The Pueblo Bonito Mounds of Chaco Canyon

MATERIAL CULTURE AND FAUNA

Edited by **Patricia L. Crown**

THE PUEBLO BONITO MOUNDS OF CHACO CANYON

THE PUEBLO BONITO MOUNDS OF CHACO CANYON

MATERIAL CULTURE AND FAUNA

Edited by **PATRICIA L. CROWN**

UNIVERSITY OF NEW MEXICO PRESS ≈ ALBUQUERQUE

Printed in the United S tates of America
21 20 19 18 17 16 1 2 3 4 5 6

Library of Congress Cataloging-in-Publication Data

The Pueblo Bonito Mounds of Chaco Canyon : material culture and fauna / edited by Patricia L. Crown.
pages cm
Includes bibliographical references and index.
ISBN 978-0-8263-5650-5 (cloth : alkaline paper) — ISBN 978-0-8263-5651-2 (electronic)
1. Pueblo Bonito Site (N.M.) 2. Mounds—New Mexico—Pueblo Bonito Site. 3. Material culture—New Mexico—Pueblo Bonito Site.
4. Animal remains (Archaeology)—New Mexico—Pueblo Bonito Site. 5. Excavations (Archaeology)—New Mexico—Chaco Canyon.
6. Indians of North America—New Mexico—Chaco Canyon—Antiquities. 7. Chaco Canyon (N.M.)—Antiquities. 8. Chaco culture.
I. Crown, Patricia L.
E78.N65P84 2016
978.9'8—dc23
2015014676

COVER PHOTOGRAPH of Pueblo Bonito courtesy of Wetherbee Bryan Dorshow
DESIGNED BY Lisa Tremaine
COMPOSED BY Counterspace Design in 10.25/13.5 Minion Pro Regular
DISPLAY TYPE is Vendetta Medium and Cronos Pro

Contents

Illustrations

FIGURES

TABLES

Preface

In 2004, W. H. Wills and the University of New Mexico received permission from the National Park Service to reopen three trenches directly south of Pueblo Bonito through and between the two mounds adjacent to the pueblo. The permit was to remove the backdirt from the trenches placed through this area in the 1920s, record and take samples from the stratigraphy of the trench walls, and then close them again. Previous excavations in Pueblo Bonito had removed hundreds of thousands of artifacts from the rooms of Pueblo Bonito to museums in New York and Washington, DC, so the National Park Service had few collections from Pueblo Bonito. Therefore, the Park Service requested that all of the dirt removed from the trenches be screened and any artifacts recovered analyzed and cataloged into their collections.

Over the four years from 2004 to 2007, the University of New Mexico held six field sessions excavating and recording the trenches, including four summers of work with paid, experienced student labor and two fall-semester field schools for undergraduate and graduate students. The following individuals participated in these field seasons and were instrumental in the success of the overall project: Ali Agirnas, Woody Aguilar, Robby Anderson, Colin Baugh, Jeremy Begay, Brandon Belis, Abbie Bollans, Bre Bolstetter, Lewis Borck, Dedie Briand, Lindsay Brown, William Brown, Julia Clark, Anne Compton, Sarah Dixon, Katherine Dungan, Jennifer English, James Gachupin, Chris Gates, Phil Geib, Travis Godwin, Martha Gustafson, Leo Gutierrez, Natalie Heberling, Carrie Heitman, David Holtkamp, Ed Jolie, Valerie King, Kim Mann, Sarah Matthews, Hannah V. Mattson, Rebecca McClure, Trish Merewether, Jeremy Mikecz, Chris Millington, James Murray, Adam Okun, Marina Parker, Kari Schleher, Jessica Sebring, Theresa Sterner, David Thompson, Meaghan Trowbridge, Luana Valdez-Bulow, Adam Watson, and Scott Worman.

All dirt from the trenches was screened through ¼- to ⅛-in. mesh following standard archaeological procedures, and the project resulted in the recovery of over 200,000 objects. Because the original project was not designed to address issues regarding the material culture of the trenches and did not include funding for analysis of those materials, I applied to the National Science Foundation for funding to complete the analysis of the material. With NSF funding, I hired a number of graduate and undergraduate students to conduct the analyses over the two years from fall 2007 to summer 2009. Four graduate research assistants helped supervise the undergraduates, including the laboratory director Natalie Heberling; ceramics analysts Hannah V. Mattson and Sandra Arazi-Coambs; and lithics analyst Adam Okun. Undergraduate students hired for the project included Wilda Bien, Kendra Edwards, Danielle Griego, Jessica LaCosse, Gary Lawson, Trish Merewether, and David Smith. High school student Martha Hughes worked on her senior project analyzing gray ware ceramics. Ceramics experts Thomas Windes and Valerie King provided training on typologies for the ceramics analysts. H. Wolcott Toll and Peter McKenna provided advice and answered questions about the Chaco Project ceramics analysis. At Simon Fraser University, Dr. Jonathan Driver supervised the analysis of all the faunal material and his student Shaw Badenhorst completed a dissertation on this fauna. This project could not have been completed without the help of all these individuals.

I gratefully acknowledge the help of Chaco Culture National Historical Park archaeologist Dabney Ford and collections manager Wendy Bustard in completing the

excavations and loaning the material for several years after the excavations were complete.

Thanks also to Anibal Rodriguez and David Hurst Thomas of the American Museum of Natural History for allowing me to analyze red ware vessels in their collections, and to David Rosenthal, James Krakker, and Bruce Smith at the Smithsonian Institution National Museum of Natural History for giving me access to the red ware vessels curated at the Museum Support Center in Suitland, Maryland. W. Jeffrey Hurst, chief scientist with Hershey, conducted the original residue analysis searching for cacao on five sherds from the trenches.

Funding for the project came from the National Science Foundation (Award BCS-0710733). The University of New Mexico gave me the time and laboratory space to complete the project. In the Anthropology Department, Amy Hathaway and Jennifer George aided the project in innumerable ways. John Byram, director of the University of New Mexico Press, provided encouragement throughout the publication process. Kate Moreau completed the copyediting for the press. Thanks to Jill Neitzel and Steve Lekson for excellent suggestions for improving the original manuscript. My research assistants, Erin Hegberg and Jennie Sturm, helped prepare the manuscript for the press. Most of all, thanks to Chip Wills for conceiving this project, offering help when needed, and listening to my woes over the decade it took to complete.

PATRICIA L. CROWN
Albuquerque, NM

Chapter 1

The Pueblo Bonito Mounds

BACKGROUND AND RESEARCH QUESTIONS

Patricia L. Crown

Just south of Pueblo Bonito sit two mounds (Figure 1.1). In the 1920s, the National Geographic Expedition supervised by Neil Judd placed three trenches through this area: one each in the West Mound and East Mound and one trench through the area between the two mounds. His goal was to determine the sequence of pottery development by excavating the mounded trash deposits (Judd 1964:212–216). Between 2004 and 2007, the University of New Mexico archaeologists directed by W. H. Wills reopened portions of these same trenches with funding from the National Science Foundation (NSF) and National Geographic Society (NGS). Their intent was to reexamine the stratigraphy of the mounds and to gather soil, macrobotanical, pollen, ostracod, and datable material from the trench walls to determine whether channels shown in Judd's illustrations were natural or cultural features. Although the excavations carried out in the 2000s removed only backdirt from Judd's trenches, the crews screened all material and excavated in 20 cm levels. It quickly became apparent that Judd had removed few artifacts from his excavations. All the artifacts recovered were taken to the University of New Mexico campus for further analysis prior to turning them over to the National Park Service for curation. With separate funding from NSF, I supervised a team of undergraduate and graduate students analyzing the material from fall 2007 through spring 2010. This volume presents the results of those analyses. The results of the University of New Mexico–sponsored excavations, including the stratigraphy and environmental data, are available elsewhere (Wills et al. 2015).

This chapter reviews the questions that guided the analyses and the analytic techniques chosen to address them. In many ways, the scope of this project is similar to the analyses that followed the excavations at Pueblo Alto, conducted by the National Park Service in the late 1970s as part of the Chaco Project (see Mathien [1997a] for an overview of the Chaco Project analyses). The numbers of artifacts recovered are similar, so it would have been a natural step to follow their procedures. But many of the Chaco Project analysts advised modification of their procedures in a number of ways. They had learned what worked well and what did not work. We followed much of this advice. We also had some different questions and several new methods available to us, so what we ended up recording and the ways that we recorded attributes were necessarily different in some cases from the Chaco Project.

BACKGROUND

The Bonito Phase (ca. AD 900–1140) in Chaco Canyon, New Mexico, is one of the most prominent and debated examples of rapid social transformation in the archaeology of North America (Altschul 1978; Bernardini 1999;

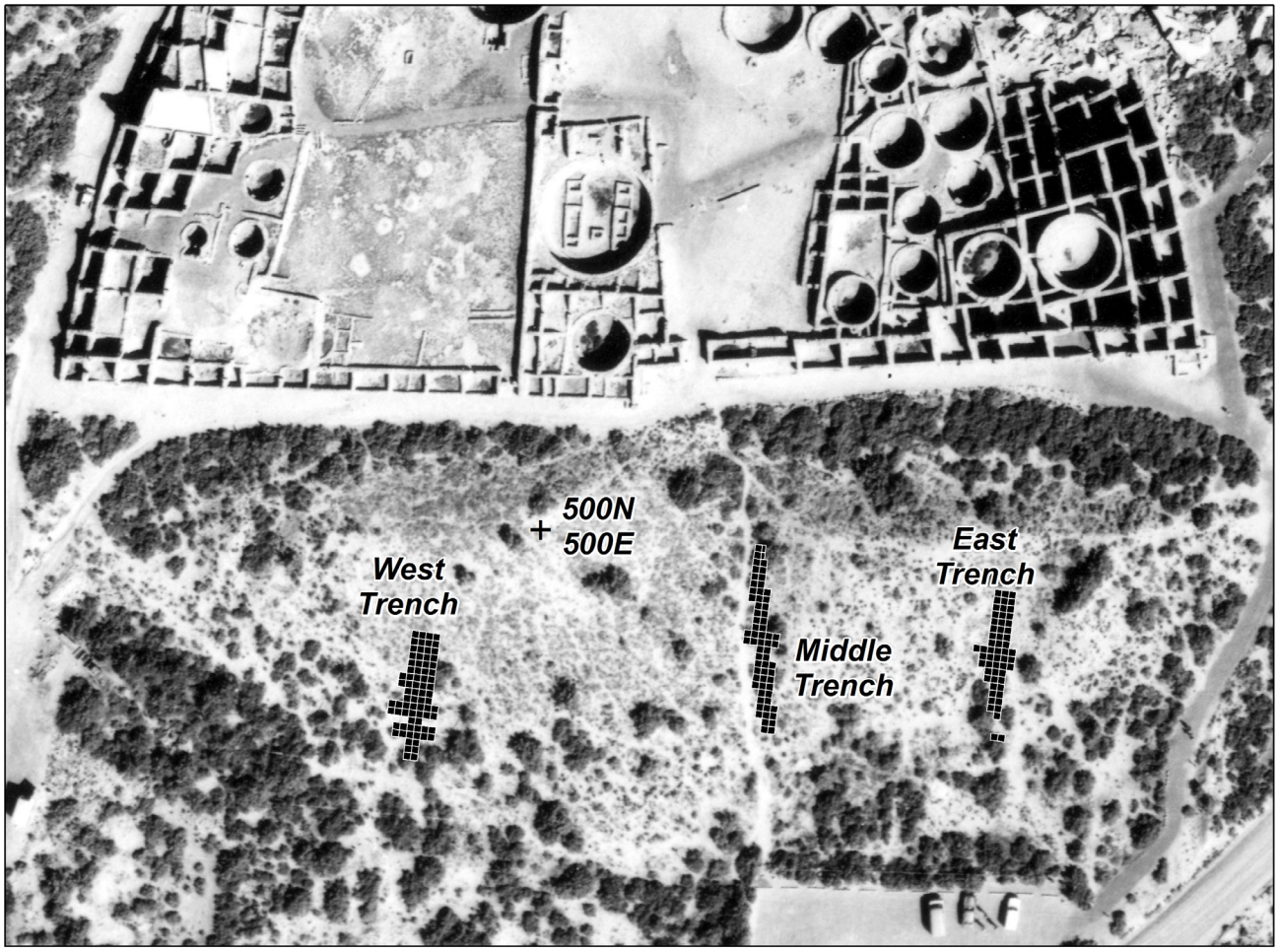

Figure 1.1 Three major trenches (shaded) excavated through and between the East and West Mounds south of Pueblo Bonito by the National Geographic Society between 1921 and 1925. Photograph and line art courtesy of W. H. Wills.

Bustard 1996, 2003; Crown and Judge 1990; Kohler 1998; Lekson 1999, 2006a, 2006b; Mills 2002; Neitzel 1999, 2003a; Vivian 1990; Wills 2001). Within perhaps only one or two generations, a regional population of dispersed farming households gave rise to aggregated settlements that were socially anchored by a dense cluster of massive stone buildings in Chaco Canyon called great houses. Labor estimates for the construction of individual great houses exceed several hundred person-hours (Lekson 1984) and bear testimony to the unprecedented amount of energy and organization that marks a shift from small undifferentiated social networks to large segmentary corporate groups (Kantner 1996; Saitta 1997; Sebastian 1992). Archaeologists have studied this striking change for more than a century, devoting great effort to understanding the role or function of great houses in their final or completed form (e.g., Cameron and Toll 2001; Renfrew 2001). They have been hampered by a limited number of excavations at great houses, primarily conducted before current standards of fieldwork were established, and sometimes inadequate publication of results.

Archaeologists consider Pueblo Bonito to be the center of the Chaco world (Neitzel 2003a). The largest and most completely excavated of the great houses in Chaco Canyon, it also produced the largest assemblage of whole artifacts. Two major expeditions excavated most of the site, providing extensive collections largely housed at the Smithsonian Institution and the American Museum of Natural History. These excavations reveal a concentration of objects never duplicated in excavations of other great houses. These objects form the basis of much of what is known about the Chacoan material world. The site is then not only the center of the Chaco world, but also the center of the Chaco archaeologists' world. Discussions of subjects such as the Mesoamerican connection rely on this material, because the preponderance

of clearly Mesoamerican objects in the Chaco world come from Pueblo Bonito. Even relatively locally made objects, such as cylinder jars, are primarily from Pueblo Bonito; for example, of 187 known examples of cylinder jars, 166 are from this site. What is not known is whether the unusual artifacts that characterize the museum assemblages also characterize the refuse at this site.

Archaeologists have interpreted the two mounds south of Pueblo Bonito as trash mounds, areas for sacrifice of items during ritual events, ritual architecture, and gardens. The contents of the mounds thus provide critical insight into life at Pueblo Bonito and the nature of the extraordinary Pueblo Bonito collections. The things that people discarded are as important as the things that they kept, and they help us to understand whether the extraordinary items found in the ruins represent a norm for the site or are extraordinary even there. Refuse, whether from everyday household activities, crafts workshops, or ritual events, provides not only the crucial last stage in the production-consumption-discard sequence, but also insights into the other two stages as well.

The current excavations of the mounds south of Pueblo Bonito provide the first opportunity to examine refuse from this pivotal site in detail. A surprising number of important issues can be addressed by examining the refuse at Pueblo Bonito (see enumeration of issues in Neitzel 2003a:7–8; see also Judge et al. 1981:91; Cordell and Judge 2001:4; Sebastian 2006:419–20; Varien 2001:51; Windes and Ford 1992:75; Windes 2003). We chose to conduct a detailed examination of the production, exchange, consumption, and discard of those materials to address a variety of comprehensive questions, including issues such as feasting, population estimates, the function of Pueblo Bonito, ritual disposal of artifacts, and exchange networks throughout the Chacoan world.

HISTORY OF RESEARCH

Expeditions in the 1890s (Pepper 1920) and 1920s (Judd 1954, 1964) excavated major portions of Pueblo Bonito, including trenches in the two mounds south of the site (see also Dodge report in Pepper 1920:23–25). In the case of Hyde Expedition, Richard Wetherill placed large trenches through the mounds primarily to locate burials (Pepper 1920:26). No burials were found. Photographs of the Pepper trenches show location but little detail. No adequate notes describing the stratigraphy have been located. At the end of the Hyde Expedition, additional trenches were placed through the mounds under the direction of Richard Dodge to examine the geomorphology (Pepper 1920:23–25). Artifacts collected from these excavations are housed at the American Museum of Natural History and are listed on the Chaco Research Archive website. From these records, it is clear that Pepper removed over 100 individual items from the mounds, along with some miscellaneous sherds and bones. The materials he removed are represented in our artifacts as well, although he did find an unusual number of bone awls (22). In 1916, Nels Nelson deepened trenches in the mounds and put two test pits in the mounds. He hoped to establish a ceramic sequence based on the stratigraphy in the mounds and argued that "it seemed a priori impossible that stylistic changes should not have taken place during the long interval of occupation suggested by the size of the refuse heaps" (Nelson 1920:383). Unfortunately, he found a great deal of what he interpreted as construction material, and little patterning in the ceramic sequence. Nelson (1920:383) felt that the mound deposits were homogenous due to rapid accumulation. He did believe that the eastern mound was started somewhat later than the western mound based on ceramic frequencies (Nelson 1920:385).

Neil Judd (1964:212–216) placed new trenches through each mound and one between the mounds as part of the 1920s National Geographic Society Expedition at Pueblo Bonito. Initially, his goals were to determine the stratigraphy and collect a stratigraphic sample of ceramics. Artifacts were collected from three test pits placed offset from the trenches, one in the West Mound and two in the East (Judd 1954, 1964:212; Roberts 1927; Windes 1987a). Judd was disappointed with the results of the ceramic sequence. He postulated that the mixing of ceramic types throughout most of the sampled areas resulted from the relocation of the mound deposits from their original location, which was closer to the pueblo during building episodes (Judd 1964:212). Frank Roberts (1927) analyzed the ceramics found in these units as part of his dissertation, including 2,117 sherds from 23 separate strata in a 1 × 1 m (3 × 3 ft) square unit in the West Mound and a roughly comparable number in a similar unit in the East Mound. His results matched Nelson's, with early and late pottery types mixed throughout the strata, as well as a "preponderance of constructional debris" (Judd 1964:213). Roberts (1927) concurred with Nelson's interpretation of the East Mound as starting later than the West Mound. In his fourth season of fieldwork (1925), Judd changed his goal for excavation of the mounds because the geologist

Kirk Bryan suggested that the two mound trenches be extended to intercept a buried channel he located to the south. Bryan (1954) and Judd (1954, 1964) report the stratigraphy of portions of the trenches, and field notes and field maps provide additional documentation of the strata and features found in the trenches.

Although it has recently been argued that Judd found no stratigraphy in these trenches (Stein et al. 2003:52), this position is a misunderstanding of Judd's use of the word "stratigraphy." Judd very clearly states that there are distinct cultural and natural strata in the mounds, which he shows in profile drawings (Judd 1964:Figure 24; see also Robert 1927:Figure 7). But he also uses the term to mean ceramics in correct stratigraphic position, with earliest on the bottom and latest on the top; it is this latter stratigraphic positioning of material that he did not find as he had hoped. Anthropogenic and natural strata are clearly present in all three trenches (Wills et al. 2015).

Judd (1964:212) writes that he limited sampling to specific areas of the trenches, and he provides catalog numbers for the units where he sampled material. By this he means that he systematically removed artifacts only from these portions of the trenches, which include the three test units reported by Roberts (one in the West Mound and two in the East Mound) that were placed offset from the trenches. Overall, trenches vary in width from about 60 cm to almost 3 m and in depth from less than 2 m to almost 7 m. Horizontal variation is related to depth: Judd made trenches wider when they were deeper, and he generally excavated to culturally sterile strata. The trenches are most shallow on the southern end and increase in depth through the mounds.

Apart from the limited artifact collections from the test units, Judd removed only about 105 artifacts from other portions of the trenches. This figure is based on what is currently curated at the Smithsonian National Museum of Natural History from the mounds. In some cases, the accession catalog records a description of shell beads but not the specific number found; so we know that at least 105 objects were removed, although the actual number is undoubtedly somewhat higher. The range of materials removed matches that of material encountered in reexcavated trenches, with the exception of two macaw skeletons and a thick-billed parrot skull, apparently found at a single depth (Level M) in the Test Unit 8, excavated for Roberts's chronology development. As with Pepper's work, Judd found an unusual number of bone awls (34) in the test trenches, and 27 of these came from the East Mound trench. As Badenhorst et al. discuss in chapter 9, Judd did collect unmodified animal bone from the trenches, particularly animal skulls. Judd (1954:66) summarizes the mound material in his volume on the material culture of Pueblo Bonito.

The high density of artifacts encountered in removing the backfill from the trenches during the 2004–2007 University of New Mexico project confirms the view that few objects were removed from the trenches during Judd's work. During the University of New Mexico project, we removed trench fill by shovel in 20 cm arbitrary levels and screened 90 percent through ¼-in. mesh and the remaining 10 percent through ⅛-in. mesh. Vertical control was maintained using arbitrary 20 cm levels, and horizontal control through a 2 × 2 m grid system and Judd's original trench walls. In an effort to obtain as much material as possible for analysis, we removed all artifacts, regardless of size. We encountered sherd densities as high as 5,000 sherds in a 20 cm arbitrary level, with a final project tally of over 191,000 sherds. For comparison, the total sherd counts from the Pueblo Alto Mound were 38,813 (Windes 1987a). Further support for the argument that Judd and his crew removed little material from the mound trenches includes the high frequency of projectile points, the presence of large decorated sherds, and the presence of many relatively rare items, such as human effigy vessel fragments, turquoise pendants, and beads.

An important question is whether Judd discarded refuse found elsewhere in Pueblo Bonito in the mound trenches. We do not believe this to be the case. First, Judd states that he discarded unwanted artifacts in two locations: the Chaco Wash (he had a dump-car track built through the northwestern edge of the West Mound to cart fill away from the ruin) and the dump-car track trench itself where he discarded an estimated 1,800,000 sherds after excavation and tabulation (Judd 1964:12; see Figure 1.2). There is no indication in any notes or published reports that Judd discarded any material from other portions of Pueblo Bonito in the mound trenches. The extra labor required to haul material up onto the mounds makes them an unlikely destination for discarded artifacts. Furthermore, artifacts are found throughout the fill of the trenches, rather than clustered as we might expect if artifacts from other locales were discarded in these trenches.

Photographs of the mound trenches (Judd 1954:Plate 47, 1964:Plates 77, 780) indicate that Judd's crew piled backdirt while excavating the trenches along the edge of each trench. Judd had his crew backfill the trenches

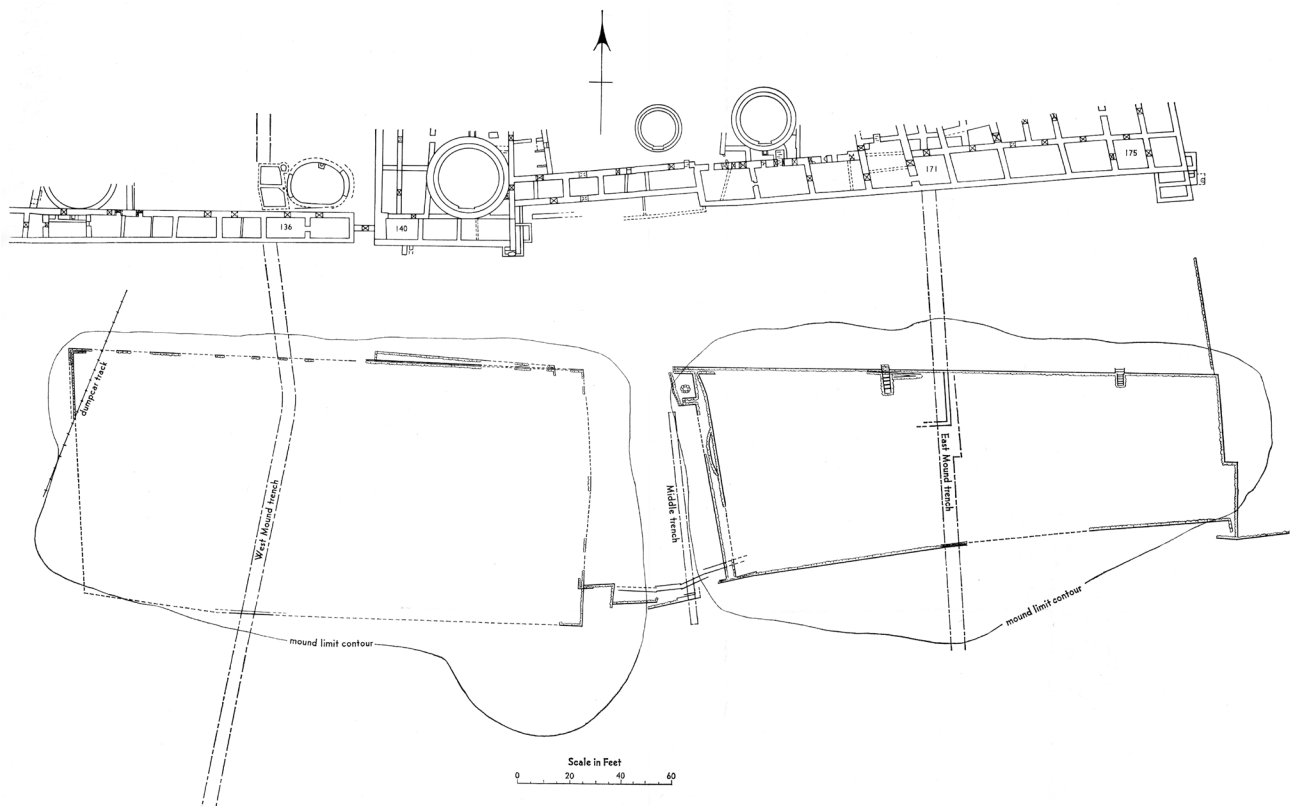

Figure 1.2 Location of the mounds relative to Pueblo Bonito and location of the University of New Mexico project trenches that reopened portions of Judd's trenches. Map courtesy of W. H. Wills.

before he left the field for the last time in 1927, and presumably they filled the trenches by shoveling backdirt from the edge. We believe that the spatial distribution of artifacts recovered from the trenches supports this assumption. The density of cultural material is significantly lower in portions of the trenches that are located beyond the mound edges (mostly in alluvial sediments with small, discontinuous midden layers) than in sections that cut through the massive trash layers found in the well-defined parts of the mounds. In other words, the density of artifacts we found in each horizontal unit of the trench fill matches the density visible in the stratigraphy of the trench wall associated with that unit. Acceptance of this scenario is crucial for the success of this research, because we must assume that the material found in the trenches came from those same trenches. No projects removed material from these trenches from the time they were backfilled in the 1920s until they were reopened in 2004–2007.

What about the artifacts curated by Judd and analyzed by Roberts? Tom Windes reanalyzed the Roberts material at the Smithsonian and published the results (Windes 1987a:626, 632, 633). Hannah V. Mattson and I reanalyzed the Roberts material in 2009 and the results of that reanalysis are presented in chapter 4 and in the appendix. While the numbers do not exactly match the original Roberts tallies, most of the material from his Test Unit 7 (West Mound) and Test Unit 8 (East Mound) is still curated. The material from one of the East Mound units (Test Unit 9) has disappeared entirely. Apart from sherds, there are no other materials except a small amount of faunal material in the East Mound unit (Windes 1987a:624). In his reanalysis of the material, Windes (1987a:624) argues that the ceramics from the mounds are in correct stratigraphic order, not mixed, and that they represent almost entirely the Classic Bonito Phase between AD 1040 and 1100.

THE CHACO STRATIGRAPHY PROJECT

Directed by W. H. Wills, the Chaco Stratigraphy Project (CSP) began with the goal of reexamining the stratigraphy in the three trenches excavated by Neil Judd in the

1920s through and between the two mounds south of Pueblo Bonito. The project research design called for documenting the stratigraphy using modern mapping methods and analyzing a variety of samples from the strata, especially to evaluate whether the water channels shown in Judd's profiles were natural or artificial. Field seasons in summer 2004, fall and summer 2005, fall and summer 2006, and summer 2007 led to the recovery of thousands of artifacts. Although this project offers an unprecedented opportunity to examine refuse from Pueblo Bonito, the lack of stratigraphic control of the material does place some limitations on the issues we can address. For instance, we cannot examine changes in artifact deposits in the trench fill over time. But the material from the mounds represents a relatively short slice of time, with ceramics indicating primary use of the mound during the time from about AD 1050 to 1100 (Windes 1987a).

The mounds at Pueblo Bonito are not the only excavated mounds in Chaco Canyon. Excavations at Pueblo Alto resulted in a significant sample of material, and smaller excavations at Peñasco Blanco, Pueblo del Arroyo, Tsin Kletzin, and Chetro Ketl produced some material (Windes 1987a:634–655), although little remains today. A number of small-site trash mounds were excavated as well. Apart from the Pueblo Alto Mound, the Pueblo Bonito Trenches provide the only great-house mound material in the canyon excavated using modern methods.

RESEARCH QUESTIONS

The primary research questions driving the Pueblo Bonito Mounds artifact analysis relate to the production, exchange, consumption, and discard of artifacts at the great houses. These issues provide the foundation for understanding the lives of Chaco Canyon residents and comparing the refuse to similar material from the Chaco world and beyond. In particular, the material from the Pueblo Bonito Mounds could be compared to material excavated by modern techniques at Pueblo Alto (a great house) and 29SJ629 (a Chacoan small site; Windes 1993a). The mound material could also be compared with the material found in the Middle Trench placed between the two mounds to evaluate whether what was placed in the mounds differed from the "background noise" of refuse found in lower densities throughout deposits in the area around Pueblo Bonito.

Production

The production of objects and food are subjects of much research for Chaco Canyon over the last century (Toll 2006), yet questions remain about the amount of material produced in the canyon, the organization of production of that material, and the loci of production. Important issues here include whether production occurred at the great houses and whether production was at the household level or concentrated in the hands of specialized producers (Earle 2001; Hagstrum 2001; Mills 2002; Peregrine 2001; Renfrew 2001; Toll 2001, 2006). Aspects of these issues can be resolved for Pueblo Bonito by examining the ratios of production debris to finished objects, presence of raw materials and manufacturing tools, standardization of finished objects (Costin 1991), and skill level of finished objects (Crown 2000, 2001).

In this volume we assume that the presence of manufacturing tools, raw material, and debris is evidence for production of objects at Pueblo Bonito. Judd (1954:184) found raw materials for ceramic manufacture, including a pile of unslaked clay, worked sherds, pigments, and polishing stones; however, he argues that they occurred in less abundance than would be expected given the size of the site. He found tools for making beads (1954:86), mixing paint, hammering, abrading, and grinding various materials. But Judd says little about chipped stone debris (1954:128) except that tools were flaked at Pueblo Bonito. He details the various bone tools, including fleshers, awls, punches, and scrapers (1954:139–152). Weaving tools found in Pueblo Bonito include spindle whorls, needles, and loom bars (Judd 1954:152–157). Clearly activities in Pueblo Bonito included crafts production, and examination of the mound refuse provides a more detailed picture of production at the site.

Regarding the organization of production, we assumed that items made by specialists exhibit greater standardization in metric attributes than those made by household producers. While there is no set standard for evaluating what level of standardization indicates specialized production, several studies provide guidelines for assessing relative degrees of standardization (Eerkens and Bettinger 2001; Schleher 2010).

Skill level relates to the age of the producer, the intensity of production, and the innate ability of the producer (Crown 1999, 2001, 2007a, 2007b). From birth to adulthood, skill level improves with the development of motor control, cognitive maturation, and practice. At a certain point, though, skill is mostly related to continuing

repetition of the motor habits involved in making an object (intensity of production) and innate ability. It is possible to measure skill levels for material through variables relating to technology, form, and design of objects such as pottery. We assume that specialized producers will exhibit higher skill levels because of their age and intensity of production. It would have been particularly instructive to examine the frequency of objects made by unskilled learners in the Pueblo Bonito refuse, because this would indicate much about how production was organized around learning/teaching frameworks and whether unskilled learners, such as children, contributed labor to finished products. My research examining whole vessels indicates that unskilled learners contributed relatively little labor to vessels made by skilled potters at Chaco. But while I hoped that the mound deposits would provide a larger sample to explore this issue further, analysis of the black-on-white sherds revealed rapidly that it was not feasible to analyze the mound assemblage in this way. In order to determine if an unskilled potter made a vessel, it is necessary to have a large portion of the vessel. But unskilled potters tend to make small vessels that break into smaller and fewer sherds than do larger vessels. This combination leads to a sampling bias: there are few large sherds with decorations made by unskilled potters. Ultimately, I abandoned this line of research because I could not overcome the biases of the small vessel / large sherd problem. Nevertheless, individual researchers did consider skill level, particularly Sandra Arazi-Coambs in chapter 3.

Exchange

Another important question regarding the material found in the Pueblo Bonito Mounds is whether it was made locally (that is, within Chaco Canyon) or elsewhere. Many Chaco Canyon sites are characterized by unusually high percentages of nonlocal items in comparison to sites in other parts of the Southwest (Cameron 2001; King 2003; Mathien 1997a:116, 2003; Mills 2002; Toll 2001, 2006; Toll and McKenna 1987, 1997; Windes 1992, 1993a). Understanding why so much material was brought in from outside the canyon, who brought it in, and whether it was fashioned into finished objects before or after reaching the canyon are subjects of ongoing debate. A high frequency of ceramics in the canyon came from areas outside the canyon, including gray and white wares from the Chuska area to the west, smudged brown ware from the Mogollon area to the southwest, and red ware from the San Juan drainage, Tusayan area, and Cibola areas to the north, west, and southwest (Mills et al. 1997, Stoltman 1999; Toll 1985, 1991). The rich variety of wares is paralleled in the variety of toolstone materials, including intrusive Chuska chert, Zuni spotted chert, and obsidian that characterize the chipped stone tools and debitage (Cameron 2001). Additional exotic materials include turquoise (Mathien 1992a, 2001, 2003; Plog 2003; Windes 1992), jet, shell (Bradley 1993), and some pigments, such as azurite and malachite. Mesoamerican goods include cacao (Crown and Hurst 2009), macaws, copper bells, and pseudo-cloisonné objects (Nelson 1995). The reason for the apparently high frequency of nonlocal items at Chaco sites is not clear: possible explanations include exchange, direct procurement, pilgrimage offerings, possessions brought by part-time residents of the canyon who lived the rest of the year elsewhere, or some combination of factors (King 2003; Mills 2002; Toll 2006).

Consumption

Issues surrounding consumption include differential access to material objects and the use of objects. Variability in consumption of nonlocal goods is particularly well documented for Chacoan great-house versus small-house sites, with many models asserting that these different consumption patterns reflect differences in the social standing of the residents of these sites (Neitzel 1995; Phillips 1996; Toll 1991, 2001). Most patterns detailed in the literature are based on comparisons of the Pueblo Alto trash mound with small sites, or the curated items from Pueblo Bonito with other sites. As Mills (2002:89) argues, these comparisons always suggest that the activities conducted at the great houses (particularly Pueblo Bonito) were different from those conducted at the small sites. Until 2004, however, the only great-house trash mound excavated in the last 50 years within the canyon was at Pueblo Alto, and the only great house thoroughly excavated and found to contain large quantities of whole items was Pueblo Bonito. Consumption patterns for great-house residents were thus based on a small, asymmetrical sample of sites.

One aspect of consumption that is particularly interesting for Pueblo Bonito is the existence of at least two genetically distinct populations at the site (Akins 1986; Schillaci 2003; Schillaci and Stojanowski 2002:348–349). Gwinn Vivian (1970) has long argued that Pueblo Bonito had a moiety form of social organization, with a dual

division most clearly demarcated by the architectural division of the central plaza area in two. Carrie Heitman and Steve Plog (2005) argue for the emergence of dual houses / social groups at Pueblo Bonito around AD 1085 to 1140. Since there are two distinct mounds at Pueblo Bonito, separated by a gap or passage, it may be that the mounds were formed by the accumulation of refuse from different portions of the residential group, such as the hypothesized moities/houses. Good anthropological support exists to support such an expectation; for example, the ethnoarchaeological studies of refuse disposal in sedentary agricultural communities in the Maya Highlands (Hayden and Cannon 1983), the Philippines (Beck and Hill 2004), and archaeological investigations of Neolithic ashmounds in India (Johansen 2004) and farm mounds in Orkney (Davidson et al. 1986) indicate that household debris and agricultural waste are often, if not typically, concentrated in well-defined areas used by specific groups of households or families. Investigation of consumption patterns takes three directions in this volume. First, we explore the issue of differential consumption patterns by examining the patterning of objects between the two mounds. If a dual division or two genetically distinct populations existed at the site, and each used one mound for trash disposal, then we anticipate differences in the consumption patterns between the two mounds. Second, we compare consumption patterns between Pueblo Bonito and another great house, Pueblo Alto, along with consumption patterns between Pueblo Bonito and the 29SJ629 small site. Finally, we use ceramic residue and use-wear analyses to determine how and to what extent different artifact forms were utilized. We record residues of food, pigment, and soot in the assemblage as part of the analysis.

Discard

Examination of discard pathways provides critical information on the social use of material objects (Walker 1995, 1998; Mills 2000, 2002, 2004). As Mills (2002:90) contends, comparison of items found in midden deposits with items discarded in caches, niches, or burials (Neitzel 2003b; Toll 2006) provides an important opportunity to identify social valuables in the Chaco world. Up until this project, most studies compared the items from these special contexts in Pueblo Bonito with the midden deposits at other sites, because midden deposits were not available from Pueblo Bonito and large quantities of such social valuables have not been recovered from other great-house sites. Here, we compare the items discarded in the Pueblo Bonito Mounds with the items found in Pueblo Bonito and housed in museum collections. In addition, estimates of total numbers of items in the mounds relative to the volume of material studied provide important comparative material for similar estimates made at Pueblo Alto (Toll and McKenna 1987:203–213).

DATA COLLECTION AND ANALYSIS

We designed protocols for collecting, analyzing and interpreting data from the artifacts gathered from the Pueblo Bonito Trenches to address the issues of production, exchange, consumption, and discard during the Bonito Phase (AD 900–1140). We sorted artifacts into material type during excavation and assigned a Field Specimen (FS) number in the field laboratory. Preliminary sorting of artifacts was completed in the field laboratory for ceramics (by ware) and lithics (by material type). Detailed analyses of all materials were conducted at the University of New Mexico, with attributes entered into Access databases by FS number. Specific methods of analysis are detailed in the individual chapters in this volume. Whenever possible, protocols for analysis match those used by the Chaco Project personnel in analyzing site materials from Pueblo Alto (Windes 1987a; Mathien 1997a) to provide as much comparability as possible in the final data base. But we often had to modify the Chaco Project protocols because they did not provide sufficient detail to address the issues we were interested in (particularly true for ceramics) or because they included too many categories that we were not able to distinguish (particularly true for chipped stone material types).

Basic Laboratory Procedures

We divided all ceramics into gray ware, white ware, and red/brown ware. To enable residue analysis, we did not wash any sherds in the field. We used pliers to create a fresh break at a corner of each sherd because it was not possible to see the aplastics on the dirty sherds. Teams of analysts were assigned to only one ware in order to maintain as much consistency as possible. For the gray ware, Hannah V. Mattson trained undergraduate students Jessica LaCosse, Kendra Edwards, and Wilda Bien to identify basic aplastic categories (sand, sherd, trachyte, and andesite/diorite) using a binocular microscope and then to analyze the material using the detailed

classification procedures and keys in Goetze and Mills (1993). White ware sherds with paint were separated from sherds without paint. Hannah V. Mattson and Sandra Arazi-Coambs, both graduate students at the University of New Mexico, analyzed the decorated sherds, beginning by separating them into wares by aplastic inclusions using a binocular microscope, and then sorting them by type based on the keys in Goetze and Mills (1993). Various analysts sorted the white ware into aplastic categories. I analyzed all the red and brown wares, using a binocular microscope to identify aplastic inclusions and presence/absence of slip. I used the keys in Goetze and Mills (1993) as well as the type descriptions in Hays-Gilpin and van Hartesveldt (1998) to sort the material. Further information on ceramic typing procedures is presented in the individual ware chapters. After sorting, attributes of form and decoration were recorded, along with metric attributes such as rim diameter and wall thickness. These attributes are further discussed below.

We had planned to analyze 100 percent of the ceramics, recording each sherd as a separate record in Microsoft Access. After a few months of analysis, it became clear that it would not be possible to record every sherd to the level of detail we had planned and still finish the project on time. Therefore, we modified the sample of sherds we analyzed and the level of detail used to analyze them. We continued with the highly detailed analysis of all rim sherds and any worked sherds, but modified the way vessel body sherds were analyzed. The first modification was to create a second Access database to record a smaller number of attributes; a single record in this database was a group of sherds of one type and form. Analysts counted and weighed all sherds, but they did not record as much detail as in the larger Access database. Finally, at the end of the project, we determined that some bags of material could not be sorted at even this level of detail. We created a final Excel database that included only counts and weights by overall ware category for white ware and decorated white ware. This allowed us to get a final count on the number of sherds recovered from the project and the overall density of materials. Obviously, we would have preferred analyzing all ceramics in the greatest detail, but time and funding did not permit this. Furthermore, most of the unanalyzed material is unpainted white ware, which contributes the least information for addressing our questions. We feel confident that the analyzed material is a representative sample so that increasing the sample would only confirm our findings. Hannah V. Mattson describes the gray ware in chapter 2, Sandra Arazi-Coambs describes the white ware in chapter 3, and I describe the red and brown wares in chapter 4. Graduate student Marilyn B. Riggs analyzed all worked sherds and completed chapter 5 detailing her results.

For chipped and ground stone, we created Access databases to record attributes. Graduate student Adam Okun and undergraduate assistant David Smith analyzed the chipped stone. Although they were not able to complete analysis of every piece completely, they recorded attributes for the vast majority of chipped stone artifacts, leaving only a small sample that was counted and weighed only. W. H. Wills presents the results of the chipped stone analysis with contributions from Adam Okun in chapter 6. Undergraduate Danielle Griego analyzed the ground stone, and graduate student Erin Hegberg and I wrote the chapter on that material (chapter 7). Hannah V. Mattson analyzed all ornaments and pigment as described in chapter 8.

We sent all fauna excluding a small sample to Simon Fraser University, where graduate student Shaw Badenhorst (2008) completed his dissertation on the material under the supervision of Jonathan Driver. David Maxwell helped complete the analysis and write-up of that material (chapter 9).

Table 1.1 lists the various databases created for the project by material type. All databases created by the project are available for use by other researchers through the Chaco Culture National Historical Park. Specific methods of analysis for each category of material are presented in the relevant chapters.

Specialized Studies

After the basic laboratory analysis was completed, we undertook additional detailed analyses of some material types. For an undergraduate honors thesis, Lewis Borck analyzed a sample of sherds for residues using gas chromatography-mass spectrometry (GC-MS) analysis at the University of New Mexico Chemistry Department. Resulting spectra were matched to National Institute of Standards and Technology (NIST) mass spectral library reference spectra or to a reference collection developed for this project. Amounts of organic compounds present in samples were computed by integrating and calculating the area under the ion current peak associated with each compound (Barnard et al. 2007; Eerkens 2005). A separate GC-MS study conducted by Glenna Dean and Ted Borek at Sandia National Laboratory used six sherds from the mounds to search for fermentation products in

TABLE 1.1 List of databases created for Pueblo Bonito Mounds

DATABASE	MATERIAL	SAMPLE SIZE
Access gray ware full	All gray ware rim sherds, all gray ware modified sherds, and a sample of gray ware body sherds larger than a thumbnail	16,302 total (3,356 rims, 12,664 body, 282 other)
Access gray ware simple	Most gray ware body sherds	49,972 (all body)
Access white ware	All white ware sherds larger than a thumbnail	3,190 (3,140 body, 50 other)
Excel white ware counts	All white ware sherds not analyzed in detail in the other databases	14,927 total (1,173 rims, 13,754 body)
Access black-on-white full	All decorated rim sherds, all decorated modified sherds, and a sample of black-on-white body sherds larger than a thumbnail	16,406 total (6,345 rims, 9,451 body, 610 other)
Access black-on-white simple	Most black-on-white body sherds	29,763 total (29,478 body, 285 other)
Excel black-on-white counts	All black-on-white sherds not analyzed in detail in the other databases	995 total (475 rims, 520 body)
Excel too small	All sherds smaller than a thumbnail, counted and weighed	52,525 (31,299 gray ware, 10,771 black-on-white, 10,455 white ware)
Access red and brown ware full	All red and brown ware rim sherds and modified sherds regardless of size	1,008 total (893 rims, 109 body, 6 other)
Access red and brown ware simple	All red and brown ware body sherds regardless of size	6,599 total (6,596 body, 3 other)
Access chipped stone	All chipped stone artifacts	24,133
Access ground stone	All ground stone artifacts	1,659
Access ornaments	All ornaments	369
Excel	All fauna	9,595 records

Note: Material descriptions are for individual Field Specimen numbers. The "Other" category for ceramics includes vessel bases, handles, and unusual forms such as effigy fragments.

some white ware vessels. Finally, several sherds from the mounds were analyzed for cacao residues using High Performance Liquid Chromatography-Mass Spectrometry. The initial study was conducted at the Hershey Medical Center (Crown and Hurst 2009), followed by analyses at the Millsaps College Keck Laboratory (Crown et al. 2015).

CONCLUSIONS

This volume presents the results of the basic artifact and faunal analyses at Pueblo Bonito. As discussed above, research questions involving artifact production, exchange, consumption, and discard guided the analysis and provided a framework for interpretation of the results. Chapters 2 through 5 detail the mound ceramics, including gray ware (chapter 2), white ware (chapter 3), red/brown wares (chapter 4), and worked sherds (chapter 5). Chapters 6 through 8 discuss lithics, including chipped stone (chapter 6), ground stone (chapter 7), and ornaments/pigment (chapter 8). Chapter 9 presents the results of the faunal analysis. Chapter 10 synthesizes the entire project by addressing broader questions about Chaco society at Pueblo Bonito. The results reveal that the mounds hold an accumulation of trash comparable to other sites in the Chaco world. While some types of materials occur in high frequencies in the mounds, they are high only relative to small sites in the area and roughly equivalent to sites of comparable size in Chaco Canyon. Overall, the results indicate that the artifacts in the mounds accumulated primarily as household refuse over the span of approximately 125 years. The East Mound began to accumulate slightly later than the West Mound and continued to be used for trash disposal for a short period after the West Mound was no longer used in this way.

The mound materials indicate exchange with surrounding areas, with a gradual shift in exchange relationships from the Four Corners area swinging south and westward to the Cibola/Mogollon area. A high percentage of material came from the Chuska area either through exchange or acquisition at the source. In addition to exchange, a wide variety of artifacts were produced at Pueblo Bonito, including some ceramics, chipped stone

tools, ground stone tools, and ornaments. There is evidence for manufacture of a variety of crafts at Pueblo Bonito. Essentially all artifact categories that occur in the rooms of Pueblo Bonito also occur in the mounds, including such rare items as cylinder jars and macaws. There is no question that the occupants of Pueblo Bonito owned many high-value and unusual items. Nor is there any question that feasts were a part of the life of the inhabitants of Pueblo Bonito. But there is currently no evidence that these items, when discarded due to breakage, were treated in any way differently from other refuse. Some differences in the material recovered from the two mounds suggest distinct groups may have discarded their refuse in separate mounds.

Pueblo Bonito remains one of the most intriguing and important sites in the American Southwest. The Chaco Stratigraphy Project offered an unparalleled opportunity to collect and analyze materials from the site using modern techniques. The resulting assemblage and data demonstrate that backdirt from old excavations holds promise for resolving issues without disturbing untouched portions of sites. Just south of Pueblo Bonito sit two mounds; as the following chapters demonstrate, their contents chronicle a critical time in Chaco Canyon's history.

Chapter 2

Gray Ware from the Pueblo Bonito Mounds

Hannah V. Mattson

The reexcavation of three trenches in front of Pueblo Bonito, two of which were placed directly through the large mounds just south of the structure, produced over 97,000 gray ware ceramic sherds. This chapter presents the results of the analyses of these artifacts, focusing on the main issues outlined in the project research design—production, exchange, use, and discard. These general research topics encompass more specific and interrelated interpretive issues at Pueblo Bonito such as site function, population estimates, feasting, and trade.

Discarded utilitarian ceramics, although typically not the focus of much scholarly attention, provide valuable information on the types and scales of activities in which people were engaged—from everyday cooking for the household to communal feasting, from local production of ceramics to large-scale importation, and from occasional occupation to more permanent habitation. Utility wares are thus fundamental to archaeological interpretations of great-house function. A significant part of the debate surrounding this issue has centered on the ceramics recovered from the Pueblo Alto Trash Mound, the only great-house midden excavated since 1931. The results of analyses presented in this chapter represent a comparative data set to that of Pueblo Alto, allowing for an expanded discussion of the role played by core canyon great houses.

After a brief summary of previous research on utility wares from Chaco Canyon, this chapter first describes the methods of analysis, including the specific attributes recorded and the type definitions utilized. The results of analysis are then presented with a focus on the distribution of various technological and functional attributes across the trenches. These results are next examined in the context of the core research issues of production, exchange, use, and discard at Pueblo Bonito. Finally, they are compared to materials from other sites in the canyon with an emphasis on Pueblo Alto. Whenever possible, comparisons with the Chaco Project results utilize the original raw data from the rough sort analysis (conducted for approximately 20,000 gray ware sherds) rather than published results of the detailed analysis sample, which is based primarily on rim sherds with the intent of representing vessels.

PREVIOUS RESEARCH

Although many different ceramic wares from various traditions were imported into the canyon, one of the unique aspects of the ceramics from Chaco Canyon is the large-scale importation of utilitarian vessels from the Chuska area, located 70 km west of the canyon. Because archaeologists generally assume that everyday cooking vessels were produced locally, much of the previous research on gray wares has focused on characterizing and explaining this massive movement of Chuska vessels into the canyon. The

presence of trachyte, initially identified simply as basalt, in ceramics from Chaco Canyon was first observed in sherds from Chetro Ketl by Florence Hawley (1934). She notes that utility ware sherds with basalt temper are twice as numerous as those tempered with sand. Since the nearest potential source of this basalt is located well outside of the canyon, she concludes that the tempering material, rather than the vessels themselves, must have been imported. In her work with La Plata ceramics, Anna Shepard (1939) identifies the temper in sherds from the Chuska area specifically as sanidine basalt, or trachyte. Shepard (1954) later conducted a petrographic study of ceramics from Pueblo Bonito that were recovered by Neil Judd and reports that gray ware sherds with sanidine basalt temper account for 75 percent of the total utility ware in upper levels and 25 percent in lower levels. She suggests Washington (or Narbona) Pass as a probable source for the tempering material and determines that culinary vessels were imported from the Chuska area into Chaco Canyon. Judd (1954) initially discounted this explanation as unlikely given the lack of a known analogue among modern Pueblo peoples.

During the Navajo Nation Irrigation Project, Peckham and Wilson (1967) conducted a large survey of the Chuska valley and slope. Warren (1967a) performed a petrographic analysis of a sample of ceramics from the project, identifying the drainages and lava flows of Narbona Pass and Beautiful Mountain as the most likely sources of trachyte temper. In subsequent studies of ceramics from Chaco Canyon, Warren (1967a, 1977, 1980) also finds that trachyte-tempered ceramics dominate the Chaco utility ware assemblages and concurs with Shepard's (1954) original explanation that most gray ware was not produced locally. Likewise, in their investigation of Kin Kletso, Vivian and Mathews (1965) conclude that almost half of the utility ware ceramic assemblage was tempered with trachyte.

The excavations conducted by the Chaco Project, including ten small-house sites in addition to Pueblo Alto, generated a veritable mountain of ceramic data (McKenna 1980, 1981, 1984; Toll 1981, 1985; McKenna and Toll 1984, 1991; Toll and McKenna 1987, 1992, 1993, 1997). Over half of the 240,000 sherds collected during the project are utility wares, the majority of which were tempered with trachyte. Using these frequencies, analysts estimate that tens of thousands of Chuska utility vessels were consumed at Chacoan sites from AD 700 to 1200 (Toll 1985). They also note that while Chuska Gray Ware comprises the majority of the combined utility ware assemblage, they appear to occur at significantly lower percentages at small sites (Toll and McKenna 1997).

Within the last decade, data recovery projects within various regions of the Chuska Valley have produced large ceramic assemblages and compositional studies of both clays and tempers, forming a valuable data set from which the temporal and spatial distribution of trachyte-tempered ceramics can be traced (Carpenter 2000; Hays-Gilpin et al. 1999; Hensler 1999; Hensler and Goff 2002; Hensler, Reed and Carpenter 2005; Mills et al. 1993; Reed et al. 1998; Reed and Goff 2000). Compositional studies of Chuska ceramics from Chacoan sites indicate that the Skunk Spring Community is the most likely source of the volumes of Chuska Gray Ware imported into the canyon (King 2003). The trachyte itself, however, appears to derive from Beautiful Mountain (Mills, Carpenter, and Grimm 1997). King (2003) suggests that there may have even been some degree of residential mobility between the Chuskan and Chacoan areas.

Other major research issues that concern utility wares include the identification of locally produced pottery and the sourcing of Cibola Gray Ware ceramics. Cibola utility wares are primarily tempered with sand/sandstone, often co-occurring with some combination of crushed sherd temper, and thus are assumed to have been produced locally. But direct evidence for pottery production in the canyon is sparse. Although fuel shortages (i.e., a scarcity of trees) possibly constrained local ceramic production, necessitating importation, agricultural groups worldwide are known to use farming waste for fuel (Toll and McKenna 1997:162–163; Rice 1987:154; Warren 1967a:55). The Chaco Project attempted to differentiate Cibola tempers based on various attributes and suggested a few possible distinctions, but no production groups could be isolated (Toll and McKenna 1997).

The importation of gray ware vessels has also figured prominently in researchers' formulations of the economic organization and nature of leadership within Chacoan society. Although a large volume of gray ware was imported into the canyon along with other nonlocal goods, little material appears to have flowed outward. This centripetal movement of mundane goods produced in relatively unspecialized contexts within the canyon core is cited as evidence that Chaco was a corporate chiefdom supported by a system of staple finance (Earle 2001; Peregrine 2001; Toll 2001). The production and transport of Chuska Gray Ware is thought to have been tied to large-scale ceremonial events, controlled by leaders only to the degree to which they had influence over the ritual calendar (Toll 2006).

Important to these interpretations of Chaco Canyon as a ritual pilgrimage center is the ceramic assemblage