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Botanical Studies

by

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ABSTRACT

The Environmental Studies crew supervised recovery of paleobotanical samples at seven sites in the Dolores Project area during the first field season. Work was begun on initial characterization of the project area environment and site catchment analysis. Identification of macrobotanical samples was undertaken and water separation of bulk soil samples was begun. Charred corn (*Zea mays*) fragments represent the major type of macrobotanical remains identified from these sites. *Juniperus*, *Pinus*, *Yucca* and *Phaseolus* have also been recorded. Appendix A presents a description of sampling techniques.

EDITOR'S PREFACE

This report details studies conducted and procedures employed by the Botanical Studies personnel of the Dolores Archaeological Program during the first season of operation of that program. It describes the objectives and activities of that group of people at a time when the botanical aspects of the program were in their formative stages. One concern of the Bureau of Reclamation archaeologists in reviewing this report was that there was no discussion of historic changes in the vegetation of the project area. At the time that this report was written such a discussion would have been premature. Subsequent reports have, however, addressed this topic. These reports include:

Kane, Allen E. 1981. Sagehen Flats archaeological locality. In Field investigations: 1978. Dolores Archaeological Program Technical Reports I(3). Final report submitted to the U.S. Bureau of Reclamation, Upper Colo. Region, Salt Lake City, in compliance with Contract No. 8-07-40-S0562.

Petersen, Kenneth L. 1982. Climatic reconstruction. In Analysis: 1978. Dolores Archaeological Program Technical Reports II(1). Final report submitted to the U.S. Bureau of Reclamation, Upper Colo. Region, Salt Lake City, in compliance with Contract No. 8-07-40-S0562.

Benz, Bruce F. et al. 1981. Final environmental studies report. In Laboratory analysis: 1980. Dolores Archaeological Program Technical Reports IX(1). First draft submitted to the U.S. Bureau of Reclamation, Upper Colo. Region, Salt Lake City, in compliance with Contract No. 8-07-40-S0562.

Bye, Robert A. 1981. Environmental studies. In Analysis: 1979. Dolores Archaeological Program Technical Reports VI(6). First draft submitted to the U.S. Bureau of Reclamation, Upper Colo. Region, Salt Lake City, in compliance with Contract No. 8-07-40-S0562.

INTRODUCTION

The responsibilities of the Environmental Studies Crew Leader for the Dolores Archaeological Program included supervising the recovery of cultural paleobotanical samples from the excavations (Sites 5MT2202, 5MT2151, 5MT2191, 5MT2193, 5MT2198, 5MT2235, and 5MT4475) and beginning the preliminary environmental assessment for the site catchment study. The development of methods for the recovery of cultural paleobotanical samples and for the site catchment study were among the initial priorities. Another initial task was supervising the flotation processing of bulk soil cultural paleobotanical samples. This included developing and testing appropriate processing methods and training necessary personnel. Identification of the macro-paleobotanical specimens recovered from the excavations was the main analytical task. Analysis is scheduled for fall and winter of 1978.

OBJECTIVES

The objectives for the first fieldwork season were as follows:

1. to develop and implement procedures for taking cultural paleobotanical samples

2. to develop and implement procedures for processing cultural paleobotanical samples

3. to develop the research design concept of site catchment analysis, with regard to the exploitation of vegetal resources, and to implement the initial environmental assessment for this study

4. to begin to collect modern botanical voucher specimens which will be used as comparative material for the identification of cultural paleobotanical remains recovered from excavated sites; and to begin to collect information about such things as availability, seasonality, and productivity of the plant resources thought to be important to the catchment study

5. to develop, whenever consistent with the goals of the overall program, new methods to improve both the amount and reliability of cultural paleobotanical information obtainable in archaeological excavation.

SUMMARY OF ACTIVITIES DURING FIRST FIELDWORK SEASON

Cultural Paleobotanical Sampling

Samples were taken utilizing the methods described in Appendix A. Three types of paleobotanical samples were sought: intact or semi-intact plant remains, bulk soil paleobotanical samples, and pollen samples. Stratigraphic control samples were also taken; these consisted of intact blocks of strata of various sizes. The numbers of these various samples taken at each site is presented in Table 6.1.

The excavators were primarily responsible for collecting intact and semi-intact paleobotanical remains and bulk soil paleobotanical samples. The crew leader provided procedural and theoretical guidelines. Initially, all pollen samples were taken by the crew leader. Later, two crew members were trained in field procedures for taking pollen samples; both then became responsible for taking pollen samples and assumed that responsibility at the sites to which they were assigned. The crew leaders supervised the overall paleobotanical sampling procedures. At the end of the summer fieldwork season, the excavation crew leaders remaining in the field were given the responsibility of taking pollen samples at their respective sites.

Initial Processing of Cultural Paleobotanical Bulk Soil Samples

After a review of the archaeological literature on flotation processing of soil samples, a flotation (water-separation) device was designed[1] (Figure 6.1). No further progress was made during the

[1]Consideration was also given to chemical separation methods. Experiments comparing water separation with chemical separation indicated that the greater expense of chemical techniques was not warranted. Water separation provided comparable results at a lower cost.

Table 6.1 Summary of Samples Taken During the 1978 Field Season

Site #	POLLEN Total Samples Taken	BULK SOIL Total Samples Taken	MACROBOTANICAL # of Bags Taken	STRATIGRAPHIC CONTROL Total Samples Taken
5MT2202	0	0	0	0
5MT2151	8	118	124	0
5MT2193	37	217	151	0
5MT2191	27	74	32	0
5MT2198	31	98	48	0
5MT2235	69	101	20	0
5MT4475	149	189	32	1
Total	321	797	407	1

Figure 6.1 Diagram of flotation (water separation) device.

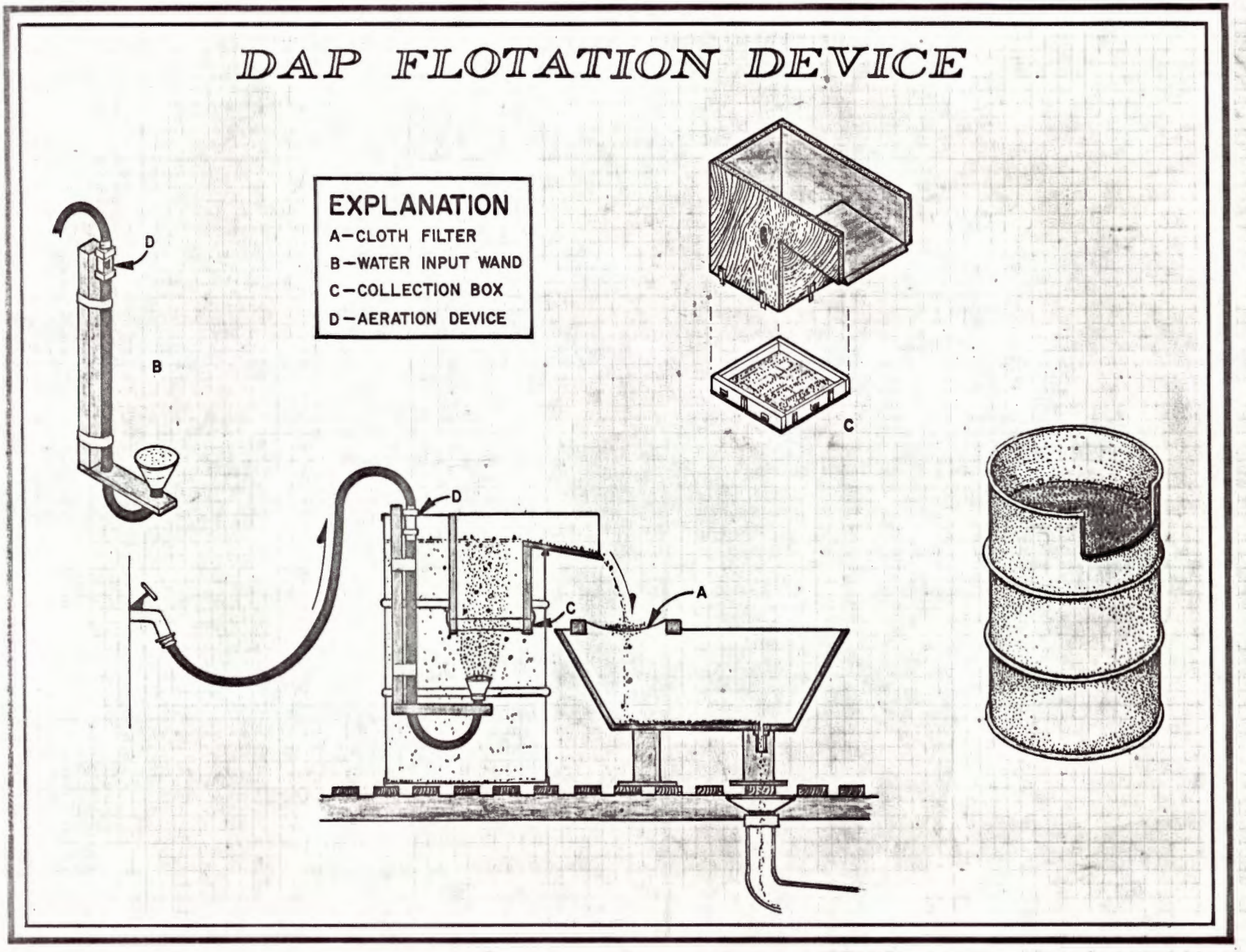
DAP FLOTATION DEVICE
EXPLANATION
A—CLOTH FILTER
B—WATER INPUT WAND
C—COLLECTION BOX
D—AERATION DEVICE
D
B
C
D
C
A

Figure 6.1

fieldwork season on processing of bulk soil samples. This was due primarily to delayed construction of the necessary facilities and equipment. Therefore, it was decided to postpone the processing of paleobotanical bulk soil samples until fall and winter of 1978.

Site Catchment Analysis

During the 1978 fieldwork season an attempt was made to assess the potential of developing a research design for the site catchment study, particularly with regard to prehistoric exploitation of vegetal resources. In addition to considering the theoretical aspects of site catchment analysis, a number of specific activities were carried out to begin the initial environmental assessment of the study area.

A visual reconnaissance of the study area was made during the summer. Preliminary notes were made on physiographic/vegetation associations, including general structure and species diversity. Two hour walking-time diameters were established in the cardinal directions from McPhee Pueblo (Site 5MT4475). Intrasite walking distances between several of the major Pueblo village sites in the study area were measured. Surveys were made for possible alternative routes. There were also attempts to establish the geographic boundaries between major habitations, as these might have influenced the boundaries of the individual catchment areas for the sites.

Sets of aerial photographs of the study area were available from the United States Forest Service and the United States Soil Conservation Service. These were useful for the catchment analysis, particularly in the areas of phytogeography and soils. The Forest Service photographs are in color stereo pairs and will be available to Dolores Archaeolog-

ical Program personnel through the Bureau of Reclamation office in Cortez, Colorado. It was recommended that the program purchase a select number of Soil Conservation Service photographs for use in the site catchment study.

An inquiry at the Soil Conservation Service district office in Cortez yielded no detailed information on the soils within the study area. However, there are reports on certain sections of private property within the study area. These provide more information than can be obtained from the general county soil map. The descriptions of general soil-type categories which are available at the Conservation Service office may provide some information on the soils found within the study area. However, for certain specific needs of the site catchment analysis, the information presently available will not be adequate.

Modern Plant Voucher Specimens and Ethnobotanical Specimens

The collection of modern plant voucher specimens and ethnobotanical specimens serves several purposes in both the paleobotanical study and the site catchment analysis.

The primary purpose of the modern plant voucher specimens is to provide study material for the positive identification of plants found within the study area. These specimens also provide comparative materials to be used in the identification of cultural paleobotanical plant remains.

The ethnobotanical specimens consist of bulk collections of plant materials. All ethnobotanical specimens are vouchered by a set of modern plant specimens to insure that all material is properly

identified. These specimens are currently housed at the Laboratory of Ethnobotany at the University of Colorado, where analysis is being carried out. The purpose of these samples is to provide comparative material for the identification of cultural paleobotanical remains, particularly when quantities of material are desired for experimental treatment. Some destructive sampling of the ethnobotanical specimens (e.g., wood samples, pollen specimens, phytoliths, and other microscopic specimens) will be carried out in order to provide specific types of comparative materials.

Additionally, ethnobotany serves as a means of collecting essential information about such items as seasonality, availability, and productivity of various plants which might have had importance in the subsistence economy in prehistoric times. Much of this information will be useful in the site catchment analysis.

Macrobotanical Analysis

Analysis of the macrobotanical remains begins with preliminary sorting and identification. Macrobotanical samples received by the ethnobotany laboratories are sorted into the following general material types: unburned material, whole and fragmented; and burned material, whole and fragmented. During the sorting process, any material which can be easily identified is given a preliminary botanical name at the genus or species taxanomic level.

Macrobotanical remains identified visually by the excavators during excavation of Sites 5MT2191, 5MT2198, 5MT2235, and 5MT4475 have undergone preliminary analysis, with the following exceptions: for Site 5MT4475, a large part of the material has not yet been received by the

ethnobotany laboratory; and for all four sites, material processed by such techniques as flotation and C-14 dating have not been analyzed.

The four sites are located in the Great Cut Area (Figure 6.2). Sites 5MT2191, 5MT2198, and 5MT2235 are small sites located in old shrub dominated fields of the Great Cut Valley. Site 5MT4475 is a large Pueblo site located on slightly elevated ground approximately 1 km from the Dolores River. Detailed descriptions of these sites are available in the appropriate survey reports and in the forthcoming fieldwork season reports being prepared by D.A.P. excavation crew leaders.

The identified remains from these sites appear to be mostly charred corn fragments. Also found were the remains of Juniperus, Pinus, Yucca, and Phaseolus (beans), and either sagebrush (Artemisia spp.) or rabbitbrush (Chrysothamnus spp.). Many wood-charcoal fragments were sorted but were not readily identifiable. Tables 6.2 through 6.5 present the results of preliminary analysis to date.

Detailed analysis will begin after more samples have undergone preliminary analysis and after comparative botanical specimens, which will aid in identification, have been sorted and identified.

Figure 6.2 Locations of sites for which macrobotanical remains have been processed.

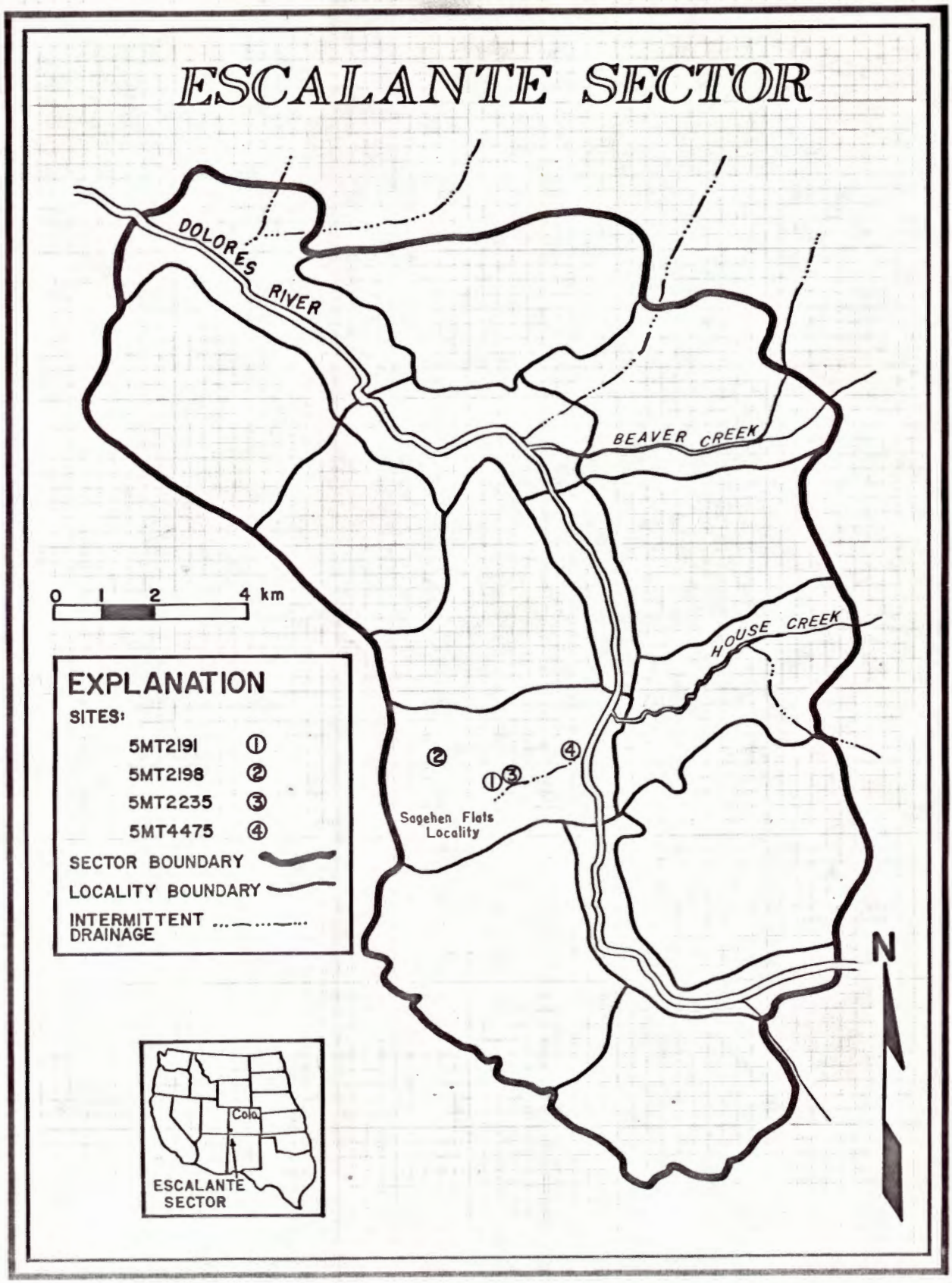
ESCALANTE SECTOR
DOLORES RIVER
BEAVER CREEK
HOUSE CREEK
0 1 2 4 km
EXPLANATION
SITES:
5MT2191 ①
5MT2198 ②
5MT2235 ③
5MT4475 ④
SECTOR BOUNDARY
LOCALITY BOUNDARY
INTERMITTENT DRAINAGE
Sagehen Flats Locality
N
Colo.
ESCALANTE SECTOR

Figure 6.2

Table 6.2 Preliminary Report on Vegetal Remains, Site 5MT2191

FS#	Description
15	charred twig fragments, tentative identification sagebrush
35	3 charred twigs, tentative identification sagebrush
39	2 charred bean cotyledons
53	1 charred corncob fragment; twig fragments, tentative identification sagebrush
61	charred bark fragments, tentative identification sagebrush
70	6 charred corn kernels; numerous charred twigs, tentative identification sagebrush
71	1 charred corncob fragment; charred twigs, tentative identification sagebrush
79	charred twigs, tentative identification sagebrush
91	numerous charred corncob fragments and corn kernels
106	numerous charred corncob fragments and corn kernels
112	charred *Yucca* spp. seeds
113	1 charred corncob fragment; 1 charred corn kernel; charred wood fragments
115	charred corncob fragment; 1 charred corn kernel
125	1 charred corn kernel; charred fragments of wood
127	numerous charred corn kernels and corncob fragments; 2+ charred bean cotyledons; 1 charred cucurbit seed; 1 charred *Yucca* spp. fruit; 6 bone fragments
128	charred bark, tentative identification sagebrush
141	charred twigs, tentative identification sagebrush
142	charred corn kernels and corncob fragments; 3 charred *Yucca* spp. fruits; 1 charred *Juniperus* spp. seed; charred wood fragments
144	charred wood fragments, tentative identification sagebrush
147	numerous charred corncob fragments

Table 6.3 Preliminary Report on Vegetal Remains, Site 5MT2198

FS#	Description
23	rabbit pellets
32	fragment of charred *Phragmites* spp. stem
41	charred fragments of wood, bark, and small twigs, tentative identification *Juniperus* spp.
48	1 charred corn kernel
54	uncharred, partially charred, and completely charred wood and bark, tentative identification *Juniperus* spp.
60	3 complete and numerous fragmented charred corn kernels
82	2 charred corn kernel fragments; numerous pieces of charred wood, bark, and twigs
84	charred wood and associated soil matrix
85	reddish-brown clay or pigment (?) and associated soil matrix
91	numerous charred whole and fragmented corn kernels
95	numerous charred whole and fragmented corn kernels; 1 charred twig, tentative identification sagebrush or rabbitbrush
96	2 recent unidentified seeds
97	numerous charred whole and fragmented corn kernels
98	numerous charred whole and fragmented corn kernels
107	numerous charred whole and fragmented corn kernels
111	numerous charred whole and fragmented corn kernels
112	numerous charred whole and fragmented corn kernels
121	numerous charred whole and fragmented corn kernels
127	2 corn kernels and a small section of a corncob
146	1 fragmented corn kernel

Table 6.4 Preliminary Report on Vegetal Remains, Site 5MT2235

FS#	Description
51	fragmented charred bark
65	charred wood fragments, tentative identification rabbitbrush, sagebrush
66	organic debris in soil matrix (flotation necessary)
70	charred wood fragments, tentative identification sagebrush
83	charred wood fragments
88	charred wood fragments
105	charred wood fragments, tentative identification sagebrush
148	3 charred corn kernels and 1 corncob fragment; charred wood fragments, tentative identification sagebrush or rabbitbrush

Table 6.5 Preliminary Report on Vegetal Remains, Site 5MT4475 (Page 1 of 6)

Box 16

FS#	Description
1	charred soil and associated wood fragments, tentative identification sagebrush
5	fragmented charred wood
6	charred wood fragments, tentative identification *Pinus* spp.
8	1 fragment of bone
15	1 small piece of charred wood
17	1 pinyon nut
44	1 charred corn kernel
52	12 charred corn kernels; numerous charred wood fragments and twigs; 1 bone
57	2 charred twigs
61	charred and uncharred wood fragments, tentative identification *Juniperus* spp. and *Pinus* spp.; 2 bones
62	numerous uncharred twigs

Table 6.5 Preliminary Report on Vegetal Remains, Site 5MT4475 (Page 2 of 6)

Box 119

FS#	Description
96	numerous charred corn kernels and fragments; charred wood fragments; numerous recent pinyon nuts
108	numerous charred corn kernels and corncob fragments; large charred wood fragments
111	numerous charred corn kernels and corncob fragments; charred wood and small stem fragments
117	1 charred stem section of *Phragmites* spp.
122	numerous charred wood fragments, tentative identification *Pinus* spp. and/or *Juniperus* spp.
132	charred corn kernel fragments; charred wood fragments, tentative identification *Pinus* spp.
137	numerous charred wood fragments
138	1 charred corncob fragment

Table 6.5 Preliminary Report on Vegetal Remains, Site 5MT4475 (Page 3 of 6)

Box 152

FS#	Description
144	1 charred stem section of *Phragmites* spp.; charred small wood fragments
146	1 charred corn kernel; 1 uncharred pinyon-nut fragment; numerous large and small charred wood fragments
151	2 large charred wood fragments
152	11 charred corn kernels; stem (?) impressions in soil
155	4 twigs, with associated soil impressions
156	wood fragments, tentative identification *Juniperus* spp.; numerous charred large and small wood fragments
166	numerous charred wood fragments, mostly small
167	numerous charred wood fragments, tentative identification of some as *Juniperus* spp.; uncharred wood fragments; 2 charred stem sections of *Phragmites* spp.; numerous pinyon nuts and fragments

Table 6.5 Preliminary Report on Vegetal Remains, Site 5MT4475 (Page 4 of 6)

Box 165

FS#	Description
179	numerous large and small charred wood fragments and associated soil matrix
181	3 complete and 1 fragmented charred corn kernel; 1 bean cotyledon; numerous charred small and large wood fragments; soil impressions and soil sample (?) with associated unidentified charred material
182	large charred wood fragments; 3 pinyon nuts; 1 bone
192	numerous charred wood fragments, with associated soil
194	2 fragmented charred corn kernels

Table 6.5 Preliminary Report on Vegetal Remains, Site 5MT4475 (Page 5 of 6)

Box 196

FS#	Description
195	1 charred corn kernel
197	1 charred fragmented corn kernel
198	3 charred corn kernels
206	15 complete and numerous fragmented charred corn kernels; 5 charred corncob fragments; 1 pinyon-nut fragment
224	1 complete and numerous fragmented charred corn kernels; numerous complete and fragmentary pinyon nuts; numerous large charred wood fragments
225	1 complete charred corn kernel; 1 charred corncob fragment
226	60+ complete and numerous fragmented charred corn kernels
227	2 complete and 2 fragmented charred corn kernels
236	numerous charred wood fragments, tentative identification sagebrush
241	numerous large charred wood fragments, tentative identification of some as sagebrush
242	numerous large charred wood fragments
243	charred wood and twig fragments
250	numerous charred wood fragments
282	numerous charred wood fragments, tentative identification of some as sagebrush
284	numerous charred wood fragments
285	1 charred corncob fragment
286	3 charred corncob fragments; 4 fragmentary charred corn kernels; 7 burned and unburned bones and bone fragments
290	numerous charred wood fragments (small branch fragments)

Table 6.5 Preliminary Report on Vegetal Remains, Site 5MT4475 (Page 6 of 6)

Box 262

FS#	Description
293	numerous large and small fragments of charred wood, tentative identification *Pinus* spp. or *Juniperus* spp.
310	numerous large charred wood fragments, tentative identification *Pinus* spp. or *Juniperus* spp.

APPENDIX A

BULK SOIL, POLLEN, AND STRATIGRAPHIC CONTROL SAMPLING

BULK SOIL AND POLLEN SAMPLING

Pollen and bulk soil sampling and proveniencing is an integral part of the Dolores Archaeological Program Research Design (Kane et al. [1]). These samples will provide economic/environmental data which will be important to the analysis of prehistoric activities.

The general purpose as outlined in the Research Design is to obtain samples from prehistoric activity surfaces of all types. The manual by Bohrer and Adams [2] provides an excellent discussion of applicable sampling techniques. Some specific guidelines for each type of sample are given below. Most of the following discussion on flotation was derived from Wagner [3].

Pollen Samples

Floor surfaces in rooms and surfaces in activity areas provide important pollen samples. A sample should be taken from each quarter of living or activity surfaces.

All features such as bins, ash layers, burials, storage pits, etc., should be sampled. If a metate is found in place on a cultural surface, a pollen sample from in front of the trough would be valuable. Good samples may usually be obtained from under rocks or stone tools that seem to have been in place since occupation.

Samples should also be taken from different types of fill layers, from around the edges of firepits, from floor surfaces in front of storage bins, from corners, and from plaster, mud coping, and wall mortar. It may sometimes be impossible to take every sample that is desired, and

some judgment should be exercised if factors such as rodent activity could affect the validity of the sample.

One person will be assigned to take the pollen samples from each site. This person will receive instruction from the ethnobotanist on the standard technique for taking samples. Within the general guidelines, the excavation crew leader, in conjunction with the pollen assistant, should decide when and where to take the samples. If any problems arise, the ethnobotanist should be consulted.

Bulk Soil Samples

Bulk soil samples will be processed either by fine-screening or by flotation and will yield an abundance of small archaeological remains. The following dicussion pertains mostly to obtaining samples for flotation; the same considerations are applicable to selecting fine-screen samples.

Flotation is a water separation technique that lifts very light organic remains from the surrounding dirt matrix. Dirt is dumped into water and objects in the dirt separate according to weight. Heavy objects, such as bone, pottery, and rock, sink and catch in a screen, whereas light objects such as charcoal remain suspended in or on the surface of the water. Many small plant remains which would otherwise pass unnoticed through a screening process will be isolated. Also, stone debitage, fish scales, small bones, and tiny gastropods may be recovered in undamaged condition.

Deposition and Preservation

The types of plant materials preserved depend not only upon their

individual characteristics (hardness, density, brittleness, etc.) but also upon the manner in which they have been deposited: charred by fire and quickly covered by dirt or gradually covered by dust during a period of years.

The cultural activities relating to deposition should also be considered. How was a plant used, and where and how was it processed? Was it processed at the site of collection or at the habitation area? An increase in a particular type of seed at the site may not indicate an increase in use, but rather a change in location of use.

Even though a plant part has been deposited it may not survive if it is uncarbonized, too carbonized, or too soft or brittle. Soil and climate further influence the condition of botanical remains. Some climate/soil combinations (dry caves, anaerobic bogs, dry deserts) favor survival of even uncarbonized material, while other combinations (areas of high rainfall and abundant microbial activity) tend to destroy all organic remains, carbonized or not.

When to Take a Sample

Sampling strategy is developed by the excavation supervisor in conjunction with the ethnobotanist. Samples from feature areas (e.g., firepits, post holes, trash pits, living surfaces, storage bins), from nonfeature areas (e.g., post-occupational fill, cultural fill), and from the areas between features can yield information concerning aboriginal activities and the overall preservation of the site. Samples should definitely be taken from areas full of charcoal, but areas which appear to be sterile should not be automatically excluded.

Metates found in place on living surfaces should be double bagged in plastic, with dirt left in the trough, and sent to the laboratory intact.

A wired tag containing pertinent information should be secured to the outside of the plastic bags. Dirt from inside all intact or semi-intact ceramic vessels should be saved for flotation. Samples should always be taken from burials. Other specific samples may be requested by the ethnobotanist.

How to Take a Sample

With a clean trowel, dig out approximately 1 L of dirt and place it in a clean bucket or tin can. Do not pack the dirt by pressure; rather shake the bucket to settle the dirt. Place the measured sample inside doubled paper or plastic bags. Care should be taken to exclude foreign matter such as rocks, roots, etc. Do not finely scrape with a trowel; fragment the sample as little as possible. On the other hand, clods of dirt are undesirable and are best broken up in the field while fresh.

Note Taking

The excavator should enter the pollen-sample numbers and bulk soil-sample numbers in his notes and should discuss the relationships, quantities and contexts of the samples in detail, especially noting any associated artifacts. The person taking the pollen samples is also responsible for recording pertinent information in his notes.

STRATIGRAPHIC CONTROL SAMPLES

Traditionally pollen and bulk soil sampling of archaeological sites has been done in the field while excavation is in progress. Unfortunately, contamination of prehistoric pollen samples with modern pollen and the problem of accurately defining each level preclude taking valid samples. Large plant parts and fine impressions are often unavoidably broken up into small pieces, which makes statistical analysis of material nearly impossible.

The purpose of the stratigraphic control samples is to allow a portion of the archaeological strata to be removed intact and delivered to the laboratory for examination under finely controlled conditions.

These samples will allow examination of the microstratigraphy of both occupational and post-occupational features and possibly the identification of varve formation. Pollen samples can be taken with absolutely no modern pollen contamination and these samples used as controls for samples taken under field conditions. Problems encountered with pedoturbation can be investigated in detail. The samples will also be used to experiment with a variety of techniques of microfossil recovery. It is hoped that an experimental approach to archaeological sampling can be developed.

Generally the stratigraphic control samples will consist of approximately 30 by 30 cm columns of strata from present ground surface to below the lowest occupational level. Due to considerations of weight and bulk, sample columns of more than 120 cm in depth will be broken into smaller units. Some smaller stratigraphic units may also be sampled, such as a section comprising 10 cm above and 10 cm below a distinct living surface.

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[2] Bohrer, V.L. and K.R. Adams 1977. Ethnobotanical Techniques and Approaches at Salmon Ruin, New Mexico. San Juan Valley Archaeological Project, Technical Series No. 2. Eastern New Mexico University Contributions in Anthropology 8(1).

[3] Wagner, G.E. 1977. Flotation Procedure Manual. Ms. on file, the Dayton Museum of Natural History. Ohio.