APACHE-SITGREAVES PALYNOLOGY

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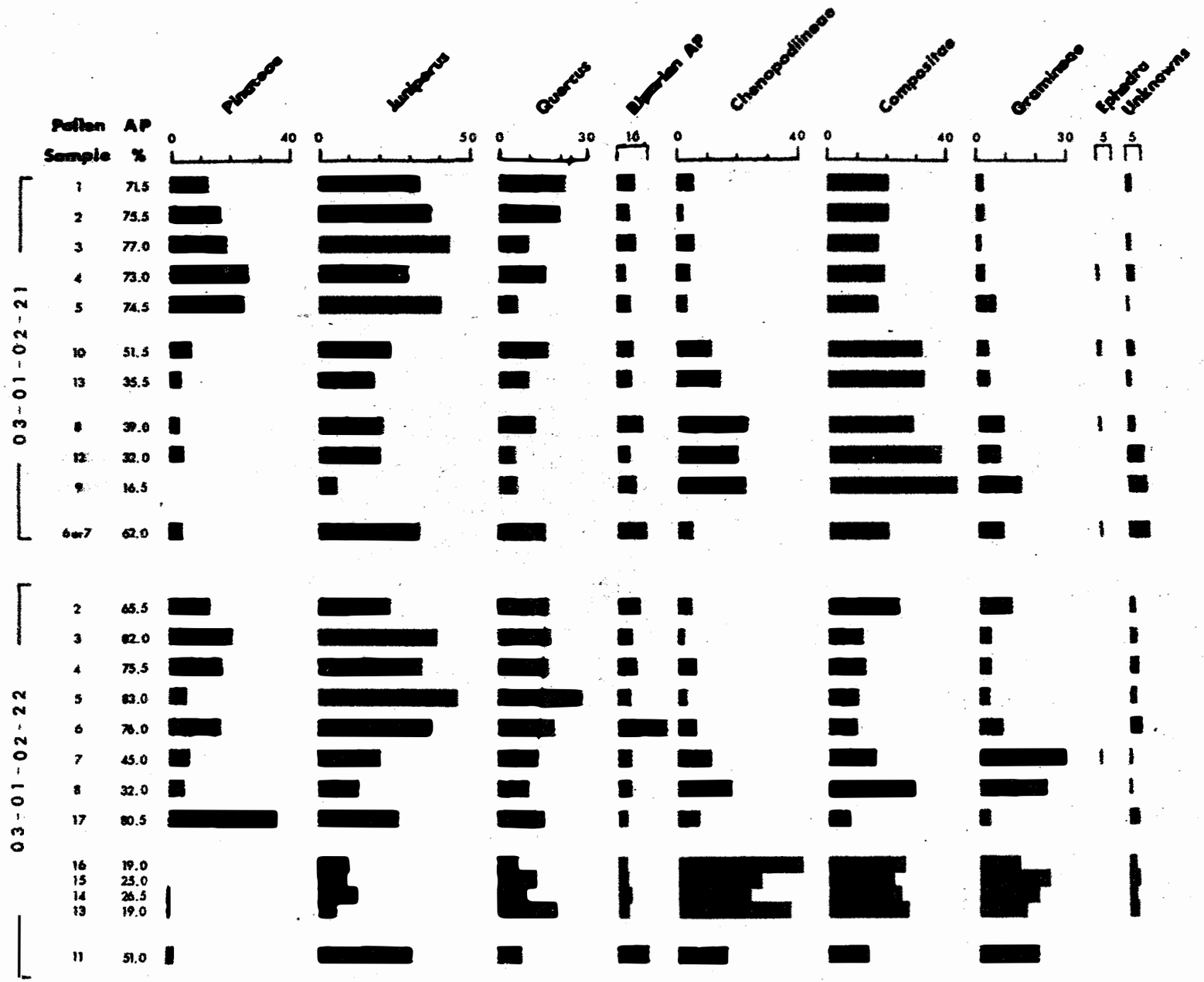
Pollen Sample
AP %
Pinaceae
Juniperus
Quercus
Ulmaceae AP
Chenopodiineae
Compositae
Gramineae
Ephedra
Unknowns
0 40
0 50
0 30
16
0 40
0 40
0 30
5 5
03-01-02-21
1 71.5
2 75.5
3 77.0
4 73.0
5 74.5
10 51.5
13 35.5
8 39.0
12 32.0
9 16.5
6or7 62.0
03-01-02-22
2 65.5
3 82.0
4 75.5
5 83.0
6 76.0
7 45.0
8 32.0
17 80.5
16 19.0
15 25.0
14 26.5
13 19.0
11 51.0

Introduction

In the period of late August through mid-October, 1975, archaeological investigations were undertaken in the Black River Ranger District area of the Apache-Sitgreaves Forest in conjunction with the Blue River Road and the Red Hill Road projects. Sediment samples were collected for pollen analysis as a normal routine of the archaeological work. This report deals with the pollen work undertaken for that purpose. It should be recognized that at present much of palynological research is experimental, and the pollen analysis of archaeological context deposits is viewed as innovative study. It is thus not surprising that the results of this report are neither particularly concrete nor particularly informative. Such effects are only to be gained through continuous effort of the sort described here, and comparative analysis.

The pollen analysis of sediment samples recovered from sites 03-01-02-21 and 03-01-02-22 was initiated in February of 1976. The standard extraction procedures utilized by this laboratory for terrestrial deposits (Schoenwetter 1975:2-4) was applied to both the 15 surface samples and the 15 sub-surface samples submitted. This produced an excess of 200 pollen grains per ml of extract in the case of 13 of the surface and 8 of the fossil samples and about 100 grains per ml of extract in the case of 3 of the fossil samples. Two of the surface samples from 03-01-02-22 yielded extracts of less than 50 pollen grains/ml, as did two of the fossil samples from that locus. Two of the fossil samples from 03-01-02-22 also produced low-yield extracts. The six samples producing low pollen yields were not analyzed, on the grounds of intrinsic lack of comperability with the other records.

All pollen extractions and pollen counts were obtained by the junior author. For purposes of record, a table of pollen observations is appended to this report, but the interpretive conclusions are supported wholly by the results expressed in the form of the pollen diagram. In that diagram all the pollen of the pine family (Pinaceae) has been considered as a unit. The separate generic-morphological diagnoses of the pollen grains involved (*Abies*, *Picea*, *Pinus edulis*-type and *P. ponderosa*-type) are recorded on the table but the observer suggests that those identifications should be recognized as tentative. Pollen of *Alnus*, *Juglans*, *Prosopis* and *Populus* has been lumped on the diagram as "Riparian AP". All the morphological varieties of Compositae pollen have also been grouped on the diagram. The *Ephedra* pollen observed is the type associated with *E. trifurca* and *E. torreyana* rather than that associated with *E. nevadensis* and *E. viridis* (see Martin 1963:51).

Site 03-01002-21: Results

Four surface pollen samples were collected from an eliptical area centered ca. 15 feet due east of Room 1 which has a long axis of 40 and a wide axis of 20 feet (Samples 1-4). Statistically significant variation occurs among the pollen records of this small area in regard to Pinaceae and *Quercus* values, but the total arboreal pollen (AP) frequency of all samples is comperable. A fifth

surface pollen sample was collected from the riparian vegetation zone situated downslope of the site. This sample does not produce significantly distinctive values of total AP or riparian AP, but it contains less oak pollen and a slightly larger quantity of grass pollen.

The fossil pollen records derive from three distinctive proveniences. Samples 10 and 13 were collected from the base of the sheet midden deposits south of Unit 1. The pollen record of the former is significantly different from that of the latter in regard to total AP frequency. The interpretation that the two samples derive from different temporal horizons may be suggested, but cannot be conclusively demonstrated. Sample 13 was associated with vessel fragments Tularosa fillet rim type of pottery. The pottery associated with sample 10 has not yet been analyzed.

Three samples derive from the architectual feature (Room 1) and are ostensibly dated to the horizon of occupancy. Samples 8 and 12 which were collected in association with a corrugated vessel lying on the floor and with the floor itself, respectively, are palynologically similar to each other and to sample 13 but not similar to sample 10. Sample 9, collected from the ash which filled the slab lined hearth feature in Room 1, contains a pollen record completely unlike any other specimen which might be dated to the time of occupancy. Two other samples from Room 1 were submitted with identical labels. It is apparent that the one which yielded data is either that collected at the Unit 3 locus at 20 cm depth or it is the one collected at 40 cm (approximate floor level). It's pollen record is more similar to those of the surface samples than the other fossil records, but the significance of this fact remains undeterminable because provenience data is inadequate.

Site 03-01-02-22: Results

Seven of the eight productive surface samples collected at this locality were recovered from the center line of the proposed
the site area; sample 8 was collected in the center area of the arc, near the room block evident at the site. Samples 7 and 8, which were the most east, have significantly lower AP values and provide pollen records surprisingly similar to those of the fossil samples. Sample 2, from the western portion of the site, contains more Compositae pollen than the "normal" surface samples of this location. Sample 5 contains very much less Pinaceae pollen than "normal" but does not have a significantly reduced total AP value because of relative increases in juniper and oak pollen.

The contrast between modern and subsurface pollen records at this site is dramatically demonstrated in the AP frequency distinction between sample 17 and samples 16-13. Sample 17 was collected on the surface of Feature 14, the test pit located between the points where surface samples 3 and 4 were collected. Samples 16-13 were collected from the pit house fill deposits at successive 10 cm intervals. The fossil records contain far more Chenopodiineae pollen than any surface sample, more Compositae and Gramineae pollen than is "normal", and far less AP of most types. The record of sample 11 is distinct from those of the normal surface samples and those from Feature 14, but is quite comparable the records of samples 7 and 8.

All of the subsurface records derive from undatable proveniences. Sample 11 is of pit fill, and samples 13-16 are of pit house fill an unknown distance the pithouse floor. They have no necessary relationship to each other or to the fossil records from 03-01-02-21.

Interpretations

Detailed information on the nature and ecological character of the local flora which ostensibly produced these pollen rains does not exist. Consideration of all the available surface data, however, does provide basis for recognition of two interesing situations. First, in the situation in which the samples are collected from an area involving only a few tens of square meters, at 03-01-02-21, significant variability only occurs in the pollen rain of individual arboreal taxa. But in the situation in which the sampled area is measured in hundreds of square meters significant variability is observed in AP/NAP ratios and all pollen taxa which occur in significant frequencies. Second, there appears no evident relationship between the proximity of the riparian vegetation zone and the frequency of pollen which ostensibly derives from the plants adapted to the zone. In light of the variability displayed by Pinaceae, Quercus and Juniperus frequencies, this characterization probably applies to the general relationship between taxon pollen frequencies and vegetation zone in such a forested area.

It has been noted that the surface samples from 02-01-02-22 fall into a "normal" category with more AP and an "abnormal" category with more NAP. Interestingly, the pollen spectra of the latter type are quite similar to that of subsurface sample 11. The antiquity of sample 11 is not exactly known, but it must derive from a time at least greater than five centuries. Also, it was collected in the area from which surface samples 3, 4 and 17 were gathered and those provide pollen records quite unlike the record from sample 11. These facts support and are consistant with the interpretation that "abnormal" group of surface samples from 03-01-02-22 are not, in fact, samples of modern pollen rain at all. Rather, sediment containing only (or principally) fossil pollen rain was inadvertantly collected because it lay at or near the present soil surface. The topographic map of the site documents that surface samples 7 and 8 were collected in an area of steep slope and sample 2 was collected at a point of drainage. Erosion could be the cause of the disparity between the pollen records of those samples and the other samples. In this report, we adopt the position that only the surface samples from 03-01-02-21 and samples 3, 4, 5, 6 and 17 from 03-01-02-22 constitute true (i.e. "normal") surface samples.

The variability in the record of individual arboreal taxa is not matched in the true surface samples by significant variation in total AP frequency. This would tend to indicate that the total AP value is ecologically significant as a characterizing variable, but the individual pollen record of arboreal taxa are not. Following this line of reasoning, one may conclude that the fossil pollen records observed reflect four distinctive paleoecological patterns. Two patterns are evident at 03-01-02-22: (A) the pattern represented by the samples from Unit 14, and (B) the pattern represented in sample 11. Three patterns are evident at 03-01-02-21: (A) the pattern evidenced in sample 9, which is identical to that reflected at Feature 14 on the other site; (B) the pattern evidenced in samples 10 and "6 or 7", which is identical that reflected in sample 11 at the other site; and (C) the pattern evidenced in samples 13, 8 and 12, which is unique to the record of 02-01-02-21. Each of these patterns must be recognized as identifying a different temporal horizon, though it is possible that two samples belonging to the same pattern derive from different temporal horizons of similar paleoecology.

Samples 8, 12 and 9 from 03-01-02-21 come from the same room but indicate two different periods of time. One could conclude from this that the pollen rain

Sampled in the hearth ash derived from a different period than that attributed to the floor. However, hearth ash is a highly specialized depositional environment and this could have affected the contained pollen record. It seems judicious to reject the conclusion as inadequately evidenced. The similarity in pollen record record indicates that the portion of the midden from which sample 13 derives was deposited at the same time as the room was used. Conversely, it seems likely that the portion of the midden from which sample 10 derives was deposited at a different time, which could also be the horizon of deposition of sample "6 or 7". If it is determined that ceramic evidence justifies the conclusion that sample 10 is earlier than 13, it also seems likely that the pollen record lacking good provienience is that from the 40 cm depth and represents a horizon prior to occupation of the room. On the other hand if ceramic evidence indicates that sample 13 is earlier than 10, the sample lackin provenience is more likely to have been recovered from the 20 cm level at Unit A.

Though the AP values are similar, the fossil pollen records from 03-01-02-22 do not conform to those of 03-01-02-21. In the former, the frequency of Chenopodiineae and Gramineae pollen tends to be meaningfully higher. It thus seems unlikely that the samples from Feature 14 at 03-01-02-22 relate to the same temporal horizon as that represented by sample 9 from 03-01-02-21, or that sample 11 from the former site reflects the same horizon as sample 10 from the later site.

The paleoecological meaning of these significant variations in AP frequency c not be clearly determined. It is intuitively obvious that they represent variations in the production and/or dispersal mechanisms of arboreal pollen, but a number of logical alternatives occur to explain this. Among them are: (A) the number of plants producing arboreal pollen has changed over time; (B) the number of flowers producing the pollen has changed but not the number of plants; (C) the number of pollen grains produced and dispersed from each flower has changed but the number of flowers or plants has not changed; (D) the amount of pollen produced has been unchanged but the amount dispersed has changed because of diesease or predators affecting the flower buds; (E) the number of arboreal pollen grains produced and dispersed has been unchanged but the number of grains dispersed at a time appropriate for incorporation into sediments has changed. (E) could occur, for example, if AP (released in Spring) normally fell onto the surface of snow rather than the soil surface. While change in climatic parameters could effect any of these alternatives, climatic change need not be the responsible agent for any of them.

Though the available data are only suggestive, I believe there may be some ecological significance to the fact that Compositae values in the surface samples of 03-01-02-21 are regularly greater than those in the samples from 03-01-02-22. The fossil records of the latter site, alternatively, show higher values of Gramineae and Chenopodiineae pollen. When more samples become available, and greater attention is paid to the floristic character of the sampling location, I believe it will be demonstrable that NAP is a more sensitive index of ecology than AP.

REFERENCES CITED

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	Sample #	Pinus 1/3	Picea	Abies	Pinus cf. edulis	P. cf. ponderosa	Juniperus	Quercus	Juglans	Prosopis	Populus	Alnus	Chenopodiineae	Lo-spine Comp (Ambrosieae)	Hi-spine Comp (Tubuli-florae)	Artemesia	Gramineae	Ephedra cf. Torryana	Malvaceae	Tribulus	Liliaceae cf. Yucca	Unknown	TOTAL
03-01-02-21	1		6	1	13	3	66	43	9	2			10	23	12	5	4					3	200
	2		16	1	12	4	74	40	2	2			4	17	14	9	5						200
	3	2	6	2	22	6	86	19	11			1	9	6	26	1	3					2	201
	4		15		35	2	59	30	4			1	7	18	13	6	5	1				4	200
	5	1	9	1	33	6	80	12	8				5	21	8	3	13					1	200
	10		4	1	9		47	32	5	5			22	21	20	21	7	2				4	200
	13				6	1	36	19	9				28	11	39	13	36					2	200
	8				6		41	23	5	2		1	45	11	37	7	17	1				4	200
	12				4		20	5	3				19	17	17	3	7					5	100
	9						11	11	7	4			43	25	50	9	28					12	200
	6 or 7		1		3		34	15	5	2	1		4	7	9	3	8	1				6	100
03-01-02-22	2		3	2	15	7	47	33	13	1			8	15	17	14	21					3	199
	3				40	2	78	35	8			1	3	1	16	5	7					4	200
	4			1	31	3	68	34	14				11	10	11	3	7		1			6	200
	5				9	2	92	55	6	2			5	5	10	4	6					4	200
	6	5	14	6	12		65	37	14		1	1	11	4	9	4	15			1		7	203
	7	2	1	1	8	3	41	27	5			3	21	9	17	5	57	1				1	201
	8	1	3		5	2	26	20	4	2		2	35	16	37	4	42				1	1	200
	17		22	2	41	7	53	31	5				14	9	2	2	6					6	200
	16						20	13		1			82	5	37	8	26					4	200
	15						18	26	4			2	54	17	14	16	47					7	200
	14				1		26	18	7	1			47	16	30	11	39					4	200
	13				1		12	19	3			3	74	13	27	12	31					5	200
	11				1	1	31	8	8	2			16	2	4	7	20						100