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EDITOR'S NOTES

News from other Societies:

El Paso presented certificates to all members completing Site Survey School at the December meeting and are getting ready to host, in April, the Annual Symposium of the Southwest Federation of Archaeological Societies.

Denver announces a series of six seminars and workshops covering artifact identification, map reading and surveying, drawing of artifacts, reproduction of Petroglyphs, removal of bone, and photographing of artifacts. Their search for a State Archaeologist will soon be decided. Their regular meeting is on the 3rd Wednesday.

Arkansas is faced with dues increase necessitated by rising publication costs. However this is spread over a total state membership of over 750 members. They report enrollment of 185 members in their certification program. They are working on the final details of a site stewardship program by which members are appointed to act as stewards over important sites in order to alert society to acts of vandalism, un-authorized excavating, or any damaging activities. They also are active in making surveys in advance of Federal, State, and municipal projects which may effect archaeological resources.

PLEASE NOTE

Our State Library in Cheyenne is able to loan copies of the WYOMING ARCHAEOLOGIST which you might want to borrow in order to make xerox copies of those issues which are now out of print. You must request the loan through your County Library, xerox just what you want and promptly return to your own Library.

Will hope to see all at the State Meeting, first week in April, at Casper.

WYOMING
ARCHAEOLOGICAL SOCIETY, INC.



PRESIDENT'S MESSAGE

October 15, 1975

To All Society Members:

During the past three months I have had the privilege of attending the summer meeting at the Lookingbill site, being a guest at the Fremont County Chapter meeting, and spending an entire week on a preliminary survey with personnel from the State Archeologist's office.

All this has been most enjoyable but through all these occurrences there seems to be voiced the need of some direction and meaning for the Wyoming State Archaeological Society.

The need for a committee on ethics and guidelines seems to have been predicated by outside interests who make their own guidelines and dictate their own ethics.

A proposal has been made (which I heartily endorse) to institute a more complete and thorough cataloging of what we find, and to urge the continued filing of site reports. All this information will be held in the strictest of confidence.

Concentrated efforts in this direction would result in untold savings of time and effort on the part of Dr. Frison and staff.

Wyoming has the largest mammoth kill site, the finest stratified site, and potentially the best folsom site in the Western Hemisphere. All these were brought about or augmented by members of this group.

The opportunity is here for us to establish a reason for continuation of this Society, and enhance the already fine rapport between our ranks and those of professionals in this state. Let us all make a concentrated effort to keep this opportunity from passing us by.

Sincerely,
/s/ George W. Brox, President

REPORT ON THE 1975 SUMMER MEETING

The 1975 State Summer Meeting was held August 29-September 1 at Bear Creek, twenty-seven miles northeast of Dubois. Eighty-one Society members representing six Chapters, their children and guests, gathered in the mountains near the Shoshone National Forest for an extended week-end of intensive archaeological work, discussion of Society interests, and relaxing reminiscences around the campfire. Thanks to special arrangements made with the State Game and Fish Commission, the many campers were allowed to overflow the small public campground located at the picturesque old Dennison Ranch. Anticipating every detail and providing excellent coordination of the many activities were members of the Fremont County Chapter, who served as hosts for the Meeting.

Highlight of the Summer Meeting was the excavation at the Lookingbill Site under the direction of Dr. George Frison, State Archaeologist. Discovered by Art and Helen Lookingbill of Riverton, the Site is located "up the mountain" from the Bear Creek campground. The Lookingbills found the site while on an elk hunting trip in the fall of 1970. Recognizing the site's potential from the surface evidence, they reported their find to the Society and to Dr. Frison. After initial investigation, Dr. Frison determined that further examination of the area was warranted, and secured permission from the United States Forest Service to conduct an exploratory dig.

The two-mile climb from the campground to the site is treacherous. Thanks to four-wheel-drive vehicles provided by Dr. Frison's crew, everyone was able to visit the site several times, although some still preferred to walk the steep and winding road. Under the careful supervision of Dr. Frison, Associate State Archaeologist George Zeimens, and the other site crew members, Society members assisted with the painstaking work of digging several substantive trenches. Digging to a depth of about eighteen inches, and after careful screening of the dirt dug from the trenches, a significant amount of cultural remains was found -- including some stone artifacts, much animal bone material, and a small amount of charcoal. It was discovered that considerable mixing of the cultural levels had occurred, and stratigraphy was quite difficult to determine. However, based upon the information gathered during the four days of digging and the other cultural evidences found in the immediate area, Dr. Frison decided that the Lookingbill Site did justify more intensive study and plans are now underway for a full-scale excavation.

While many were digging at the site, others scoured the surrounding countryside in search of surface remains. A number of important finds were made, including some "exotic" projectile points similar to those found at the

dig. Although conclusive proof has not been established, the archaeologists are estimating by the typology of the artifacts, faunal remains, and other clues that human activity in the area occurred at numerous times during periods dating back to 5,000 and 7,500 years ago. If established by further laboratory analysis, reconstruction of the cultures represented may yield valuable new information on the altithermal period.

While everyone found it difficult to leave the excitement of the dig, many found time to visit other sites in the area. Perhaps among the most interesting were the rock "blinds" and log traps used by area Indians some one-to-two hundred years ago in the procurement of mountain sheep. The blinds and traps remain in excellent condition in many cases. Information provided by hikers led Dr. Frison and a few other hardy hill-climbers to some previously unreported trap sites which, according to Dr. Frison, are among the best he has seen. He took several pictures of the traps, one of which has its "drive-line" and "ramp" in a remarkable state of preservation. Dr. Frison seemed particularly excited about the discovery of the sheep traps, and suggested that they will provide valuable new information in the reconstruction of the cultural history of the area.

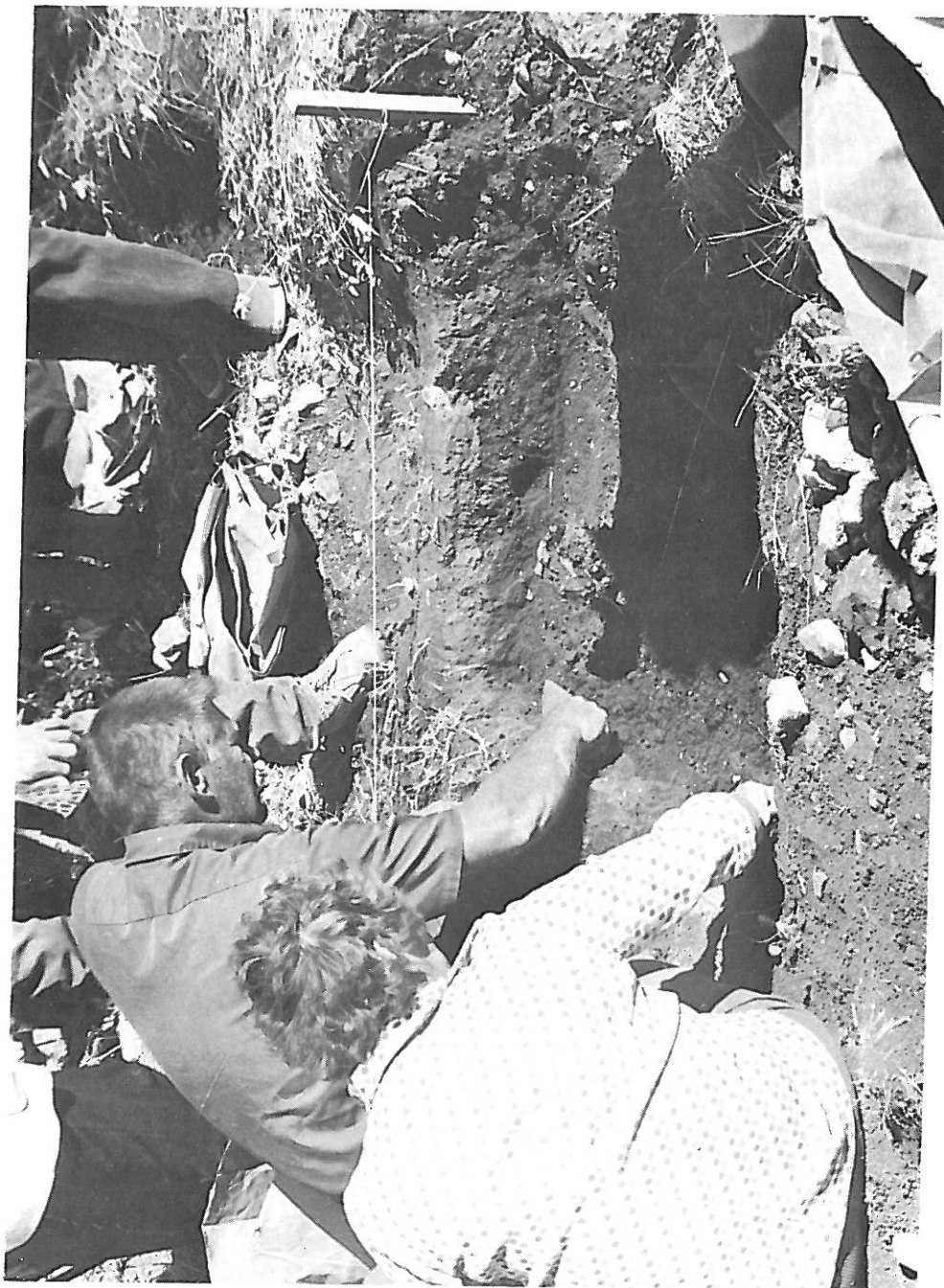
Ladies of the Fremont County Chapter served a delicious dinner around the campfire Saturday night, and an informal business session followed. After opening remarks by Lorene Iverson, Fremont Chapter President, and a welcome from Society President George Brox, Dr. Frison gave a short history of archaeology in Wyoming and North America. Frison's remarks focused on the growing significance of Wyoming archaeology and pointed up the remarkable progress made in the study of early man in North America during the past half-decade. He displayed a number of interesting artifacts and reported on progress at other Wyoming sites during the summer.

Because of the cooperation of the State Archaeologist and his highly skilled and patient crew, the good planning of the host Chapter, and the positive attitude of the weather, all who were privileged to attend the 1975 State Summer Meeting sensed that they had contributed in some measure to an important new chapter in Wyoming archaeology. We will be hearing more about the Lookingbill Site.

Larry D. Osborne
Executive Secretary



Lookingbill Site - 1975 Summer Meeting
"Everybody lends a hand"



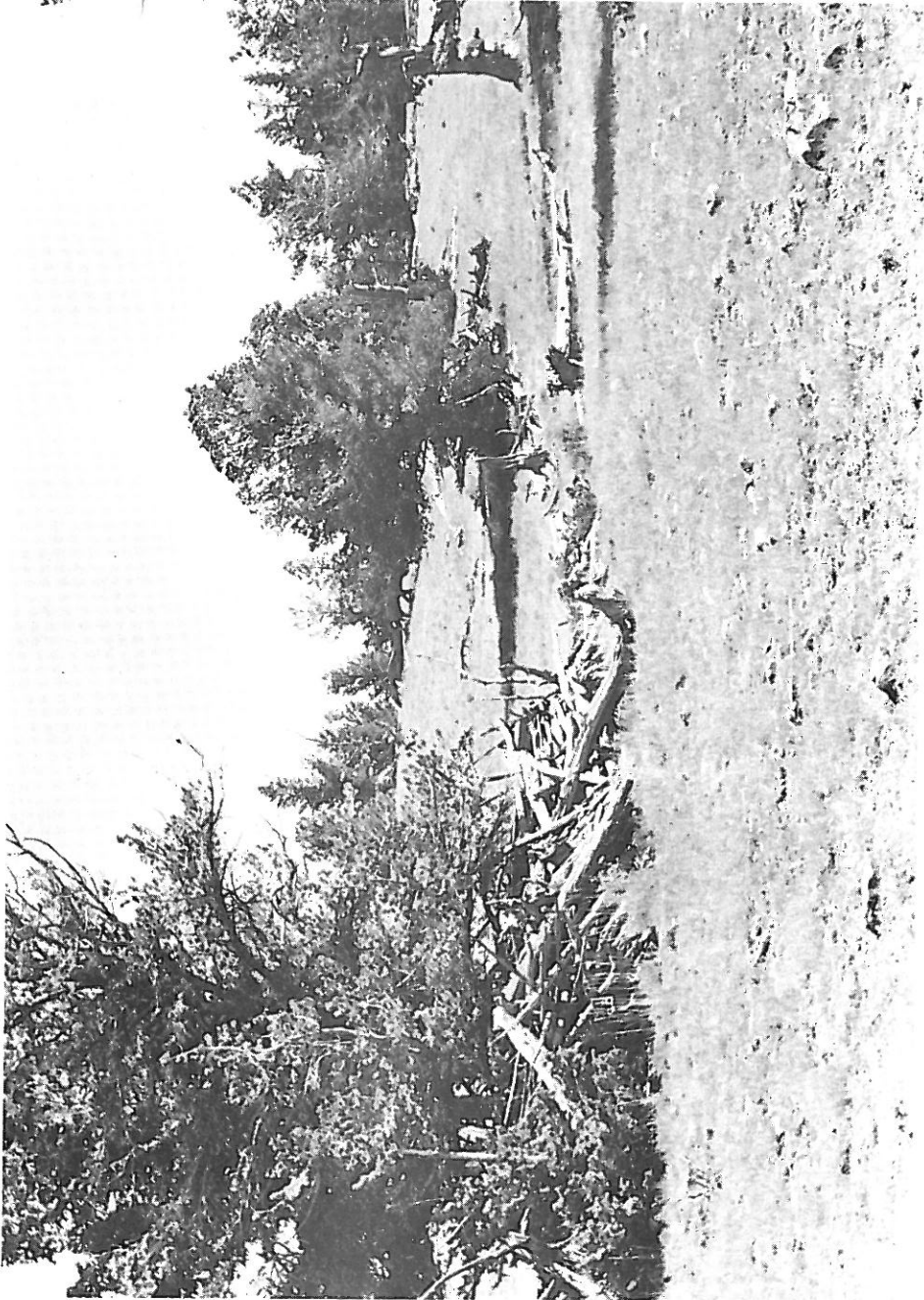
Lookingbill Site - 1975 Summer Meeting
George and Therese Babel of Rock Springs digging a trench



Lookingbill Site - 1975 Summer Meeting
George Babel of Rock Springs with some points



Lookingbill Site - 1975 Summer Meeting
George Zeimens and Dr. Frison in the trenches



Sheep Trap and Drive-Line
A few miles from the Lookingbill Site

SITE NUMBER 48-PL-301

The 1973-74 Wheatland High School anthropology class under the direction of Mr. C. Dale Anderson decided to conduct an archaeological dig on Mr. Dick Morrison's ranch located west of Wheatland on the North Laramie River. Twenty-five students began the excavation April 23, reinforced with hearty sack lunches.

The purpose of this trip was to get our anthropology class into the field to get actual experience of a dig and to attempt to draw logical conclusions from the evidence we found. In class all throughout the year we studied how to tell different artifacts apart, and what their uses were. But the only way to find out what an excavation was really like was to go on one.

Necessary preparation was: figuring out some way to number and classify the artifacts, mapping technique, equipment such as shovels, screens, spikes, etc., and what to do once we got the artifacts back to the classroom.

On the night before the excavation Mr. Anderson, Mr. Zeimens and his wife surveyed the area to decide which sites would be best for us to work on. They decided on three sites, two stone circles and a trench. We had one other large area on which to surface hunt for artifacts. Because we had a professional anthropologist from the University, an official site number, 48-PL-301, was established.

Most of the artifacts we found were from fairly recent to 2,000 years old, according to Mr. Zeimens. For instance, a few of the projectile points were metal, which dated them after the white man's contact with the Indians. We determined the dates by relative dating, such as its position in the soil and the shape and condition of the artifact.

We found projectile points (perfect and broken), broken knives, broken hatchets, bones (probably buffalo), and a drill. Some were found by Mr. Zeimens because of his well trained eyes.

This whole project was done by high school students who had no background in this kind of stuff so this whole job was done by complete amateurs.

Submitted by Wheatland High School

AN ARCHAEOLOGICAL SURVEY REPORT ON A
PROPOSED LIMESTONE MINE IN
LARAMIE COUNTY, WYOMING

By

Danny Walker, Tom Larson and George Zeimens

An archaeological reconnaissance survey was conducted on a proposed limestone quarry for Great Western Sugar south of Granite, Laramie County, Wyoming on March 5, 1975. Several areas of archaeological concentrations were found including one quarry site and one campsite. All areas except the two sites mentioned above were surface concentrations lying directly on limestone bedrock. These areas contain no archaeological materials of a diagnostic nature and need no further work or analysis.

The quarry site is an outcropping of the local bedrock with agate and quartzite nodules included in the limestone. Several small prehistoric prospect holes could be discerned on the surface but no tools were found. The material presently found there is highly fractured and broken. The area is off the strip-pable limestone outcrops and will not be destroyed by the mining activities presently proposed. If mining activities should be expanded to include this area, the site need not be protected or preserved. This site has been assigned site number 48LA327 by the Wyoming State Archaeologist Office.

One campsite was found in the bottom of a canyon separating two areas of mining activity. This site is on the inner terrace of an oxbow meander and surface materials consisted of numerous scattered flakes, flake tools, one point base and burned broken bone. The point base is of the small side-notched variety considered typical of the Late Prehistoric Period. The areal extent of this site is between two and three acres and will not be destroyed by present mining activities due to its location. However, it is recommended that Great Western Sugar protect this site from any form of destruction, either by direct mining activities or any activities of mining personnel or visitors to the area. This site will be nominated to the National Register and if accepted for nomination, must be protected from destruction. It has been assigned site number 48LA328.

Other terrace areas in the bottom of this canyon may also contain sites. A cone-shaped fire hearth was found approximately two hundred yards upstream from the campsite. Based on present knowledge, these other terrace areas need no protection. If other sites are found in this area during construction, the Office of the State Archaeologist should be notified immediately and the sites protected.

All artifacts recovered in the process of this survey have been catalogued, analyzed and stored at the Department of Anthropology, University of Wyoming, which has been designated the official repository for all pre-historic archaeological material recovered in the State of Wyoming. This proposed mining area now has clearance from the Office of the State Archaeologist for issuance of a mining permit with the above recommendations.

PHOTOGRAPHING ROCK ART WITHOUT CHALKING
AND
HOW TO TRANSFER A ROCK ART DESIGN SUITABLE FOR FRAMING

By Mary Helen Hendry

For many years it has been an acceptable practice to chalk over rock art to make it "show up" before snapping the shutter. After studying the rock art in Wyoming and observing the stains, damage and distortion from chalking, I would like to discourage further marking over these ancient arts and offer you a safer and better method of preparing the rock art for recording with your camera.

The distortion inherent in chalking should be a major reason for not using chalk or any other kind of marking material on the art. After chalking you have a chalk drawing which no longer resembles the pecked or incised art below. What you actually record with your camera is your own chalk drawing and probably part of someone else's. Chalking is an interpretation of the rock art with some unintended embellishment and the accuracy you were striving for is lost.

Most chalk contains a binder which leaves a greasy film on the stone, and the softer the stone the more penetrating the chalk. After following the act of some chalker/photographer, the sensitive materials I have used in impression techniques reveal particles of the chalk still clinging to the rock although to the eye the stone may appear to be clean.

In some areas of the state people have even used felt tip pen markers to define rock art for their cameras. I can assure you that this ink can never be removed and will present a damaged and distorted surface for any future recording.

There are sites in the state where the pecked and incised art has been touched and outlined with pigment matching nearby painted art (pictographs). So, in addition to distortion of the art, chalking presents a dilemma for those doing later research when confronted with red, black, and white pigment.

The only method I would recommend for "bringing out" rock art for viewing or for photographing, is simply spraying a fine mist of clean water over the art just before you are ready to use your camera. The water brings the art into the sharpest relief in its original form, isolates it for easy identification in your view finder, and then dries quickly without doing any harm.

The fine mist water spray cannot damage the stone surface any more than would gentle rain. Application with a sponge or a soft rag, if done with a light touch, also works. However, more water must be carried along to use with either of these applicators than with the spray bottle. The sloshing and dripping which usually occurs with either rags or sponges does not enhance the photo.

There is a plastic spray bottle found in grocery and auto supply stores for about one dollar. These are easy to carry along and refill. They hold about a pint of water and release a very fine spray. An empty Windex bottle with a sprayer cap would also work.

Painted art is especially brightened with a light mist of water spray. In fact, you may notice that areas of color, nearly vanished, will briefly reappear. You will probably also notice some old chalking reappearing, too!

If you find yourself at a site without water, try holding something over the surface of the stone in such a manner as to shade the art from direct sunlight which tends to fade out the design.

Once you have mastered the technique of photographing rock art you may wish to have something to hang on your wall. Slides, of course, can be enlarged and printed. The following technique would make good use of your slide collection and can provide interesting wall hangings.

For this project you will need a small bottle of glue, about a quart of clean sand or some red soil, and fine to medium surfaced watercolor paper mounted on heavy cardboard. Art supply stores carry this kind of watercolor board and they will cut it to your specifications. If you use ordinary paper it will wrinkle and buckle with the moisture of the glue and the weight of the sand or soil, so the paper mounted panel is most satisfactory.

(1) Select a favorite slide with one particularly strong petroglyph in it and project it on the wall. A white wall, or light colored one works best. Hold a pre-cut piece of watercolor board against the wall under the projected image. Center the projected design on your watercolor panel and tape the panel to the wall with masking tape.

(2) Use a pencil, a piece of charcoal, or a piece of terracotta chalk and trace the projected design on your panel. The choice between pencil, charcoal or chalk may be influenced by your choice of sand or soil pigment used later for the finished reproduction. Take care to completely trace the design. Check on your progress by turning off the projector and looking at your tracing.

(3) Once you have traced the design from the projected slide, remove the watercolor panel from the wall and place it on a flat surface (kitchen counter top or table). With a bottle of Elmer's glue, or some other favorite, re-trace your design while extruding a small bead of glue directly from the bottle. The larger the bead of glue, the longer it will take to dry, and the higher the ridge of your reproduced design. You may wish to keep the glue bead small because the thicker bead may require expensive shadow box framing. Note that an incised line will require a glue line. If tracing a pecked design, you would make dots of glue.

(4) Spread newspaper on the working surface of your table and pick up your panel without tipping it to keep the glue from running where you don't want it to go. Place the panel face side up on the newspaper and allow the glue to dry slightly.

(5) While the glue is still wet, on the tacky side, sprinkle sand or soil over it. Cover the entire panel. Red soil which has been put through a sieve is my favorite pigment for these reproductions. Make certain that the design is completely covered with the sand or the soil. Leave the panel undisturbed until the glue is dry. Usually overnight drying is sufficient. Keep your fingers off the glue bead to avoid flattening it.

(6) Once the glue is dry, pick up the panel on one side and tip it to let the excess sand, or the soil, fall away from the unglued areas. Tap the panel gently on edge against the paper covered table to remove any loosened particles from the design.

If you should discover that you have missed covering any of the design, use a small stick, a brush or the glue bottle tip to touch up, then sprinkle on a little more sand, or soil if you are using that, and let it dry.

The completed panel is not a petroglyph, but a petroglyph design produced in natural materials. For your efforts you should have a panel suitable for framing and a reminder of an enjoyable outing.

RESEARCH DESIGN AND THE LARGE CONTRACT SURVEY

By
Charles A. Reher

University of New Mexico
Office of Contract Archeology

Paper Presented at the 32nd Plains Conference

November 7, 1974

ACKNOWLEDGEMENTS

The research noted in this paper was only feasible because of the integrated multidisciplinary efforts of many people within the organizational framework of the Office of Contract Archeology. The writer expresses his debt and his thanks to these researchers; the following list briefly characterizes their contribution, but the significant amounts of work by which the research design was ultimately realized is best seen in the final report.

Jim Judge - Principal Investigator, founder of OCA, and proponent of the CGP project as a research entity

Frank Broilo - Project Director, Acting Principal Investigator, founder of OCA, and also a supporter of contract research

Albert Ward - Laboratory Director, and analysis of Navajo material culture and ethnohistory

Dan Witter - Ecology Consultant, vegetative and archaeological analysis, part-time survey crew member

Dick Chapman - Lithics Consultant, lithics and archaeological analysis

David Love - Geological Consultant, geomorphological and hydrological analysis

Richard Loose - Survey Crew Chief, analysis of pre-Pleistocene geology, ceramics thin sections

Jim Ebert and Bob Hitchcock - Aerial Photographic Consultants

Bill Allan - Survey Crew Chief, present and past climate and agricultural potential

Tom Windes - Ceramics Consultant, laboratory staff, part-time survey crew member

Emily Abbink - Navajo material culture analysis, laboratory staff, drafting staff

John Stein - Navajo material culture

John Thrift - Survey crew member and crew chief

John Beardsley, Jim Enloe, Ron Ratkevitch, Jan Biella and Weber Greiser - Survey crew members

Jeanne Schutt - Laboratory staff, general supervisor of multitudinous aspects of archaeological analysis, lithics analysis

Sharon Debowski - Laboratory staff and supervisor of similar multitudinous aspects of analysis

Lisa Jones, Renee Richardson, Dick Taylor, John Hewitt, Pat Sagal, Charles Lumpkin - Laboratory staff

Margaret Brooks - Secretary and typist

Susan McLean - Drafting staff

Lynn Jorde, Tom Fulgham - Computer Consultants

ABSTRACT

A contract survey of about 70 square miles in northwestern New Mexico which yielded over 700 sites is used as a specific example for discussion of the more general concerns of the role of research design in large areal surveys. A case is made for the development of a theoretical research design prior to entering the field in order to insure collection of data relevant to explanatory problems, to generate "turnaround" data for use during field operations, and for general increases in survey efficiency. In the writer's opinion such research is not an esoteric academician's procedure, but is in fact necessary for fulfilling archaeological and legislative requirements. Such research invariably entails detailed analysis of environmental systems; destruction of site contexts results in irretrievable loss of cultural-resource information as surely as destruction of the sites themselves.

Hypotheses on the nature of settlement-subsistence systems ranging from PaleoIndian to Archaic, Anasazi, and modern Navajo were generated and tested by the Coal Gasification Project survey. The resultant explanatory devices are allowing relatively precise prediction of site locations and site densities; further development should make them amenable to research in other areas.

RESEARCH DESIGN AND THE LARGE CONTRACT SURVEY

Introduction

This paper discusses the role of research design in contract archaeology, more specifically when the contract or "salvage" work involves surveying large blocks of land. A survey of 70 square miles and over 700 sites in northwestern New Mexico is used as a departure point for discussion of more general concerns, hopefully amenable to the interests of Plains Conference participants.

The CGP survey (Reher n.d.) was undertaken on Navajo Reservation lands leased to Utah International Incorporated and Western Gasification Company for construction of coal gasification plants and associated coal strip mining operations. An inventory archaeological survey was contracted with the Office of Contract Archaeology, University of New Mexico, to comply with current environmental impact legislation, and to provide the basis for a later phase mitigating this impact through an excavation program. The CGP lease area and associated industrial corridors and lease amendments contain about 70 square miles of land along the lower Chaco River in the San Juan Basin, about 12 miles south of the San Juan River and 25 miles east of the Chuska Mountains, which run along the Arizona-New Mexico border.

The west side of the lease area is described physiographically by riparian flats along the Chaco River, extensive badlands and scarp areas characterize the middle of the lease, and plateau-like grassy flats, in some places overlain by extensive sand dune deposits, are found on the east side. Two major and 16 minor arroyos cross-cut the area from east to west.

Sites found in the course of the survey include 412 Navajo components, 190 Anasazi, 5 Basketmaker, 99 Archaic, 3 PaleoIndian components, and 5 unknowns.

The area was surveyed in 98 field days arranged around the weather from October 15, 1973 to May 30, 1974 by two crew chiefs, six crew members, and the writer as field director. An east-west interval transect sampling design was imposed over the main lease (about 65 mi.²) to gain the necessary environmental control and insure turnaround or "multistage" (Redman 1973) data of known percentage as the survey progressed to 100% completion. Each member of the survey had walked somewhere around 750 miles by completion.

It was the writer's overriding philosophy that archaeological needs, legislative requirements, and the contractor's legislative needs are one and

the same. No assessment of significance or mitigation program can be developed until the archaeologist has a basic understanding of the settlement and subsistence system with which he is dealing. Such understanding requires survey, initially, and a program of research designed to explain the prehistoric adaptations encountered. The program must include collection of relevant environmental data and extensive laboratory and computer analysis. "Research" is construed here as simply the collection and analysis of archaeological data for specific purposes, not as an esoteric academician's procedure beyond the purposes of contract work. The argument here is that current theoretical interests in archaeology and environmental legislation requirements both entail problem-oriented research designed to elucidate the articulation between the cultural system and other natural systems.

Research design as the initial input in organizing a large survey ensures collection of relevant data and increases overall efficiency. Under such considerations, funding and time allotments for evolving research strategy during gearing-up phases should be standard procedure. We have encountered attitudes, frankly disturbing, whereby spending time on initial research input is extravagant and grandiose, and not necessary in contract work. It is the writer's opinion that such research is necessary for fulfillment of contract obligations; entering the field with problems formulated, test expectations laid out, and running tables and graphs for the necessary data already constructed results in savings of money and time for all concerned.

At the 10% juncture, turnaround data indicated we were dealing with up to five times the site density expected and budgeted for. With these indications, I changed the format of the publication and requested a series of articles multi-disciplinary in scope from various consultants, crew members, and laboratory personnel involved in the project. The results of the survey are being published in a volume with the writer as editor and one of 16 contributors.

An attempt was made to structure the CGP survey within an explicitly theoretical research design. This meant making basic assumptions explicit and reducing more specific statements about cultural systems on the lease area, which could be tested by gathering the necessary data during the course of the survey. Large surveys offer large site samples which can be used to test hypotheses about settlement systems on a regional scale. The CGP research design was primarily concerned with explicating the relationships between resource-extractive behavior and site contents, and between site location and potential access to resources, that is the energy gates in a particular prehistoric ecosystemic. Two basic assumptions underlie this approach - culture as adaptive, maximizing behavior, and environmental determinism.

Culture is most elegantly defined in terms of man's extrasomatic adaptation to his environment, that is the basic behavioral definition first put forward

by Leslie White (1949, 1959). Recent anthropological research has demonstrated that man is basically a rational animal (which is surprising or not surprising, depending on how you look at it), and adaptive decisions are formed via least-cost, pay-off estimates among alternative strategies. Subsistence labor is thus apportioned to minimize energy expenditure while maximizing energy acquisition, and can be modeled within game theory frameworks (Gould 1969; Lee 1969; Davenport 1960). A number of archaeologists, especially those in the Southwestern Anthropological Research Group (SARG) have found it useful to use a mini-max strategy as a warranted assumption (Judge 1971:40) in explaining why sites are located where they are.

While most archaeologists would agree that site locations and site contents are a function of, that is determined by, adaptive responses to resource potentials, raising the Medusa's head of environmental determinism is still enough to turn large portions of an audience to stone. Thus we are confronted with the paradoxical situation of archaeologists who would argue strenuously to what degree they hold such an assumption, but who could not work without it. Unless this assumption is made explicit a multitude of logical conclusions will not be followed out and general principles uniting this multitude will not be found. A statement by Chenall is appropriate to these considerations:

If culture were entirely a response to the natural environment, it would be possible (theoretically, at least) to predict the precise types of cultural phenomena that would be found in any given environmental situation. No one in years has carried environmental determinism to this extreme (1972:4).

Chenall is unwillingly correct that prediction of cultural phenomena does require theory and a basic assumption of environmental determinism. But if we can predict with 95% correlation what types of sites and how many for an area such as the CGP lease is this carrying things to an "extreme"?

Operationalizing the Research Design

Operationalizing the research design required data on two basic sorts of parameters - behavioral and environmental. As noted above, we began within a theoretical framework which emphasized the relationship of sites, as loci of adaptive behavior, to certain energetic characteristics of the prehistoric environment. While we expect sites were located according to needs for shelter, firewood, water, and numerous other considerations, an ecosystemic model was developed that said adaptation to potential food would indicate the main determining parameters. This led to a series of deductions about a) what components of the

environment were relevant to a particular adaptation, for instance a generalized Archaic one, and b) what spatial locations, densities, and types of sites were then to be expected in specific localities on the lease. Specifying the dynamics of these ecosystemic relationships automatically constructs a model testable with reference to the archaeological record.

It must be stated at this point that a basically inductive approach will not efficiently lead to explanatory principles of settlement behavior. The environment offers an infinite number of possible attributes that can be recorded, just as sites and site contents can be categorized an infinite number of ways. Unless the hypothetico-deductive method is used to state beforehand what components of the environment are thought to be the determining factors in a given adaptive system, the results are a hodge-podge of important correlations, spurious correlations, and correlations that did not exist prehistorically. Matrices of archeo-environmental correlations are increasing rapidly in archaeological literature throughout the United States, especially with settlement pattern analysis and surveys, and most of these provide no criteria for evaluation of results since there was no attempt to warrant the data's relevance before they were collected.

In other words, such research should deductively reconstruct the main parameters of the hypervolume niche space (Hutchinson 1957) of a prehistoric adaptive system and test for fit with a regional or subregional site sample. Too many projects currently reported in the literature instead note what plants, soils, or topographic features are correlated with sites, and assume these define a prehistoric niche (e.g. Matson 1974). In many cases these plants may have been irrelevant to the prehistoric inhabitants, and in some cases the plants recorded are there because they are weedy plants growing in disturbed soils, such as on sites!

More importantly, it must be realized that a "relevant environmental parameter" may be something totally unlike a simple description of a topographic "feature" or a plant community. For instance, in investigating Archaic site distribution we found it necessary to monitor plant diversity in four mile "localities" (Willey and Phillips 1958:18) surrounding site clusters; in dealing with Anasazi farming systems we found it necessary to measure hydrologic characteristics of particular drainage systems up to 70 miles square in size. In the latter case the actual plants located around a site were irrelevant for our purposes, certainly not one of the main determinants in Anasazi decision making processes, but an inductive strategist would have found high correlations between certain species of plants and Anasazi sites.

Behavioral and Ecological Parameters

Behavioral data, then, mostly concerned testing site locations and

densities with respect to ecological parameters deemed significant, after using site contents to categorize the site within a functional "type" within the settlement pattern. This involved complete aerial photographic coverage of the area, intensive morphological and microscopic wear-pattern analysis on over 12,000 flakes and several thousand lithic artifacts, and an intensive analysis of over 15,000 pottery sherds. It necessarily required extensive use of computer technology (at least 20 different types of programs, with versions for different time periods in many cases). Navajo informants were also used to gather ethno-historic data on specific sites, site types, and historical events on the lease area.

Ecological parameters within the framework of the design were basically of two types - "constant" and "stochastic". Constant parameters refer to soils, vegetation and other features which, although they change slowly, are relatively constant or given for the state of a particular adaptive system. Stochastic phenomena are those which change more rapidly, such as rainfall, temperature, and runoff, and which are always best described by a stochastic time series plot.

Given the requirements of specific hypotheses complete control was necessary on general plant community composition on the whole lease, and on the soils and water parameters governing these plant associations. This has allowed accurate reconstruction of vegetational distribution and makeup on the lease area under any set of past climatic conditions. More specific vegetative data was required to test hypotheses concerning the broad-spectrum, hunting and gathering Archaic adaptation. This involved mapping 35 plant associations in a 3-1/2 square mile area, measuring plant density per species in 35 sample plots, and deriving a computer program to generate Shannon-Weaver diversity indices from these data (Pielou 1969:221; Emlen 1973:383; Pianka 1974:233). Techniques were then developed to extend comparable diversity indices to Archaic site settings throughout the rest of the lease area, using aerial photography. The result is an explanatory device directly applicable to an Archaic adaptation in any area.

Hypotheses concerning Anasazi farmers required use of geologic consultants to investigate the present hydrologic system and reconstruct its behavior during Anasazi times. This was combined with other hydrologic information, data on present climate and agricultural potential and tree ring series to reconstruct past climate, to derive regression formulae which accurately predict numbers and types of Anasazi farming manifestations. Similar analyses were carried out for Navajo sheep-herding adaptations, PaleoIndian, and early Basketmaker adaptations on the lease.

Summary

This necessarily sketchy treatment of a research project in northwestern New Mexico has argued that:

a) a theoretical research design should be the initial input to any archaeological project, but especially to one carried on within the time, money, and legal constraints of contract archaeology.

b) research to explain settlement and subsistence systems is the means to the common end of fulfilling archaeological and legislative requirements; removing site materials from the path of impending destruction and describing them is no longer sufficient.

c) such research requires a multidisciplinary approach and a regional perspective, including intensive analysis of environmental systems; it is clear that destruction of archaeological site contexts results in irretrievable loss of significant, non-renewable, cultural information as surely as destruction of the actual site.

d) funding from contracting agencies companies for research design formulation before entering the field is not extravagant but in fact necessary for efficient performance of contract obligations.

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