PIONEER MEMORIAL PARK PALYNOLOGY

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PROJECT HISTORY

The November, 1991, issue of Petroglyph, the newsletter of the Arizona Archaeological Society, noted the fact that the material remains excavated from the Pioneer and Military Memorial Park were being made available to qualified students and professionals for archaeological analysis. I contacted Mr. K.J. Schroeder, the project director, regarding study of a suite of the sediment samples that had been collected at the site for palynological research. We agreed at that time that a number of samples might be analyzed as a classroom project by students registered for the course ASM 435: Archaeological Pollen Analysis, which was scheduled to be taught during the Spring Semester, 1992. At that point it was reasonable to assume that at least 12 or 16 analyses would be performed, and this was assessed as satisfactory for a pilot study. At a minimum, the data recovered would adequately allow estimation of the productivity of pollen samples collected at the site, and would suggest the character of any major distinctions in pollen records attributable to the three occupation horizons.

Early in January, 1992, Schroeder prepared and sent me an inventory of the pollen samples that had been collected during the excavations conducted between October 1980 and May 1991, organized by specimen number, archaeological provenience and depositional type (e.g. trash, floor, pitfill). Subsequent discussions clarified the occupational horizons to which each sample might be relegated. He also provided a copy of the second preliminary report prepared for the site (Schroeder 1991). Later that month the entire inventory of pollen samples was released to the Palynological Laboratory of the Department of Anthropology at Arizona State University by the curator of collections at the Pueblo Grande Museum. On January 29, 1992, I visited the part of the site then being excavated to obtain field impressions of the contexts from which the pollen samples had been collected. Schroeder and I also used the occasion of my presence to collect a pollen sample sequence from Trench 18.

Ultimately, five undergraduate and one graduate students enrolled in the ASU course. The six students extracted pollen from 12 surface samples, 4 Historic Horizon samples, 3 Colonial Period samples and 5 Pioneer Period samples. The graduate student undertook extraction of an additional 8 Colonial Period samples. Pollen counts were obtained for the 12 surface samples, 3 Historic Horizon samples, 5 Colonial Period samples and 5 Pioneer Period samples. Because each student was required to produce two surface sample pollen counts and one count for each of the occupation horizons, some of the site-context samples were counted independently by more than one observer. Each of the 3 Historic Horizon samples was independently observed by two students, and sample #3001 and #3507 of the Colonial and Pioneer Periods, respectively, were each observed by two students.

The data collection phase of the pollen study proceeded in a fairly standard and straightforward manner. Once the students had become familiar with a variety of different pollen types, each was required to observe, identify and record 35 pollen grains from each of four samples. Since each student examined a different suite of grains, the result was an analysis of approximately 210 pollen grains from one of the samples of each of the four temporal horizons. These data were integrated, and the students were asked to assess them vis-a-vis textbook discussions of the sorts of information that are recognized to bias palynological data base interpretations. This exercise demonstrated forcefully a high probability that the site-context samples contained sufficiently high frequencies of cheno-am pollen that statistical assessment of the frequencies of other pollen types would be mathematically constrained if "standard" 200-grain pollen counts were the sole product of the analyses. Accordingly, the goal of analysis for each sample was set at a sum of 150 pollen grains of all types exclusive of cheno-am pollen plus the record of the number of cheno-am pollen grains observed at the time that goal was achieved. As Pearsall notes (1989:280), pollen sums of 150 - 200 grains have long been recognized as providing a statistically adequate record if fewer than 20 pollen taxa are commonly observed in a sample. 200-grain counts exclusive of cheno-am pollen would have improved the statistical quality of the analyses by a significant value, but the increased amount of time required to make the difference between 150 and 200-grain pollen sums was not logistically tolerable.

RESULTS: THE OBSERVED POLLEN RECORD

As a general rule, the ratio of poorly-preserved pollen to well-preserved pollen grains tends to increase in archaeological site-context samples as their antiquity increases because, normally, the pollen of older samples has had more opportunity to suffer the degrading affects of mechanical damage, exposure to corrosive agents and infection by microherbivores. Though this rule is broken sufficiently often that the likelihood of successful analysis can rarely be predicted for any given suite of samples, it is consistent enough to create difficulties for students who are yet unaccustomed to observing and identifying pollen grains. Students are therefore commonly introduced to the problems of analyzing samples that have been deposited more recently before progressing to samples of ever-increasing antiquity.

Because students who enroll in ASM 435 at ASU are not expected to have any prior experience in the extraction, identification or analysis of the pollen contained in sediment samples, they undertake the observation and analysis of the pollen of surface samples prior to that of the fossil pollen of archaeological site-context samples. Clearly, however, the analyses (so-called "pollen counts") generated by students with limited experience at observing/ identifying pollen are more suspect than those generated by more experienced workers, and their surface sample analyses are more suspect than their fossil sample analyses. The effect of the experience factor is mediated by the availability of an experienced palynologist-instructor who will independently observe/identify anything seen through the microscope upon student request. The degree to which students need, employ, or rely upon outside expertise in identification is highly individualized, however. Some students are overly confident of their ability to properly

SURFACE SAMPLE ASU SITE NUMBER	U:9:area	U:9:25	U:9:28	U:1:2	U:1:46	U:1:47	U:1:48	U:1:49	U:10:9	U:10:10	T:8:52	T:8:63
OBSERVER	TG	MB	MB	MB	MS	MB	TP	MB	MS	TG	TP	ME
ORIG SAMPLE CC's	75	90	75	75	100	100	100	100	100	106	100	100
EXOTIC SPORES	7	5	3	3	5	1	3	4	9	2	1	4
OLLEN CONC./CC	15,073	19,688	45,173	28,233	13,794	57,717	18,271	14,248	7,865	31,561	63,888	19,602
Pinus	32	31	10	10	7	9	2	3	18	11	2	19
Juoiperus				2				1				
Quercus	9	10			7		1		6	12	10	22
Salix								1				
Populus								1				
Alnus			1									
Juglans		9									4	
Celtis			3			4						3
Prosopis	3				2		1			3	2	
Olneya												
Cercidium	8											
Ulmus			4								1	
Carya	7											
Larrea											11	1
Agave												
Yucca				1								
Acacia								1				
N&T Ephedra		4	3	18	4		3	4	5		2	5
Fouqueria					1		3		3		5	
Pericolp. Cact.							1					
Cereus-type		15			4	2					4	
Platyopuntia		2										
Cylindropuntia												
Cheno-am	67	99	129	21	44	2	3	17	48	23	20	66
Low Spined Comp.	56	55	25	86	86	106	115	106	95	77	53	67
High Spined Comp.	22	19	3	13	22	8	4	15	13	29	11	7
Gramineae	8		90		7	18	4		7	15	24	20
Plsntage	5			1								
Artemisia												
Lilliacese												
llestroemia												
eguminesae-type												
Tidestromia			3			1						
Cruciferae			1									
Onagraceae												
Labitae								4				
Euphorbia												
Umbelliferae			4					5				
Eriogonum				1								
Erodium				22	2			6		4		1
Rumex											2	
Sphaeralcea											1	
Nyctaginacese									1			4
Zea												
Cucurbita												
Gossypium												
Unkn./Unident.	1		4	4	5	2	14	2	8		25	
TOTAL POLLEN OBS.	218	244	280	175	190	259	151	167	195	174	176	216
TOTAL BROKEN		3	8	13	6	5	11	10	9		13	3
Sroded			6	1		3	1	1				
Corroded			2					1				

Table 1: Surface Sample Pollen Records

AZ:T:5:12(PGM) SAMPLE NUMBER	5475	5475	5471	5471	1339	1339	3001	5024	2932	3018	5086	3001	4884	4880	4258	3507	3507	4539
OBSERVER	MD	ME	MB	TP	TG	MS	MB	MB	MS	MD	TP	TG	MD	MS	MB	ME	TP	TG
ORIG SAMPLE CC's	100	100	75	75	75	75	85	100	100	75	100	100	100	100	75	100	100	75
EXOTIC SPORES	14	22	7	5	9	8	6	18	20	76	6	83	30	37	15	25	10	64
POLLEN CONC./CC	9,127	6,732	31,045	41,430	23,016	13,613	15,374	6,917	4,410	2,270	2,420	1,347	3,352	2,561	13,068	8,168	2,299	
Pinus		6	10	5	3	1	1	1		2			1	1	28	8		6
Juniperus													2					
Quercus		7		8	6	8					10					6	3	5
Salix																		
Populus																		
Alnus			1															
Juglans	1										1							
Celtis	1						2								2			
Prosopis				1	3		1		2								2	
Olneya											3		1			1		
Cercidium	2			1			3					6					1	
Ulmus															2			
Carya							1				3		1		1		4	
Larrea							2			2								
Agave		13				2											1	
Yucca	1																	
Acacia			1															
N&T Ephedra					2		1	1	5	2	7							
Fouqueria	1			7										2			4	
Pericolp. Cact.								5										
Cereus-type	2									1								
Platyopuntia										4						2		
Cylindropuntia		22							3	26		11	11			14	16	9
Cheno-am	202	248	298	273	180	83	65	191	98	269	250	158	127	116	248	123	75	154
Low Spined Comp.	80	36	74	65	59	91	25	49	92	46	40	53	68	67	32	26	45	44
High Spined Comp.	52	20	15	23	53	28	3	25	18	41	28	30	47	56	7	29	19	27
Gramineae		1	46	12	16		85	35	11		17	31	1	3	77	16	23	13
Plantago	1						4			2	3					1	2	25
Artemisia															1			
Lilliaceae	3	4					4			1	1		1					5
Kallestroemia	2	2					1						2		3		1	
Leguminosae-type				1						2								
Tidestromia								6							4			
Cruciferae			3				14									1		
Onagraceae												2						8
Labitae													1					
Euphorbia						6			1					4				
Umbelliferae																		
Eriogonum																		
Erodium																		
Rumex																		
Sphaeralcea			1	7									1				1	
Nyctaginaceae		22			6			8	5	3		16		8		8	1	8
Zea		5					2	5					1			11		
Cucurbita							2					1				5	1	
Gossypium													1					
Unkn./Unident.	4	22		25		6		17	8	14	41		11	4		23	26	

Table 2: Fossil (Site-Context) Pollen Records

distinguish pollen from other materials that occur in the sample (e.g. spores and cell or tissue fragments), or to differentiate pollen types, so they misidentify some pollen consistently or count things which are not pollen at all in one or another category of pollen types. For other students, failure to employ outside expertise at an appropriate time creates one or more persistent patterns of misidentification. At the other extreme, some students develop too little confidence and so tend to recognize and record only that pollen in the sample that is best preserved, thus undercounting what is indeed there or overcounting the numbers of pollen fragments and/or unidentifiable pollen.

Table 1 records the pollen counts the students made of the surface samples and Table 2 records those made of the site-context (fossil) samples. The pollen concentration (pollen/cc volume) values presented on the tables were calculated for each count using Polypodium spores as an exotic marker according to the method established by Benninghoff (1962, also see discussions by Pearsall 1989:281-2 and Moore et. al. (1991:53-4). The numbers of broken, eroded and corroded pollen grains observed in the course of the pollen count also appear on Tables 1 and 2. Damaged pollen was incorporated into the counts in either the Unknowns/Unidentifiable or an identifiable pollen taxon category. The numbers of damaged pollen grains, then, are not independent of the number of counted pollen.

RESULTS: EVALUATION FACTORS

Prior to interpretation, the data of Tables 1 and 2 must be evaluated in two frames of reference. One frame seeks to recognize and eliminate errors imposed as a result of the lack of expertise of the students who generated that data. The other seeks to identify and reduce the interpretive affects of classically recognized data biases.

There are three sorts of information presented on Tables 1 and 2 that provide insight into the nature and occurrence of errors resulting from lack of experience. First, the record of broken pollen observed relative to the number of pollen grains relegated to the Unknowns/Unidentifiable category. When both are relatively high, they present evidence of either poor preservation or taxonomic confusion on the student's part. In either case, the data of that pollen count are suspect. Relative to all others, the two samples with these characteristics on Table 1 are those observed by student TP collected from the surfaces of AZ U:1:48 (ASU) and T:8:52 (ASU). The data provided to Table 2 by student TP is similarly patterned.

Second, a pattern of consistently higher or consistently lower record for a particular pollen type suggests that the observer is persistently misidentifying members of that taxon or persistently failing to recognize its occurrence. Relative to the others, student MB has consistently recorded more observations of Graminese pollen. Also, though MB contributed only 1/6th of the data records, his counts contain 1/3 of the unique pollen identifications in the set of observations.

Third, error is suggested by a pattern of divergence when the same sample is observed independently by two students. Since only three of the four Historic Horizon samples yielded sufficient pollen for analysis, each was observed independently by two students. The count provided by student ME for sample #5475 diverges radically from that provided by student MB and also from the other data records of Historic Horizon samples. Interestingly, 3 of the 5 pollen types recorded only by ME for this sample (Pinus, Agave, and Nyctaginaceae) are large pollen grains with heavily sculpted exines, and a fourth (Zea) is also unusually large. In combination with the observation of greater numbers of pollen grains placed in the Unknowns/Unidentifiable category, it seems likely that ME consistently identified large cell fragments, spores and other detritus occurring on the slide as pollen in this case. ME's misidentification pattern seems to have persisted through her analysis of sample she observed significantly more Pinus, Nyctaginaceae, Zea, and Cucurbita pollen than student TP, though both observed unusually large numbers of Cylindropuntia, Unknowns and broken grains. The pollen records for Historic Horizon sample #1339 by students MS and TG diverge in a number of ways, but it seems particularly significant that the one submitted by MS records no Gramineae pollen at all, significantly less of all the common pollen types observed in the other

Historic Period samples, more Unknowns, and multiple observations of both Euphorbia and Agave pollen. In the record submitted for sample #2932, MS's analysis contains a significantly lower value for cheno-am pollen and a significantly higher value for Low Spined Compositae pollen than is normal for samples of the Colonial Period. MS also was the only observer to recognize Euphorbia pollen.

My evaluation of the data base is that all data provided by students TP and MB is suspect and potentially unreliable, that provided by student ME is suspect for sample #5475 and #3507 and those provided by student MS for sample #1339 and #2932 are also suspect. These data are probably not entirely worthless, but they seem too likely biased by a lack of expertise to be accepted at face value as a basis for interpretation.

Even granting the observations and recording are flawless, pollen records are recognized as subject to biases induced by ecosystem conditions prevailing at the time the observed pollen was deposited, or subsequently. The classical literature of pollen analysis (e.g. Faegri and Iverson 1950, 1964) refers to four such biases as the "errors" induced by sample contamination, local overrepresentation, long-distance pollen transport and statistical sampling. Subsequent research has identified the potential for data biases resulting from differential pollen preservation (Havinga 1964) and pollen downwash transport (Dimbleby 1957).

One determines the occurrence of such biases by the existence of unexpected pollen taxa or pollen values. Once recognized, the influence of such biases upon interpretation may be reduced or eliminated through arithmetic manipulation of the data base. This is possible because interpretation of pollen records such as those of Tables 1 and 2 is based upon pollen frequency, rather than the presence or absence of particular pollen taxa or suites of pollen taxa, and the frequency of any palynological category is calculated in respect to a number (called the pollen sum) which is subject to arithmetic modification.

For example, let us imagine the objective of the analysis is to identify ecosystem conditions occurring at the sample locus at temporally segregate horizons. Though various amounts of pine, juniper and oak pollen might have been observed in different samples, recognition that none of these pollen types were ever produced by plants responding to the local ecosystem -- thus all represent long distance transport -- supports an argument that consideration of those pollen types is not relevant to the objective of the analysis. To the degree that they (singly or in combination) affect the frequency values of the pollen types contributed by local flora, they constrain appreciation of any statistically significant differences between those pollen types in samples from different horizons. One way to eliminate any potential bias (or "error") in the frequency values calculated for the pollen records would be to eliminate the numbers of pine, juniper and oak pollen grains from the sum used to calculate the pollen frequency values for the sample. This arithmetic manipulation of the data base is not wholly without affect, for it reduces the pollen sum and thus allows each frequency value a somewhat broader confidence interval. However, the statistical influence of these long distance transport pollen types would be reduced to zero.

From the example just presented, one can understand the logic behind the decision that was made to observe 150 pollen grains from each sample <u>exclusive</u> of the observation of cheno-am pollen. The class study of two surface and three fossil pollen samples suggested that cheno-am pollen was likely to account for 50-70 percent of the pollen observable in any given sample. There are only three forms of data an analysis may identify: the pollen concentration value, the variety of pollen taxa which exist in the sample, and the amount of pollen of each taxon. In order to compare samples, the amount of pollen of each taxon must be expressed in percentage terms rather than in absolute terms. If expressed in percentage terms, however, this datum is subject to statistical constraint. Since the total percentage value must equal 100, the occurrence of one pollen taxon at a very high percentage value will necessarily constrain the percentage values of all the other taxa to low values. Constraint of this sort is a bias imposed upon the data base as a consequence of statistical sampling. It can be eliminated by excluding the taxon which occurs in very high values from the pollen sum used to [illegible]. The percentage values of the non-excluded taxa can then be compared exclusive of the constraint, while the values of the ratio of the excluded taxa to the pollen sum can also be compared (Moiseman 1965). Since it was anticipated that most of the pollen taxa of the samples would occur at percentage values <5.0%, a pollen sum of 150 grains or more was necessary to identify which such taxa were observed at statistically significant frequencies and which were not.

There are other ways of manipulating the data base to reduce recognized biases, as well. For example, Plantago pollen has an unexpectedly high numerical value in sample #4539. Plantago pollen can be confused with cheno-am pollen when both are poorly preserved, and the low pollen concentration value for this sample argues for misidentification. But the pollen records submitted by student TG do not suggest a pattern of such misidentification is likely. On the other hand, Plantago plants are short, so disperse their pollen close to the ground surface, and the accidental inclusion of an abundance of Plantago pollen grains in a site-context depositional environment seems not too improbable in light of the autecology of the genus. Treating the unusually high pollen count for Plantago as a case of local over-representation would be justifiable, then, and would also function to reduce the significance of the observation if it were in actuality an identification error.

Though there are other alternatives, I would opt to reduce the significance of the erroneous observation by substituting for it the average value for Plantago observations in pollen records where Plantago occurs. In the fossil record, Plantago pollen occurs in seven samples (including sample #4539). Given a total of 38 observations, the average observation value for Plantago is 5.43. I would round that to an observation value of 5, and substitute the value 5 for the value 25 when calculating the pollen frequencies for sample #4539.

Other techniques for reducing data base biases include collapsing pollen taxonomic categories into artificial categories (e.g. All Riparian Plants, or Economic Plants), and pooling the data of a suite of comparable samples into one larger sample. Both act to normalize, and thus reduce extreme, data values.

ANALYSIS: PALEOENVIRONMENTAL RECONSTRUCTION

Traditionally, pollen analyses are undertaken for the purpose of reconstructing broadly-scaled vegetation patterns such as plant biomes or plant communities. An appropriate form of analysis to effect that objective would determine whether or not the variability expressed by surface pollen samples representing low elevation, near-streamside Sonoran Desert pollen rain was significantly different from the variability expressed by the set of fossil pollen records or the subset representing any particular horizon of time. Granting the assumption that the site-context proveniences of the fossil records would expectably result in biases which were functions of behavioral patterns, it would be judicious to modify the data base to remove those pollen types one could argue were very probably introduced because of human/plant interactions which were not functions of biome or plant community ecology. For example, the pollen records for domesticated plants (Zea, Cucurbita, Gossypium); those of taxa which are known to be overrepresented (Fish 1983) in samples that represent pollen rains of the surfaces of prehistoric irrigated fields (Sphaeralcea, Nyctaginaceae); and those taxa ethnographic analogy suggests are likely to represent use of wild plant food harvests (Cylindropuntia). Also, to remove pollen types which represent plants introduced to the Sonoran Desert as cultivars or escapes during the past few centuries (Carya, Ulmus, Erodium, Rumex). Also, to consider removal of cheno-am pollen records.

Most palynologists concerned with Hohokam site-context pollen records consider cheno-am pollen frequencies as probable indices of habitat disturbance in archaeological context pollen records. Cantly (1987) examined the problem most recently, using pollen recovered from the floors of houses dated through archaeomagnetic analyses and ceramic assemblages at La Ciudad. He identifies a statistically significant correlation between site population size and cheno-am values: episodes of site population increase (measured by pithouse number) were accompanied by significant increase in cheno-am pollen and episodes of site population decrease were accompanied by significant decreases in cheno-am pollen.

SAMPLE	U:9 area	U:9:26	U:1:2	U:1:46	U:1:49	U:10:9	U:10:10	T:8:63	5475	1339	5024	3018	3001	4884	4880	4539
Pollen Concentration	15,073	19,683	28,233	13,794	14,248	7,865	31,581	19,602	9,127	23,016	6,917	2,270	1,373	3,352	2,561	2,299
High Elevation Trees	28.5	30.1	9.5	9.7	2.8	14.4	15.6	27.5		6.3	0.7	1.7		2.2	0.7	9.7
Riparian Trees		6.6			1.4				0.7			0.9				
Desert Wash Trees	2.1			1.4			2	2	0.7	2.1		2.6		0.7		
Desert Shrubs	5.6	8.8	4	6.3	3.5	5.5		4	4	1.4	4.3	7.8	4.9	0.7	1.5	
Low-Spined Compositae	38.9	40.4	68.3	59.7	73.6	65.1	52.4	45	53.3	41.5	35.3	40	43.4	50	54.9	38.9
High-Spined Compositae	15.3	14	10.3	14.6	10.4	8.9	19.7	4.7	34.7	37.3	18	35.7	24.6	34.6	40.9	23.9
Grasses	5.6			4.9		4.8	10.2	13.4		11.3	25.2		25.4	0.7	2.2	11.5
Spring Annuals	3.6		4		0.7			1.3	2.7		4.3	2.6	1.6	0.7		15.9
Summer Annuals			0.8		6.3				1.3			1.7		2.2	2.9	
Unknown/Unident.	0.7		3.2	3.5	1.4	1.4		2	2.7		12.2	7		8.1	2.9	
Pollen Sum	144	136	126	144	144	146	147	149	150	142	139	115	122	136	137	113
Cheno-am:Sum Ratio	0.465	0.728	0.167	0.305	0.118	0.329	0.156	0.443	1.347	1.268	1.374	2.339	1.295	0.943	0.847	1.363
	1st. terrace Permant Stream 1300'		1st. Terrace Intermittant Tributary 1500'		W. Facing Mountain Foothills 1800'			E. Facing	1st Terrace Permanent Stream							
									Historic Horizon		Colonial Period			Pioneer Period		

Table 3: Interpreted Pollen Frequencies

If cheno-am pollen values index changes in local disturbance brought on by population changes at the site, or any other changes in cultural conditions, it would be appropriate to exclude them from the data base to remove that bias from an environmental analysis. Since changes in cheno-am values may index non-cultural modifications of the paleoenvironment, however, it is pertinent to the analysis to keep track of them. For this purpose, one may employ a form of expression of cheno-am pollen frequency values which does not affect that data base. The ratio of the number of observed cheno-am pollen grains to the number of pollen included in the data base can serve this purpose. A significant change in that ratio expresses change in the cheno-am value irrespective of causal factors affecting the data base itself. Presumably, to the degree that such changes are responses to modifications of vegetation patterns, they will correspond to and parallel data base changes.

Modification of the raw data base of Tables 1 and 2 to reduce the affect of biases induced by lack of expertise, to remove potential data base bias by cheno-am pollen, and to reduce local overrepresentation bias for Cereus-type pollen in sample U:9:26, for Ephedra pollen in sample U:1:2, and for Plantago and Onagraceae pollen in sample #4539 was undertaken to operationalize a traditional vegetational interpretation of the data base. The resulting data base is presented as Table 3. Since the object of the analysis is vegetation pattern reconstruction, certain pollen taxa categories have been collapsed to create artificial pollen type categories representing vegetative conditions. Pollen of Pinus, Quercus and Juniperus have been summed within the Higher Elevation Trees category; pollen of Salix, Alnus, Populus and Juglans in the Riparian Trees category; Celtis, Olneya and Prosopis in the Desert Wash Trees category; Cercidium, Acacia, Yucca, Agave, Ephedra, Fouqueria, Larrea, Platyopuntia and Other Cacti in a Desert Shrubs category; and Leguminosae type, Euphorbia-type Tidestromia-type, Umbelliferae, Labitae, Eriogonum and Kallestroemia-type in the Summer Annuals category; and Lilliaceae-type, Cruciferae-type, Onagraceae and Plantago in the Spring Annuals category. To allow more facile comparison, numeric values have been calculated as percentages of the pollen sum. Pollen concentration values and the cheno-am: pollen sum ratio are also included.

The surface samples from sites in the U:9 quadrangle were collected from ridge-slope and ridge-crest locations above the Salt River floodplain north of Tempe Butte in Papago Park. Though probably more disturbed and subject to more effective drainage (so somewhat drier), they offer opportunity to observe pollen records that are likely to be fairly similar to those that were produced under the ecosystem conditions that would prevail at the Phoenix Pioneer and Memorial Park location today if it were maintained in a similarly "naturally" vegetated state.

The principle contrasts between these surface pollen records and those from archaeological proveniences at AZ T:12:5 (PGM) lie in the distinctions in pollen frequency values for High Elevation Trees, for High Spine Compositae and for Grasses. Higher frequency values for High Elevation Tree pollen in the U:9 surface samples may be confidently interpreted as a function of local underrepresentation of Low Spined Compositae pollen with consequent increase in the overrepresentation of pollen transported from a long distance. Thus the sort of High Elevation Trees and the Low Spine Compositae pollen values observed today in the U:1 surface samples are closer to those expectable for the T:12:5 location, though one might anticipate Low Spine Compositae values in the 45 - 55% range and High Spine Compositae values in the 20 - 30% range.

Generally speaking, all of the fossil pollen frequency values of Table 3 fall within parameters that modern surface sample pollen statistics suggest are expectable for Sonoran vegetation at the topographic/edaphic situation of AZ T:12:5 (PGM). Though the cheno-am: pollen sum ratio reflects local disturbance consequent upon site occupation, nothing in this record suggests urban population densities or a landscape/ecosystem that was significantly modified by human technology.

ANALYSIS: CULTURAL PATTERNS RECONSTRUCTIONS

Similarly, the Phoenix Pioneer and Memorial Park pollen record presents no data patterns suggestive of cultural patterns not previously or traditionally accepted in the interpretation of the Hohokam material culture record. The acceptable palynological records argue for cultivation of maize, squash and cotton through irrigation agriculture on both prehistoric horizons as well as common use of cholla buds as a harvested wild food resource. As noted elsewhere (Schoenwetter 1980) the correlation of high values for Cylindropuntia pollen and the deposits that in-fill pits argues for the use of such pits as ultimate disposal areas for latrine waste. Samples #3001 and #5024 were collected from the floors of pithouse feature 8 and 117, respectively. Their similarly high Grasses pollen values is probably not coincidental, and may represent local overrepresentation consequent upon use of grass plants for construction material, such as matting or thatch.

Perhaps the most unexpected result of this study is the lack of significant distinction between pollen records of the Historic and Prehistoric horizons. Though the population of Historic Horizon samples is too small to be representative, I had anticipated that the effect of distinctive landuse on the pollen record would be more dramatic. There is a general contrast in pollen concentration values, with those of Historic Horizon samples being greater than those attributable to the Prehistoric Horizon. I suspect that this pattern reflects pollen preservation as a function of the passage of time since burial, but variability in the pollen concentration values of the surface samples argue that a more complex explanation may be in order.

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