

This vessel was found by my father Doyle Marshall in High Park, Teller County, Colorado not far from Cripple Creek. The vessel was found in a small cave located in an area of numerous tipi rings most probably affiliated with the Mountain Ute.


Original picture by Michael P. Marshall

This vessel exhibits a constellation of traits which indicate an affinity with either the Tewa or Northeast Keres polychrome series of the Central-Northern Rio Grande region. The geographic locus of the vessel and the presence of tipi motifs on the vessel are, however, atypical and may be ascribed to Ute association. Of the styles described for the Tewa and Northeast Keres polychrome series (Mera 1939 and Harlow 1967, 1973), Powhoge Polychrome is the most similar with Cochiti Polychrome another possibility. While the paste, temper and certain decorations on this vessel are certainly unlike either the Tewa or Northeast Keres series, affinity with the late Tewa polychromes (Ca, A.D. 1760-1850) is judged most probable.

This vessel tells of a time when the Ute people raided the Tewas of the Northern Rio Grande region and perhaps of a female captive-slave taken from her family and home into the mountains of the Northern frontier. Here she continued the ceramic craft of her people using local raw materials. In her craft she absorbed the images of her environment and in this case portrayed the homes of her captives.

DESCRIPTION

<u>Surface Finish</u>:

A. White Slip. The upper vessel body (above the point of maximum diameter) is slipped with a gray-white bentonite clay. The slip exhibits a fine crackle overall. In some areas the slip has flaked from the surface. The slip is stone polished and vertical streaks are evident.

B. Black Paint. Decorations in black carbon pigment appear over the white slipped portion.

C. Red Slip. A red slipped zone of iron oxide is present in a narrow band (1.5 cm) which encircles the vessel just below the point of maximum diameter. This band overlaps both the white of the upper body and the yellow-brown of the lower body. This red slip is also present on the upper interior neck and spout extending 2.0 cm. into the vessel.

D. Yellow-Brown Slip. The lower vessel body (3.0 cm.) is slipped a yellow-brown in color. The surface is well polished with horizontal streaks present. This slip is finely crackled only in the areas of thickest application. The slip exhibits minute flakes of muscovite.

<u>Paste</u>:

The paste is a deep brown-red color being oxidized throughout the core. The texture of the paste is moderately coarse and granular. The fracture is irregular, oblique and rough.

<u>Temper</u>:

The temper is moderate to slightly heavy. The temper shape is subangular. Some of the grains are rounded but none are spherical. Temper grains are medium to coarse in size (.25 to 1.0 mm). The tempering material is granitic sand. Clear and smokey quartz predominates although pink feldspars and very small black mineral crystals also appear.

Designs:
Designs are in black carbon paint and are confined to the white slipped zone. The rim is painted. The lower limit of the white field is framed with a broad line .7 cm in width.

Perhaps the most unique and revealing aspect of this vessel is the three tipi motifs which appear on the neck. Each motif consists of a equilateral tipi form. Ridge poles are indicated by ticked lines below the base line. Smoke is indicated by wavy lines, three within each tipi and a single line expanding out and above the tipi apex. But no smoke flaps nor upper ends of ridge poles were attempted. Two of the tipis also have a row of dots which occur within the motif just above the base line. These dots may represent the rocks which were employed to hold tipi covers or they may represent shield decorations on the tipi.

Decorations which appear on the lower body in the white field consist of a parallel wavy line meander which encircles the vessel. This meander is embellished with diagonal cross hatching and four circles with dots within. Three small rectangular forms which contain diagonal cross hatches run down from the meander to the lower framing line. Two additional small elements (Fig. A) appear on the lower framing line below the meander on opposite sides of the handle. Two bird motifs (Fig. B) occur on opposite sides of the handle and are set diagonally above and appended to the meander. The occurrence of a parallel wavy line meander with appended bird form is suggestive of a serpent-bird zoomorph.  A solid and parallel line motif is present on the handle (Fig. C).

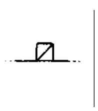

Figure A

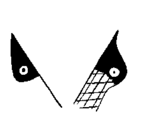

Figure B

Figure C

Vessel Form and Size:
The vessel is a spouted pitcher form with a single vertical coil handle and a ringed base. The form is clearly of European origin. Measurements: maximum vessel height 15.3 cm.; maximum vessel diameter 9.5 cm.; height of maximum diameter 4.5 cm.; diameter of the ring base 5.9 cm.; minimum diameter of the neck 3.5 cm.; diameter of the coil handle 1.4 cm.; and thickness of the vessel wall .6 cm.

Comparison with the Tewa and Northeastern Keres Polychrome Series:
The nearest described relative of this vessel is Powhoge Polychrome. The white and red slips, stone polishing and the carbon paint are similar to the Tewa Series. But the ringed base spouted pitcher form was never common within the Tewa polychrome series. Cochiti Polychrome includes some pitcher shapes, but not of this European style (Harlow, 1973, Plate 20). The yellowbrown slip of the lower vessel body also differs from described vessels of the Tewa and Keres Polychromes. The paste of this Tewa-Ute vessel is harder, more red in color, and coarser than those of the Rio Grande vessels. In this it more closely resembles Cochiti vessels. But temper is granitic sand in contrast to the pumice-tuff tempered Tewa materials of the Rio Grande or the angular crushed rock of Cochiti wares. The basic decorative scheme is similar. However, the appearance of tipi motifs is certainly absent from the Rio Grande Tewa designs.

References Cited: (Bibliography)

Harlow, Francis H.
1967 Historic Pueblo Indian Pottery, Painted Jars and Bowls of the Period 1600-1900. Monitor Press, Los Alamos, New Mexico.

1973 Matte-Paint Pottery of the Tewa, Keres and Zuni Pueblos. Museum of New Mexico Press.

Mera, H. P.
1939 Style Trends of Pueblo Pottery. Memoirs of the Laboratory of Anthropology, Vol. III, Santa Fe, New Mexico.

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# Analysis Of Five Anasazi Mineral Paint Samples

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(from *Pottery Southwest*, Vol. 21, No. 2, April, 1994)

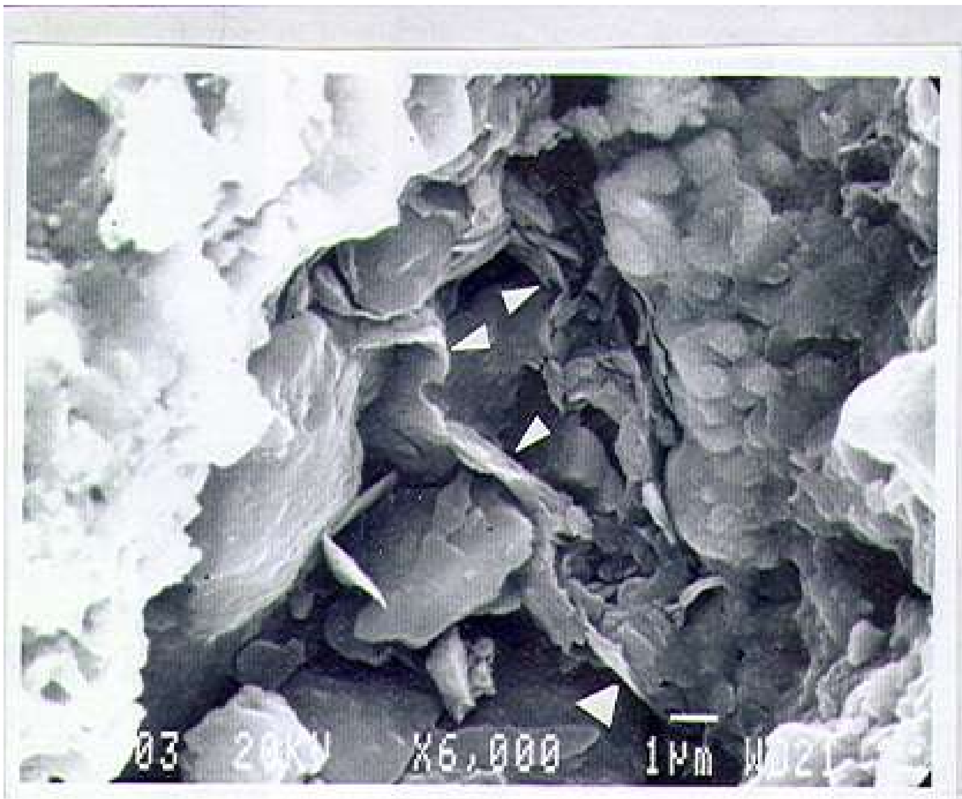


Figure 1. Sample 1 pigment with preserved clay mineral morphology (narrow arrows) and minerals undergoing fusion (broad arrows). Photomicrograph scales are indicated by 1 or 10 $\mu$m bars at the bottom of each picture.

Despite pioneering work by Shepard (1936, 1939) and Hawley and Hawley (1938) in the first half of this century, relatively few analyses of Anasazi mineral white ware pottery pigments have been carried out and reported. This paper summarizes the analyses of five mineral paint samples from three different areas of the northern Southwest. Two of the sherds come from unprovenienced excavation contexts (backdirt) attributable to a Pueblo II component at Site 423-130, northeast of Gallup, New Mexico. These sherds were collected as part of a study of kiva mural pigments (Kay and Phagan 1993). The third unprovenienced sherd is attributable to a late Pueblo II occupation at LA 65030 in the La Plata River Valley and was provided by Eric Blinman. A fourth sherd was submitted by Clint Swink from an unprovenienced collection in the Montezuma Valley, Colorado, and the final sherd was provided by Joel Brisbin from kiln excavations at Site 5MV3989.

Analyses were carried out at the laboratory facilities of the Adolph Coors Company with the aid of their analytic staff. The analyses included use of powder X-ray diffraction (XRD) and selective examination with a scanning electron microscope capable of producing energy dispersive spectra (SEM/EDS). The former technique allows observations of mineralogy, while the latter technique provides visual images of paint morphology as well as information on chemical element composition. Element composition is available for all elements above boron (B) where element concentration is greater than 1 percent by weight.

These studies assert that pottery pigments, like other Anasazi paints, may be artisan's mixtures rather than simply pure minerals (Kay and Phagan 1993). Also, the variability in appearance of mineral paints--from unfused and powdery through strongly glazed, and from reddish brown through deep black--suggests that their final morphology and mineralogy is strongly influenced by firing history, including both temperature and atmosphere. As such, sequences of phase changes are an important concept in the analysis of individual paint samples. Basic research on these changes has been studied both as part of modern ceramic technology research and research on mineral formation in the earth's mantle (e.g., Hurlbut and Klein 1977).

Thermal reactions in these general mixtures begin with the loss of molecular water through 400° C. Dehydroxylation (loss of OH bonds) typically occurs between 400° and 750° C, forming new but not necessarily stable compounds. At 750° C and above, recrystalization forms new material phases. The transformation of clay minerals to other stable silicates begins by at least 950° C, and amorphous compounds (glasses) form at temperatures of 1225° C and higher. Various of these phase changes have been reported at lower temperatures in the presence of fluxes, under the influence of increased water of reaction pressures, or when combinations of elements and thermal conditions complement effectively. Persistence of black color in paints indicates that a stable end product was achieved by the firing, while red or brown colors could indicate either stable or unstable end products, with unstable end products undergoing diagenesis to stable forms after firing.

<u>Sample 1: Cibola Tradition, Pueblo II Age</u>

Paint color was jet black, with a matte or dull finish. The pigment was well bonded to the substrate and was moderately hard (sintered). Painted areas had pronounced topography, the pigment appeared to be layered, and it was crazed. Sample quality was excellent since the pigment could be scraped from the well-fired substrate with no apparent contamination. The degree of firing of the substrate resulted in the formation of amorphous material, limiting the usefulness of the XRD analysis of the substrate.

SEM/EDS revealed the presence of oxygen (0), magnesium (Mg), aluminum (Al), silicon (Si), potassium (K), calcium (Ca), titanium (Ti), and iron (Fe). Iron was a predominant element in the pigment, while aluminum and silicon dominated the substrate with only minor amounts of iron. XRD analysis of the paint revealed the presence of magnetite ($Fe_30_4$), fayalite ($FeSi0_4$), ferroan forsterite [$(Mg,Fe)_2Si0_4$], hercynite ($FeAl_20_4$) rutile ($Ti0_2$), and quartz ($SiO_2$). Quartz was the only mineral in the substrate that survived the firing process.

SEM photomicrographs of the paint and substrate morphology document some of the changes in structure that accompanied firing. The thin platy features at the narrow arrows in Figure 1 (see front page of this issue) are clay structures. The broad arrows identify an area of transition of clay structures to a partially fused lumpy paint mass at the right of the field. Figure 2 represents the transformation of the paint to the sintered state--fusion without actual melting, and a closeup of the fused paint is presented in Figure 3. An unpainted area of the amorphous substrate is presented in Figure 4, revealing the extreme fusion of the substrate in contrast to the more refractory behavior of the paint.

On the basis of the clay structures in the photographs, the paint includes amendments of clay, but the clay did not behave the same as the clay used in the substrate. The substrate condition implies firing temperatures of between 900° and 1225° C. If the precursor silicate minerals had been the same in the paint and substrate, their condition would suggest a lower firing temperature for the paint, on the order of 500° to 750° C, and either dual firing or a different suite of clay minerals is indicated. Potentially relevant precursors and pathways for this paint sample are listed in Figure 5. Depending on firing temperature history, a variety of high iron source minerals (including clay) could be involved, whether a natural mineral or an artisan's mixture.

Sample 2: Cibola Tradition, Pueblo II Age

Paint color was jet black, with a dull or matte luster. The paint was moderately hard and well bonded to the substrate. In cross section, the paint was thin, uniform in texture, and solid. SEM examination shows that the paint was not sintered. Sample quality is good since the substrate was well fired and the pigment could be scraped off with little contamination.

SEM/EDS analysis of the paint detected the presence of oxygen, aluminum, silicon, potassium, calcium, and iron, with a trace of magnesium. Iron was predominant in the paint while aluminum and silicon were present in only small amounts. The substrate included the same elements as the paint, with the addition of titanium. Aluminum and silicon dominated the substrate, while iron was scarce. XRD identified magnetite, ferroan forsterite, quartz, pyroxene (diopside?) [$(Mg,Fe)_2Si_2O_6$], maghemite ($\gamma Fe_2O_3$) and hematite ($\alpha Fe_2O_3$) in the paint. Because of the firing intensity, only quartz and feldspar were detected in the substrate, the remainder of the material having been rendered amorphous. No clay minerals were detected in either paint or substrate. Otherwise the mineralogy of this sample is similar to Sample 1 with the exception of pyroxene (diopside) rather than fayalite.

Although the substrate mineralogy suggests a relatively high firing temperature, the reactions suggested by the paint composition and mineralogy can be accommodated within the 600-900° C range. Precursors of the paint could include high iron clays, ferroan magnesite, or iron dolomite/ankerite, where magnesium plus iron is the key combination.

Sample 3: Mesa Verde Tradition, Late Pueblo II Age

The paint was a deep green-black color, with a shiny luster due to an amorphous or vitrified nature. The paint layer was thin and cratered, apparently due to offgassing. The paint was extremely hard and well bonded to the substrate, so that it could not be scraped and instead had to be chipped off and mounted as a fragment. The substrate was not analyzed.

SEM/EDS analysis revealed the presence of oxygen, magnesium, aluminum, silicon, potassium, calcium, titanium, and iron, with aluminum, silicon, and iron as the predominant constituents. XRD analysis reflected the presence of fayalite, hercynite, and quartz. No clay structures were detected by either technique.

The end products in this sample suggest firing to the point of turning the paint into a glaze rather than simply a sintered material as was represented by Samples 1 and 2. The aluminum content of the paint (higher than the preceding samples) suggests that an extremely high iron clay could have been a sole precursor for the paint, coupled with higher firing temperatures or longer duration than is suspected for the other samples.

Sample 4: Mesa Verde Tradition, Pueblo II Age

The paint color on this sherd was a deep redbrown, and its substance was fragmentary in nature and poorly bonded to the substrate. The paint crumbled and flaked easily, resulting in a nearly pure pigment sample. A brownish red stain was left on the substrate after sampling. The substrate was gray, reflecting reduction or limited oxidation, as opposed to the oxidized state of the paint.

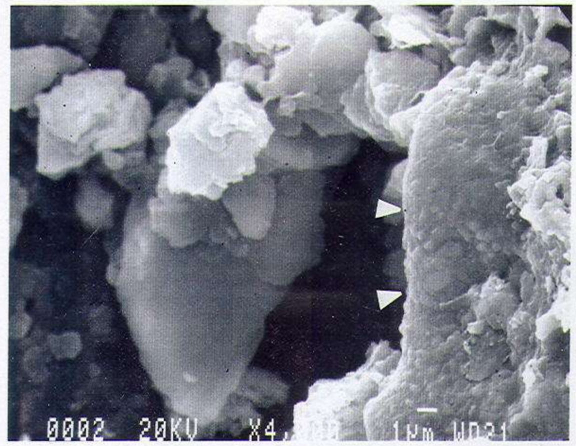

Figure 2. The fused mass of Sample 1 pigment is indicated by the arrows.


Figure 3. Detail of the fused pigment mass shown in Figure 2.

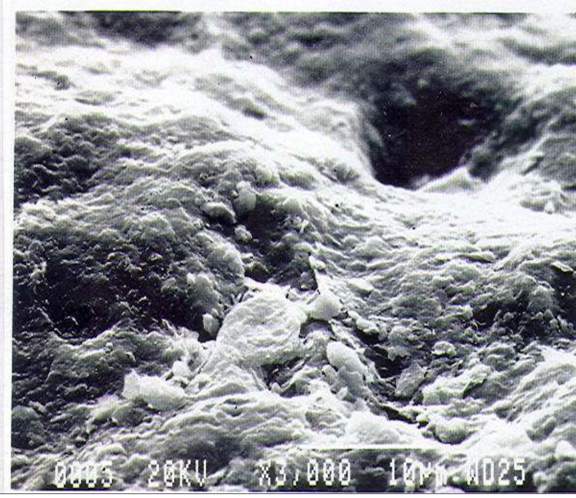

Figure 4. Unpainted area of the sintered substrate of Sample 1.

Figure 5. Potentially relevant phase changes from mineralogical studies.

### Reducing Conditions

| Experimental temperatures | Phase changes | Sample Number 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 400° C | hematite + clay + calcite → maghemite + calcite + trace of clay | | | | | x |
| 600° C | hematite + clay → fayalite | x | | | | |
| 600° C | serpentine → forsterite | (not seen in samples) | | | | |
| 600° C | {Fe dolomite, ankerite} + {clay, talc} → pyroxene, magnetite, forsterite | | x | | | |
| 650° C | hematite → magnetite | x | x | | | |
| 650-900° C | hematite + clay + calcite → magnetite + lime + calcite | | | | x | |
| 750° C | {jarosite (+ clay), $(Na,Mg,K)Fe_3(SO_4)_2(OH)_6$} → fayalite | x | x | x | | |
| | → ferroan forsterite | | x | | | |
| | → magnetite | | x | | | |
| 750° C | magnetite → magnetite + rutile | x | x | | | |
| 700-800° C | {high Fe chlorite clay, glauconite} → ferroan forsterite | x | x | | | |
| | → fayalite | x | | x | | |
| | → hercynite | x | | x | | |
| 750° C | {$Fe_2O_3$ + silicates, $Fe_3O_4$ + silicates, $FeCO_3$ + silicates} → olivines | x | x | x | | |
| | → spinels | x | x | x | | |
| 850° C | chlorite + kaolinite + $Fe_2O_3$ → hercynite + magnetite | x | | | | |
| 900° C | kaolinite → spinels | x | x | x | | |
| 900° C | {$Fe_2O_3$ + kaolinite, $Fe_3O_4$ + kaolinite, $FeCO_3$ + kaolinite} → olivines | x | x | | | |
| | → spinels | x | x | | | |
| 1000° C | {illite, montmorillonite} → spinels | x | x | x | | |
| | | x | x | x | | |

### Oxidizing Conditions

| Experimental temperatures | Phase changes | Sample Number 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 220° C | $Fe_3O_4$ → $\gamma Fe_2O_3$ | | x | | | |
| 550° C | $\gamma Fe_2O_3$ → $\alpha Fe_2O_3$ | | x | | | |
| | magnetite + lime + calcite + water → maghemite + calcite + lime | | | | x | |

SEM/EDS analysis of the paint resulted in the detection of oxygen, sodium (Na), magnesium, aluminum, silicon, potassium, carbon, titanium, iron, and chlorine (CI). Predominant elements were silicon, followed by moderate quantities of aluminum and iron. The substrate analysis revealed a predominance of aluminum and silicon, with weak presence of iron, and no sodium or chlorine. XRD of the paint establishes the presence of quartz, maghemite ($\gamma Fe_2O_3$) and calcite ($CaC0_3$) with the probability of some lime (CaO) superimposed on the calcite peaks. The substrate was not studied by XRD. No clay structures were detected by either technique.

This sample raises several issues. The presence of sodium and chlorine in the paint and not the substrate suggests that salt was present in or added to the paint. This amount of salt could have been supplied by the binder, with substances like bloods providing adequate quantities for detection by this analysis. Calcium carbonate was also present, and it may explain the presence of the maghemite form of iron oxide. Unstable magnetite could have been formed during firing, while the calcite would decompose at least partially to lime. After firing, the lime would absorb water and act to reverse the iron reaction, transforming the unstable magnetite to maghemite. Complete reversion from maghemite to hematite would take place only if the sherd were subsequently reheated to more than 100° C. This reaction in the presence of calcium carbonate conforms to the view expressed by some archaeologists that the brown mineral paints appear to have "rusted" from their original state (Joe Ben Wheat, personal communication, 1992).

Sample 5: Mesa Verde Tradition, Early Pueblo II Age

This sherd is a spall from a bowl that fractured during firing, and it is very similar in appearance and properties to Sample 4. The paint is deep reddish brown and is powdery, soft, and only weakly bonded to the substrate. The substrate was also soft, except for a fire-clouded area, where a paint sample was taken from the harder substrate with little if any contamination.

SEM/EDS analysis of the paint detected oxygen, sodium, magnesium, aluminum, silicon, potassium, calcium, manganese, iron, and copper. Iron was predominant with moderate aluminum and slight silicon; the presence of both manganese and copper is unique in this sample. Analysis of the substrate detected no manganese or copper but did detect titanium. Silicon was predominant in the substrate, with moderate aluminum and scarce iron. XRD analysis of the paint identified quartz, maghemite, calcite, calcium oxide (lime), and a mixed layer (illite or smectite) clay. Analysis of the substrate identified quartz, clay, feldspars, calcite, and rutile.

The character of the paint and substrate confirm the low firing temperature suggested by the softness of the sherd. In the presence of clay and calcite, hematite begins to transform to maghemite at 400° C, while retaining the morphology of the original compound (Figure 6). The undeformed smectite clays in the paste (Figure 7) should have begun to collapse at about 500° C and should have been transformed beginning about 750° C.

Similar undeformed clays are present in the substrate (Figure 8). The firing temperature is unlikely to have reached 750° C, and even though the end products are similar to those in Sample 4, the pathway to maghemite was necessarily different, Sample 5 never achieving the transformation to magnetite.

Discussion

These mineral paints can be grouped into three major categories: those made from clays alone, those having iron complexes such as hematite or goethite added to silicates (clays), and those in which a mineral such as hematite is added to a plant extract preparation such as beeweed.

The dominance of iron in these otherwise disparate paint types is explained by the great diversity of iron minerals that occur in nature. Iron occurs in a great variety of silicates, as discrete minerals or as complexes in clays, as ferromagnesian carbonates such as iron dolomite or ankerite, in sulfates such as jarosite, and sulfides such as pyrite, and as oxides and oxyhydroxides such as hematite and goethite. When any of these iron minerals is combined with silica or silicates and subjected to high heat in a reducing atmosphere, very dark green-to-black paints are formed. This study identifies olivines (fayalite and ferroan forsterite), spinels (magnetite, hercynite, and maghemite), and pyroxenes (diopside).

Sample 3 may have been an extremely high iron clay. Samples 1 and 5 include some clay as evidenced by the photomicrographs or XRD spectra. Although Sample 2 yielded no positive evidence of a clay component, it cannot be ruled out as a constituent. In at least one case (Sample 1), there is a difference in the degree of fusion between the paint and the clay body, suggesting that possibility of dual firing or the use of clays with very different sintering thresholds. Manganese and copper are present in only small amounts in only one sample, and they are known to occur naturally as minor elements in hematite (Kay and Phagan 1993).

Mineral pottery pigments reflect a complex system of transformations. Potential precursors can range widely in mineralogy and elemental composition, complicated by both natural impurities and conscious mixtures by the potter. The contributions of the binder, especially hydrocarbons and perhaps salts (potential fluxes), are also essential elements of the process. Firing has a tendency to simplify this variety, driving reactions toward a predictable (but still somewhat diverse) number of end products. The experimental transformations discussed here occur within a wide temperature range from 550 to 1200° C, suggesting that temperature and precursor variation determines the mineralogy and stability of end products.

Most of the precursor agents discussed in this article are seen in the Anasazi archaeological record, although not always in contexts that would confirm their use in pottery decoration. However, their presence and the apparent consistency of mineral painted white wares across much of the Colorado Plateau show that a reasonably well understood technology and procurement strategy must have been in place, leading to generally successful results.

Figure 6. Maghemite partices (arrows) in Sample 5 that retain the form of hematite.

Figure 7. Undeformed clay minerals in the paint of Sample 5. Arrows identify clay platelets.

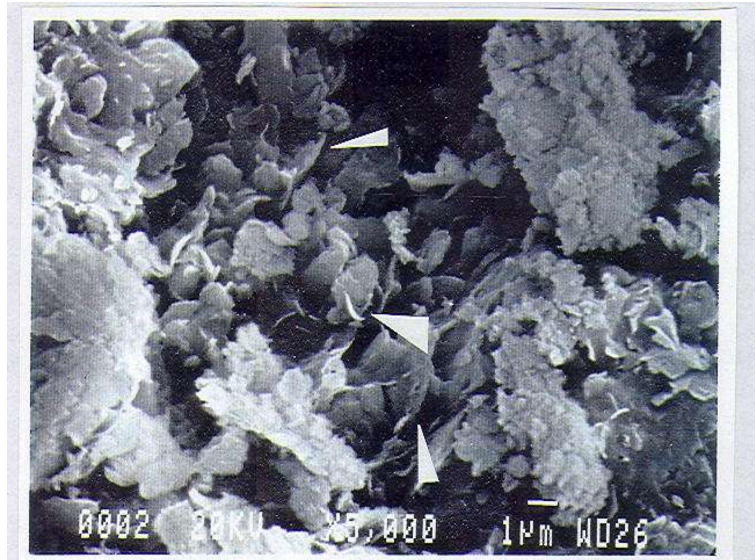


Figure 8. Undeformed clay minerals in the substrate of Sample 5..


Acknowledgements:

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Author's Notes: A) The end-product reactions summarized under "Reducing conditions" in Figure 5 are the results of what mineralogists generally describe as 'topotactic reactions under conditions of oxygen fugacity'- The new minerals are formed by acquiring the needed oxygen from associated minerals in the mix not from the atmosphere. B) Although it was rejected when first mentioned in this article, it is now recognized that multiple firings were routine during some prehistoric production activities-as many as 5 in some Mayan types (2004 personal communication, Ron Bishop, Smithsonian Institution).

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**References**


Hawley, Fred, and Florence Hawley (Ellis)

1938 *Classification of Black Pottery Pigments and Paint Areas.* The University of New Mexico Bulletin 321. Anthropological Series, Vol. 2, No.4. Albuquerque.

Hurlbut, C.S., Jr., and C. Klein

1977 *MalJual of Mineralogy* (after James D. Dana), 19th ed. John Wiley and Sons, New York.

Kay, Paul T., and Carl J. Phagan

1993 A High-Technology, Multi-disciplinary Characterization of Pigments, Plasters, Paints, and Selected Classes of Archeological Materials. In Across the Colorado Plateau: Anthropological Studies for the Transwestern Pipeline, Vol. XVII. UNM/OCA and the Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Shepard, Anna O.

1936 Letter to Mr. Earl H. Morris. Cited by permission of the Archives of the University of Colorado Museum, Boulder, Colorado.

1939 Technology of La Plata Pottery. In *Archaeological Studies in the La Plata District: Southwestern Colorado and Northwestern New Mexico,* by Earl H. Morris, pp. 249-287. Carnegie Institution of Washington Publication 519.

# Protohistoric Ceramics from Sites Near Datil, New Mexico

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Recent excavations of small seasonal sites near the town of Datil, west central New Mexico, were conducted as part of the Datil Mountain Project by the Office of Archaeological Studies (Hayden et al. 1996). The sites are in prime hunting locations and had evidence of seasonal occupations spanning the Archaic, Formative, and Protohistoric periods. Small numbers of protohistoric sherds were recovered at two sites (LA 39998 and LA 104381). Both sites included thin utility ware similar to that found at early Athapaskan sites scattered throughout the Southwest. One site (LA 39998) also yielded utility and glaze ware sherds similar to protohistoric Puebloan ceramics from the Rio Abajo region of the Rio Grande Valley. While historical sources indicate that the Datil area was in the northern part of an extensive region occupied by Chiricahua Apaches (Opler 1983; Schroeder 1962), there is little archaeological evidence of Apachean occupations. The scarcity of such evidence results in part from difficulties in identifying ephemeral early Apache seasonal sites and camps and distinguishing them from earlier Archaic and Mogollon components. These collections provided a rare opportunity to characterize early Southern Apachean occupations.

## Ceramic Evidence of Protohistoric Occupations

Protohistoric ceramics from LA 104381 consisted of 175 Athapaskan sherds from a minimum of three vessels. The other site (LA 39998) yielded 26 Athapaskan utility ware sherds from at least 5 vessels, 35 Puebloan utility sherds from a minimum of 3 vessels, and 23 sherds from at least 4 Pueblo glaze ware vessels. Frequencies of these Protohistoric types as well as earlier Mogollon and Anasazi types at these two sites are indicated in Table 1.

## Athapaskan Utility Ware

Athapaskan Plain Utility pottery was differentiated from other traditions by a distinct dark paste and thin walls. All sherds assigned to this category were derived from jars. Whereas the very few complete Apachean vessels found in the southern highlands of New Mexico and Arizona have pointed bottoms (Ferg 1988; Gunnerson and Gunnerson 1971:21), the overall shape of vessels associated with the Datil sherds could not be determined. Pastes were dark gray to black but fired to red colors in an oxidizing atmosphere. This reflects the use of high iron clays originally fired in a reduction atmosphere. Surfaces were usually plain but were sometimes smeared, striated, or decorated with fingernail shaped incisions. These sherds were tempered with a fine angular volcanic rock containing sparse mica flakes that were sometimes visible through the surface. Petrographic analysis indicates the use of volcanic materials common in clays and rocks in the Mogollon Highlands (Hill 1995), materials similar to the temper in earlier Mogollon Brown Wares (Wilson 1994). This combination of high iron clay and volcanic temper indicates the probable use of pedogenic clays with volcanic inclusions (Hill 1995). Similar materials occur in clays and rocks found in areas to the south of the Datil sites, and it is presently not possible to distinguish Athapaskan sherds produced in different areas of the Mogollon Highlands.

The thin utility wares recovered at Datil sites represent a regionally distinct variant of a extremely widespread early Athapaskan utility ware technology (Brugge 1982; Gunnerson 1979). The Datil pottery is distinguished from other early Athapaskan utility wares of the Southwest by the use of clays and tempering material characteristic of the Mogollon Highlands. This variant is presumably ancestral to the pottery produced by the later Apache groups native to this area such as the Chiricahua. This is further supported by characteristics of the thin utility wares from Datil sites that are transitional between the earliest Athapaskan pottery scattered throughout the Southwest (Brugge 1982; Gunnerson 1979) and later historic Chiricahua or Western Apache pottery from sites in Arizona (Ferg 1992; 1995; Gifford 1980). Thus, this pottery bridges protohistoric and more recent historic ceramic traditions of Apachean groups in the Mogollon Highlands.

Table 1.
Distribution of Ceramic Types from Datil Project Sites

| Ceramic Type | LA 39998 | | LA 104381 | |
|---|---|---|---|---|
| | (N) | (%) | (N) | (%) |
| Alma Brown | 3 | 3.2 | | |
| Reserve Plain Corrugated | | | 58 | 23.7 |
| Reserve Indented Corrugated | | | 1 | 0.4 |
| Reserve Indented Corrugated Smudged | | | 2 | 0.8 |
| San Francisco Red | | | 1 | 0.4 |
| Anasazi Gray Body | 2 | 2.2 | | |
| Anasazi Early Painted White | 2 | 2.2 | | |
| Anasazi Late Polished White | 1 | 1.1 | 2 | 0.8 |
| Reserve Black-on-white | | | 2 | 0.8 |
| Anasazi Early Polished White | | | 4 | 1.6 |
| Socorro Black-on-white | 1 | 1.1 | | |
| Athapaskan Plain Utility | 18 | 19.4 | 175 | 71.4 |
| Athapaskan Incised Utility | 1 | 1.1 | | |
| Athapaskan Thin Polished | 7 | 7.5 | | |
| Thick Brown Paste (pueblo Utility) | 33 | 35.5 | | |
| Basalt Tempered (pueblo Utility) | 2 | 2.2 | | |
| Sherd Tempered Pueblo Red Slipped | 1 | 1.1 | | |
| Red Slipped Exterior (piro) | 3 | 3.2 | | |
| Red Slipped Interior (piro) | 1 | 1.1 | | |
| Red Slipped Glaze Paint (piro) | 2 | 2.2 | | |
| White Slipped Interior (piro) | 3 | 3.2 | | |
| Polished No Slip (piro) | 5 | 5.4 | | |
| White Slipped Exterior (piro) | 4 | 4.3 | | |
| White Interior (piro) | 3 | 3.2 | | |
| White Slipped Exterior (piro) | 1 | 1.1 | | |
| Total | 93 | 100.0 | 245 | 100.0 |

Pueblo Utility Ware

While it is likely that pottery production by Athapaskan groups in the Southwest was ultimately adopted from Puebloan sources (Brugge 1982; Opler 1971), sherds assigned here as Athapaskan Plain Utility are distinct from the utility wares at nearby protohistoric Puebloan sites (Kintigh 1985; Marshall and Wait 1984). Utility wares were placed into Puebloan types in this study based on browner pastes, evidence of polishing, thicker vessel walls, and the presence of added temper in one case. Many of these sherds resemble Mogollon Brown Wares (Haury 1936), although slight differences in paste color and range of surface treatments were noted.

Pueblo Glaze Ware

Still other protohistoric sherds in the Datil collections had polished surfaces, red to brown pastes, basalt temper, and decorations in glaze paint. These sherds are similar to pottery from Piro pueblo sites in the Rio Abajo of the Rio Grande Valley (Marshall and Wait 1984; Shepard 1942). Unslipped surfaces were brown, but a white or light gray slip was usually present on one surface and a dark red slip often occurred on the other. These combinations of temper, paint, paste, and slip are very similar to those noted on a late variant of Socorro Glaze Ware briefly described by Shepard (1942). This variant is assumed to have been produced by Piro Pueblos along the lower Rio Abajo (Marshal and Walt 1984; Mera 1940). Sherds stored at the Laboratory of Anthropology from Piro pueblos in the Socorro and Magdalena areas were examined as part of this study (Mera 1940). These examinations indicate that proto-historic Piro glaze wares are very similar to the decorated pottery at the one Datil site. Sherds exhibiting characteristics described here as Athapaskan Utility wares were absent in the collections from protohistoric Piro sites, further supporting a non-Puebloan or Apachean association of the Athapaskan Plain Utility sherds. In addition to decorated Piro tradition sherds, a single sherd with a bright red slip and sherd temper may have been produced at Zuni or Acoma area Pueblos (Harlow 1973; Woodbury 1966), although similar sherd temper, slips, and pastes were sometimes employed at pueblos in the southern Rio Grande (Shepard 1942).

Dating of Protohistoric Datil Components

The initial suggestion of the existence of protohistoric components at Datil Mountain Project sites was based on the presence of Athapaskan and Historic Puebloan types. These components were later supported by radiocarbon dates at both sites indicating occupations in the 16th or 17th century (Hayden and others 1996; Oakes 1996).

Ceramic dating of the two protohistoric components is dependent on a number of assumptions. The date associated with the early end of the protohistoric occupation span depends primarily on the time of introduction of Athapaskan pottery into the Southwest. Arguments for the beginning of Apache ceramics are mainly based on data from other areas occupied by Athapaskan speaking groups, particularly the Navajo occupation of the Upper San Juan region (Brugge 1982; 1992; Gunnerson 1979; Wilson and Blinman 1993). While archaeologists have noted that Western Apache groups may have arrived in the upland Southwest soon after its abandonment by prehistoric Mogollon and Anasazi groups at about A.D. 1300 (Brugge 1992; Eddy 1966), until recently it was generally believed that Apachean components would have been archaeologically invisible until after the 17th century. This was based on the assumption that ceramics and other traits allowing the archaeological recognition of early Athapaskan occupations were not present until after the Pueblo Revolt in the late 17th century (Baugh and Eddy 1987; Brugge 1963; 1982; Carlson 1965). More recent investigations of early Navajo sites indicate that pottery similar to that found in later Navajo and Apachean sites may have been widely produced by Athapaskan groups by the beginning of the 16th century (Brown and Hancock 1992; Reed and Reed 1992; Winter and Hogan 1992). Closer to the Datil Project area, sherds classified as Navajo utility ware were recovered from a hearth west of the town Quemado yielding radiocarbon dates in the late 16th to mid-17th century (Oakes 1986). These sherds are similar to the Athapaskan sherds at the Datil site, and they could represent occupations by similar groups.

The Piro glaze wares from LA 39998 exhibit styles and treatments known to have been utilized by Piro potters from about 1500 until the abandonment of all their villages by 1685. Thus, the joint presence of Piro Glaze Ware and Athapaskan Utility Ware types is consistent with the radiocarbon dates from the sites. The presence of Piro pottery at one of these sites is not that surprising given historical references regarding trade between Piro villages and Apache bands (Forbes 1960), and the Datil Mountain sites are only about 45 miles from the nearest historically occupied Piro villages. These include several large sites near the modern towns of Socorro and Magdalena (Marshall and Walt 1984; Mera 1940).

However, the proximity of the Piro villages raises another issue: are the Apachean and Puebloan sherds associated with the same component at LA 39998? If they do represent a single component, their association would reflect an Apache occupation where additional vessels were obtained through trade or raiding from surrounding Puebloan groups. This indicates an occupation contemporary with nearby Piro villages between A.D. 1500 to 1680. Even though such an association has not been previously noted archaeologically, such a correlation is supported by early historical accounts of Apachean groups as well as interaction between Apache and Piro groups.

Another potential interpretation of this combination of ceramic types is that two distinct temporal components are represented. The first would include Pueblo utility and decorated wares, indicating use of LA 39998 by Piro groups sometime during the late prehistoric or early protohistoric period. The presence of thin (Apachean) utility would then reflect later occupation by Apachean groups during the historic (post-A.D. 1680) period. The possibility of occupations by Pueblo groups in this area is raised by early historical accounts of Piro groups temporally abandoning their villages and going into the surrounding mountains in order to seek refuge from Spanish expeditions (Forbes 1960). It may also be supported by a site described by Hough (1907) during his early survey of the Upper Gila drainages. While he noted that few ruins were present in the Datil area, Hough (1907:29) described a cliff house of five or six contiguous ruins located 4 miles north of Datil. He noted that the pottery from this site was "dull gray and brown in color and of crude manufacture resembling that from near Magdalena, New Mexico, and stations of the Rio Grande" (Hough 1907:29). He also noted that the size, location, and plan of this ruin were similar to those common in the mountains of southern New Mexico and Arizona. This site could represent a small settlement of Piro groups in the Datil area. If this is the case, such sites could be the source of the Puebloan sherds at LA 39998. It is also possible that this site could represent a structure, similar to the pueblitos constructed by the Navajo to the north, built and occupied by local Athapaskan groups. Another possibility is that the Puebloan pottery at the site described by Hough could have been broken by Athapaskan groups camping on a earlier Mogollon or Anasazi Pueblo. Although I believe that the Apache and Pueblo ceramic types found at LA 39998 are contemporaneous and reflect part of a seasonal round by Apache groups during the 16th or 17th century, further investigation of protohistoric sites in this region are required to determine if this is the case.

## Conclusion

Small numbers of sherds recovered from two sites near Datil provide clues concerning protohistoric occupations in this area. A thin utility ware recovered from both sites probably represents pottery produced by early Athapaskan groups residing in the Mogollon Highlands. The presence of Puebloan utility and glaze ware sherds at the (LA 104381) site may reflect sequential occupations by both Apachean and Pueblo groups, or it may simply reflect the fortuitous breaking of non-local vessels by ancestors of the Chiricahua Apaches. In either case, it is likely that these two sites are roughly contemporaneous, dating sometime between

A.D. 1500 to 1680. I prefer the interpretation that both traditions of pottery are associated with Athapaskan occupation of the area, reflecting contact between Apache groups and Piro groups to the east. This association would be similar to those noted for other early Athapaskan occupations spread across the Southwest and Southern Plains, including similar utility ware pottery technology and the presence of pottery acquired from surrounding Puebloan groups (Habicht-Mauche 1991; Opler 1971; Reed and Reed 1992; Woosley and Olinger 1990). Similarities in patterns noted between various regions may reflect a widespread strategy of interaction between Puebloan and Athapaskan or other mobile non-Puebloan groups that ultimately benefited both populations (Spielmann 1991; Wilcox 1984). I suspect that additional investigations in this area and other areas of the Southwest will indicate surprisingly early beginning dates for Athapaskan pottery, as well as confirming the geographic extent and high degree of interdependence of Puebloan and Athapaskan groups which included the production and movement of ceramics.

**Notes on Early Chiricahua Occupations in Western New Mexico**

The Chiricahua are one of seven historically documented Southern Athapaskan speaking or Apachean tribes. Various Chiricahua bands occupied a large area that covered much of Southwest New Mexico including the Datil Mountains, as well as parts of Southeastern Arizona, Northern Mexico and West Texas (Opler 1983; Schroeder 1962). Knowledge of these occupations is based almost entirely on ethnographic and historic accounts (Opler 1983; Schroeder 1959; 1962), as almost nothing is known about the Apache archaeology of this area (Brugge 1982; Gunnerson 1979). Protohistoric Apache occupations in this area reflect adaptations resulting from the movement of Athapaskan groups into areas earlier abandoned by the Anasazi and Mogollon. These groups appear to have practiced economies focusing on hunting and gathering as well as the occasional addition of limited agriculture (Opler 1983).

Early historic accounts in New Mexico were primarily concerned with the Apaches as a threat to Spanish settlements, but they still provide information concerning the presence of Southern Apachean groups as well as evidence of interaction with surrounding Puebloan groups. Among the earliest accounts was one recorded in 1583, concerning the presence of a numerous and warlike people in the highlands south of Acoma (Schroeder 1959). These people were referred to as Querechos by the Pueblos, and traded regularly with the inhabitants of Acoma. It is likely that these "mountain Querechos" belonged to an Eastern Chiricahua band (Opler 1983). In 1630, the inhabitants of a Piro pueblo in the Socorro area were at war with Apaches who surrounded the Pueblo on all sides (Earls 1992; Hodge et al. 1945; Schroeder 1959). The Piro villages suffered considerably from increased hostilities between the Spanish and Apaches between 1668 to 1680. Despite increased Apache hostilities, the Piros and other Puebloan groups maintained trading ties with the Apache during early historic periods. Raids by Apache groups from both sides of the Rio Grande may have been one factor in the depopulation and subsequent abandonment of the Piro Pueblo villages along the lower Rio Grande area at A.D. 1680 (Mera 1940; Schroeder 1979).

## References Cited


Baugh, Timothy G., and Frank W. Eddy
1987 Rethinking Apachean Ceramics: The 1985 Southern Athapaskan Ceramic Conference. *American Antiquity* 52:793-798.

Brown, Gary and Patricia M. Hancock
1992 The Dinetah Phase in the La Plata Valley. In *Cultural Diversity and Adaptation:* The *Archaic, Anasazi, and Navajo Occupation of the Upper San Juan Basin,* edited by L.S. Reed and P.F. Reed, pp 69-90. Bureau of Land Management, New Mexico State Office, Cultural Resource Series 9, Santa Fe.

Brugge, David M.
1963 *Navajo Pottery and Ethnohistory.* Navajo Nation Papers in Anthropology. Window Rock, Arizona.
1982 Apache and Navajo Ceramics. In *Southwestern Ceramics: A Comparative Review.* The Arizona Archaeologist 15. Arizona Archaeological Society, Phoenix.
1992 Discussion of Athabascan Research. In *Current Research on the Late Prehistory and Early History of New Mexico,* edited by B.J. Vierra, pp. 337-342. New Mexico Archaeological Council Special Publication I, Albuquerque.

Carlson, Roy L.
1965 *Eighteenth Century Navajo Fortresses of the Gobernadar District.* University of Colorado Series in Anthropology 8. University of Colorado Museum, Boulder.

Earls, Amy C.
1992 Raiding, Trading, and Population Reduction Among the Piro Pueblos, A.D. 1549 to 1680. In *Current Research on the Late Prehistory and Early History of New Mexico,* edited by B.J. Vierra, pp. 11-20. New Mexico Archaeological Council Special Publication I, Albuquerque.

Eddy, Frank W.
1966 *Prehistory of the Navajo Reservoir District Northwestern New Mexico.* Museum of New Mexico Papers in Anthropology 15, Part II. Museum of New Mexico Press, Santa Fe.

Ferg, Alan
1988 *Western Apache Material Culture:* The *Goodwin and Guenther Collections.* The University of Arizona Press, Tucson.
1992 Western Apache and Yavapai Pottery and Features from the Rye Creek Project. In The *Rye Creek Project: Synthesis and Cone/usion,* edited by M.D. Elson and D.B. Carait, pp. 3-25. Center for Desert Archaeology, Anthropological Papers 11, Tucson.
1995 Excavations of a Protohistoric Western Apache Activity Area at the Eagle Ridge Site Locus D. In The *Roosevelt Community Development Study: New Perspectives on TOnlo Basin Prehistory,* edited by M.D. Elson, M.T. Stark, and D.A. Gregory, pp. 499-512. Center for Desert Archaeology, Anthropological Papers 15, Tucson.

Forbes, Jack D.
1960 *Apache, Navaho and Spaniard.* University of Oklahoma Press, Norman.

Gifford, James C.
1980 *Archaeological Exploration* in *Caves* in *the Point of Pines Region Arizona.* Anthropological Papers of the University of Arizona 36. The University of Arizona Press, Tucson.

Gunnerson, James H.
1979 Southern Athapaskan Archaeology.In *Handbook of North American Indians, vol 10, Southwest,* edited by A. Ortiz, pp 162-169. Smithsonian Institution, Washington, D.C.

Gunnerson, James H., and Dolores A. Gunnerson
1971 Apachean Culture: A Study in Unity and Diversity. In *Apachean Culture History and Ethnology,* edited by K.H. Basso and M.E. Opler, pp. 7-28. Anthropological Papers of the University of Arizona 21. The University of Arizona Press, Tucson.

Habicht-Mauche, Judith
1991 Evidence for the Manufacture of Southwestern-Style Culinary Ceramics on the Southern Plains. In *Farmers, Hunters, and Colonists: Interaction Between the Southwest and Southern Plains,* edited by K.A. Spielmann, pp 51-70. The University of Arizona Press, Tucson.

Harlow, Francis H.
1973 *Matte-Paint Pottery of the Tewa, Keres and Zuni Pueblos.*Museum of New Mexico, Santa Fe.

Haury, Emil W.
1936 *Some Southwestern Pottery Types.* Medallion Papers 19. Gila Pueblo: Globe, Arizona.

Hayden, David J., Lloyd A. Moiola, and Yvonne R. Oakes
1996 The *Datil Mountain Project: Archaic, Puebloan, andAthabaskan Campsites along U.S. 60 near Datil, New Mexico.* Museum of New Mexico, Office of Archaeological Studies, Archaeology Notes 177, Santa Fe.

Hodge, Fredrick Webb, George P. Hammond, and Agapito Rey
1945 *Fray Alonso de Benavides' Revised Memorial of 1634*. Coronado Cuarto Centennial Publications 4. University of New Mexico Press, Albuquerque.

Hill, David V.
1995 Petrographic Analysis of Datil Project Ceramics. Manuscript on file, Museum of New Mexico, Office of Archaeological Studies, Santa Fe.

Hough, Walter
1907 *Antiquities of the Upper Gila and Salt River Valleys* in *Arizona and New Mexico.* Bureau of American Ethnology, Bulletin 35, Washington, D.C.

Kintigh, Keith
1985 *Settlement, Subsistence, and Society in Late Zuni Prehistory.* Anthropological Papers of the University of Arizona 44. University of Arizona Press, Tucson.

Marshall, Michael P., and Henry J. Walt
1984 *Rio Abajo: Prehistory and History of a Rio Grande Province.* Historic Preservation Division, New Mexico Office of Cultural Affairs, Santa Fe.

Mera, H.P.
1940 *Population Changes* in *the Rio Grande Glaze Paint Area.* Laboratory of Anthropology Technical Series Bulletin 9. Museum of New Mexico: Santa Fe.

Oakes, Yvonne R.
1986 *Navajo and Basketmaker Ill--Pueblo I Occupations of Two Sites Near Quemado, Catron County.* Laboratory of Anthropology Note 355. Museum of New Mexico, Santa Fe.

1996 ExpandingAthabaskan Chronometric Boundaries in West-Central New Mexico. In *La Jornada: Papers in Honor of William F. Turney,* edited M.S. Duran and D.T. Kirkpatrick, pp 139-150. The Archaeological Society of New Mexico Papers 22, Albuquerque.

Opler, Morris E.
1971 Pots, Apache, and the Dismal River Aspect. In *Apachean Culture History and Ethnology.* edited by K.H. Basso and M.E. Opler, pp 7-28. Anthropological Papers of the University of Arizona 21. The University of Arizona Press, Tucson.

1983 Chiricahua Apache. In *Handbook of North American Indians, Vol. 10, Southwest,* edited by Alfonso Ortiz, pp 401-418. Smithsonian Institution: Washington, D.C.

Reed, Lori Stephens, and Paul F. Reed
1992 The Protohistoric Navajo: Implications of Interaction, Exchange, and Alliance Formation with Eastern and Western Pueblos. In *Cultural Diversity and Adaptation: The Archaic, Anasazi, and Navajo Occupation of the Upper San Juan Basin,* edited by L.S. Reed and P.S. Reed, pp 91-104. Bureau of Land Management, New Mexico State Office, Cultural Resource Series 9, Santa Fe.

Schroeder, Albert H.
1959 A Study of the Apache Indians, Part 1: The Apache and their Neighbors, 1540 to 1700. Manuscript on file, Laboratory of Anthropology, Santa Fe.
1962 A Study of the Apache lndians, Part 4: The Mogollon, Copper mines, Mimbres, Warm Springs, and ChiricahuaApaches. Manuscript on file, Laboratory of Anthropology, Santa Fe.
1979 Pueblos Abandoned in Historic Times. In *Handbook of North American Indians, vol 10, Southwest,* edited by Alfonso Ortiz, pp 236254. Smithsonian Institution, Washington, D.C.

Shepard, Anna O.
1942 *Rio Grand Glaze Painted Ware:* A *Study Illustrating the Place of Ceramic Technological Analysis in Archaeological Research,* Carnegie Institution Contributions to American Anthropology and History, Washington D.C.

Spielmann, Katherine A.
1991 Coercion or Cooperation? Plains-Pueblo Interaction the Protohistoric Period. In *Farmers, Hunters, and Colonists: Interaction Between the Southwest and Southern Plains,* edited by K.A. Spielmann, pp 3650. The University of Arizona Press, Tucson.

Wilcox, David R.
1984 Multi-Ethnic Division of Labor in the Protohistoric Southwest. In *Collected Papers in Honor of Harry* L. *Hancock,* edited by N.L. Fox, pp 141-156. Archaeological Society of New Mexico, Albuquerque.

Wilson, C. Dean
1994 Implications of Ceramic Resource Surveys in the Northern Mogollon Country. In *Mogollon VII: The Collected Papers of the 1992 Mogollon Conference.* Coas Publishing and Research, Las Cruces.

Wilson, C. Dean, and Eric Blinman
1993 *Upper San Juan Region Pottery Typology.* Office of Archaeological Studies, Archaeology Notes 80, Santa Fe.

Winter, Joseph C. and Patrick Hogan
1992 The Dinetah Phase of Northwestern New Mexico: Settlement and Subsistence. In *Current Research on the Late Prehistory and Early History of New Mexico,* edited by B.J. Vierra, pp. 299-312. New Mexico Archaeological Council Special Publication 1, Albuquerque.

Woodbury, Richard B., and Nathalie F.S. Woodbury
1966 Appendix II. Decorated Pottery of the Zuni Area. In *The Excavation of Hawikuh by Fredrick Webb Hodge* 1917-1923, by W. Smith, R.B. Woodbury, and Nathalie Woodbury, pp 301-33. Contributions from the Museum of the American Indian Heye Foundation 20. Museum of the American Indian Heye Foundation, New York.

Woosley, Anne I., and Bart Olinger
1990 Ethnicity and the Production of Micaceous Ware in the Taos Valley. In *Clues to the Past: Papers in Honor of William* M. *Sundt,* edited by M.S. Duran and D.T. Kirkpatrick, pp. 351-373. Papers of the Archaeological Society of New Mexico 16, Albuquerque.

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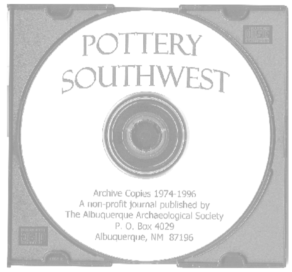


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