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Author(s): Shirley Powell, Peter P. Andrews, Deborah L. Nichols, F. E. Smiley
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FIFTEEN YEARS ON THE ROCK: ARCHAEOLOGICAL RESEARCH, ADMINISTRATION, AND COMPLIANCE ON BLACK MESA, ARIZONA

Shirley Powell, Peter P. Andrews, Deborah L. Nichols, and F. E. Smiley

The Black Mesa Archaeological Project has been conducting field investigations and archaeological research in northeastern Arizona since 1967. The work is contracted for by Peabody Coal Company in order to comply with federal, state, and tribal statutes. The longevity of the project, as well as its size and complexity, affords a unique opportunity to evaluate and refine research, project administration, and legal compliance procedures. In most situations, clear advantages have resulted from the opportunities to learn from the project's history. Unfortunately, changing statutes and changing interpretations of the same statutes have resulted in major problems—both for the archaeologists and for the Peabody Coal Company.

THE BLACK MESA ARCHAEOLOGICAL PROJECT has been conducting field investigations and archaeological research since 1967. The 256-km^2 project area is located on lands leased by Peabody Coal Company from the Navajo and Hopi Indian tribes in northeastern Arizona (Figure 1). Peabody Coal Company operates two large surface mines on the Black Mesa leases. These mines recover coal that is shipped to customers in northern Arizona and Nevada. Ultimately the coal fuels generating plants that provide electricity to Phoenix, Tucson, and southern California. The Black Mesa Archaeological Project (BMAP) is studying the cultural resources located within the Peabody leasehold prior to their destruction by the mining activities. The longevity of the project, its size and complexity, and the many institutions and agencies associated with BMAP have created a situation unique in the archaeological experience.

Over a 15-year period, BMAP has interspersed annual fieldwork with analysis and interpretation of the recovered materials. Hence, we have been in a uniquely advantageous position to evaluate initial findings and to refine descriptive generalizations about the sequences of events occurring on Black Mesa before the arrival of Peabody Coal Company. The research conducted by BMAP over the years has proceeded from description to methodological reevaluations of the initial descriptive generalizations, then to refined descriptions, and finally to theory-building.

Administratively the project has grown from a single full-time employee who coordinated the necessary impact-mitigative activities through an undergraduate field school, to an operation that employs eight persons full-time and over 200 summer field supervisors and laborers. At times it seems that the administrative burden of running the project has increased geometrically while the administrative structure has increased arithmetically.

At the same time, the relationships that the archaeological project has with Peabody Coal Company, local Black Mesa residents, tribal officials, and state and federal agencies have become amazingly complex and confusing. Initially the project personnel interpreted and complied with historic preservation legislation without guidance from federal, state, or tribal authorities. The inception of BMAP predated much of the federal historic preservation legislation, and the rules and regulations for the implementation of that legislation. Now individuals at all three levels within the administrative hierarchy demand involvement in the compliance procedure, hence greatly complicating the administrative context within which BMAP must operate. Further, Peabody Coal

Shirley Powell, Peter P. Andrews, Deborah L. Nichols, and F. E. Smiley, Center for Archaeological Investigations, Southern Illinois University, Carbondale, IL 62901

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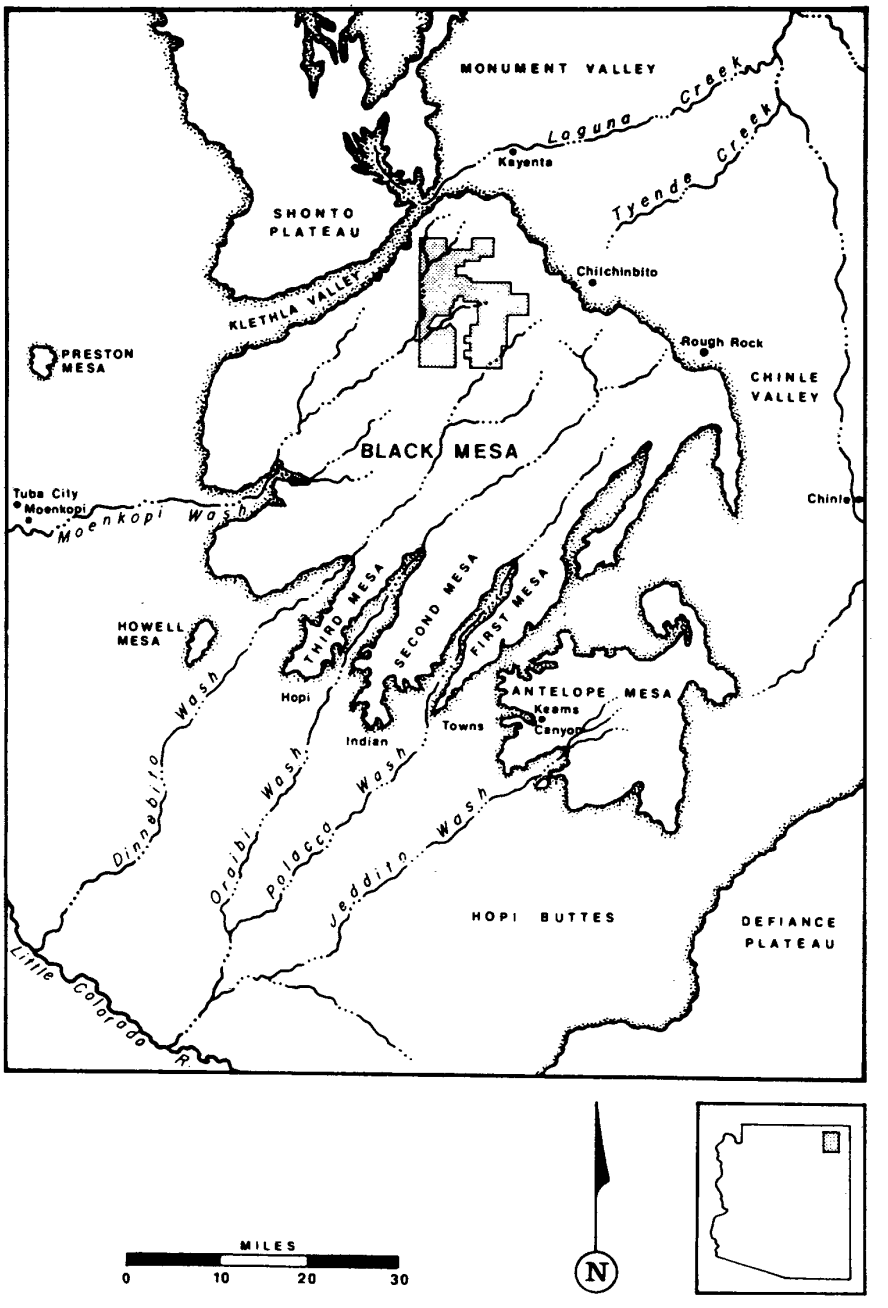

Figure 1. Black Mesa and vicinity showing areas of survey and excavation.

Company's concern with monitoring compliance with federal and local environmental legislation has become equally complex. The resulting growth in the administrative load has been exponential. Peabody's involvement has grown from a single, annual meeting of project administrators with the corporate vice-president for engineering to multiple meetings, reviews, and telephone conversations between BMAP archaeologists and Peabody Arizona Division environmental specialists. The specifics of the Peabody-BMAP interactions are detailed in a contract which exceeds 50 pages in length.

With the clarity of hindsight we see that there are many things that could have been done more easily. Our growing familiarity with local conditions, administrative procedures, and federal legislation suggests many situations in which the project may have proceeded more effectively. Beyond its archaeological contributions, BMAP provides a continuing cautionary lesson in the hazards which the amalgamation of big business, big bureaucracies, and academia can present to archaeologists.

PROJECT HISTORY

In 1967 the corporate vice-president for engineering, Peabody Coal Company, St. Louis, Missouri, contacted Robert C. Euler, then of Prescott College in Arizona. Peabody Coal Company had negotiated leases with the Bureau of Indian Affairs and Navajo and Hopi tribes for 256 km^2 on Black Mesa in Arizona. Peabody had negotiated the lease agreements in ignorance of existing historic preservation legislation. However, one stipulation of the lease agreement with the Bureau of Indian Affairs was that all cultural resources be identified, and that impacts upon the resources be evaluated and mitigated if necessary.

Not surprisingly, Peabody was not pleased with these developments, and by the time that he contacted Euler, the Peabody vice-president was thoroughly disgusted with archaeologists and their lack of business acumen. He had spoken with representatives of two archaeological contractors prior to Euler and had requested information on costs for archaeological survey and mitigative work for access roads and coal processing areas. Euler was the only archaeologist of the three who requested acreage estimates and maps of the areas of potential impact. Because the vice-president was impressed by this businesslike approach to archaeological contracting on Euler's part, a relationship was established between the Peabody Coal Company and what was to become the Black Mesa Archaeological Project.

Administrative History

The first full field season of the Black Mesa Archaeological Project was summer, 1968 (Gumerman 1970). Ten students, two cooks, and three supervisors were assisted by three local residents during an eight-week field season. Laboratory analysis was conducted by five Prescott College students during the fall semester, 1968. Fifty-six sites were identified during survey and eight were excavated. The final report on the 1968 field season was published in 1970 (Gumerman 1970). Costs for the first field season were less than $40,000.

Between 1968 and 1973 the project continued to operate on much the same scale from a base at Prescott College. However, in 1974 Prescott College declared bankruptcy and closed. As rumors of Prescott's imminent closing became more persistent, BMAP employees removed many of the vital records and collections from the Prescott laboratories. While the collections left at Prescott were (and continue to be) tied up in the legal machinations associated with the bankruptcy proceedings, the survey and excavation records, as well as many of the artifactual collections, were removed from Prescott and presently are curated at Southern Illinois University.

The 1974 field season was coordinated from Ft. Lewis College, Durango, Colorado, where Euler had taken a faculty position. However, it was becoming increasingly evident that the project could run more effectively from a university with a graduate program. Thus, when Euler took a position at Grand Canyon National Park, BMAP moved to Southern Illinois University-Carbondale with George J. Gumerman. Gumerman, who had full-time teaching and administrative responsibilities

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at SIU-Carbondale, hired Stephen Plog to direct the project. BMAP continued operating a field school during the 1975–1977 field seasons; however, the number of nonfield-school summer personnel increased dramatically to keep pace with the growing amount of work required by Peabody. In 1976 over 65 students and staff members were housed in the Black Mesa field camp—a camp designed for approximately 30 people. After 1977 the field school was discontinued altogether.

While Plog directed BMAP, the first explicitly stated research policies were written (Plog 1978; Klesert 1979). The research design was not "tied to any particular archaeological site or sets of sites but . . . focused on northern Black Mesa as a whole" (Plog 1978:21). Plog's design emphasized the roles of population increase and environmental variability in organizational and subsistence change. However, in addition to the new research topics, much research actually conducted during this period reconsidered earlier descriptive generalizations; methods were refined and the data were reevaluated.

In 1978 Plog moved to the University of Virginia, and Shirley Powell was selected to direct BMAP. Her tenure as BMAP director coincided with major changes in the internal organization of Peabody Coal, as well as with increased governmental monitoring of compliance with historic preservation legislation. As demands for documentation of the compliance process have escalated, the number of full-time BMAP employees has increased from one to eight.

Also in 1978, Peabody Coal Company reorganized into six regional offices. The newly created Arizona Division was responsible for the administration of the Black Mesa and Kayenta Mines, on Black Mesa. Within the Arizona Division, the Environmental Quality Office assumed responsibility for compliance with all environmental protection legislation—including historic preservation. Whereas the corporate offices had provided archaeology with a minimum of annual funding, the Arizona Division Environmental Quality Office was eager to finish archaeological reconnaissance and mitigation as quickly as possible and therefore urged expansion.

At the same time, procedures for the implementation of federal historic preservation legislation had been codified, though not yet standardized. The National Park Service, through a programmatic memorandum of agreement with the Bureau of Indian Affairs and U.S. Geological Survey, assumed responsibility for monitoring Peabody's compliance with the federal legislation. One year later, the Office of Surface Mining claimed responsibility as lead agency through the provisions of the Surface Mining Control and Reclamation Act (P.L. 95–87). Unfortunately, it is well known that federal agencies differ markedly in their procedures for compliance. Thus, in a one-year period, BMAP moved from a situation of almost total autonomy to one entailing a close working arrangement with Peabody, along with multiple, often conflicting federal authorities.

RESEARCH ORIENTATION: DEVELOPMENT AND EVALUATION

Contract archaeology is not particularly well known for the sophistication or theoretical content of its research designs (Keene and MacDonald 1980, 1981; Schiffer 1975; Goodyear et al. 1978). Nor has it been generally successful at producing synthetic or analytical studies based on the derived data. These problems stem, in part, from the limited focus and scale of many projects; from the impossibility, in most instances, of controlling the geographic extent or placement of the study areas; and from time constraints on fieldwork and analysis.

It is our good fortune that BMAP has not encountered most of these problems. Even the inability of researchers to control the location of the study area has been offset, to some extent, by the size of the project area and by the work of both contemporary and earlier projects in the Black Mesa region. Such work includes the Pinyon Project (Linford 1982), the Long House Valley Project (Dean et al. 1978), and early twentieth-century work in the Skeleton Mesa and Kayenta areas (Kidder and Guernsey 1919; Guernsey and Kidder 1921; Morss 1927).

Over the past decade and a half, the research aspects of BMAP have passed, sometimes painfully, through various pioneering inductive, methodological, and theoretical phases; however, these phases have not occurred in the simple logical order just suggested. From its inception BMAP has applied a vigorous research orientation to the problem of properly mitigating the

adverse impacts of mining activities on the environment, in the fulfillment of contractual obligations to the Peabody Coal Company. This orientation was initially expressed by Gumerman (1970) and has been reiterated frequently over the years (e.g., Gumerman et al. 1972:3; Plog 1977:30; Plog and Powell 1982). In what follows, it should be obvious that BMAP has enjoyed a number of advantages rare in the contract milieu for the development and pursuit of research goals—although not all goals have been achieved. Given this unique situation, it follows that review of the BMAP project can have interesting implications for the planning and conduct of CRM projects in general.

Perhaps the most unusual aspect of BMAP research is the length of time it has been in operation in a single geographical area. As noted above, such a condition is unusual in contractual work (e.g., Goodyear et al. 1978). Project longevity has provided both the opportunity and the stimulus for the evolution of research questions and for their periodic reevaluation and reinterpretation. Accordingly, the scope and depth of the research effort have undergone a number of episodes of expansion. Such expansions have resulted in the development of a web of academic research ties embracing a wide variety of academic institutions and analyses (Table 1).

Additional favorable aspects of the Project are the extent of the study area (256 km^2) and the generally high visibility of its archaeological remains. The size of the study area makes it possible to undertake regional approaches to the prehistory of Black Mesa. The generally high archaeological visibility and accessibility of cultural resources on the mesa are a consequence of the nature of vegetative cover and physiography (as well as of the extent of the Peabody road network). These attributes provide fieldwork advantages not enjoyed in many regions; advantages that are meaningful in terms of large-area survey, collection, and excavation planning.

In addition, both the prehistoric Anasazi and historic Navajo occupations on Black Mesa span critical periods of cultural transition. As Goodyear et al. (1978:160) note, the integration of prehistoric and historic research objectives in one project exemplifies an important aspect of

Table 1. BMAP Subcontractors and Student Researchers.

BMAP Subcontractors	
University of Arizona	Tree-ring research
Northern Arizona University	Soils and geomorphology
Arizona State University	Ethnographic studies
	Lithic analysis
	Ceramic analysis
University of Massachusetts, Amherst	Paleonutrition
	Human osteology
University of Michigan	Ethnobotany
University of Texas, El Paso	Faunal analysis
Texas A&M University	Palynology
Student Researchers	
Southern Illinois University	Master's theses
	Doctoral dissertations
Arizona State University	Doctoral dissertations
Texas A&M University	Master's theses
University of Texas, Austin	Master's thesis
University of Michigan	Doctoral dissertations
University of New Mexico	Doctoral dissertations
University of Massachusetts, Amherst	Doctoral dissertation
	Individual research
University of Virginia	Individual research

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CRM work—fortunately BMAP has had the capability to unify these usually disparate archaeological aspects.

On the one hand, the Anasazi occupation provides an opportunity to investigate early food production, transitions in social organization, and the perennial questions associated with southwestern regional abandonment. The Basketmaker II (Lolomai phase) occupation, beginning ca. 600 B.C., represents the earliest intensive use of Black Mesa, though three apparent late Archaic sites were excavated during the 1981 and 1982 field seasons. The adaptive problems faced by these earliest Black Mesa Anasazi are of interest for a number of reasons. In addition to pioneering settlement in the area, the Basketmaker II groups were involved in solving problems related to the relatively new (for the Colorado plateau) technology of agriculture. The ensuing Basketmaker III-Early Pueblo I (ca. A.D. 600–900) period is, at present, poorly understood and may contain more than one occupational hiatus. By late Pueblo I times (Dinnebito phase) the Anasazi occupation was well established. The remaining phases (Gumerman and Euler 1976:167–170) show general trends of population increase and spread into previously uninhabited parts of the study area. Population rose dramatically just prior to the abandonment of large areas of the northern mesa (ca. A.D. 1130–1150). The Anasazi occupation of Black Mesa is a story of continual adaptive change in systems that probably never experienced appreciable periods of stasis.

On the other hand, the historic Navajo occupation encompasses an equally interesting period of major demographic, social, ideological, and technological change. The Navajo scenario begins with the earliest identifiable Navajo utilization of Black Mesa (ca. 1840) and the mass deportation of Navajo people by the U.S. Government in the early 1860s to Fort Sumner, New Mexico (Kluckhohn and Leighton 1946). During this period northern Black Mesa was largely depopulated, serving as a refugium for scattered groups of Navajo resisters. After the Fort Sumner incarceration, a period of resettlement and population expansion ensued. Navajo history to the present, then, is a story of growing Anglo influence on subsistence, trade, and social organization of the essentially pastoral and tribal Navajo people of Black Mesa. The Navajo occupation of the northern mesa is a story of social and economic adaptation and change of considerable magnitude with general implications for the study of the interaction of tribal societies with their social, political, and economic environments.

Emergence of Research Design

Full recognition of the research possibilities and opportunities at hand in the prehistoric and historic archaeological records on Black Mesa has been a consequence of many years of project involvement and the luxury such involvement affords for periodic reevaluation of extant data. In this respect, BMAP development has followed a path somewhat different from that described by Goodyear et al. in which many contract undertakings "develop problems, hypotheses, and relevant methods specific to a project as it goes through its various stages . . . [and develop] increasingly specific [research] designs throughout the life span of a project" (1978:162). While the methods BMAP has developed are regionally specific, where research design is concerned, BMAP has tended toward increasingly general models and a broader theoretical orientation.

Prior to 1968, virtually nothing was known of the archaeology of northern Black Mesa. Previous research by the Rainbow Bridge/Monument Valley Expedition of 1936–1937 (Beals et al. 1945) consisted of the excavation of a single site and shed little light on Black Mesa prehistory. Gumerman (1970:1–2) has noted that contract projects often make research possible in areas that otherwise might never have been studied. This has been particularly true for northern Black Mesa. At the same time, the Peabody leasehold posed the kinds of problems always encountered in archaeologically unknown territories. First among these is that until investigators have a general idea of the types of resources, the quality of preservation, and the nature of variability, raising general theoretical questions is not particularly productive. This operational fact of life fit well with the "salvage" approach to archaeological contracting in favor when BMAP was begun. Since archaeology had not been considered in Peabody's planning for the Black Mesa mines, the archaeologists had very little time to develop research priorities for their study of the area. Ac-

cordingly, early efforts were directed toward developing a cultural history and determining general relationships between Black Mesa prehistoric cultures and their pan-southwestern contemporaries (Gumerman 1973; Gumerman et al. 1972). The phase system thus derived has been revised and adjusted over the past 15 years as fieldwork and analysis accumulated (Klesert 1979).

As the details of the cultural sequence became clear, several early research trends emerged. Foremost among these was the multidisciplinary effort to generate a paleoclimatic model to aid archaeological interpretation (Karlstrom et al. 1974; Karlstrom et al. 1976; Euler et al. 1979; Karlstrom 1977). Another early research goal was the development of demographic and settlement pattern models throughout the area (Phillips 1972; Swedlund and Sessions 1976). The combination of work in the general areas of paleoclimatic studies and population dynamics resulted in the formulation of preliminary cultural change models. On the basis of the alternation of drought and mesic climatic patterns inferred from geological, edaphic, and dendrochronological studies (Karlstrom et al. 1976; Dean and Robinson 1977; Karlstrom 1977) and on the initial interpretation of settlement patterns and population curves, an environmental "pull" model was developed. This construct explained the apparent shift in later Puebloan times from lowland floodplain to upland dry farming as a result of a long-term shift to more favorable climatic conditions. It was posited that the observed increase in effective moisture made it possible for the Anasazi to utilize upland areas previously suitable only for hunting and gathering. However, continuing fieldwork identified material patterns not explainable solely by paleoclimatic variation. Swedlund and Sessions (1976) alternatively identified population "push" as the primary variable in the settlement shift. Had BMAP been as limited in duration as most contractual efforts, our knowledge of Black Mesa prehistory would have been truncated at this point.

Methodological and Analytical Reorganization

The mid-1970s were a time of reevaluation of analytical, theoretical, and methodological approaches. During this period, some of the early research goals were brought to fruition (see Gumerman et al. [1972]) and were incorporated into a more general, formalized, revised research policy (Layhe et al. 1976; Plog, ed. 1977; Plog 1977, 1978). The theoretical reorientation involved a systemic approach to four major research categories: population dynamics; differentiation (of intersite and intrasite activities); variation in the degree of sociocultural integration over time; and energy flow in the Black Mesa region. In addition, new survey and excavation methods were initiated. Important developments included the ethnoarchaeological program, ceramic attribute analysis system, lithic and ceramic exchange studies, statistically valid sampling strategies, and recovery and analysis of nonartifactual remains.

In 1975 the project initiated the Navajo ethnoarchaeology program (Plog and Powell 1982; Blomberg and Smiley 1982). Work on the historic Navajo occupation has since concentrated on the development and testing of models of settlement and subsistence change (Blomberg 1981; Blomberg et al. 1982), environmental interaction (J. Dean, personal communication), economic and ceremonial change (Russell et al. 1981), and on the development of analog models for use in interpretation of the prehistoric data from Black Mesa (Powell 1982).

A second innovation was a major reorientation of the ceramic analysis from type-variety systematics to an attribute analysis system designed to provide both a means for dating sites at a high degree of temporal resolution and a means of delimiting the full range of ceramic variability (Plog and Hantman 1979). Third, an excavation strategy involving systematic, stratified, unaligned sample selection (Redman 1974) was initiated to provide statistically valid means for efficient recovery of the full range of site remains. Previous excavation efforts had concentrated on areas within sites that had surface indications of architectural and midden remains. Fourth, survey work was greatly intensified resulting in the identification of more sites, including more sites from earlier periods and more sites with low archaeological visibility.

During this period the scope of analysis was also expanded to recover and analyze macrofloral remains from all excavations (Cowan et al. 1978; Moore 1979), as a complement to earlier palyno-

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logical work. Analysis of faunal, human osteological, and lithic materials increased in intensity and detail, and other academic institutions were consulted to help deal with the increased number of categories and vastly increased volume of remains recovered. The volume increase was due both to employment of more systematic recovery techniques and to an increase in the size of the mitigation effort.

Reinterpretation of Models

The middle and late 1970s were also a period of reinterpretation of the models and the descriptive generalizations formulated during the early years. The realization that the early univariate "push" or "pull" models of cultural change needed revision to reflect the growing awareness of complexity in the archaeological and paleoclimatic records was a major impetus for change.

Plog (1978) and Powell (1980), for example, provide more recent interpretations of settlement pattern, demographic and subsistence data derived from Black Mesa survey, and excavation work. In these new models, temporal trends in mobility strategies, intensity of resource exploitation, seasonal patterns of resource exploitation, the interactive effects of human alteration of the Black Mesa environment and the intensification of social interaction are viewed as critical factors in cultural change.

The earlier models (Swedlund and Sessions 1976; Karlstrom et al. 1976) postulated year-round occupation of the study area for all ceramic-period phases by agricultural groups who were in the process of becoming increasingly dependent on food production. Earlier constructs also posited a shift from lowland, floodplain occupations to lowland and upland food production at approximately A.D. 1000. This shift was attributed either to development of more favorable conditions for agriculture or to population growth.

In contrast, Plog's 1978 model places cultural factors in an ecosystemic framework. The emergent pattern of settlement is one of permanent habitation of lowland settings along major drainages by A.D. 900, in conjunction with seasonal or specialized exploitation of upland areas. After A.D. 900, permanent occupation extended even to the upland areas. A second major difference between Plog's model and those provided by earlier explanations is that Plog considers some ways in which social organization may have interacted with the physical environment to change the ecosystem.

In another new model, however, Powell (1980) posits a very different scenario, employing ethnoarchaeological data, plus excavation and survey data from a sample of study area sites. She finds that prior to A.D. 1050, the study area was subject only to seasonal exploitation by groups that also utilized areas outside the Peabody leasehold. After A.D. 1050, she too finds the emergence of year-round habitation simultaneously in lowland and upland settings. Like Plog's 1978 model, Powell's 1980 interpretation contrasts strongly with the implications found in earlier work for social structural, subsistence, and demographic change. An important element of the newer interpretations is that each has attempted to incorporate the greater range of complexity now recognized in the data. Both Powell and Plog posit trends toward reduction in mobility options, decreases in subsistence territory size, and concomitant increases in the interaction among social units (Plog and Powell 1982; see also Braun and Plog [1982]) as critical aspects of the adaptive process.

The reevaluation of settlement pattern models has provided a new perspective on the importance of environmental factors in evaluating Black Mesa's diachronic cultural variability. Layhe (1977, 1981) observing population trends at finer resolution than was possible in earlier studies (e.g., Swedlund and Sessions 1976), observes variability in the rates of population change. Layhe's construct represents a departure from the smooth ascending curve previously used. Further, the peaks in Lahye's population curve do not correspond exactly with the beginning of climatic amelioration thought to have permitted migration to upland areas nor to the climatic deterioration posited to have resulted in abandonment.

The advent of intensive ethnobotanical research also revealed flaws in the assumption that reliance on agricultural production steadily increased during later occupation periods (e.g.,

Gumerman 1970; Swedlund and Sessions 1976). Current estimates indicate *fluctuation* rather than steady increases in the degree to which Black Mesa populations were reliant on agricultural production and wild foods (Ford 1978, 1982; Plog 1978; Plog and Powell 1982).

Studies of regional exchange networks have helped clarify the areal extent of lithic and ceramic materials exchange and have demonstrated the interdependence among social units on and off Black Mesa particularly in the later periods. Earlier works (Gumerman et al. 1972; Gumerman and Euler 1976) posited that Black Mesa populations were grouped into autonomous villages. However, lithic source analysis and on-site frequencies analysis (Green 1978, 1982; Fernstrom 1980; Hantman and Plog 1982; Plog 1980a, 1980b) indicate that a considerable volume of nonedible materials exchange took place over a considerable geographical area.

The studies outlined above exhibit a unifying theme best expressed by their contributions to the development of theoretical models of sociocultural evolution. Braun and Plog (1982) provide the best example—drawing, in part, on data and studies produced by BMAP for the development and testing of an evolutionary-ecological model of the processes of tribalization. These diverse research efforts all focus in one way or another on the process of social intensification in an environment characterized by uncertainty. The reevaluation of early descriptive generalizations and models now proceeds with an increased awareness of social and environmental complexity for all periods of human occupation on Black Mesa.

Priorities for the Future

Ongoing and future project research priorities include most of the topics already discussed with emphasis on the development of general sociocultural models. The ethnoarchaeology is being pursued from two directions. First, the size of the current effort and the intensity of individual site excavation, mapping, and collection should provide a strong data base against which methods may be evaluated. Second, the use of data derived from both informants and archaeology will contribute to the ethnographic record of the Navajo people (Blomberg and Smiley 1982; Blomberg et al. 1982). At the same time, ethnobotanical efforts will continue to center on early agriculture and on the interaction between the natural environment, human groups, and the anthropogenic environments they created.

Human osteological analysis will expand as the size of the burial population from Black Mesa sites nears the level of statistical reliability. Such analysis will focus on paleonutrition, paleopathology, and burial practices (e.g., Ravesloot and Martin 1980; Martin 1981).

A synthesis of lithic data is badly needed at present and lithic analysts will continue to study exchange activities and raw materials sources. Ceramic analysis continues first with respect to the problem of refining an attribute analysis useful for chronometrics and, second, in development of models of social interaction and change (e.g., Braun and Plog 1982). A further synthesis will comprise a study of functional aspects of vessel morphology and materials.

Studies of geology and soils are improving our understanding of environmental complexity (e.g., Karlstrom 1982). Such work promises to provide insight into previously unsuspected features of the paleoclimate and geomorphology—such as the presence of shallow ponds in parts of northern Black Mesa—as well as to aid interpretation of erosional/aggradational episodes during the past 2,500 years.

The early period of the Black Mesa prehistoric occupation is slated to receive increasing emphasis. The Basketmaker II, Basketmaker III, and early Puebloan manifestations are not yet well understood. Although recent excavation efforts have been channeled in this direction to correct sampling biases toward later occupational periods, additional data and analyses are needed.

In summary, BMAP has progressed over the last decade from an inductive, pioneering phase to definition of broad research objectives, and thence to development and testing of general models of sociocultural change. During this period project personnel addressed a large number of technical and methodological problems in order to solve difficulties in site-specific and region-specific data acquisition and interpretations. Studies have begun to characterize the complexity and variability of Black Mesa archaeological resources and to answer general theoretical ques-

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tions. Future work accordingly will focus on reinterpretation of currently held ideas and in the testing of increasingly general models and theoretical constructs.

ADMINISTRATION

The operation and management of BMAP is coordinated through a formal administrative structure that has emerged to accomplish project objectives: BMAP's contractual obligations to Peabody Coal Company, the requirements of federal, state, and tribal regulatory agencies, and our own research goals. Although the essential purpose of the organization has altered little over the years, having been divided between contractual compliance and academic research, the administrative structure has itself experienced major changes. The stimuli for these developments may be attributed to two central factors: first, the necessity for expanding the scale of operations to accommodate increases in Peabody's mining activity, and, second, a continuing response to the progressive formalization of Cultural Resource Management (CRM) legislation. As the size and scope of BMAP operations have increased, so have those of the administrative organization. Each administrative function ultimately affects our ability to achieve both compliance and research objectives. The relationship is exemplified by the necessity to combine the annual mitigation plan and the annual research plan in the same document.

Since their inception, the objectives of BMAP research have been subject to review in an attempt to remain current with the rapidly advancing ideas of contemporary archaeology. Concurrently, the administration of project research has become more formal. The organization of the research program is decidedly influenced by the relatively great geographical distance that separates Illinois and Arizona, the two work localities in which the project operates. These circumstances require an adaptable administration, the functions of which must accommodate the two contrasting situations presented by the university and the field settings. It is also necessary to consider the logistics of adapting the project's objectives to the requirements of a university administrative system, on the one hand, and to the constraints imposed by private industry and the myriad of interested regulatory agencies on the other.

University Operations

During the university's academic year, when the project is based with its parent institution, the Center for Archaeological Investigations at Southern Illinois University-Carbondale, BMAP employs six full-time archaeologists, two full-time secretaries, eight graduate assistants, and various consultants and student workers. During this period, project staff are primarily engaged in the business of data management, curation, and information dissemination. The latter involves an annual descriptive report, detailing the activities and analytical results obtained during the previous field season. The administration also coordinates individually directed research efforts, which are primarily produced in the form of dissertations, theses, meetings papers, and published research reports. Moreover, plans and preparations for the forthcoming field season are an important aspect of year-round administrative activities. In many instances, the objectives of research and compliance activities converge, as, for example, in data management where the administrative interface between research and CRM goals is clear.

The conduct of business within a university administrative infrastructure has benefits as well as liabilities. At times the sheer size and sweeping scope of the university operation, and its degree of internal heterogeneity, leads to problems of red tape and miscommunication with respect to meeting the equally diverse needs of BMAP. Budgetary actions, for example, must filter through the several branches of the university fiscal machinery (e.g., budget, accounting, purchasing, and payroll offices) before many transactions may be executed. The apparent inflexibility of the university system can, at times, appear to make expectably uncomplicated affairs both laborious and cumbersome. On the other hand, the university provides many services that would, if performed independently, require considerable additional expertise and resources. The university system thus provides services that are more diverse and ultimately more effective than what

BMAP could afford were it completely independent. Furthermore, our research capability is unquestionably enhanced by our position within the diversified and enriched milieu of a large university.

Field Operations

During the summer field season, which is run annually between May and August in northern Arizona, the administrative effort is almost entirely concerned with data collection. The exception to this is occasional staff meetings with coal company officials at the Peabody divisional offices in nearby Flagstaff, Arizona (225 km from the field camp). The field operation involves maintenance of a camp for more than 70 people, training and coordinating survey and excavation crews, preliminary laboratory analyses, temporary curation, and ensuring compliance with the contractual agreement represented by the annual mitigation plan.

The logistics of a large field program are diverse, ranging from the assimilation of personnel into the cultural and environmental setting of the Navajo and Hopi Indian reservations to problems of supply acquisition and transportation to and from the isolated field location. Transportation of equipment and personnel, both between Illinois and Arizona, as well as within the study area itself, requires a large fleet of vehicles that are adapted for off-track driving. Project personnel are housed in a tent community situated within the Peabody leaseholdings, and laboratory and eating-cooking facilities are located in semi-permanent plywood structures. These facilities are expanded as the size of the program increases. Although camp life operates under relatively primitive conditions, access to electricity, running water, and certain limited mine facilities (especially hot showers and the emergency medical clinic) helps to moderate the Spartan lifestyle.

The secure storage of curated materials is a necessity. In the field, materials are housed in either auxiliary lab space or in supplementary tent space. The transfer of materials from sites to lab, and finally into storage, is a critical process, requiring assurance that at each stage of analysis and curation data are not lost or materials damaged. Finally, during or near the end of the field season, all materials must be inventoried and boxed for shipment back to SIU-C or to the appropriate subcontractor. Each of these objectives requires cooperation and coordination among a large group of people and encourages constant communication among supervisors, field crews, and laboratory personnel.

Another important dimension of the field operation is the extraordinary setting of the program. Project personnel must adapt themselves to two host populations: the immigrant Peabody mining population and the Native American peoples who live and work on northern Black Mesa. For the field archaeologists, this social milieu presents a very interesting and rich cross-cultural experience. The project plays an important role in the lives of the local Native American population, on whose lands we live and work. The project annually hires approximately 80 to 120 Navajo and Hopi for assistance in the lab and field. Both the native wisdom and the rugged individualism that are a dominant aspect of these peoples' ethos make the field experience a rewarding and educational encounter.

The mines' operations management performs many tasks to keep the field camp operative, in addition to helping to expedite the business of data collection. Peabody's contributions vary from supplying detailed maps of the study area to pulling a mired vehicle from an arroyo bottom. Such aid is indispensible, providing a resource that is utilized continuously during the course of the summer.

Data Collection

Strategies for site selection and site sampling are influenced by environmental factors, site presentation, and research interests. The principal rationale for selecting sites is the need to extend our understanding of spatio-temporal variation in settlement and subsistence patterns for each of the six cultural phases represented in the 1,500-year prehistoric record. Navajo sites are accorded similar attention for historic period research, although excavation is generally unnecessary in obtaining essential information about Navajo ethnoarchaeology (Blomberg and

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Smiley 1982). Beyond these general guidelines, site selection takes into consideration the requirements of ongoing, individual research projects that address a wide variety of technical, methodological, and theoretical issues (Plog 1977, 1978; Klesert 1979; Klesert and Layhe 1980; Andrews 1982; Plog and Powell 1982). The excavation strategy combines probability and nonprobability sampling procedures in an effort to provide both substantively and statistically significant samples of cultural and noncultural remains from each site.

The annual volume of materials for analysis and curation is large. During the 1981 field season 20 Anasazi and two Navajo sites were excavated, and approximately 180 historic sites were mapped and surface-collected. Ideally all preliminary analyses are performed in the field. In situations where this is feasible, as is the case with ethnobotanical, ceramic and groundstone materials, the continuous feedback between lab analysts and field crews is of inestimable value in planning and directing excavations. Furthermore, a reasonable interpretation of excavated data is often practical only with the benefit of certain critical analytical results. The great success of our ethnobotanical laboratory, in its expediency and proficiency, provides us with a model for field laboratory performance (French et al. 1982). However, in certain instances, the cost, logistics, and other related factors require the use of subcontractors who are not generally accessible to the field operation. This problem may, however, be attenuated through the maintenance of adequate lines of communication between BMAP and its subcontractors.

Data Management

Data management and curation constitute two major challenges to project administration. Ease and convenience of access to information is the principal concern, both with respect to contractual compliance as well as in research activities. Data management originates in the field and is a function of both the kinds of information that are recorded and the appropriateness and adaptability of the recording format. Detailed survey and excavation procedure manuals and standardized, coded recording forms substantially ease the burden of managing data derived from field records and artifact analyses. The large university computer system adds considerable depth to the capability and adaptability of our information-processing system. Figure 2 provides a schema of the data management process, although certain aspects of this system are still under development.

Computer facilities are also employed in manuscript and report production, ranging from the text editing capabilities of the Waterloo Script package to the preparation of camera-ready copy using a Diablo daisy wheel printer. Analytical graphics packages such as the SYMAP program are used to create spatial graphs of site and areal distributional data. All of these facilities substantially increase our capabilities for both planning and implementing data management objectives.

Curation

Permits issued by the Department of Interior have designated BMAP as curator of all archaeological materials recovered from the Peabody leaseholdings. These materials are to be held in trust until such time as the Navajo and Hopi tribes request their return. This responsibility requires the storage and maintenance of each season's accumulated assemblage of portable cultural materials. At present the project requires 257.5 m^2 (2,800 ft^2) of area for the curation of artifacts and other collected materials, a number that will steadily increase with future field seasons. All ceramic and chipped stone artifacts, in addition to certain classes of ethnobotanical samples and C-14 samples, are stored in facilities held or leased by the Center for Archaeological Investigations at SIU-C. Other materials, the plant macrofossils, for example, are temporarily curated by subcontracting institutions, where they are undergoing analyses, or—as in the case of bulky and abundant groundstone artifacts—are stored in Arizona. While the advantages of having analytical samples accessible for additional study are obvious, such benefits need to be considered within the context of the enormous responsibilities of curation.

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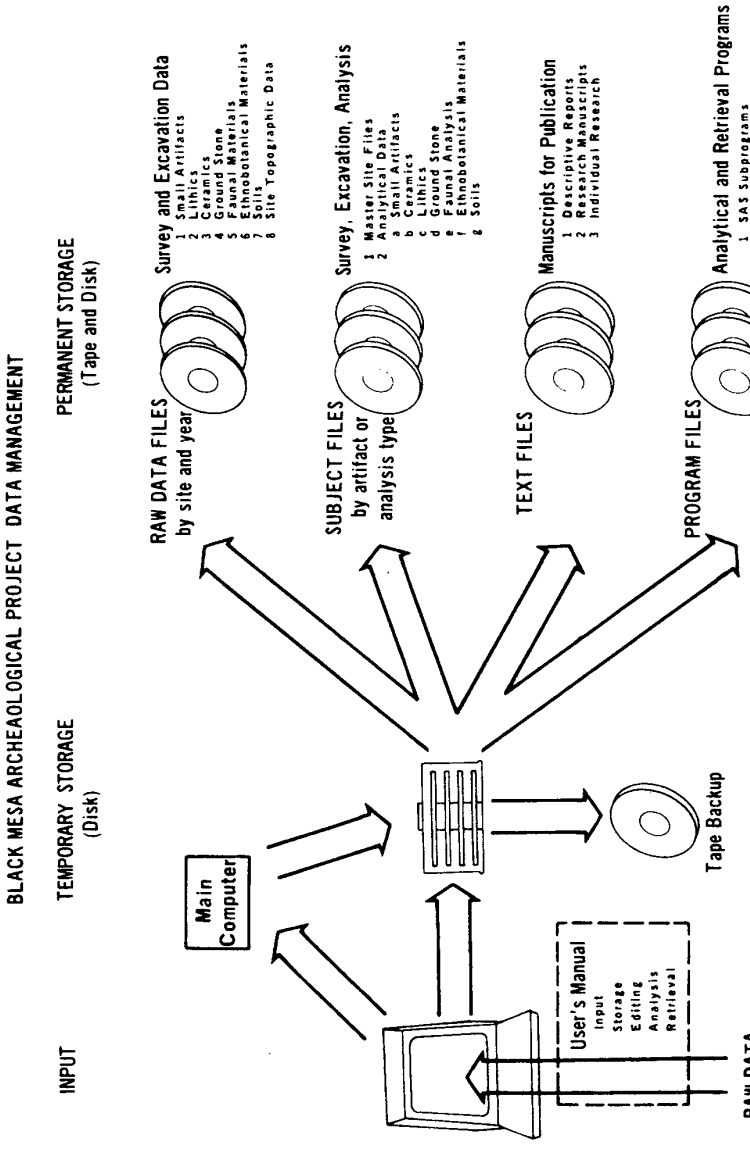

Figure 2. Black Mesa Archaeological Project data management system.

Summary

The administrative operation of BMAP has become a very complex business. Both the size of the program and the scope of the contractual-research enterprise have required the development of a formal administrative structure, employing a full-time staff. The project operates in two contrasting, seasonally determined work environments, requiring a flexible and adaptable administration. Our position within a university system, although at times constraining, ultimately enhances our potential to fulfill the project's objectives.

Unfortunately, the development of BMAP's administrative structure always has lagged behind the actual needs of the project. Any year's administration was developed to deal with problems and deficiencies faced by the prior year's structures, not in anticipation of future demands. In addition, the demands placed on the project's administration also have escalated. The result has been an administrative structure that is at least one year behind the actual needs of the growing project.

THE PAPER CHASE

The compliance work of the Black Mesa project, and most contract archaeology, involves four major activities: (1) identification of cultural resources, (2) evaluation of significance, (3) preparation of mitigation proposals, and (4) implementation of proposals including report preparation and dissemination. For the Peabody Coal Company's leasehold, there is the additional step of obtaining and complying with permits to work on tribal lands that are under the jurisdiction of the federal government.

Permits

Two Federal Antiquities Permits are required, one for Hopi land and one for Navajo land. The Navajo Tribe also issues its own antiquities permit and is the only tribe in the United States to do so. The Hopi Tribe grants permission for work on their land in the form of a cover letter attached to a tribal resolution on archaeology.

Each permit stipulates constraints on various activities ranging from report deadlines to location of camp facilities. Clearly, some stipulations were not prepared with large, long-term projects in mind. For example, copies of all published and unpublished papers, books, reports, theses, etc., are required to be provided to the Tribal Councils, Bureau of Indian Affairs, Navajo Nation's Cultural Resource Management Program, as well as other agencies. The BMAP bibliography contained 112 entries as of December 1980. Copies of the bibliography as well as required reports are distributed; however, the cost of reproducing and disseminating all materials to all agencies would be prohibitive to BMAP, and the volume of paper would be overwhelming to the agencies.

The most difficult aspect of permitting procedures is simply the length of time required for processing the biannual Federal Antiquity Permit applications. Experience has shown that it requires up to eight months for approval of permit applications, even with persistent phone calls and letters encouraging action. This problem appears to be due partly to inadequate staffing and high turnover rates in government agencies. Whatever the cause, little archaeology is accomplished in the time spent pursuing permit applications through the bureaucracy.

Identification of Resources

The first major compliance activity is identification of cultural resources by means of an inventory survey, which has been done through systematic reconnaissance involving 100% ground coverage. The 256-km^2 project area is large, but 100% survey is quite feasible nonetheless because of sparse vegetative cover, high visibility of archaeological remains, and an extensive network of dirt roads providing good accessibility (though not all the individuals who have worked on survey may agree with the last statement). As a result of Peabody Coal Company's initial approach to archaeological compliance, survey of the leasehold was done in increments rather than

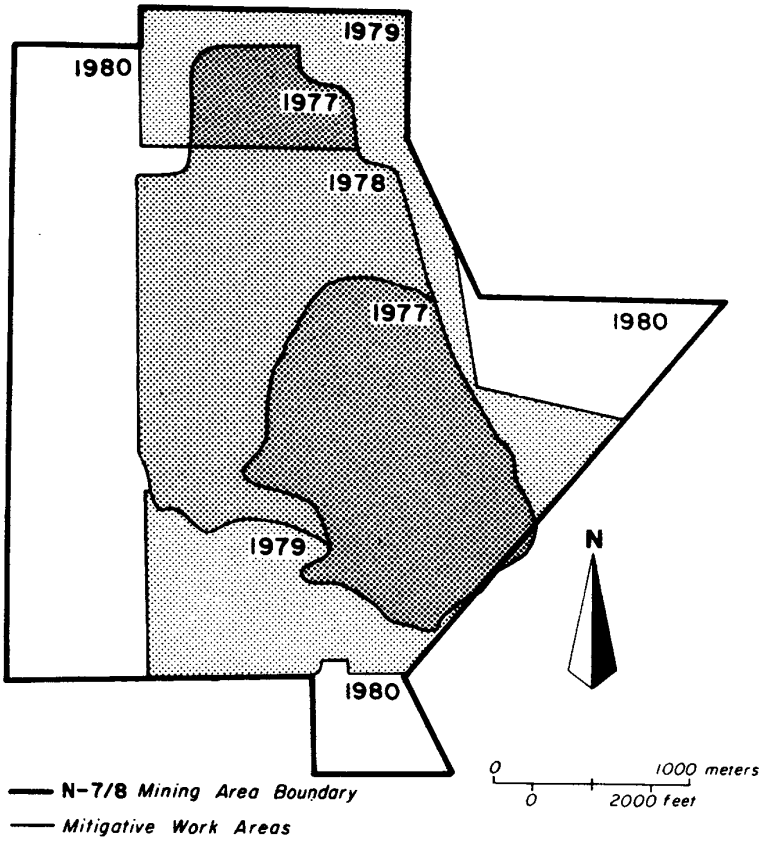

Figure 3. Redefinitions of the N-7/8 mining area boundaries. N-7/8 is one of several surface mining pits located within Peabody Coal Company's Black Mesa leasehold.

all at one time. Impact areas originally were defined by coal crop lines with a 300–500-ft (91.4–152.4-m) buffer zone around coal recovery or mining area. Thus, the leasehold contained irregularly shaped impact areas in which archaeological surveys and mitigation were performed. When economic and technological changes led to expansion of areas of potentially recoverable coal, survey and mitigation were required on areas surrounding the previously assessed impact zones. See Figure 3 for an illustration of how impact areas were successively enlarged. This could be called the concentric zone approach to cultural resource management. In 1980, Peabody Coal Company redefined mining areas as contiguous units comprising the entire leasehold; priorities then were assigned for completing archaeological compliance activities and "filling in the gaps."

Survey data are basic to other compliance activities, significance evaluations and mitigation, as well as to research. Additionally, governmental agencies frequently request information on surveyed sites, sometimes on very short notice. Thus, information management is critical and has admittedly been a problem because of the project's longevity, complicated impact area boundary changes, the sheer number of sites (nearly 2,500), and personnel changes. Moreover, survey methods have been modified to incorporate new techniques and experience (e.g., Gumerman 1970; Plog and Klesert 1978); consequently, data from early surveys are not entirely comparable with recent survey data.

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Site Significance

One objective of inventory surveys is to acquire data for evaluating site significance. Probably no aspect of cultural resource management is surrounded by more confusion and controversy than the issue of significance (Barnes et al. 1980; Klinger and Raab 1980; Raab and Klinger 1977, 1979; Sharrock and Grayson 1979). While comprehensive discussion of this issue is beyond the scope of this paper, a brief discussion of significance is provided for the aid of readers who are unfamiliar with historic preservation laws.

The quality of "significance" for inclusion of sites in the National Register of Historic Places (36 CFR 60.6) is defined by vague criteria. In addition to sites listed on the Register, those that are eligible for nomination to the Register must be considered for mitigation; sites not eligible "are not worth worrying about" (King et al. 1977:35). The BMAP uses a broadly based approach to significance which was developed in conjunction with the National Park Service and in consultation with representatives of the Bureau of Indian Affairs, Arizona State Historic Preservation Office, and Peabody Coal Company.

The Black Mesa Multiple Resource Area, encompassing the leasehold, was created as part of the first eligibility evaluation (Levine 1978). Black Mesa sites, like most archaeological sites, are determined eligible for nomination to the Register on the basis of their research values. In terms of National Register criteria A-C, few of the sites qualify:

> None of the sites is known to have special religious significance or unusual heritage values to the local Native American populations. Neither are these sites important markers related to the life and time of any tribal leaders or famous Americans. None of the proposed sites within the Black Mesa Multiple Resource Area is an outstanding example of Kayenta Anasazi architecture [Levine 1978:23].
>
> Neither has any Navajo site of outstanding architectural significance been identified [Levine 1978:29].

Thus, the significance of Black Mesa sites lies in their potential to yield information "important in prehistory or history" (36 CFR 60.6, Criterion D). "The Black Mesa sites have been used to test methodological, theoretical, and technical questions important in the study of Southwestern prehistory" (Levine 1978:23). "The Navajo sites can provide answers to questions related to changes in Western Navajo land use, subsistence, and settlement patterns" (Levine 1978:29).

With the exception of three classes of sites, most Black Mesa sites are considered significant. First, Navajo sites with burials are determined not eligible for the Register because of their sacred character (Doyle 1982; Holt 1982). Second, Anasazi sites that research has shown predictably have no subsurface remains are considered archaeologically insignificant (Powell and Klesert 1980, 1982) because survey collections effectively exhaust all information from these sites. Third, occupied Navajo sites are recommended not eligible for the Register, although informant and ethnohistorical data are collected on the sites. However, these three classes of sites amount to only 15% of the total; thus, most Black Mesa sites are considered significant.

In order to reduce the quantity of paperwork, eligibility evaluations are prepared in a report format rather than as a National Register nomination form for each site. However, following the first Black Mesa eligibility evaluation, the Keeper's Office requested that subsequent reports contain fewer sites. The National Park Service submitted our first evaluation (Levine 1978) for 1,565 sites in 1978. This number represented over two-thirds of all sites submitted by 22 Department of Interior agencies for eligibility determinations in 1979—(the only year for which statistics were readily available (General Accounting Office [GAO] 1981:4). Note that the significance review process was apparently not designed to handle such large projects in a timely manner, and it has taken as long as two years for our eligibility evaluations to be reviewed.

Mitigation and Data Recovery

All eligible, significant sites must be considered in the planning process, although additional work may not be necessary on every site. There are essentially three mitigation strategies: avoidance, protection/improvement in place, or data recovery. The third applies to the Black Mesa

sites, and in most contractual situations. Thus, data recovery procedures must be proposed, reviewed and approved, and implemented; then the results must be reported.

Mitigation proposals have had to be prepared annually as Peabody Coal Company informs BMAP of areas to be impacted. The size of areas to be investigated and the quantity and types of information required in proposals have increased significantly in recent years. For example, areas surveyed in 1968 contained 56 sites (Gumerman 1970); in contrast, areas covered in the 1982 mitigation proposal contain 631 sites (Nichols et al. 1982).

Data recovery proposals are developed from research objectives for the project area as a whole, even though individual proposals cover only specific mining areas. An alternative approach, one preferred by some governmental archaeologists, would be to collect additional data from a representative sample of sites in each mining area. As noted earlier, however, mining area boundaries were not fixed until recently, and more important, these boundaries were defined on the basis of the economics of coal recovery and Peabody's contractual arrangements. This, of course, also applies to the leasehold boundaries. Thus, mining area boundaries are totally arbitrary with respect to the factors that actually influenced the spatial distributions of Anasazi and historic-period sites.

We feel that a broad, problem-oriented approach to mitigation best serves the intent of historic preservation laws. This allows previously acquired information and research to be incorporated into data collection procedures, reduces redundancy, and directs emphasis to areas where data are inadequate. As noted in the introduction, one advantage of the project's longevity has been the opportunity to incorporate research results into survey and mitigative procedures.

American Indian Religious Freedom Act

A major disadvantage of project longevity is the need for complying with changing legislation and regulations. The following provides a good example. The American Indian Religious Freedom Act (P.L. 95-341) was passed in 1978 to protect the rights of Native Americans to practice their traditional lifeways and religions. The Peabody Coal Company leasehold straddles the present boundaries of the Navajo and Hopi reservations. Thus, future land modification activities might inhibit Hopis and Navajos from practicing their traditional religions through destruction of sacred/ceremonial places or by disruption of access to such places.

However, the 1978 law did not require implementing regulations and none have been enacted. Furthermore, there are no precedents in the Southwest for a large-scale effort to mitigate threats to religious freedom. We anticipate, from past experience, that different governmental agencies will have different opinions as to what constitutes appropriate mitigative procedure, particularly in this situation involving two different cultures—both of which are rapidly changing. Thus, the mitigation plan proposed by BMAP for the leasehold will serve as a test, or trial case, for developing such procedures.

Implementation

Implementation of proposals for impact mitigation is the next step in the compliance process and aspects of this were discussed in the preceding section. The permits require a preliminary report at the end of each field season. This preliminary report accompanies a request that Peabody Coal Company be granted provisional clearance on areas covered by the mitigative work. The National Park Service (acting for the U.S. Geological Survey), recognizing the length of time involved in compliance procedures, has been willing to grant Peabody Coal Company provisional permission to proceed with land modification prior to completion and approval of final reports. Final descriptive reports are typically completed 12 to 16 months from the end of each field season, and acceptance of these final reports places Peabody Coal Company in compliance with cultural resource laws and regulations. Copies of the final reports are distributed to libraries of southwestern institutions, to individuals from numerous institutions who were involved in the work, and to governmental agencies. Copies can also be purchased at cost by individuals who are interested in results of the work.

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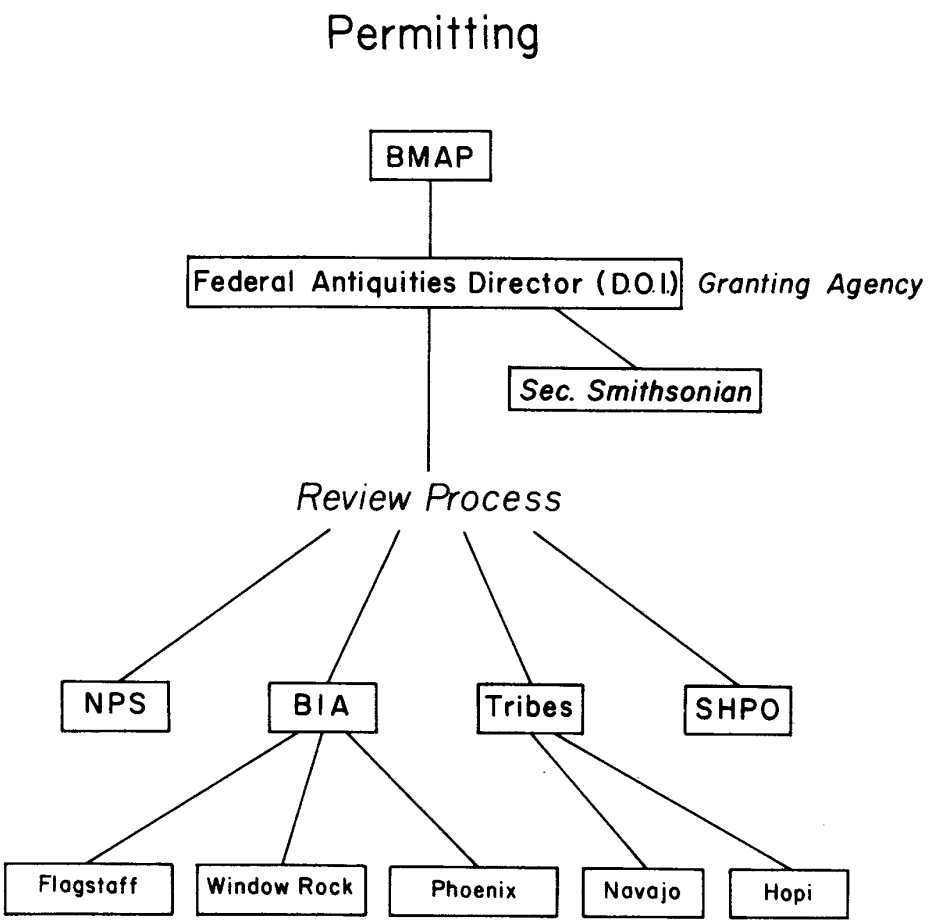

Figure 4. Steps for obtaining an Antiquities Act Permit on Indian lands.

Review and Concurrence

Over 10 governmental agencies review the project's compliance activities, as shown in Figures 4 and 5. Not surprisingly, conflicts occur over procedural or administrative issues as well as substantive issues. The following examples are offered to bring these conflicts to the attention of the profession and to indicate to governmental agencies how their actions affect and are seen by contractors.

Between 1977 and 1982, a Memorandum of Agreement gave the National Park Service (NPS) responsibility for providing the U.S. Geological Survey (USGS) with technical assistance in the management of cultural resources on Indian lands. During this time, the NPS acted as lead agency for archaeological work (excluding permitting) in the Peabody Coal Company's leasehold. Reports, proposals, and significance evaluations were submitted by the project on behalf of the coal company to the NPS. As lead agency, the NPS reviewed materials, distributed them to other agencies for review and concurrence, and provided assistance to the project on various matters. The role

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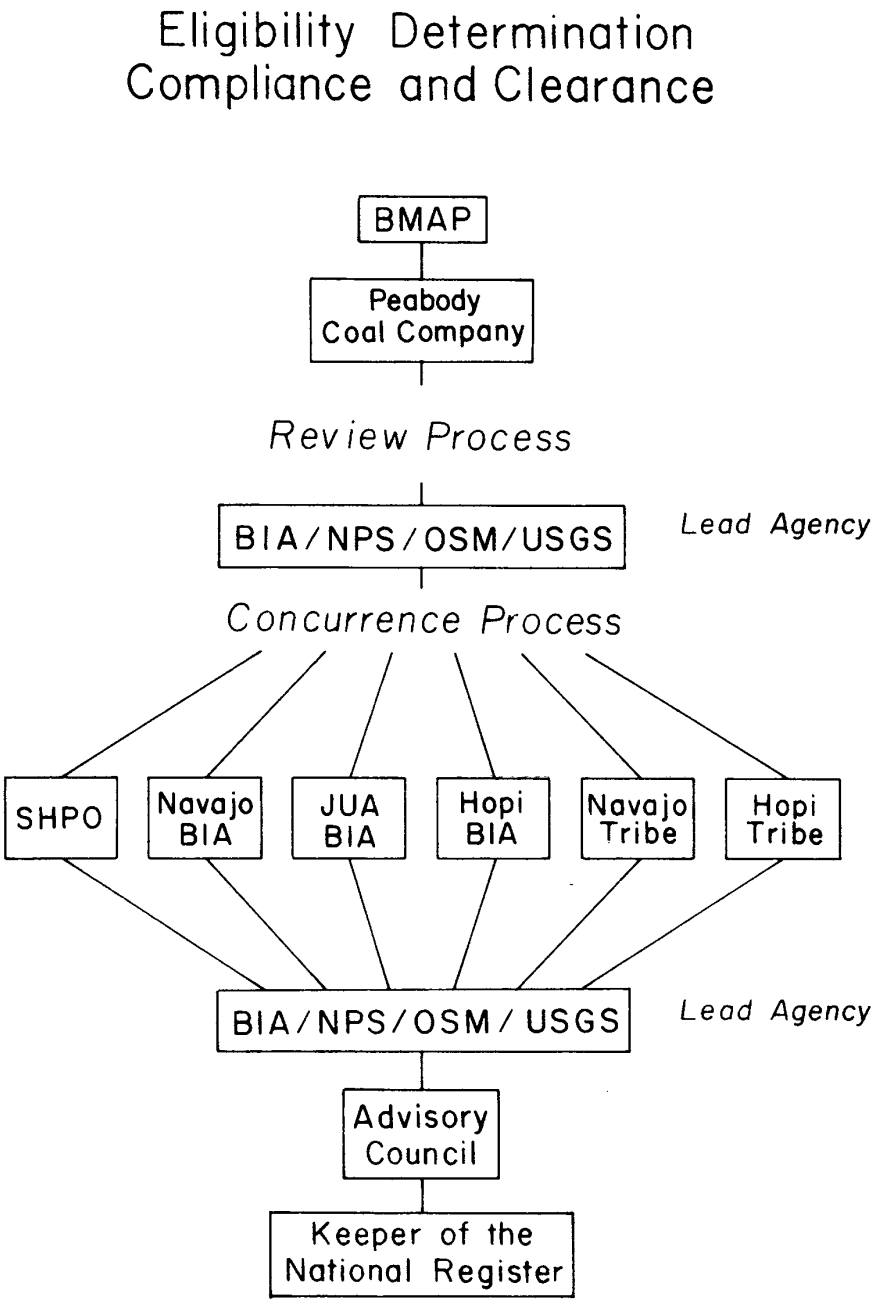

Figure 5. Eligibility determination, compliance, and clearance.

of lead agency is not a small task and centralization of review procedures by NPS greatly facilitated our compliance work. The professional work of the National Park Service's Office of Indian Assistance, Santa Fe, deserves acknowledgment for their efforts on behalf of this project.

In 1981, Peabody Coal Company was told informally by the Office of Surface Mining that OSM had lead agency responsibility for cultural resources in the leasehold by authority of the Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87). The OSM, then, attached stipulations to Peabody Coal Company's 1981-1985 mine permit, giving the OSM, Bureau of Indian Affairs (BIA), the tribes, and Arizona State Historic Preservation Office review authority, and excluding the NPS. However, the Memorandum of Agreement between the NPS and USGS was still in effect. The confusion was further compounded: first, by a decision to shift cultural resource management responsibility on Indian lands from the NPS to BIA and second, by a legal ambiguity over the OSM's regulatory authority on Indian lands. Peabody Coal Company and BMAP had to proceed as if there were multiple lead agencies and simultaneously take on the lead agency's normal responsibility of overseeing the distribution of compliance documents. Nearly five months elapsed before the Advisory Council for Historic Preservation initiated steps to resolve the issue.

Interagency conflicts over substantive issues seem to develop when one agency or office makes policy changes without consulting with other concerned agencies. All too often changes are implemented without notifying other agencies, much less the companies and contractors who must comply with them. When changes reverse or contradict previously established procedures and policies, compliance is virtually impossible without advanced notification.

Recently, BMAP prepared a significance evaluation of sites in Peabody Coal Company's 1981-1985 mine plan areas (following the OSM stipulations on the mine permit) in advance of proposing mitigative procedures to be implemented in 1982. This significance evaluation followed procedures established in previous eligibility determinations, discussed earlier. Shortly before the document was to be submitted, the NPS informed us that the Keeper of the National Register had made policy changes on which sites could be determined eligible for nomination to the Register. As told to us, these changes are: (1) no site under 50 years of age can be determined eligible for nomination unless it is of outstanding National Heritage value, and (2) no site that has been entirely surface collected can be determined eligible without additional testing. The first policy most affected sites in the project area, for many Navajo sites post-date 1930. Despite their recent age, these sites have research value as discussed earlier. In fact, the Keeper's Office had previously determined that many post-1930 Black Mesa Navajo sites were eligible for nomination to the register. Fundamental research objectives and mitigative procedures, therefore, had been designed to incorporate the research value of these sites.

Ironically, the only reason we learned of these changes before submitting the 1982 eligibility evaluation was because of a lengthy delay in the processing of our 1981 eligibility evaluation. This was the second occasion in less than six months in which an agency had made policy changes affecting significance evaluations in the project area. Needless to say, Peabody Coal Company personnel have justifiably begun to wonder if archaeologists communicate with one another.

The pervasiveness of interagency conflicts is documented in a recent U.S. General Accounting Office report (GAO 1981). The reasons for conflicts may be entirely justified; however, the lack of prior notification of policy and procedural changes, and the length of time necessary to resolve administrative disputes pose serious problems for cultural resource management. The time and effort expended on interagency disputes exhausts time, effort, and public and corporate funds which are, therefore, not spent on archaeological resources "important in prehistory and history."

CONCLUSIONS

The preceding pages have summarized the history of the Black Mesa Archaeological Project, the problems encountered during its 15 years of operation and the benefits derived from it since its inception. In most situations, the project's longevity has resulted in substantial advantages. Research has progressed past the descriptive generalizations that are all too easy to make in the

early stages of any archaeological investigations. Through the years we have come to reevaluate both field techniques and the processes of making behavioral inferences from material remains. We have had the luxury of time, permitting feedback, arguments, and reconsiderations among the many analysts working with BMAP data. As a result, BMAP researchers have generated a picture of variable organizational and technological responses to an extremely unpredictable biosocial environment. The prehistoric Black Mesa adaptations differ from those hypothesized for other areas and times in the American Southwest, but the relatively complete understanding of the physical environment, the chronology, and the relationships between the material remains and the behaviors that produced them, make the Black Mesa patterns generalizable to other research areas.

The administration of the project has grown slowly, made mistakes, and tried to learn from its mistakes. Because of our experiences, we can sympathize with archaeologists facing the mixed blessings of coordinating large contracts. The logistical problems of assembling large numbers of qualified people on short notice, of establishing and supplying a large field camp, and of coordinating fieldwork and results without respite are enough to make any sane person question why he or she went into archaeology in the first place.

The only situation we have faced in which the project's longevity was not a major advantage has been in our dealings with federal agencies. Changing statutes and changing interpretations of the same statutes have caused major problems for BMAP and especially for the Peabody Coal Company. Peabody has been placed in double jeopardy because of the lack of communication among agency archaeologists. Because of their problems with the federal bureaucracy that coordinates archaeological compliance, Peabody has developed a cautious and defensive attitude towards archaeology: an attitude compatible with businesslike archaeological contracting, but contrary to the goals of archaeological science.

If we were to make a single recommendation on the basis of our combined experiences, it would be to stage the mitigative phases of an archaeological project as slowly as possible without hindering the sponsor's objectives. This would permit development of an understanding of the local archaeological setting and of methods for interpreting the material remains well and accurately. Slow progress would result in a smaller project operating over a longer period of time—thus easing the administrative burden. Unfortunately, Peabody's tangled relations with federal cultural resource managers have led them to recommend a "fast as possible" approach to archaeological contracting (an opinion that Peabody has communicated to other energy development companies operating on federal lands). We have explained the research and administrative advantages of the smaller, more slowly developing mitigative effort, and Peabody personnel are sympathetic to our recommendations. However, given our own experiences with the paper chase, we cannot, in good conscience, recommend that Peabody follow our advice. Unpredictable and often apparently unreasonable requests from certain federal agencies have put Peabody perilously close to noncompliance with agency stipulations. While many large private companies are willing to comply with the public will as expressed in federal and state historic preservation legislation, contracting archaeologists and regulatory agencies must make an effort to ensure that preservation is coordinated with private developmental priorities. While none of us feels that these problems have made the project a total failure, all of us feel that Black Mesa archaeology, and contract archaeology as a whole, could have been better served by communication and cooperation among contract and agency archaeologists.

Acknowledgments. Many individuals have contributed to the Black Mesa Archaeological Project since its inception. Peabody Coal Company has generously supported the mitigative activities and subsequent research for 15 years. Peabody's patience with the vagaries of archaeological contracting is greatly appreciated. The continued interaction among prior and incumbent BMAP directors has been instrumental in the genesis of the current program; Robert C. Euler, George J. Gumerman, Stephen Plog, Anthony L. Klesert, and Robert W. Layhe all deserve our gratitude. Additional thanks go to Bob Euler and Steve Plog for providing insightful comments on earlier drafts of this paper. Finally we would like to thank the two anonymous reviewers for their insightful comments and editorial assistance. The archaeological investigations on northern Black Mesa are conducted under Antiquities Act Permits 81-AZ-141 and 80-AZ-058 and Navajo Tribal Permit 1981-1. Thanks also are due to Patrick Dunlavey, who drafted the illustrations in this paper.

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