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Pollen Analysis - 1979

by

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ABSTRACT

Pollen analysis of 10 prehistoric sites excavated during the 1979 field season of the Dolores Archaeological Program (D.A.P.) was centered on three localities. Seven of the 10 sites were located in Sagehen Flats Locality, including one site which was represented by only a modern pollen sample. These sites date to the Sagehen, McPhee, and Sundial phases. Two sites in Grass Mesa Locality were selected for pollen analysis; they date to the Sagehen and McPhee phases. McPhee Pueblo (Site 5MT4475), located in Periman Locality, was the remaining site selected for analysis; it dates to the McPhee Phase. Information concerning both the environment and potential economic base at these sites was sought. The environment of Sagehen Flats Locality appears to have remained relatively stable and was dominated primarily by Artemisia during the Sagehen, McPhee, and Sundial phases. The economic pollen record from these sites suggests that the cultigen Zea, and Cleome, which has been recorded as a utilized native plant, were consistent elements of the Anasazi potential resource base of this region.

INTRODUCTION

Palynological investigations carried out in conjunction with excavations of the Dolores Archaeological Program (D.A.P.) focused on 10 sites during the 1979 field season. The archaeological sites examined in this study represent the Sagehen, McPhee, and Sundial phases, and date from approximately A.D. 600-1100. The purpose in analyzing the pollen content of samples from these sites was to provide data to be used in addressing questions put forth in Problem Domains 1 and 3 of the project Research Design (Kane et al. [1]). Problem Domain 1 concerns the prehistoric economic system and cultural adaptation, an understanding of which involves the identification of the available resources and an assessment of the role of domesticates in the Anasazi economy. Problem Domain 3 concerns the reconstruction of prehistoric behavior patterns and activities. The questions posed from these problem domains will be considered here in a general manner rather than on a specific question by question basis. Results of pollen analysis for the sites investigated during 1979 are reported in detail in appendixes to the individual site reports.

Five of the archaeological sites chosen for pollen analysis in this study date to the Sagehen Phase (A.D. 600-850). These sites include Site 5MT4512, Cascade House (Wilshusen [2]); Site 5MT4545, Tres Bobos (Brisbin [3]); Site 5MT2198, Sagehill Hamlet (Hewitt [4]); Site 5MT2192, Pheasant View Hamlet (Yarnell [5]); and Site 5MT2151, LeMoc Shelter (Hogan et al. [6]). The latter site is located in Grass Mesa Locality; the remaining four are in Sagehen Flats Locality.

Four McPhee Phase (A.D. 850-970) sites were examined for pollen analysis. These sites include Site 5MT0023, Grass Mesa (Breternitz and

Campbell [7], Ahlstrom and Dohm [8], Emerson et al. [9], and Dohm [10]), in Grass Mesa Locality; Site 5MT2191, Little House (Hewitt [11]), and Site 5MT2203, Casa Roca (Brisbin [12]), in Sagehen Flats Locality; and Site 5MT4475, McPhee Pueblo (Brisbin [13]), in Periman Locality.

Site 5MT2235, Marshview Hamlet (Wilshusen [14]), was the only Sundial Phase (A.D. 1050-1200) site chosen for pollen analysis. It is a small hamlet located in the Sagehen Flats Locality.

Pollen samples from floor-contact proveniences, as well as samples from specialized activity areas or artifacts, were examined to determine the resources available during the time of occupation of these sites and to identify elements of the paleoenvironment. In addition to identifying the resources available to these prehistoric peoples, pollen samples from a variety of locations within these structures, including metates, interiors of vessels, mealing bins, storage cists, and hearths were studied to answer questions concerning the processing and storing of vegetal materials. Ethnographically documented uses of some of the plants found in the project area today and prehistorically are presented in Table 8.1.

This report includes an intersite discussion incorporating results from pollen analyses at these sites. Activity patterns and continuity of pollen frequencies are considered among structures of the same and different time periods. Patterns of resource utilization are examined among sites containing similar or comparable pollen samples.

One of the major strategies for the first year of pollen analysis was to analyze a variety of sites and features in order to build a relatively comprehensive list of the resources available to the prehistoric peoples occupying these sites. The purpose of this comprehensive approach was to determine which samples are most likely to generate data to answer

Table 8.1 Ethnobotanic Uses of Pollen Types Observed in the Dolores Project Area (Page 1 of 4)

Scientific Name	Common Name	Ethnobotanic Use
Arboreal Pollen		
Abies	Fir	Ritually smoked (1), twigs used for making pipestems (2)
Alnus	Alder	Red dye for deerskin (2)
Juniperus	Juniper	Firewood and general construction, medicinal, paint, berries eaten (1, 2), firewood, seeds strung as beads (4)
Picea	Spruce	Gum used for waterproofing, ceremonial (1, 2)
Pinus	Pine	Pinyon nuts eaten, firewood, chewing gum, gum used as adhesive (4)
Quercus	Oak	Wood used to make rabbit sticks, arrows, bows, digging sticks, clubs, and other utensils (1), acorns eaten, wood used to make utensils similar to above (2)
Salix	Willow	Used in roof construction, making prayer sticks, ceremonial (1)
Nonarboreal Pollen		
Ambrosia-type	Ragweed*	
Artemisia	Sagebrush	Spring leaves eaten, medicinal, used on prayer sticks (1), medicinal, firewood (2), medicinal (infusion of leaves), leaves baked and eaten, sprig attached to paho or prayer stick (3), medicinal (infusion of leaves), leaves rubbed on temples for headache, leaves baked and eaten in early spring (4), seeds ground (5)
Compositae	Composite	Senecio used as brush to remove spines from Opuntia (3, 4), Chrysothamnus is one of four kiva fuels, used in construction, stems used to make arrows and wicker plaques, yellow flowers used as yellow dye (1), one of four kiva fuels (4)

Table 8.1 Ethnobotanic Uses of Pollen Types Observed in the Dolores Project Area (Page 2 of 4)

Scientific Name	Common Name	Ethnobotanic Use
Chenopodiaceae and Amaranthus (Cheno-ams)	Chenopod (goosefoot) Amaranth (pigweed)	Mixed with food, used on prayer sticks, young leaves eaten (1), eaten as greens (2), Atriplex used as kiva fuel, leaves boiled and eaten, seeds ground and mixed with cornmeal, used as piki dye (3), cooked as greens, gathered and strung in long bunches to hang in house, has been used in times of famine, salty leaves of Atriplex eaten, Chenopodium seeds ground and flowers eaten, Atriplex used as kiva fuel (4)
Sarcobatus	Greasewood	Wood used for rabbit sticks, planting sticks, stirring rods, musical rasps, lease rods, clothing hooks in houses, arrows, general construction, chief kiva fuel (1), one of four sacred kiva fuels (3, 4)
Cleome	Beeweed	Eaten as greens, used in manufacture of prayer sticks (1), eaten as greens, dried, used to make paint (2), boiled leaves and flowers highly esteemed (3), leaves boiled with green corn (4), tender leaves cooked, large quantities of leaves gathered and hung indoors to dry for winter use (5)
Collomia	Collomia	
Cruciferae	Mustard family	Medicinal, paint, greens eaten (1), paint, greens eaten (2)
Lepidium	Pepper grass	Member of mustard family
Cucurbita	Squash	Cultivated, flowers may also be eaten (1), cultivated, important crop (2)
Cyperaceae	Sedge	Ceremonial (1)
Ephedra	Mormon tea	Medicinal (1, 2)
Eriogonum	Buckwheat	Medicinal (1), leaves boiled and used to make a kind of piki bread (3), infusion drunk to expedite childbirth and cure disorders of the stomach (4)

Table 8.1 Ethnobotanic Uses of Pollen Types Observed in the Dolores Project Area (Page 3 of 4)

Scientific Name	Common Name	Ethnobotanic Use
Gramineae	Grass family	Ceremonial, used on prayer sticks, used in basketry, Oryzopsis is eaten, used in roofing, pipestems (1), used for brooms and brushes (2), used for brooms and brushes, seeds ground and mixed with cornmeal, basketry (3), seeds ground with corn, flower stem used for hairbrushes, used to make coiled baskets (4)
Liliaceae	Lily family	Allium (wild onions) used for flavoring, Calochortus (Mariposa lily) root eaten raw, Yucca roots crushed and used for soap, medicinal, leaves used in basketry, paint brushes (1)
Opuntia	Prickly pear cactus	Joints and fruits eaten (1), fruits eaten (2), fruit eaten also dried for winter use, dried fruit ground into flour (5)
Onagraceae	Evening primrose family	Ceremonial, medicinal (1), maidens decorate hair with Oenothera (3)
Polygonum P. sawatchense	Knotweed Sawatch knotweed	
Portulaca	Purselane	Cooked in gravy (1), greens eaten, also in gravy (2), boiled with meats (3), plant eaten (4)
Rosaceae	Rose family	Arrows, bark used for weaving or dyeing leather (1)
Shepherdia	Buffaloberry	
Sphaeralca	Globe mallow	Medicinal (1, 2, 3)
Typha	Cattail	Mature heads chewed as gum, ceremonial (1)
Umbelliferae	Carrot family	Herbs for flavoring, roots eaten (1)

Table 8.1 Ethnobotanic Uses of Pollen Types Observed in the Dolores Project Area (Page 4 of 4)

Scientific Name	Common Name	Ethnobotanic Use
Zea	Corn, maize	Cultivated, important both as food and ceremonially, wide variety of methods of preparation, including eating fresh corn, dried corn, dried corn also ground (1, 2, 5)

(1) Whiting [15]

(2) Robbins et al. [16]

(3) Fewkes [17]

(4) Hough [18]
Hough [19]

(5) Stevenson [20]

*Also inclues *Franseria* (sand-bur), *Zanthium* (cocklebur), and *Iva* (marsh-elder).

questions posed in the problem domains. This first year of research was also intended to define the most productive areas for pollen research in future years.

METHODS

The pollen samples were taken in the field using special sterilized equipment. Standard-sized scoops were sterilized in the laboratory and placed in individual sterile plastic bags for use in the field. Pollen samples were taken by members of the environmental studies crew and by crew chiefs, then packaged in commercially sterilized and sealed plastic bags. The strategy for selecting areas to be sampled for pollen content is outlined by Litzinger [21]. Pollen washes were taken from several vessels and metates. These washes were taken by using distilled water and/or diluted (10 percent) hydrochloric acid to rinse out the vessels and metates.

The pollen was extracted from the sediment samples. A chemical preparation based on flotation was selected as the most effective method of removing the pollen from the large volume of sand, silt, and clay with which it was mixed.

The method used to prepare the samples for analysis was as follows:

1. Hydrochloric acid (10 percent) was added to approximately 50 ml of dry sediment and this mixture was stirred to dissolve any calcium carbonate. The mixture was stirred until there was no further reaction.

2. The material was screened through 150 mesh to remove the larger inorganic material. The samples were then centrifuged to concentrate the material for flotation.

3. Zinc bromide (density 2.0) was used to float all samples, except the pollen washes from vessels and metates. The flotation process was executed three times, after which the supernatant containing the pollen and other organic material was saved, and the inorganic material discarded.

4. The supernatant was diluted with distilled water and hydrochloric acid, then centrifuged. The samples were washed several times with distilled water.

5. Fifty percent hydrofluoric acid was added to the samples to remove any traces of clay remaining after flotation.

6. The remaining sediment was acetolyzed for three minutes.

7. All samples were thoroughly washed prior to making the microscope slides. The slides were made with glycerine jelly and stained with basic fuschin.

A light microscope was used to count the pollen at a magnification of 430x. Oil immersion at a magnification of 970x was occasionally employed to discern the features of certain pollen grains. When possible, a total of 200 pollen grains was counted from each sample; tallies of poorly preserved grains were kept.

These pollen types occur in the archaeological record fairly regularly. Most of the rarer nonarboreal pollen types in the archaeological samples are also not represented in the modern sample.

The prehistoric environment reflected in the pollen records at Sites 5MT4545, 5MT2198, and 5MT2192 appears to be very similar to that near Site 5MT4512 today. Artemisia is the dominant element in the pollen record, and similar nonarboreal pollen types are also noted to contribute to the pollen in the samples. There are some minor differences between these sites. Site 5MT2198 and Site 5MT2192 both have generally higher aboreal pollen and Pinus pollen frequencies than does Site 5MT4545, and might have been a little closer to pinyon-juniper stands. Site 5MT2192 also exhibits higher high-spined Compositae pollen frequencies than do Site 5MT4545 and Site 5MT2198.

The prehistoric environment at Site 5MT2151, a rock shelter in Grass Mesa Locality, appears to be similar to that of today; however, it differs in several aspects from that of Sagehen Flats Locality. There is currently a large ponderosa pine growing in front of the rockshelter; large quantities of oak (Quercus) and squawbush (Rhus) were also observed. The prehistoric pollen record from Site 5MT2151 indicates the proximity of Pinus to the site, since many of the samples contain over 40 percent Pinus pollen. Quercus frequently occurs in higher quantities, and Artemisia in lower quantities, in samples from Site 5MT2151 than in the samples from Sagehen Flats Locality. The high-spined Compositae and Cheno-am frequencies at Site 5MT2151, however, are similar to those in some of the sites from the Sagehen Flats Locality.

Pollen evidence of cultigens during the Sagehen Phase is limited to Zea, which occurred with regularity, and Cucurbita, which was observed

once near a hearth at Site 5MT2192. At Site 5MT4545, Zea pollen occurs with a frequency of at least 1 percent in every sample. Only the sample taken from a surface structure which might have served as a storage area contained a large quantity of Zea pollen. Twenty-five percent of the samples from Site 5MT2198 contained only a limited amount of Zea pollen; 1 percent in each of two samples taken from under a mano and near a hearth. Site 5MT2192 also contained a very limited amount of Zea pollen in 22 percent of the samples; 1 percent was recovered from in the northeast corner of the pitstructure and 1 percent from in front of the east wingwall. Site 5MT2151 exhibits at least some Zea pollen in 65 percent of the samples; however, most of the samples associated with two metates do not contain Zea pollen. The largest frequency of Zea pollen at this site was from the lowest fill of a hearth. Although the quantities are not large in most of the samples, the consistent presence of Zea pollen in the samples from Site 5MT4545 and Site 5MT2151 indicates that Zea was probably a constant element in the diet of the occupants of these sites. Zea pollen does not occur as frequently at Site 5MT2198 and Site 5MT2192. The overall frequency for Zea pollen during the Sagehen Phase is 52 percent (Table 8.2).

Cleome is the most frequently occurring noncultivated economic pollen type at the sites dating to the Sagehen Phase (Table 8.2). Cleome contributes to the pollen record in all of the samples from Site 5MT4545, in 62 percent of the samples from Site 5MT2198, in 55 percent of the samples from Site 5MT2192, and in 82 percent of the samples from Site 5MT2151. Overall, Cleome is present in 75 percent of the samples analyzed from this phase. The largest frequencies of Cleome came from the

Table 8.2 Frequency of Occurrence of *Zea* and *Cleome* in the Sagehen, McPhee, and Sundial Phases

Phase/Site Number	Percent of Samples Containing *Zea*	Percent of Samples Containing *Cleome*
Sagehen Phase*		
5MT2151	65	82
5MT2192	22	55
5MT2198	25	62
5MT4545	100	100
Sagehen Phase average	52	75
McPhee Phase		
5MT0023	40	100
5MT2191	33	50
5MT2203	0	100
5MT4475	36	100
McPhee Phase average	32	88
Sundial Phase		
5MT2235	47	94
Sundial Phase average	47	94

*Site 5MT4512 is excluded from this table because no prehistoric pollen samples were recovered from this site.

antechamber of the pitstructure at Site 5MT4545, from under a mano at Site 5MT2198, from in front of the east wingwall in Pitstructure 1 at Site 5MT2192, and from the floor of Room 6 at Site 5MT2151. Samples from the latter provenience were recovered from under or near various metates, and from under a canine skull located behind the west wingwall. The consistent occurrence of Cleome in the samples from these sites, as well as the association of larger frequencies of Cleome with metates, suggests that Cleome played an important role in the diet of the occupants of these sites during the Sagehen Phase.

Other plants which might have been utilized either as food or as medicine also contributed to the pollen record at Saehen Phase sites, although not as consistently as Cleome. The Cheno-ams are generally considered to be part of the ambient pollen at most of the sites, since the quantity of Cheno-am pollen within each site is relatively consistent. Site 5MT2151 is different. The amount of Cheno-am pollen at Site 5MT2151 appears to be fairly small (usually less than 10 percent). Cheno-ams only occur in large quantities occasionally and are interpreted to have economic significance only when they approach or exceed 20 percent of the total pollen. Cheno-am frequencies at Site 5MT2151 were high in the area to the east of the hearth in Pitstructure 2, and in three samples associated with the metates in Room 6.

High-spined Compositae pollen is also considered primarily as ambient pollen from these sites. It occurs in high frequencies only in the sample from the lowest layer of a pitstructure hearth at Site 5MT2151, indicating that high-spined Compositae might have had some economic significance in this provenience.

Opuntia pollen was noted only at Site 5MT2198 and Site 5MT2192, which were the sites containing the least Zea and Cleome pollen. At Site 5MT2198, Opuntia was noted in samples taken from the main hearth, from under a lap anvil, and from under manos. All of these samples were located in Pitstructure 1. The association of Opuntia pollen with tools used for food preparation and with the hearth indicate that Opuntia was a part of the diet at this site. The only occurrence of Opuntia pollen at Site 5MT2192 was in the sample taken from northeast of the pitstructure hearth. It is possible that this sample also indicates that Opuntia was cooked and eaten at the site.

Sphaeralcea pollen was noted at Sites 5MT4545, 5MT2198, and 5MT2151. No pattern was noted in the distribution of Sphaeralcea at these sites; however, there is ethnographic documentation of the use of this plant (Whiting [15).

Typha pollen was noted only in Sample 31 from Site 5MT2192. Interpretation based on only one pollen grain at one site cannot be made.

Umbelliferae pollen was noted at Site 5MT2198 and Site 5MT2151. At Site 5MT2198 Umbelliferae pollen was noted in the sample taken from beneath the lap anvil and occurred in high frequencies in the main hearth of the pitstructure. At Site 5MT2151 Umbelliferae pollen was noted in samples taken from a possible pigment-grinding stone, from the open end of the large, inverted metate, and from the hearth; all of these samples were recovered from Pitstructure 1. The upper level of the hearth yielded more Umbelliferae pollen than the lower level. It is probable that Umbelliferae was utilized at these sites, and that Umbelliferae should not be considered to be just a portion of the ambient pollen.

The locations of economic pollen concentrations in Sagehen Phase sites were compared in an effort to determine spatial patterning. Surface structures at Site 5MT4545 and Site 5MT2151 were sampled for pollen content. One surface structure at Site 5MT4545 contained a large amount of Zea pollen, indicating that Zea may have been stored in that structure. One of the surface structures at Site 5MT2151 contained a large quantity of Cheno-am pollen, and small amounts of Cleome and Zea. It is probable that at least Cheno-ams were either processed or stored in that structure, and possibly also Cleome and Zea. An ash pit from Surface Structure 11 at Site 5MT2151 contained a moderate amount of Cleome, while a sample from a postmold in Surface Structure 10 contained a large amount of Gramineae pollen.

Pitstructures were sampled for pollen content in all of the Sagehen Phase sites; Cleome and Zea pollen were noted in all of the pitstructures. Most of the larger frequencies of economic pollen occurred in association with the hearths, in front of the wingwalls, or behind the wingwalls. Although the highest concentrations of economic pollen were generally noted in these areas of the pitstructures, economic pollen also occurred in other areas of the pitstructures. Very little economic pollen was recovered from the southwest corner of two Sagehen Phase pitstructures. Despite the general trends noted above, no definitive patterns emerged concerning the concentration of specific pollen types.

Although differences in the environment were noted between sites in Sagehen Flats Locality and Site 5MT2151, in Grass Mesa Locality, the economic pollen recorded for these two areas was very similar. There are no remarkable differences in the utilization of vegetal resources recorded in the pollen deposited at these two different environmental areas.

McPhee Phase

The McPhee Phase is represented by one site in Grass Mesa Locality (Site 5MT0023) and three sites in Sagehen Flats Locality (Site 5MT2191, Site 5MT2203, and Site 5MT4475). The three sites from Sagehen Flats contained slightly less arboreal pollen (specifically *Pinus* pollen) than the sites from Sagehen Flats dating to the Sagehen Phase. The arboreal pollen frequencies are also more stable in the samples recovered from sites dating to the McPhee Phase. This slight variation in arboreal pollen frequencies between the Sagehen and McPhee phases might be due to the location of individual sites relative to the areas of pinyon-juniper woodland, or it might actually reflect a slight decline in the pinyon pine population in Sagehen Flats Locality.

Site 5MT2191 and Site 5MT2203 exhibit pollen evidence indicative of an environment dominated by *Artemisia*. They contain similar amounts of *Artemisia*, high-spined Compositae, and Cheno-ams when compared to the other sites in Sagehen Flats Locality from the Sagehen Phase, and to the modern pollen sample from this area.

Site 5MT4475, however, exhibits a different pollen assemblage. *Artemisia* is not the dominant pollen type. It might have been a prominent part of the environment, but members of the chenopod and amaranth families appear to have been more abundant near this site than at other McPhee Phase sites in Sagehen Flats Locality. It should be noted, however, that members of the chenopod and amaranth families are more prolific pollen producers than *Artemisia*. Thus, the increase in Cheno-am pollen probably indicates a larger population of Cheno-ams near this site, but it does not necessarily mean that they were the dominant element of the local environment.

Site 5MT0023 is located on Grass Mesa, a small mesa above the Dolores

River. The present environment is composed of sagebrush, grass, and small herbaceous plants. Some pinyon, juniper, and Gambel oak are also present. Interpretations of the prehistoric environment at this site during the time of occupation are very difficult. Pollen Sample 4, from a floor cist in Room 4, is probably the only sample from this site to represent the period of occupation. This sample contains a large quantity of economic pollen. Sample 74, from a metate in Pitstructure 5, is probably indicative of post-occupational fill and contains a very large quantity of Ambrosia pollen. This may be due to the colonization of the disturbed soils by Ambrosia around the site immediately after abandonment. The Cheno-am pollen frequencies are also relatively high in most of the metate samples, which may indicate similar colonization by these plants. The arboreal pollen frequencies are fairly low in all samples from this site, except Sample 75 taken from between a mano and metate. Since a modern pollen sample was not available from this site, the prehistoric environment cannot be accurately compared to the modern environment.

Pollen evidence of cultigens during the McPhee Phase is limited to Zea, which occurred sporadically in samples from four sites. Site 5MT0023 contains Zea pollen in 40 percent of the samples (including a metate-fill sample), while Site 5MT2191 contains Zea pollen in 33 percent of its samples (Table 8.2). Zea pollen was not noted in any of the samples from Site 5MT2203, but occurs in 36 percent of the samples from Site 5MT4475. Zea pollen was noted in a large quantity only in Sample 37 from Room 6B at Site 5MT4475. Zea pollen is not as consistent in the pollen record in the McPhee Phase sites as in the Sagehen Phase sites. The overall frequency for Zea pollen in the McPhee Phase is 32 percent, while it is 52 percent for the Sagehen Phase. Two of the sites during the

McPhee Phase (Site 5MT2191 and Site 5MT2203) are probably field houses rather than habitation sites. Further pollen analysis of field houses and habitation sites is necessary to define the pattern of occurrence of economic pollen at these types of sites.

Cleome is the most frequently occurring noncultivated, economic pollen in the samples from the McPhee Phase sites (Table 8.2). It was noted in all of the samples from Site 5MT0023, Site 5MT2203, and Site 5MT4475, and in 50 percent of the samples from Site 5MT2191; thus, the overall frequency is 88 percent. This is a higher frequency than was noted in the sites from the Sagehen Phase. The largest frequencies of Cleome pollen were observed in the fill from a cist at Site 5MT0023 and in a sample from Room 6B at Site 5MT4475.

Other plants which might have been utilized either as food or medicine also contributed to the pollen record, although not as consistently as Cleome. High-spined Compositae pollen was observed in a very large quantity in a sample taken from near the open end of a metate at Site 5MT4475. Opuntia pollen was noted as a single pollen grain in the wash from a Chapin mug at Site 5MT4475, while Portulaca pollen was observed in a sample taken from in a bin in Room 3 at Site 5MT4475. Shepherdia pollen was noted in a sample taken from outside of a bin in Room 6A, as was a single grain of Onagraceae pollen. One percent Typha pollen was noted in the sample from Room 6A at Site 5MT4475, in an area also containing concentrations of Cleome, Zea, and Umbelliferae pollen. Umbelliferae pollen was noted from the pollen wash and fill sample taken from one of the metates at Site 5MT0023, and from the pollen wash and fill samples taken from a Chapin mug at Site 5MT4475. The largest frequency of

Umbelliferae pollen was noted in the sample taken in Room 6B at Site 5MT4475.

The locations of concentrations of economic pollen types among the McPhee Phase sites were investigated; however, no specific patterns were noted. The sites analyzed for pollen content from the McPhee Phase were not very similar to one another, and sampling strategies for these sites varied considerably.

The sites analyzed for pollen content in this study show a decrease in Zea pollen during the McPhee Phase and an increase in the occurrence of Cleome pollen. Analysis of pollen from additional sites dated to the Sagehen and McPhee phases is needed to substantiate this observation.

Sundial Phase

Site 5MT2235, in Sagehen Flats Locality, was the only Sundial Phase site tested for pollen during the 1979 field season. Statements concerning the prehistoric environment during this phase are made solely on the pollen record for this site and may not represent the entire environmental picture during this phase. The arboreal pollen represented in the archaeological samples is relatively consistent throughout the pitstructure at this site. These frequencies are slightly higher than at the other sites in the Sagehen Flats Locality during the Sagehen and McPhee phases, with the possible exception of Site 5MT2198 (Sagehen Phase). Specifically, there is an increase in Pinus pollen frequencies in the samples from Site 5MT2235. It appears that the arboreal pollen frequency increased from the McPhee Phase to the Sundial Phase, possibly indicating an increase in the tree population, specifically Pinus. More Picea pollen was also noted in the samples from this site. Since Picea does not grow in the vicinity of these sites, but rather at higher

altitudes in the nearby mountains, it is possible that the increase in Picea pollen at this site corresponds to an increase in the Picea population in the mountains, or a change in wind direction and/or velocity. Changes in the wind patterns would result in an increase or decrease in the pollen deposition of montane species at lower elevations.

Artemisia was apparently the dominant vegetation cover near Site 5MT2235 during the prehistoric occupation. The Cheno-am frequencies are higher at this site than at other sites in Sagehen Flats Locality, with the exception of Site 5MT4475.

Sagehen Flats appears to have been dominated by Artemisia from A.D. 600-1100, as represented by the pollen record from the sites in this study. Minor fluctuations in the Pinus pollen frequencies and arboreal pollen frequencies have been noted among samples within the same phase, and also among phases. It is difficult to ascertain whether this fluctuation represents a change in the Pinus population in Sagehen Flats Locality, or whether it is related to the distance of the individual sites from pinyon-juniper stands.

The pattern of economic pollen from this single site in the Sundial Phase is similar to that observed in the Sagehen and McPhee phases. Zea pollen was the only cultigen noted, and it occurs in 47 percent of the samples. This frequency is very similar to the overall occurrences of Zea in the Sagehen Phase (52 percent), and more than the overall frequency for the McPhee Phase, which was 32 percent (Table 8.2). No large quantities of Zea pollen were noted in the samples from Site 5MT2235, however.

The most frequently occurring pollen from a noncultivated plant during the Sundial Phase is Cleome, occurring in 94 percent of the samples from Site 5MT2235 (Table 8.2). This is slightly more than the

amount noted for the McPhee Phase (88 percent) and much more than that noted for the Sagehen Phase (75 percent). Cleome was noted in a large quantity only in the sample taken from near the base of a cist in the southwest quadrant of Pitstructure 1.

Other plants which may have been utilized either for food or medicine also contributed to the pollen record at Site 5MT2235. Portulaca pollen was noted in samples taken from the base of a cist and a possible rodent hole in Pitstructure 1. Shepherdia pollen was noted in the surface sample and in the sample from the southwest quadrant of Pitstructure 1. Sphaeralcea pollen was observed in a sample from the southeast quadrant of the floor and the possible rodent hole in Pitstructure 1, while Umbelliferae pollen was observed in the samples from the southwest quadrant and the probable pot rest in Pitstructure 1. None of these pollen types were as abundant in the pollen record as Cleome.

Regional Patterns

The evidence presented in this study indicates that the environment and subsistence data of the D.A.P. area did not change significantly through time. While interpretation of the D.A.P. material alone is valuable within the confines of the Dolores River valley, it is necessary to compare the D.A.P. results with the paleoenvironmental and subsistence data that has been generated over the last 20 years in southwestern Colorado and northwestern New Mexico. The following discussion compares the D.A.P. data with results of paleoenvironmental interpretations from other palynological studies of the region for the period between A.D. 600-1100.

Environment

Much of the previous paleoenvironmental interpretation has been

developed by using arboreal pollen frequencies. This method has been utilized consistently by investigators because the arboreal pollen frequency tends to be sensitive to and reflect climatic fluctuations through time. One of the major studies of this type is by Schoenwetter [22], who combined palynological information from several sites to produce an effective moisture curve for the Colorado Plateau indicating environmental changes between A.D. 200-1900. The curve shows that the A.D. 600s were a period of relative moisture increase, and that the environment from A.D. 700-1000 was similar to today. Apparently the environment was wetter than it is today from A.D. 1025-1075, but it was followed by a drought beginning before A.D. 1100. Schoenwetter produced a general moisture curve based on the analysis of five areas in the southern portion of the Colorado Plateau. These results generally hold true for other areas of the Colorado Plateau.

Other studies concerning the paleoenvironment tend to be more restricted in their scope and focus on limited areas (e.g., Hovenweep) or specific sites. Previous palynological investigations in southwestern Colorado do not show significant changes in the climate for the period A.D. 600-1100. Scott [23] notes that the environment in Mancos Canyon from A.D. 610-700 appeared to be similar to that of today, but slightly drier than present during the Pueblo II period (A.D. 900-1100). Martin and Byers [24] record low arboreal pollen frequencies during the Pueblo II and Pueblo III periods at Mug House, but also note that the frequencies of economic pollen, particularly Cleome and weedy species, including Cheno-ams and high-spined Compositae, are very high during this time period. The low arboreal pollen frequencies exhibited at Mug House are probably the result of a depression of the arboreal pollen values by

increased economic pollen and pollen from plants which thrive on disturbed ground. No significant changes in the climate of Mesa Verde were hypothesized as a result of the pollen study at Mug House.

The palynological record at Hovenweep (Weir [25, 26]) is the only indication in southwestern Colorado of a relatively wetter climate between A.D. 700-900. This interpretation is based on an increase in the arboreal pollen frequency and the presence of Typha and Cyperaceae pollen in greater amounts in areas where they are only weakly represented today.

Several related palynological studies from northwestern New Mexico also yielded paleoenvironmental information from sites dating between A.D. 600-1100. Schoenwetter [27] evaluates the pollen record from the Navajo Reservoir District, which suggests that the climate during the period A.D. 600-700 was similar to the present. It appears that the climate was slightly wetter between A.D. 700-750, while A.D. 775-900 was noted to have lower effective moisture values than occur today. The effective moisture values continued to decline during the A.D. 900s, then rose again about A.D. 1000 to levels above those exhibited today. Schoenwetter further notes that the period A.D. 600-800 was characterized by winter-dominant storms, while summer-dominant storms are hypothesized between A.D. 800-1050.

Schoenwetter's [22] study in the Chuska Valley also notes periods of winter- and summer-dominant storms. He suggests that the climate was characterized by winter-dominant storms before A.D. 700. Between A.D. 700-800 this pattern was reversed to produce summer-dominant storms, which lasted until A.D. 1100, when winter-dominant storms prevailed again. Periods of a minimum amount of moisture are noted from about A.D. 850-975, while the maximum amount of moisture is recorded at about A.D. 1050.

In another study of two sites in the Chuska Valley, Scott [28] indicates that the environment between A.D. 800-1150 was similar to that of today. These interpretations are based primarily on floor samples, rather than stratigraphy, which would be more reliable in interpreting environmental changes through time. The fluctuations observed by Schoenwetter in northwestern New Mexico were not evident at these sites.

Farther to the east, in an area west of Chaco Canyon, Scott [29, 30] notes that the Basketmaker III period was similar to the present in arboreal pollen frequency, while the Pueblo I period was characterized by slightly less to a similar amount of arboreal pollen as today. The Pueblo II period was represented by amounts of arboreal pollen similar to amounts observed at those sites today. Hall [31], in a study in Chaco Canyon, also noted that sites dating to the Basketmaker III and early Pueblo periods contained less arboreal pollen than the present, indicating that the precipitation during these periods was less than it is today.

Tree-ring chronologies from Mesa Verde (Fritts et al. [32]) indicate that the early A.D. 600s were fairly dry, and that this era was followed by generally wetter conditions until the early A.D. 700s. With the exception of a wet episode around A.D. 800 and another around A.D. 860, the climate between A.D. 700-1050 was similar to that of today. Between A.D. 1050-1100 the moisture level increased again. The slight fluctuations in the arboreal pollen frequencies between the Sagehen, McPhee, and Sundial phases of the D.A.P. correlate well with the tree-ring chronologies from Mesa Verde. The Sagehen Phase includes sites that date from A.D. 600-830 in this study. Within this time period the tree-ring record at Mesa Verde indicates that generally wetter conditions prevailed during the mid- and late-A.D. 600s and around A.D. 800. Increases in the available moisture

during these times may have been sufficent to raise the arboreal pollen frequencies at Sagehen Flats slightly during this time period. Samples from sites dating to the McPhee Phase contain slightly lower arboreal pollen frequencies. The tree-ring record between A.D. 875-950 indicates a climate very similar to that of today, and definitely drier than that exhibited during the late A.D. 600s and around A.D. 800. The one Sundial Phase site sampled for pollen by the D.A.P. exhibits an increased frequency of arboreal pollen dating from A.D. 1050-1100. Although the changes in arboreal pollen frequencies are small in the Dolores Project area, they do correlate well with the tree-ring chronology from Mesa Verde. It may be that environmental zones more sensitive to climatic fluctuations will exhibit greater diversity in the pollen record during these phases.

Petersen [33] used palynological data from the La Plata Mountains to suggest that, between A.D. 800-1050, the environment of the project area was about as wet as the present century; however, from A.D. 800-1100, the environment was cooler than today. Palynological evidence from the archaeological sites in the project area support the observation that the moisture level was probably similar to that present between A.D. 870-950. There is no evidence in the archaeological pollen record, however, to indicate whether it was relatively warmer or cooler than present during the occupation of the sites studied.

A review of the palynological literature from southwestern Colorado and northwestern New Mexico indicates that there is not total agreement between the pollen records concerning the paleoenvironment between A.D. 600-1100. There is some indication in the pollen record and the tree-ring chronology that the A.D. 600s and A.D. 700s had more effective moisture

than today. However, in some areas, evidence indicates a climate similar to that of today. Only Chaco Canyon is described as being similar to the present or drier, with the exception of two wet episodes in the tree-ring chronology. There is abundant evidence of a wetter climate beginning around A.D. 1000-1050.

The D.A.P. arboreal pollen frequencies in Sagehen Flats Locality sites vary only slightly throughout this time. The early and late phases contain slightly more arboreal pollen than the middle phase. This suggests that climatic conditions may have been similar to today or slightly wetter from A.D. 600-830, and slightly drier from A.D. 870-950, returning to a climate similar to today or slightly wetter from A.D. 1050-1100. Sagehen Flats Locality is not an environmentally sensitive area; therefore, it may be that confirmation of these environmental patterns in the project area must await the sampling of archaeological sites in an ecotone more likely to have responded to climatic fluctuations.

Economy

It has long been known that the Anasazi cultivated corn, beans, and squash. Although this triad of cultigens was an important element in the Anasazi diet, diversity was necessary to insure both enough food to eat and a nutritious diet. Such diversity in the vegetable portion of the diet was acheived through the utilization of certain native plants, some of which would have been eaten fresh, while others were processed for storage and later use. The growth of some of these plants was probably encouraged. One of the most important native plants in the Anasazi diet appears to have been Cleome.

The most abundant economic pollen types observed in the samples from D.A.P. sites are Zea and Cleome. These samples represent proveniences from within surface structures, pitstructures, isolated hearths, and cists. Several other sites in the Southwest exhibit similar patterns of economic pollen from samples associated primarily with living areas. The economic pollen at the sites west of Chaco (Scott [29, 30]) consists primarily of small amounts of Cleome and Zea, which is similar to that noted in the project area. Examination of vessels found in rooms at MV820, a Pueblo II site on Mesa Verde, produced higher frequencies of Zea pollen than were observed in the project area, but the Cleome frequencies were similar (Scott [34]). Other vessels found in the trash midden at MV820 contained much higher quantities of Cleome pollen and less Zea pollen. High frequencies of Cleome pollen were frequently observed in trash middens. The trash midden at Mug House in Mesa Verde National Park (Martin and Byers [24]) contained very large quantities of Cleome pollen during both the Pueblo II and Pueblo III periods, and the trash midden at Hoy House in Mancos Canyon, dating from A.D. 1100-1200, also contained large quantities of Cleome and smaller amounts of Zea (Scott [35]).

The pollen record of Anasazi sites in this region is relatively stable, indicating that Zea was cultivated continuously from A.D. 600 to the abandonment of the region. Cleome was apparently a consistent element of the diet throughout this same period.

Palynological evidence of the cultivation of other plants is very minimal. A single pollen grain of Cucurbita was noted during the Sagehen Phase, and no Phaseolus pollen was observed. Pollen evidence of these two cultigens is very rare because the pollen does not cling to the squash and beans, which are harvested and brought to the site. Evidence of the

cultivation of these foods will have to rest on macrofloral analysis. Sporadic evidence of the utilization of other plants which are native to this area was noted in the pollen record from these sites. Those plants which were probably utilized at the D.A.P. sites include Cheno-ams, high-spined Compositae, Liliaceae, Opuntia, Portulaca, Onagraceae, Shepherdia, Sphaeralcea, Typha, and Umbelliferae.

CONCLUSIONS AND RECOMMENDATIONS

Pollen samples from 10 archaeological sites were selected for the initial pollen analysis of archaeological sites within the D.A.P. area. Eight of these sites were located in Sagehen Flats Locality, two were in Grass Mesa Locality, and one was in Periman Locality. The sites from Sagehen Flats Locality date to the Sagehen Phase (A.D. 600-850), the McPhee Phase (A.D. 850-970), and the Sundial Phase (A.D. 1050-1200), which allows comparison through time in a single locality.

The pollen record demonstrates very little change in the plant communities in Sagehen Flats Locality. The composition of this open sagebrush area during the entire period of its occupation by the Anasazi, as represented in these samples, appears to have remained fairly stable. There is a slight fluctuation in the arboreal pollen frequency between the phases, however. The arboreal pollen frequency during the Sagehen Phase was very similar to that of the present, but this frequency declined slightly during the McPhee Phase. The arboreal pollen frequency rose again during the Sundial Phase to levels which were similar to the Sagehen Phase. This fluctuation in the arboreal pollen frequency might be in response to changes in the climate, or it might reflect the cutting of local stands of pinyon-juniper by the inhabitants of Sagehen Flats Locality during the McPhee Phase. Comparisons of the slight fluctuations in the arboreal pollen frequencies among the Sagehen, McPhee, and Sundial phases with the tree-ring chronology of Mesa Verde (Fritts et al. [32]) indicate a certain degree of continuity. If the slight fluctuations in arboreal pollen frequencies observed in this initial study of 10 sites

from the project area are indicative of changes in the available moisture, then analysis of sites from environmental zones which are more sensitive to fluctuations in the climate should produce greater variations in the arboreal pollen frequencies.

The pollen record also shows a similarity in type and frequency of economic pollen observed. Zea and Cleome pollen were the most consistent economic pollen types noted at these sites, indicating that Zea and Cleome were probably both important elements of the prehistoric diet. Concentrations of economic pollen were noted only in a few areas. High frequencies of economic pollen in a few specific locations at these sites suggest that these species were stored, ground, prepared, or otherwise utilized at these specific locations, on, in, or with certain tools, artifacts, or features.

Future pollen analysis in conjunction with the D.A.P. should focus on the systematic investigation of selected sites. Since it is not practical to comprehensively analyze every site for pollen, a limited number of sites should be selected for analysis, rather than relying on a shotgun approach of taking a few samples from most of the sites. There needs to be consistency in the samples selected for analysis to facilitate the interpretation of the pollen record, and to determine inter- and intrasite relationships through time and space. Pollen samples should be selected from similar areas within similar structure types to obtain a "core" of pollen samples to establish a data base. These consistencies should also be extended through time. Unique and unusual features should not be ignored, however. Both field house and habitation sites are represented in the project area, and should be adequately represented in the selection of sites for pollen analysis. A sufficient data base

concerning the economic pollen record at field houses must be established to compare with the pollen records of habitation sites of the same phase.

Analysis of more sites from each time period will build a data base from which more positive interpretations can be made concerning both the economy and the environment. Environmental information should be sought in more environmentally sensitive areas than Sagehen Flats Locality. Sagehen Flats Locality may yield good information concerning economy, use, and function, but thus far this area has not yielded conclusive evidence of variations in the climate. It may be that there was no significant environmental change in Sagehen Flats Locality, and that more marginal ecotones should be sought to study potential environmental fluctuations.

Trash middens usually provide excellent economic information. Economic pollen types are frequently higher in trash middens than in most of the samples taken from habitation structures. The economic pollen noted in trash deposits represents items which have been discarded, and thus can provide valuable information concerning the use of plants. If any trash middens are excavated, it would be advisable to analyze at least one stratigraphic column from a trash midden from each phase represented in the study area.

The analysis of several samples from a duck effigy vessel from Site 5MT2235 produced pollen in every sample. The preliminary analysis of the sediments from this vessel indicates that further analysis of all layers of the vessel fill may supply detailed environmental information over a very short period of time. Additional analysis should be undertaken utilizing absolute pollen counts. The layers of sediment in the vessel formed narrow bands, suggesting that they might represent soil washed into the vessel after individual rainstorms. This vessel represents a rare

opportunity to investigate the environment near the site after the vessel was discarded, and possibly after the site was abandoned, through the examination of very fine water-laid deposits.

In summary, standardization in the selection of pollen samples is very important. In order to build an adequate model of the paleoenvironmental and subsistence patterns in the D.A.P. area, a data base must be developed which contains information from similar contexts within phases, as well as among phases. Before one can assess changes through time, one must first establish patterns concerning both the environment and subsistence in each phase and locality. The most practical way of identifying patterns is to establish a routine line of investigation (in this case a standardization of important pollen samples), with supplementation of samples from unique and unusual features.

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RESULTS OF ANALYSIS

Dolores Project Patterns

Relative frequencies of the different pollen types recovered from sites excavated during the 1979 field season are presented in Figure 8.1. The data are organized according to phase designation to facilitiate comparison between time periods. Percent of poorly preserved pollen grains for each site is also indicated.

Sagehen Phase

Pollen samples dated to the Sagehen Phase were recovered from three sites in Sagehen Flats Locality (Sites 5MT4545, 5MT2198, and 5MT2192), and from one site in Grass Mesa Locality (Site 5MT2151). Collectively, these sites date from approximately A.D. 600-850. A sample from modern ground surface at Site 5MT4512 contained pollen in frequencies consistent with the vegetation patterns noted in Sagehen Flats Locality today; it was, therefore, chosen as representative of modern vegetation in this area. Sagehen Flats Locality is currently an open area dominated by *Artemisia* intermixed with pinyon-juniper stands in the northern portion of the locality. *Artemisia* is the dominant element of the pollen record, although other nonarboreal pollen types are also present. The *Juniperus* and *Pinus* frequencies are not abundant; however, they do contribute to the pollen present, as would be expected, since both are wind-pollinated. The pollen recovered from Site 5MT4512, representing the modern environment, is also very similar to the prehistoric pollen recovered from the other sampled sites in Sagehen Flats Locality. The primary difference among the modern and prehistoric samples is that the former does not contain pollen evidence of *Cleome*, *Opuntia*, Rosaceae, *Sphaeralcea*, or Umbelliferea.

APPENDIX

POLLEN REPORT FOR SITE 5MT4512

SITE 5MT4512

This site is represented only by a modern pollen sample indicative of the current vegetation and apparently representive of the environmental characteristics typical of the sites located on the Sagehen Flats. Sagehen Flats is a large, relatively flat area above the Dolores River Valley. The primary vegetation on Sagehen Flats is Artemisia, although Chrysothamnus, Catelleja, and miscellaneous grasses were also observed. Sagehen Flats is ringed with pinyon-juniper, and isolated shale outcrops support a small amount of pinyon within Sagehen Flats.

The modern pollen at Site 5TM4512 is represented by a moderate amount of arboreal pollen (21 percent), including Juniperus, Pinus, Quercus, and Salix. Since this site is located in an open sagebrush area, the occurrence of arboreal pollen within the modern surface at the site is attributed solely to wind transport of these grains. The non-arboreal pollen within the modern surface at the site is attributed solely to wind transport of these grains. The non-arboreal pollen at this site consists of short-spined Compositae, Artemisia, high-spined Compositae, Cheno-am, Sarcobatus, Ephedra, Graminae, Polygonum and Polygonum sawatchensis, Eriogonum, and Zea. Palynologically there is evidence of a relatively large amount of sagebrush in the generaly vicinity of this site, as well as a number of weedy plants. These weedy plants could include ragweed or bursage, high-spined Compositae (probably Chrysothamnus, which was observed near the site), and members of the cheno-pod and amaranth families. There is also evidence of some greasewood in the area, as well as some Ephedra or mormon tea. Grass was also noted in the pollen record as was a member of the Cruciferae family, 2 species of Polygonum, and one

species of Eriogonum. The corn pollen noted in this sample might be either a contaminant from corn currently being grown in the vicinity or it might be a contaminant from prehistoric use of this area.

This modern pollen sample reflects well the general environment described by D.A.P. personnel for the Sagehen Flats Locality (Greenwald 1979). This sample also strongly resembles the archaeological pollen record from Site 5MT4545, Site 5MT2198, Site 5MT2192, Site 5MT2191, Site 5MT2203, Site 5MT4475, and Site 5MT2235, which are all located relatively close to one another in the Sagehen Flats Locality.

APPENDIX

POLLEN REPORT FOR SITE 5MT4545

SITE 5MT4545

Tres Bobos (Site 5MT4545) is a small hamlet consisting of one pitstructure, 13 small rooms, which probably served as storage areas, and a number of exterior features including heating pits and 2 large slab-lined hearths (J. Brisbin, personal communication). The site is located in Sagehen Flats and dates to approximately AD 600-650 and falls in the Sagehen Phase (A. Kane, personal communication). Tres Bobos is located in the Sagehen Flats Locality near Site 5MT2198, Site 5MT4512, and Site 5MT2192 (all Sagehen Phase) and Site 5MT2203 (McPhee Phase). Seven samples were collected for analysis, including 2 floor-contact samples from 2 of the surface structures, 2 floor-contact samples from the 2 pitstructures, and 2 samples from a Chapin Gray jar.

The floor-contact samples (Pollen Samples 5 and 8) from the 2 surface structures were taken from under rocks or slabs. Pollen Sample 5 was taken from under a large slab in the southwest quadrant of Surface Structure 1, while Pollen Sample 8 was taken from underneath a rock, directly on the floor in the north one-half of Surface Structure 6 (Table 1).

Pollen Sample 5 from Surface Structure 1 contains a relatively small amount of arboreal pollen (9 percent) and a large amount of Artemisia pollen (50 percent). The pollen in this sample reflects the environment of Sagehen Flats, which is primarily sagebrush. The surface structures at this site might have been used as storage units (J. Brisbin, personnal communication), and the economic pollen present in this sample supports this hypothesis. Cleome pollen is present as one percent of the total pollen, but Zea contributes 12 percent of the pollen observed. This

Table 1. Provenience of pollen samples from Site 5MT4545.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
5	239	SS 1	SW quad., Surface 1, under large slab
6	239	PS 2	Antechamber, under flat rock on floor
7	366	PS 1	Main chamber, under rock NE of hearth
8	497	SS 6	N half of floor, Surface 1, under rock directly on floor
9	232	PS 1	Hematite fill of small Chapin Gray jar
10	521	SS 12	N half of floor, Surface 1, under rock, no pollen
11	232	PS 1	Control fill sample from small Chapin Gray jar containing hematite

frequency of Zea pollen is the highest observed in this study and suggests that this structure was used to store corn.

Pollen Sample 8 from Surface Structure 6 contains more arboreal pollen (particularly Pinus pollen) and less economic pollen than does Pollen Sample 5. Sample 8 contains 2 percent Cleome and one percent Zea pollen, which are not sufficient to indicate that this surface structure was also used for storage. Surface Structure 6 had not burned and apparently was abandoned while it was intact, which would allow the continued accumulation of pollen in the structure after abadonment. The pollen in Sample 8 represents primarily ambient pollen, particularly in the absence of any evidence of large quantities of economic pollen.

A single pitstructure was noted at Site 5MT4545, although the main chamber was designated Pitstructure 1, and the antechamber was designated Pitstructure 2. The names main chamber and antechamber will be used instead of pitstructure numbers, since only one pitstructure is represented at this site.

Pollen Sample 6, taken from the antechamber of the pitstructure, contains a relatively small amount of arboreal pollen (11 percent), which is similar to the amount noted in Pollen Sample 5 from Surface Structure 1. The non-arboreal pollen consists of a larger amount of Cleome pollen (7 percent) than noted elsewhere in the site, as well as one percent Zea pollen. The larger amount of Cleome pollen might have indicated the storage or preparation of Cleome, and possibly other food items, in this area. Zea pollen was regularly noted as one percent or 2 percent of the pollen record in most of the samples taken at this site.

Pollen Sample 7, taken from under a rock to the northeast of the hearth in the main chamber of this pitstructure, contains a much larger

frequency of arboreal pollen (31 percent) than does Sample 6 from the antechamber. This large amount of Pinus pollen near the hearth might reflect the use of Pinus as fuel in the hearth, or alternatively the use of Pinus in the construction of the roof. It is also possible that this sample contains primarily ambient pollen similar to that in Surface Structure 6. Small amounts of both Cleome and Zea were noted in this sample, but neither occurred as more than 2 percent of the pollen record.

Cleome and Zea were noted as one percent or 2 percent of the total pollen in almost every sample form this site, so it is difficult to ascertain wheher the low freuqencies of these pollen grains might be attributed to their general presence at the site, or whether they indicate limited use in specific areas sampled.

Pollen Samples 9 and 11 represent the hematite fill and a control fill sample from a small Chapin Gray jar found in the fill of the main chamber of this pitstructure. The hematite sample contained more arboreal pollen, again primarily Pinus pollen, than did the control fill sample form this same vessel. Both the hematite and control fill samples from this vessel contain small amounts of Cleome and Zea pollen. Although these 2 pollen samples contain some differing frequencies in the pollen types noted, there is not a sufficient difference to indicate that pollen, or any plant substance, was added to the hematite found in the bottom of this vessel. Both samples appear representative of ambient or background pollen at this site.

Pollen evidence of the prehistoric resources available near Site 5M4545 and/or utilized at the site include: Juniperus, Pinus, Quercus, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Cleome, Ephedra nevadensis-type and Epherdra torreyana-type, Eriogonum,

Graminae, Polygonum sawatchensis, Rosaceae, Sphaeralcea, and Zea. The only cultigen noted at this site was Zea, which occurred in small fregencies (3 percent or less). Cleome pollen was noted consistently in the samples from this site, although it also usually occurred in small frequencies (2 percent or less). The presence of 7 percent Cleome in the antechamber of the pitstructure is suggestive of the use of that area for food preparation. The large frequency of Pinus pollen from Sample 7 might indicate its use as a fuel or in the construction of the roof of this pitstructure. The large frequency of Pinus pollen observed in Surface Structure 6 (Sample 8) is tentatively ascribed to the accumulation of ambient pollen in the room or possibly to construction activities.

APPENDIX

POLLEN REPORT FOR SITE 5MT2198

Site 5MT2198 (Sagehill Hamlet)

Sagehill Hamlet is a small habitation site located on a low hillock north of the Sagehen Flats marsh and dates from AD 665-685 in the Sagehen Phase, (A. Kane, personal communication, December 1979). This site is located to the west of Site 5MT4545, Site 5MT2192, and Site 5MT4512, all of which date to the Sagehen Phase and is composed of a pitstructure and exterior use areas. The area around the site contains good aeolian and alluvial deposits that would have been suitable for horticulture. This site appears to have served as a central base or habitation for one household unit. The inhabitants might have been practicing horticulture within a short distance of the site and aslo collecting wild resources (Kane 1979:27-28).

The first sample diagrammed form this site, Pollen Sample 7, represents the upper-most layer of a stratigraphic column taken from the pitstructure (Table 1). This sample was taken from 0-20 cm below the present ground surface, from the site. Sample 7 contains slightly less arboreal pollen than does the modern pollen sample from Site 5MT4512, the difference between the 2 samples is primarily that the sample from Site 5MT4512 contains more Pinus pollen. In most respects, however, Sample 7 reflects the same pollen rain exhibited in the modern sample from Site 5MT4512.

All of the archaeological pollen samples from this site were taken from Surface 1 in Pitstructure 1. Pollen Sample 13 was taken from contact with the floor in the northwest quadrant of this pitstructure. Pollen Sample 15 was taken from beneath a lap anvil in the same quadrant of the same pitstructure. The pollen composition of these 2 samples is extremely

Table 1. Provenience of pollen samples from Site 5MT2198.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
7	84	PS 1	0-20 cm below present ground surface, SW quad, against wall
13	83	PS 1	NW quad, Surface 1
15	114	PS 1	Under lap anvil, NW of hearth, Surface 1
19	114	PS 1	SW quad, in front of wingwall, Surface 1, SQ 030026
20	126	PS 1	SQ quad, behind west wingwall, Surface 1, SQ 030028
21	114	PS 1	S edge of main hearth
22	124	PS 1	Under mano behind distal end of east wingwall, Surface 1
24	115	PS 1	SE quad, corner where east wingwall meets wall of structure, Surface 1, SQ 032-026, no pollen
28	132	PS 1	Under mano, behind west wingwall, Area B, Surface 1
29	127	PS 1	Below rim of main hearth, SE corner, 5 cm N of slab, no pollen
31	127	PS 1	Below main hearth, SW corner, 4 cm NE of slab, no pollen

similar and appears to represent primarily ambient or background pollen from this pitstructure. A small amount of Cleome (one percent) was noted in the floor-contact sample, while the sample taken from under the lap anvil contained 5 percent Cleome, one percent Opuntia, and one percent Umbelliferae pollen. This lap anvil is located slightly to the northwest of the hearth. It might be that the increased amount of economic pollen relates to activities around the hearth, rather than specificially to this lap anvil.

Pollen Sample 19 was taken from inside the main chamber just in front of the west wingwall. Sample 24 taken from near the east wingwall where the wingwall joints the main chamber did not yield sufficient pollen for analysis. Pollen Sample 20 represents the area behind the west wingwall. The primary differences between the 2 samples analyzed is that Sample 20 has slightly more Artemisia, and Cleome pollen (2 percent) was found only in Sample 19. Neither of these samples contain any evidence of Zea pollen. The pollen record suggests that these 2 areas sampled were probably not connected with food-processing activities or vegetable storage.

Pollen Samples 28 and 22 were taken from beneath mano fragments behind the wingwalls. These samples contain arboreal pollen frequencies similar to one another, and in fact, they have pollen records similar to Samples 13 and 19. Both mano fragments contain evidence of Opuntia pollen (one percent), and one contains evidence of Cleome pollen (12 percent) while the other contains a small amount of Zea pollen (one percent). The Cleome pollen in Sample 22 indicates that the mano sampled was probably used to gind Cleome seeds.

Three pollen samples were taken in association with the hearth in

this pitstructure. Pollen Sample 21 was taken from the south edge of the hearth and was the only sample to contain sufficient pollen for analysis. Samples 29 and 31, taken from below the rim of the hearth from below the hearth, respectively, these contained insufficient pollen for analysis. Pollen Sample 21 contains arboreal pollen frequency similar to those of the rest of the samples from this pitstructure (22 percent). The unique components of this pollen sample include a trace of Opuntia pollen and 5 percent Umbelliferae pollen.

The pollen evidence indicates that the prehistoric environment at or near this site offered the following vegetation types for exploitation by the inhabitants of the site: Juniperus, Pinus, Quercus, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Cleome, Ephedra nevadensis-type and Ephedra torreyana-type, Eriogonum, Gaminae, Opuntia, Rosaceae, and Umbelliferae. Zea was the only cultigen noted in the pollen samples from this site. The archaeological pollen samples at this site establish a fairly uniform record of ambient or background pollen in this pitstructure. The variations in pollen content in these samples appear in the ones taken from under the mano fragments, which contain evidence of Opuntia, Cleome, and Zea pollen. The relatively small frequencies for these pollen types make it difficult to ascertain whether this pollen should be attributed to ambient pollen in the area or to grinding activities of the mano. The limited occurrence of these economic pollen types in this pitstructure suggests that their occurrence in samples associated with features and artifacts is probably related to food-preparation activities.

The hearth sample also contains evidence of Opuntia, Zea, and Umbelliferae pollen. The association of these pollen types with the mano

fragments and hearth appear to indicate not only the use of *Cleome*, *Opuntia*, Umbellferae, and *Zea* as food items, but also their preparation for consumption at these specific lcoations in the pitstructure.

APPENDIX

POLLEN REPORT FOR SITE 5MT2192

SITE 5MT2192

Pheasant Hamlet (Site 5MT2192) is located in the Sagehen Flats Locality immediately north of Site 5MT2203 and Site 5MT4512. This site consists of a pitstructure, a roomblock, several use areas, and isolated features and hearths. Pheasant Hamlet dates from about AD 675-775 (A. Kane, personal communcation, December 1979) to the Sagehen Phase.

All the samples from this site were taken from Surface 1 in Pitstructure 1, with the exception of the samples from the burial pit and a sample taken within an isolated pit, Feature 1. The first 6 samples represented on the pollen diagram were taken from floor-contact samples in the northwest corner of the structure, the northeast corner, slightly to the northwest of the hearth, to the northeast of the hearth, in front of the east wingwall, and behind the west wingwall (Table 1).

These 6 samples from Pitstructure 1 contain slightly varying amounts of arboreal pollen. These variations are relatively small and are probably indicative of the distribution of ambient pollen within the pitstructure rather than due to activities within the pitstructure.

The non-arboreal pollen frequencies also vary within these 6 samples. The most notable variations occur in some possible economic pollen types. Cleome pollen occurs as 4 percent or less of the pollen in the samples from the northwest and northeast corners of the structure, and to the northwest of the hearth. However, Cleome occurs as 15 percent of the pollen present in the sample taken in front of the east wingwall. This increase in Cleome pollen in this single location in the pitstructure probably indicates that this area was used for the purpose of food preparation, specifically Cleome.

Table 1. Provenience of pollen samples from Site 5MT2192.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
1	1		General surface from fill within feature
21	143	PS 1	Burial #1, rib cage
24	143	PS 1	Burial #1, under cranium
26	161	PS 1	Grid #1, NW corner, floor contact
29	164	PS 1	Grid #4, NE corner, floor contact
31	159	PS 1	Grid #6, NW of hearth, floor contact
32	166	PS 1	Grid #7, NE of hearth, floor contact
36	158	PS 1	Grid #11, in front of distal end of east wingwall, floor contact
38	179	PS 1	Locus 13, W half of south room, floor contact, behind west wingwall
45	200	PS 1	Locus 3, sipapu, no pollen

Zea pollen was noted to occur only in the samples from the northeast corner and in front of the east wingwall as one percent of the total pollen. This distribution of Zea pollen within the pitstructure makes interpretation very ambiguous. The presence of Zea pollen within this pitstructure, however, is indicative of its use. Curcurbita pollen was noted only in the sample taken from the northeast of the hearth as one percent of the total pollen as was Opuntia pollen. Cleome pollen was noted as 4 percent of the total pollen in the sample taken to the northwest of the hearth. The occurrence of Curcubita, Opuntia, and Cleome pollen in samples taken near the hearth may be associated with cooking activitis at this hearth.

The sample taken from behind the west wingwall near the southwest corner contains the least amount of economic pollen observed in this pitstructure. This sample contains only one percent Cleome pollen; n other economic pollen types were noted. The palynological evidence does not indicate that this area was utilized for the storage of vegetal foods.

The largest amount of arboreal pollen at this site was observed in the fill from Feature 1. Feature 1 is a round, basin-profiled pit dug into the prehistoric ground surface about 5 meters southeast of the pitstructure. This pit has not direct association with any structural unit at the site and is unlined and unburned. No artifacts were recovered inside the pit, and no function has been postulated. The arboreal pollen in this sample is comprised almost totally of Pinus pollen, which accounts for 42 percent of the total pollen and is more than double the Pinus pollen observed in any other sample from this site. This sample contains siilar amounts of Artemisia pollen when compared to the rest of the site,

but slightly less high-spined Compositae and Cheno-am pollen. There are also fewer pollen types observed within this pollen sample than in most of the other samples at this site. The significance of the large amount of Pinus pollen in this sample cannot be determined, or even speculated upon, until more is known about this feature.

Pollen Samples 21 and 42 were taken from the rib cage and beneath the cranium of Burial 1 respectively. The burial was located in the vent shaft of Pitstructure 1. Pollen Sample 21 from the rib cage appears to contain primarily ambient pollen, as it closely resembles most of the other pollen samples from the pitstructure, with the exception that it contains no economic pollen. Pollen Sample 24, taken from under the cranium, may also represent ambient pollen. The arboreal pollen from Sample 24 is higher than in most of the samples from this site due to an increase in both Juniperus and Pinus pollen. No economic pollen types were observed in this pollen sample.

The pollen evidence from Site 5MT2192 indicates that the prehistoric environment offered the fllowing types of vegetation which may have been utilized by the inhabitants of this site: Juniperus, Pinus, Quercus, Salix, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Sarobatus, Cleome, Cruiciferae cf. Lepidium, Ephedra nevadensis-type, Ephedra torreyana-type, Eriogorum, Graminae, Liliaceae, Opuntia, Polygonum, Polygonum sawatchensis, Rosaeceae, Sphaeralcea, Typha, and Umbelliferae. Both Cucurbita and Zea were also cultivated and utilized at this site. The archaeological samples establish a fairly consistent record of ambient-pollen types from this site, which is representative of an open environment dominated by Artemisia. The pollen record for this site is very similar to that of other sites from the

Sagehen Flats Locality. The pollen record at this site also contains evidence of the riparian environment of the Dolores River below, which is not evident in most of the other sites from Sagehen Flats. Both Salix and Typha pollen were noted to occur at this site, albeit in very low frequencies.

Cultigens noted in the pollen record at this site include both Zea and Cucurbita. Zea pollen was noted in the northeast corner of the pitstructure and the sample taken in front of the east wingwall. Curcurbita pollen was noted in the sample to the northeast of the hearth. Pollen from several plants with documented economic importance was also noted in these samples.

Cleome occurred in relatively small frequencies in the samples form the northwest and northeast corners of the pitstructure, to the northwest of the hearth, and behind the west wingwall. A much larger frequency of Cleome pollen was noted in the sample taken in front of the east wingwall. Opuntia pollen was noted in the sample taken to the northeast of the hearth only. Sphaeralcea pollen was observed in the northeast corner of the pitstructure and also in Feature 1, while Typha occurred only in the sample taken to the northwest of the hearth. The economic pollen occurred most frequently in the samples taken around the hearth and in front of the east wingwall, which is probably indicative of the preparation of foods in these areas.

APPENDIX

POLLEN REPORT FOR SITE 5MT2151

SITE 5MT2151

LeMoc Shelter (Site 5MT2151) is situated in a rock shelter in the Grass Mesa Locality. Located on the north face of the Dolores Canyon, the site affords access to the arable floor plain of the canyon and the upland resource areas to the north. The site consists of 2 pithouses, a house block containing 10 rooms, and associated storage and other use areas. Two habitation episodes probably date from AD 700-800 and AD 810-830 (A. Kane, personal communication). Reuse of the roomblock and the building of rooms and areas on the fill of the pithouses were noted to form a limited-activity occupation or camp which probably dates from AD 975-1075 (A. Kane, personal communication).

This site served as a small habitation or hamlet during the Sagehen Phase and was probably used by one or 2 households. The inhabitants probably farmed the bottom lands adjacent to the Dolores River and also exploited the resources of the area by engaging in hunting and gathering activities (Kane 1979:31).

Unlike the other sites represented in this study, this site is a rock shelter, which has been severely potted. The large degree of disturbance at LeMoc Shelter makes paleoenvironmental reconstruction very tenuous. Samples noted to be from undisturbed contexts will be noted individually.

Pollen Sample 2 was taken fromn a posthole in Surfce Structure 10 containing a mixture of ash and sand. Much of the floor of this surface structure was also fire reddened so the accumulation of the ash sediment may have been coincidental. This pollen sample contains a rather large frequency of arboreal pollen (53 percent), comprised primarily of pine pollen (33 percent). The non-arboreal pollen percentages from Sample 2

are fairly low when compared with the sites on Sagehen Flats. The frequency of Graminae pollen (13 percent) in this sample, however, is much larger than that observed in other samples at this site or at any of the sites in this study. No economic pollen types were noted in this sample (Table 1).

Pollen Sample 5 was taken from the floor plaster in Surface Structure Room 6. The amount of arboreal pollen in this sample is much less than that observed in Surface Structure 10. The Cheno-am pollen frequency in this sample, however, exceeds 40 percent. It is possible that this very large frequency of Cheno-am pollen in Sample 56 has some economic significance, possibly indicating the storage or preparation of vegetable materials. The samples from thsis site generally contain very low frequencies of Cheno-am pollen, so it is less likely that the large frequency of Cheno-am pollen in this sample be attributed to the wind transport of the pollen. A small amount, one percent, of Cleome pollen was also observed in this sample, as well as one percent Zea pollen.

Pollen Sample 19 was taken from a probable ash pit in Surface Structure 11, which is one of 2 surface structures noted not to have been potted. This pollen sample contains a large frequency of arboreal pollen (52 percent) comprised primarily of Pinus pollen. This sample appears very similar to Pollen Sample 2 from an ashy deposit in Surface Structure 2 in both the frequencies of arboreal pollen noted and the frequency of mos of the non-arboreal pollen noted and the frequency of most of the non-arboreal pollen types. The primary difference between these 2 samples is that the sample from Surface Structure 11 does not contain a large amount of Graminae pollen which was noted in Surface Structure 10. There is also one percent Zea pollen and 8 percent Cleome pollen noted in the

Table 1. Provenience of pollen samples from Site 5MT2151.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
2	84	Room 10	Feature 21, posthole
5	172	Room 6	Floor palster
6	200	PS 1	Subarea 3, 10E17, floor contact, no pollen
11	578	PS 1	Ceramic bowl, insufficient pollen, scan only
19	578	SS 11	Feature 81, probable ashpit, SE quad
30	669	PS 2	NW corner, possible paint-grinding stone
33	699	PS 2	E of hearth, Surface 1
34	700	PS 2	Beneath large inverted metate, in front of east wingwall
35	700	PS 2	Associated surface at open end of larger metate, east wingwall
36	700	PS 2	Associated surface east of smaller metate, in front of east wingwall
38	700	PS 2	Associated surface between the 2 metates, in front of east wingwall
39	700	PS 2	Associated surface N of smaller metate, in front of east wingwall
40	706	PS 2	Under canine skull, behind west wingwall
41	724	PS 2	Lowest fill of hearth (1st stratum), N half
42	726	PS 2	3rd stratum of hearth fill, N half
43	727	PS 2	4th stratum of hearth fill, N half
44	721	PS 2	Inside wall of floor cist, no pollen
46	730	PS 2	Floor cist, no pollen

Table 1. Continued.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
48	125	PS 1	Pollen wash from large corrugated vessel, Pot 2, SW Quarter or SE Quarter
49	125	PS 1	General fill from large corrugated vessel, Pot 2, same location

sample from Surface Structure 11. The high frequency of arboreal pollen from these 2 samples may be connected to the fact that both samples were taken from ashpits. The presence of both Cleome and Zea pollen in this sample is at least indicative of the presence of Cleome and Zea pollen in this surface structure. This ashpit may have ben used in the preparation of food either for consumption or for storage.

Pollen Sample 111 was taken from the interior of a ceramic bowl found in an unspecified pit feature in Pitstructure 1. Although there was insufficient pollen for a complete anlaysis, the material was scanned in an effort to ascertain whether or not economic pollen was present in the sample. Evidence of both Cleome and Zea pollen was noted in this sample, although no estimation was made as to the frequency of their occurrences.

Pollen Samples 48 and 49 were also taken from Pitstructure 1 and represent a pollen wash and pit fill, respectively, from a large corrugated vessel. These pollen samples contain an extremely large frequency (80 percent) of arboreal pollen. Most of the non-arboreal pollen frequencies from these 2 samples are similar to one another. The exception being that 2 percent Zea pollen was noted in the pit fill, but not in the pot wash?. The pollen evidence from this vessel would suggest that it was not used in the preparation or seving of vegetal food containing pollen, since the only economic pollen noted in the pollen wash was one percent Cleome pollen and a similar amount of Cleome pollen was also noted in the pit fill from this same vessel. It is probable that most of the pollen observed in both the pot-fill and pollen-wash samples was derived form the fillings of the vessel after abandonment of the area.

The remainder of the pollen samples at Site 5MT2151 were taken from Pitstructure 2. Pollen Sample 30 was taken in the northwest corner of

Pitstructure 2, from a possible paint-grinding stone. This sample also yielded a relatively large frequency of arboreal pollen (62 percent), composed primarily of Pinus pollen. The non-arboreal pollen frequencies within this sample were very small. Possible economic pollen noted within this sample include 3 percent Cleome pollen, one percent Sphaeralcea pollen, one percent Umbelliferae pollen, and 2 percent Zea pollen. The presence of economic pollen in this sample suggests that this portion of the pitstructure may have been used for storing or preparing vegetal remains.

Pollen Samples 33, 41, 42, and 43 represent a series of pollen samples taken in conjunction with the hearth in Pitstructure 2. Pollen Sample 33 was taken from just east of the hearth, while Pollen Samples 41, 42, and 43 were taken from the first, third, and fourth strata of the hearth. Strata 1 and 3, represented by Pollen Samples 41 and 42 respectively, are apparently the result of natural depositional processes rather than actual hearth fill (P. Hogan, personal communication). Interpretations of Pollen Samples 41 and 42 will be made based on the assumption that they represent post-occupational fill. The lowest stratum represented by Pollen Sample 43, however, contains a remnant of charcoal and a remnant of ash from the hearth's use.

Pollen Sample 33, located east of the hearth, contains the least amount of arboreal pollen of any of the samples associated with the hearth. It does, however, exhibit a large frequency of Cheno-am pollen (31 percent) and 3 percent Zea pollen. The large amount of Cheno-am pollen in this sample probably has economic significance, as most of the samples from this site contain less than 10 percent Cheno-am pollen.

Pollen Sample 43 represents the lowest stratum of the hearth fill

containing charcoal and ash from the use of the hearth a relatively high frequency of arboreal pollen. This sample contains the only evidence of Cyperaecea pollen from this study. Zea pollen was noted as 5 percent, Cleome pollen as 5 percent, and Umbelliferae pollen as 7 percent of the total pollen. Several clumps of Umbelliferae pollen were noted in this sample, which would probably only occur if a flower (or whole plant) had been deposited in the hearth. The presence of Zea, Cleome, and Umbelliferae pollen in this sample may indicate that Zea, Cleome, and Umbelliferae were all cooked in this hearth.

Pollen Samples 41 and 42 from the upper fills of the hearth also contain evidence of economic pollen. Sample 42, from Stratum 3, directly above the charcoal and ash sample, contains more arboreal pollen than Sample 43 and 4 percent Zea pollen. Sample 41, from the uppermost stratum, contains less arboreal polen than either of the other samples and also contains 3 percent Cleome, one percent Umbelliferae, and 7 percent Zea pollen. The presence of the economic-pollen types in these post-occupational depositions in the hearth is probably indicative of thier presence in the soil that washed into the hearth.

Pollen Samples 34 through 39 represent s series of pollen samples taken in connection with 2 metates in Pitstructure 2. Pollen Sample 34 was taken from beneath a large inverted metate and Pollen Sample 35 was taken from the open end of the same metate. Pollen Sample 38 was taken from the associated surface between the 2 metates, while Pollen Sample 39 was taken from the associated surface to the north of the smaller metate. This smaller metate was noted to have been upright.

Pollen Sample 34, taken from beneath the large inverted metate, contains a relatively small frequency of arboreal pollen. Cheno-ams (50

percent) is the dominant pollen from this sample and has a frequency much higher than that observed in any of the other samples associated with these 2 metates. It also contains 8 percent Cleome pollen, but no Zea pollen. This metate was probably used to grind Cheno-am seeds and possibly Cleome seeds.

Sample 35 was expected to yield similar pollen frequencies to those from Sample 34. The pollen frequencies, however, differ radically. Pollen Sample 35, taken from the open end of this metate contains a large freqqueny of arboreal pollen (64 percent), comprised primarily of Pinus pollen (56 percent). The frequency of Cheno-am pollen in this sample is very depressed compared to that in the sample taken from beneath the inverted metate, and it contains one percent Cleome pollen. The reason that similarity was expected between these 2 samples is that vegetal remains being processed on a metate may be expected to fall off the open end of the metate during preparation.

The pollen sample taken from the associated surface between the 2 metates (Sample 38) more closely resembles the pollen sample taken from beneath the inverted metate. It does contain a slightly higher frequency of arboreal pollen than does the sample beneath the inverted metate, a smaller frequency of Cheno-am pollen (39 percent), and 11 percent Cleome pollen.

The 2 samples taken from the north and east of the smaller metate contain large frequencies of arboreal pollen similar to that noted at the open end of the large metate. Again most of the non-arboreal pollen frequencies are relatively depressed. Zea pollen was noted only as one percent of the pollen taken from the north of the smaller metate. The samples taken from the open ends of the large metate and from the north

and east of the smaller metate are very similar to other samples tkaen in this pitstructure and probably represent ambient pollen typical of this pitstructure. Only Samples 34 and 38 differ significantly from other pollen samples taken within this pitstructure. Pollen Sample 34 contains large quantitites of Cheno-am pollen and a moderate amount of Cleome pollen suggesting that both Cheno-am and Cleome seeds may have been ground on that metate. This supposition is supported by the higher frequencies of Cheno-am and Cleome pollen found in most of the samples associated with the metates.

Pollen Sample 40 was taken from underneath a canine skull locatd behind the west wingwall in Pitstructure 2. This pollen sample contains a relatively small amount of arboreal pollen and typical amounts of most of the non-arboreal pollen types. The only exception is the very large frequency of Cleome pollen observed (29 percent). Two percent Zea pollen was also noted. It is possible that the Cleome was utilized in association with this burial; however, it is more probable that the Cleome and Zea pollen were deposited in the area during food preparation or storage, making the association of these economic pollen types with the burial incidental.

The pollen record from this site indicates that the prehistoric environment of LeMoc contained the following elements, some of which may have been exploited by the inhabitants of the shelter: Alnus, Juniperus, Pinus, Quercus, Salix, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Sarcogatus, Cleome, Cruciferae, Cyperaceae, and Umbelliferae. Zea pollen as noted consistently in the samples from LeMoc in frequencies varying from one percent to 8 percent. In addition to the cultigen Zea, Cheno-ams, Cleome, and Umbelliferae pollen appear to have

been utilized within the shelter. Large frequencies of Cheno-am pollen were noted in Surface Structure 6, to the east of the hearth in Pitstructure 2, under the large overturned metate, between the 2 metates, and to the east of the smaller metate. The concentration of Cheno-am pollen in these locations is probably representative of food preparation and possibly storage of Cheno-ams at this site. The largest quantity of Cleome pollen was noted in the sample taken from beneath the canine cranium behind the west wingwall in Pitstructure 2. Moderate amounts of Cleome pollen were noted in Surface Structure 11, the lowest stratum of the hearth in Pitstructure 2, under the large, overturned metate, between 2 metates, and to the east of the smaller metate. The presence of Cleome pollen in these contexts is probably indicative of the preparation or cooking of Cleome in each of the proveniences. Umbelliferae pollen was noted as 7 percent of the pollen in the sample from the lowest stratum of the hearth in Pitstructure 2 and probably indicates that Umbelliferae was either cooked or prepared near the hearth.

APPENDIX

POLLEN REPORT FOR SITE 5MT0023

SITE 5MT0023

Site 5MT0023 is a village located on Grass Mesa that dates from about AD 850-920 (A. Kane, personal communication). The present environment at Grass Mesa is composed of sagebrush, grass, and small herbaceous plants. Some pinyon and juniper were also noted, as well as Gambel oak. Nine pollen samples were collected from 4 different localities and 2 metates within this site (Table 1).

Pollen Sample 3 is from Feature 3 located in Level 4 of excavation Unit 2. This sample did not produce sufficient pollen for analysis.

Pollen sample 4 represent the bottom of a presumed storage cist, which was lined with a single large cobble in Surface Structure 2. This sample contained a relatively small amount of arboreal pollen (10 percent). The 2 most obvious components of the non-arboreal pollen in this sample are 33 percent Cheno-am pollen and 37 percent Cleome pollen. The Cheno-am pollen is probably the result of ambient pollen, since it is wind-pollinated and noted in similar amounts in most of the other samples from this site. The Cleome pollen, however probably indicates that Cleome was stored in this cist. This cist was noted to have been filled with refuse, so the high frequency of Cleome pollen noted in this sample might be the result of the use of the cist for trash disposal.

Pollen Sample 17, taken from the floor behind the east wingwall in Pitstructure 1 did not yield sufficient pollen for analysis. Pollen Sample 37 was taken from the side of the hearth in Surface Structure 12. This sample also did not contain sufficient pollen for analysis.

A series of 5 samples was taken from 2 metates from Pitstructure 5 at this site. The first metate is represented by Pollen Samples 77 and 78.

Table 1. Provenience of pollen samples from Site 5MT0023.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
3	199	EUNIT 2	Level 4, Feature 3, outside hearth, no pollen
4	396	SS 2	Bottom of small floor cist, presumed storage cist, bottom lined with a single large cobble, trash fill noted
17	633	PS 1	Floor contact behind E wingwall, no pollen
37	1143	SS 12	Side of hearth, Feature 50, no pollen
77	1517	PS 5	Pollen wash from basin of reconstructable metate (basin intact), no pollen
78	1517	PS 5	General fill, reconstructable metate
74	1301	PS 5	Pollen wash from metate with mano in situ
75	1301	PS 5	Fill between metate and mano
76	1301	PS 5	General metate fill from metate with mano in situ

Although this metate was broken, the basin of the metate remained intact. The pollen wash from this metate (Sample 77) did not yield sufficient pollen for analysis. The sample taken from the matrix fill of this metate (Sample 78) yielded a relatively small amount of arboreal pollen (13 percent). The unique factor of the pollen content of ths sample is the extremely large frequency of short-spined Compositae pollen. Short-spined Compositae is not noted in such large frequency in any other sample in this study. The pollen referred to as short-spined Compositae type may include members of the following genera: short-spined Compositae, Franseria, Iva, and Zanthium. Since this large frequency of short-spined Compositae pollen was noted in the metate-fill sample and not in a pollen wash, it is probable that the pollen was carried in and deposited as the metate was filled after abandonment of the area. Short-spined Compositae and Franseria are common plants in disturbed areas and frequently invade recently abandoned areas. The large frequency of short-spined Compositae pollen within this sample may be attributed to the growth of these weedy plants in the area after abandonment.

Pollen Samples 74, 75, and 76 were taken from a metate located in Pitstructure 5 that still had a mano resting in its basin. Pollen Sample 74 represents the pollen wash, Sample 75 represents the fill between the metate and the mano, and Sample 76 is from the general metate fill. Pollen Sample 76 contains slightly more arboreal pollen (17 percent) than does the metate fill from the other metate in this pitstructure. The non-arboreal pollen in this sample is composed of 29 percent short-spined Compositae, roughly half that observed in the other metate from this same pitstructure. Sample 75 yielded considerably more arboreal pollen (34 percent) than did the other samples taken from this metate, while the

pollen wash contained 11 percent arboreal pollen. The samples from this metate vary in their arboreal pollen frequencies; Sample 75, taken from between the metate and mano, contains the largest amount of arboreal pollen percentages. This difference was primarily in the Pinus pollen content. Samples 75 and 74 both contained less short-spined Compositae pollen than did the general fill sample form this metate, suggesting that the short-spined Compositae pollen within the general fill samples of these metates is probably attributed to growth of short-sprined Compositae within the area, and to subsequent washing into the metates of the dirt fill which accumulated in the metates after abandonment of the area. Samples 75 and 74 show slightly higher high-spined Compositae pollen frequencies than does the general fill sample from this metate. The pollen wash also shows a larger frequency of Cheno-am pollen, as well as the only occurrence of Zea pollen from this metate. The pollen evidence from this metate does not overwhelmingly suggest that any particular type of food or plants was processed on it. It is possible, however, that Cheno-ams, Cleome and/or corn kernels were ground on this metate.

The pollen record from Site 5MT0023 indicates that the following plants were present in the general environment during the prehistoric occupation of the site and may have been utilized by the occupants of the site: Juniperus, Pinus, Quercus, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Sarcobatus, Cleome, Graminae, Polygonum, and Umbelliferae. Some of these genera may reprsent long distance transport of the pollen grains. The only cultigen noted at this site was Zea. The presumed storage cist in Surface Structure 2 contained a very large amount of Cleome pollen. Since this cist was noted to contain refuse, it is difficult to determine whether the Cleome pollen is

associated with this refuse or the original contents of the cist. Samples from 2 metates were also analyzed and found to contain primarily ambient pollen. The pollen washes from these metates did not yield significantly different pollen to suggest that they had been used to grind particular types of food.

APPENDIX

POLLEN REPORT FOR SITE 5MT2191

SITE 5MT2191

Little House (Site 5MT2191) is located on a low ridge line north of the Sagehen Marsh near Site 5MT2235. This site appears to have been a seasonal field house utilized by a household group from the McPhee community. The presumed use as a seasonal field house would indicate that the members of the household probably occupied Little House during the growing season and were performing activities associated with the maintenance of nearby agricultural fields (Kane 1979:28-29). Little House dates from AD 825-875 (A. Kane, personal communciation), and falls within the McPhee Phase. Areas excavated at the site include a small 4 room houseblock and ancillary use areas to the south and southwest. The pollen samples from this site were taken in a roomblock and 2 use areas at this site (Table 1).

Pollen Sample 3 was taken from Use Area 1 continguous to the roomblock, against a west-facing wall. This sample did not yield sufficient pollen for analysis.

Pollen Sample 7 was taken from the floor in Room 2. This sample yielded a very small amount of arboreal pollen (6 percent). Aside from the 2 percent Zea pollen noted in this sample, there is no indication of economic pollen. All other pollen types within this sample can be attributed to bakcground or ambient pllen.

Pollen Sample 25 was taken from the bottom of a pit in Room 3 and contains 23 percent arboreal pollen. There are no indicatins of economic pollen from Sample 25, all pollen types present can be attributed to background or ambient pollen.

Pollen Sample 2 was taken from the northeast quadrant of Floor 1 in

Table 1. Provenience of pollen samples from Site 5MT2191.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
3	66	Work Area	SE quarter or NE quarter, against W facing wall, no pollen
7	95	Room 2	Floor 1, SE quad, floor contact
20	85	Room 1	Floor 1, NE quad, floor contact
22	84	Room 1	Floor, SE quad, floor contact
25	122	Room 3	Bottom of pit
27	125	Room 1	Floor 1, hearth, no pollen
28	136	Isolated firepit	SQ 018,022
32	127	Use Area 2	Bottom of fill of Feature 7, large trash pit, no pollen
33	141	Use Area 2	Feature 11, stone-lined firepit, SQ 014-012, no pollen
34	142	Use Area 2	Bottom of fill of Feature 12, oval-shaped, stone-lined, storage cist, no pollen
37	142	Use Area 2	Bottom of fill of Feature 12, oval-shaped, stone-lined, storage cist

Room 1, while Sample 22 was taken from the southeast quadrant of Floor 1 in Room 1. The pollen contents of these 2 samples are very similar and apparently represent ambient or background pollen. A small amount of Cleome (3 percent) was noted in Sample 20, but no other economic pollen types were noted in either sample. The presence of Cleome pollen does suggest that Cleome was utilized in Room 1. Room 1 also yielded another Pollen Sample (27), taken in the hearth of Floor 1 but it did not yield sufficient pollen for analysis.

An isolated firepit located approximately 10 meters southeast of Use Area 2 was sampled for its pollen content (Sample 28). This firepit contained 14 percent arboreal pollen. With the exception of the Zea, Sphaeralcea, and Cleome noted within Sample 28, most of the pollen is attributed to ambient or background types. It is probable that the Cleome and Zea pollen observed in this sample may be accounted for by the cooking of food in this firepit or their preparation near the firepit.

Pollen Samples 32 and 33 were taken from the bottom of the fill of a large trash pit and from a stone-lined firepit, respectively. Neither of these samples contained sufficient pollen for analysis.

Pollen Sampes 34 and 37 were taken from the bottom of the fill in Feature 12, a stone-lined storage cist. Sample 34 did not contain sufficient pollen for analysis, but Sample 37 did. This storage cist contains very little economic pollen. It is difficult to ascertain whether the 4 percent Cleome pollen might have been due to the storage of Cleome within this cist or to ambient pollen which may have been present in the dirt which filled the cist. All other pollen in this sample may be attributed to the accumulation of ambient pollen.

Elements of the prehistoric environment at this site represented in

the pollen record include: Juniperus, Pinus, Quercus, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Sarcobatus, Cleome, Lepidium, Ephedra nevadensis-type, Ephedra torreyana-type, Eriogonum, Graminae, Polygonum sawatchensis, and Sphaeralcea. Zea was the only cultigen noted in the pollen record. Most of these samples appear to be composed primarily of ambient pollen, with very little evidence of economic pollen. Cleome pollen was noted in Room 1, the isolated firepit, and the bottom of a stone-lined storage cist (Feature 2). This pollen evidence suggests that Cleome was probably cooked and stored at this site. Cleome leaves may have been boiled down into a paste, then made into cakes, and allowed to dry (Robbins et al. 1916:58-59) before being stored for future use. Zea pollen was also noted in Room 2 and in the isolated firepit sample. If this site was a seasonal field house (Kane 1979: 28-29), the Zea pollen indicates the possible field preparation and storage of corn as it was brought in from the fields.

APPENDIX

POLLEN REPORT FOR SITE 5MT2203

SITE 5MT2203

Site 5MT2203 consists of a masonry room which may have been used for the storage of field produce after the initial step of preservation (boiling and dehydration) had taken place (J. Brisbin, personal communication). It is located between Site 5MT2192 and Site 5MT4512 in the Sgehen Flats Locality. This site has been dated from approximately AD 875-950 (A. Kane, personal communication) in the McPhee Phase.

Pollen Sample 8 was the only sample taken from within the masonry room at this site, but unfortunately this sample did not contain sufficient pollen for analysis. The hearth, which was associated with this site but located outside and to the northeast of the masonry room, was sampled on it north, west, and southwest edges. The samples were taken just outside the hearth, and all 3 samples yielded sufficient pollen for analysis (Table 1). These 3 pollen samples contain very similar amounts of arboreal pollen, 16 percent, 18 percent, and 17 percent from Samples 13, 14, and 15, respectively. This similarity in pollen content also extends to the non-arboreal pollen portion of the pollen record. Aside from the one percent Cleome observed in all 3 samples, no economic pollen types were observed in these samples. Unfortunately, pollen analysis at this site was unable to positively identify any plants which might have been prepared or stored at this site.

The prehistoric environment reflected in the pollen record at Site 5MT2203 closely resembles that of the other sites from the Sagehen Flats Locality and includes, Juniperus, Pinus, Quercus, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Sarcobatus, Cleome, Ephedra nevadensis-type, Ephedra torreyana-type, Eriogonum, Graminae, Polygonum,

Table 1. Provenience of pollen samples from Site 5MT2203.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
3	56	SS 1	NE quad, Surface 1, no pollen
13	51	Occupied Area #1	Adjacent to N side of hearth, GS 016S-018E, Surface 1
14	51	Occupied Area #1	Adjacent to W side of hearth, GS 016S-018E, Surface 1
15	51	Occupied Area #1	Adjacent to SW side of hearth, GS 016S-018E, Surface 1

and *Polygonum sawatchensis*. No *Zea* pollen was noted in the samples from this site, and the limited amount of *Cleome* pollen observed is not sufficient to ascertain whether or not it was processed at this site.

APPENDIX

POLLEN REPORT FOR SITE 5MT4475

SITE 5MT4475

McPhee Pueblo (Site 5MT4475) is a major architectural unit within the McPhee village complex.

> "McPhee Pueblo is situated on a low terrace west of the river in Dolores Canyon; this position allows easy access to riparian zones along the river, alluvial soil deposits in the valley and to aeolian soil areas and sagebrush/pinyon zones to the west. The pueblo consists of a horseshoe-shaped, double-row roomblock and an enclosed plaza area containing pitstructures, a trash midden is located to the south. The site functioned as part of the central habitation of the McPhee community during the McPhee Phase. During maximum occupation periods the Pueblo probably was the home base for 8-10 households or 40-70 individuals. McPhee served as the hub for many types of intra-community economic, technical, and social acitivities. It is also a speculation that McPhee may have served as a location for inter-community social and ceremonial activities as well; the village may have been one unit of a regional central place system" (Kane 1979:29).

A roomblock and an associated pitstructure dating from AD 850-950 (A. Kane, personal communciation), were excavated and sampled for pollen content (Table 1). All pollen samples from this site contained sufficient pollen for analysis. The samples taken within the roomblock are from several different proveniences including floor contacts, bins, and a sample taken in association with a metate.

Pollen Sample 12 was taken from the surface beneath the burned roof fall in Room 2 on Floor 2. This sample contains 13 percent arboreal pollen. The pollen in this sample appears to represent ambient or background pollen types occurring in the room immediately before the burned roof fell. Although no Zea pollen was noted in this sample, 4 percent Cleome pollen was present, indicating that Cleome was present in this room prior to its burning.

Pollen Samples 37 and 9 were taken from the floors of Rooms 6B and 6A, respectively; however, there is considerable difference between the

Table 1. Provenience of pollen samples from Site 5MT4475.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
7	103	Room 6A	Inside mealing bin, NW quarter of NW quarter
9	99	Room 6A	Floor contact, NE quarter of NW quarter
12	117	Room 2	Floor contact beneath burned roof fall, Floor 2
37	135	Room 6B	Floor contact, NW quarter of NE quarter
40	99	Room 6A	Floor contact, Surface 1, near oustide wall of small storage bin, NW quarter of NW quarter
44	114	Room 3	Floor contact of stone-lined bin
45	149	Room 7	Associated working surface in front of in situ metate, NE quarter or SW quarter
85	192	PS 2	Floor contact, Floor 2, SE quarter of NE quarter
133	284	PS 2	Floor contact, Floor 1, SW quarter
500	129		Chapin mug associated with Burial #2, general fill
501	129		Pollen wash from Chapin mug associated with Burial #2

pollen content in these 2 samples. Both samples contain ambient pollen typical of the Sagehen Flats Locality, but the difference between these 2 samples arises mainly in the economic pollen types present. Sample 37 from Room 6B contains 16 percent Cleome, one percent Typha, 4 percent Umbelliferae, and 8 percent Zea, suggesting that food was processed or prepared near the location where this pollen sample was taken. Pollen Sample 9, however, contains only 2 percent Cleome pollen, representing perhaps food processing or the ambient pollen with the room.

Pollen Sample 40 was taken from the contact with Surface 1 near the outside wall of a small storage bin in Room 6A, not far from Pollen Sample 9. The pollen content within this sample varies only slightly from that of Pollen Sample 9, and does have large frequencies of economic pollen types. Sample 40 includes one percent each Cleome, Onagraceae, Shepherdia, and Sphaeralcea pollen, indicating the possibility that some or all of these plants were processed in this area.

Pollen Sample 7 was taken within the small storage or mealing bin near Pollen Sample 40. The pollen assemblage in this sample is not unlike that noted in Pollen Sample 40. The desgination "mealing bin" for this feature implies a food-related use which is not substantiated by the pollen record. This sample contains only 2 percent Cleome pollen and no other economic pollen types.

Pollen Sample 44 was taken from the contact surface on the interior of a stone-lined bin in Room 3. Although the economic pollen frequencies are not large, there are numerous pollen types represented. The large frequencies of Cheno-am pollen in this sample indicate the possibility that Cheno-am might have been stored within this bin. Small amounts of Cleome, Portulaca, Sphaeralcea, and Zea are indicative of their presence

at this site if not their storage within this bin.

Pollen Sample 45 was taken from in front of a metate in situ on an associated working surfce from Room 7. The most outstanding feature of this sample is the very large frequency of high-spined Compositae pollen. It is possible that seeds from a high-spined Compositae, possibly sunflower, might have been ground on this metate and some of the remains spilled on the floor in front of the metate. Other pollen types within this sample are probably attributed to ambient or background pollen types.

Pollen Sample 8 was taken from Floor 2 in Pitstructure 2, while Pollen Sample 133 was taken from Floor 1 in Pitstructure 2. These samples are similar to one another in their pollen content and appear to contain primarily ambient or background pollen. Five to 6 percent Cleome pollen wsa noted in these samples, indicating the prsence of Cleome in this structure. No Zea pollen was noted in these samples.

Pollen Samples 500 and 501 were taken from a small Chapin mug. Sample 500 represents the mug fill, and Sample 501 represents the pollen wash taken after removal of the fill. The pollen assemblages in these 2 samples are very similar to one another. The mug fill contains 17 percent arboreal pollen, while the pollen wash contains 12 percent arboreal pollen. This difference is primarily in the content of Juniperus pollen. The non-arboreal pollen types are also represented by similar frequencies. The economic pollen frequencies happen to be identicial: 4 percent Cleome, one percent Umbelliferae, and one percent Zea in both of the samples. There appears to be no significant difference between the fill and the wash samples of this mug, suggesting that whatever the original contents of this mug, it did not leave behind a residue rich in pollen.

The pollen record at this site indicates that the prehistoric environment of this site was composed of Juniperus, Pinus, Quercus, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Sarcobatus, Cleome, Cruciferae, Lepidum, Ephedra nevadensis-type, Ephedra torreyana-type, Eriogonum, Graminae, Opuntia, Polygonum, Polygonum sawatchensis, Portulaca, Onagraceae, Rosaceae, Shepherdia, Sphaeralcea, Typha, and Umbelliferae. Zea pollen was the only cultigen noted in the pollen record and Cleome was noted as a minimum of at least one perent in each sample. Only Sample 37 from Room 6B contained a large frequency of Cleome pollen. Ths sample also contained evidence of Typha, Umbelliferae, and Zea pollen indicating that the area was probably used for food processing.

All pollen samples from the roomblock at Site 5MT4475 contain at least some evidence of economic pollen. There is pollen evidence in these samples for the presence and/or utilization of the following plants which have been noted in the ethonographic literature to have economic significance: short-spined Compositae, Cheno-ams, Cleome, Ephedra, Portulaca, Shepherdia, Sphaeralcea, Typha, Umbelliferae, and Zea. The only areas which were noted to have concentrations of economic pollen were Sample 37 from Room 6B, and Sample 45 from the open end of the metate in Room 9. The samples from Pitstructure 2 and the vessel were also noted to contain economic pollen, primarily Cleome.

APPENDIX

POLLEN REPORT FOR SITE 5MT2235

SITE 5MT2235

Marsh View Hamlet (Site 5MT2235) is located on a low knoll north of the Sagehen FLats Marsh near Site 5MT2191 and Site 5MT4515. This site consists of a domestic pitstructure, a large cist and associated surface features, and hearth and use surface in the upper fill of the kiva. This site appears to have been used as a small hamlet during the sundial Phase from AD 1050-1100, and probably was occupied by one household group. The hearth and use area noted in the upper fill of the kiva probably were associted with a seasonal or camp use by members of a single household unit from AD 1100-1200. The residents probably exploited the wild resources in the vicinity of the marsh, as well as participated in limited horiticultural (Kane 1979:30), [A. Kane, personal communication, December 1979].

All pollen samples from this site were taken from Pitstructure 1 (Table 1). Two floors, Floor 2, in use at the time of abandonment, and Floor 1 an earlier floor which had been plastered over, were located within the pitstructure. Pollen sample 15 represents the uppermost sample, 0-10 cm below the present ground surface, from the stratigraphic column taken in this pitstructure. This sample was chosen for analysis because it was though that it would most likely yield information concerning the modern environment at the site. The extremely large frequency of Artemisia pollen within this sample is not consistent with the modern surface sample taken at Site 5TM4512, only a short distance away. This large frequency of Artemisia pollen from Site 5TM2235 may be due to the presence of sagebrush in the immediate vicinity of where the sample was taken from.

Table 1. Provenience of pollen samples from Site 5MT2235.

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
15	178	PS 1	0-10 cm below pgs, upper sample from strat column
35	185	PS 1	Floor 2, Floor contact, NE quarter, no pollen
36	185	PS 1	Floor 2, Floor contact, NE quarter
37	187	PS 1	Floor 2, top area of hearth in ash fill
39	188	PS 1	Floor 2, bottom of Feature 12, a shallow circular depression, possible pot stand
41	189	PS 1	Floor 2, upper fill of Feature 13, a cist
42	189	PS 1	Foor 2, base of Feature 13, a cist
44	185	PS 1	Floor 2, beneath mano fragment, SW quarter
47	198	PS 1	Floor 2, scatter sample, floor contact, SW quarter
49	199	PS 1	Floor 2, scatter sample, floor plaster, SE quarter
56	203	PS 1	Floor 2, near base of Feature 20, sipapu
58	205	PS 1	Floor 1, near base of Feature 22, a possible rodent hole, NW quarter
59	206	PS 1	Floor 1, near base of fill, Feature 23, a cist, NW quarter
60	207	PS 1	Floor 1, near base of fill of cist, Feature 24, SW quarter of floor
63	184	PS 1	Layer 1, fill in the bottom of a duck effigy vessel
65	184	PS 1	Layer 3a, duck effigy vessel

Table 1. (cont.)

POLLEN SAMPLE #	FS #	PITSTRUCTURE/ SURFACE STRUCTURE #	PROVENIENCE AND COMMENTS
66	184	PS 1	Layer 3b, duck effigy vessel
67	184	PS 1	Layer 3c, duck effigy vessel

The archaeological pollen samples from Floor 2 in Pitstructure 1 were taken from a variety of localities. Samples 35 and 36 were taken in the center of the northeast quadrant of the floor. Sample 35 did not yield sufficient pollen for analysis, whereas Sample 36 contains abundant pollen. The pollen exhibited in Sample 36 most closely resembles the modern sample from Site 5MT4512 than does any other of archaeological samples from Marsh View Hamlet. This pollen sample appears to contain primarily background pollen types, eventhough a small amount of Cleome pollen was observed in the sample and the Juniperus frequency is higher than in other samples from this site.

Sample 49 is scatter sample taken from the southeast quadrant from the floor plaster and Sample 47 is another scatter sample from the southwest quadrant of the pitstructure. These 2 samples from the floor contain very similar pollen to one another. The primary differences are?? that the Sample 47 or 49 contains Cleome, Shepherdia, and Umbelliferae ??? pollen, which is noted in the 47 or 49.?? Most of the pollen in these 2 samples represent ambient pollen types present in the pitstructure.

The 3 samples taken from Floor 2 of this pitstructure contain fairly similar frequencies of arboreal pollen. Sample 36 had the largest frequency of arboreal pollen while Sample 49 contains the largest frequency of Cheno-am pollen. Cleome pollen was noted in both the northeast and southwest quadrants of this pitstructure. No Zea pollen was noted in any of these pollen samples.

Pollen Sample 4 was taken from beneath a mano fragment in the southwest quadrant of Floor 2 in Pitstructure 1. Five percent Cleome and one percent Zea represent the only economic pollen noted in this sample. Sample 44 was compared to Sample 47, the scatter sample from the southwest

quadrant near the mano. The mano sample contains more Cheno-am pollen and slightly more Cleome pollen than does the scatter sample. The mano also contains Zea pollen, which was not noted in the scatter sample. It is possible that Zea, Cleome. and/or Cheno-ams were ground with this mano.

Pollen Sample 39 was taken from the bottom of Feature 12, a shallow circular depression (perhaps a pot stand), on Floor 2 of Pitstructure 1. the pollen in this sample is very similar to that observd in Sample 44; the only significant difference noted was the presence of one percent Zea pollen in Sample 39.

Pollen Samples 41 and 42 were taken from the upper fill and, respectively, the base of Feature 13, a cist, in the northwest quadrant of Floor 2 in Pitstructure 1. The difference in pollen frequencies noted in these 2 samples is that Sample 41 contains more arboreal pollen,while Sample 42 contains 5 percent Graminae pollen and one percent Portulaca pollen which do not occur in the upper fill. One percent Zea pollen was noted in both samples. It is possible that Graminae and Portulaca were stored in this cist.

Pollen Sample 56 was taken from near the base of Feature 20, the sipapu. This sample contains similar pollen to that from Sample 42 at the base of the cist, with the exception that no Portulaca pollen was noted in the sipapu. There is no evidence that pollen was intentionally placed in the sipapu. All pollen present in this sample can be accounted for as ambient pollen within the pitstructure.

Pollen Sample 37 represents the top of the ash fill in the hearth. This sample appears to contain primarily ambient pollen. The Cheno-am pollen frequency is rather high for this pitstructure, and one percent Cleome and one percent Zea pollen were also noted. There is no definite

evidence for the cooking or preparation of specific foods in or near the hearth; however, these low frequencies of economic pollen and slightly increased Cheno-am pollen might be ambient pollen from the pitstructure.

Pollen sample 58 was taken from near the base of the fill in Feature 22. This feature might be a rodent hole, so all pollen in this sample is considered ambient pollen from this pitstructure. The pollen frequencies in this sample are similar to many of the samples from this structure, and no large quantities of economic pollen were noted in the sample.

Pollen Sample 59 was taken from near the base of Feature 22, a cist, in the northwest quadrant of Floor 1 of Pitstructure 1. The pollen content of this sample is similar to other samples from this pitstructure, although it has a slightly higher frequency of Artemisia pollen and a lower quantity of cheno-am pollen. Both Cleome and Zea were represented as one percent of the total pollen. The probable contents of this cist cannot be speculated upon the basis of the pollen record.

Pollen Sample 60 was taken from near the base of the fill in Feature 24, a cist, in the southwest quadrant of Floor 1 of Pitstructure 1. This pollen sample contains a large frequency of Cleome pollen (19 percent). No other economic pollen types were observed and the remaining pollen in the sample is similar to other samples from this pitstructure. The large quantity of Cleome pollen indicates that this cist was probably used to store Cleome.

The pollen record from Site 5MT2235 indicates that the prehistoric environment near Marsh View Hamlet included the following vegetation types: Alnus, Juniperus, Pinus, Quercus, short-spined Compositae, Artemisia, high-spined Compositae, Cheno-ams, Sarcobatus, Cleome, Collomia, Cruciferae, Ephedra nevadensis-type, Ephedra torreyana-type,

Eriogonum, Graminae, Polygonum sawatchensis, Portulaca, Rosaceae, Sphaeralcea, Shepherdia, and Umbelliferae. Zea was the only cultigen noted in the pollen record. Cleome pollen was noted in all samples with the exception of Sample 36 from the northeast quadrant of the pit-structure. Zea pollen did not occur in any of the general floor samples, or Sample 56, but did occur in all other pollen samples from this pitstructure.

Pollen Sample 15, taken from 0-10 cm below the present ground surface, contains a very large quantity of Artemisia pollen when compared to the rest of the samples from this site, and it is considered aberrant. The proximity of this site to Sage Flats Marsh, however, is not readily apparent from the pollen record. There is a consistency in the pollen record in this pitstructure that makes interpretation of individual features very difficult. Sample 10 is the only sample that contains a large amount of economic pollen. This sample contains a large frequency of Cleome pollen, which probably indicates the storage of Cleome in this cist.

Four samples from a duck effigy vessel were also examined for their pollen contents. The fill of this vessel was composed of several distinct layers. Pollen Sample 63 represents Layer 1, the fill in the bottom of the vessel consisting of an irregular layer of ash. Layer 2 in the vessel consists of fine reddish sand, this layer was noted to have pollen, but a full analysis was not completed on the sample. Layer 3 is composed of approximately 8 distinct lamella (W. Litzinger, personal communication). Samples 65, 66, and 67 represent Layers 3a, 3b, and 3c, from bottom to top respectively. Layer 4 consists of a coarse reddish sand and was noted to contain pollen, although a complete pollen analysis was not done. Zea

pollen was noted only in Layer 1. Cleome pollen was noted in all samples analyzed, and it increased in frequency in the upper layers form this vessel. With the possible exception of the ash in the bottom of the vessel, the distinct layers in this vessel probably represent the accumulation of soil in the vessel following individual rainstorms. The arboreal pollen frequency in these samples varies slightly. Sample 63 contains 14 percent arboreal pollen, which increases to 20 percent in Layer 3a. The arboreal pollen then declined to 16 percent in Layer 3b and 12 percent in Layer 3c. Similar fluctuations were observed in the non-arboreal pollen frequencies. These pollen samples are probably comprised primarily of pollen which was present in the soil at the time it was deposited in this vessel. These samples contain slightly less arboreal pollen and more Cheno-am pollen than most of the other samples from this site. These fluctuations may be due to subtle changes in the local environment or to variations in the amount of pollen present in the soil based on the time of year that the layers were deposited in the vessel.