ARCHAEOLOGICAL POLLEN STUDY OF AR4

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A suite of 24 sediment samples collected in association with archaeological remains at site AR4 were submitted to the laboratory for analysis in September 1977. Logistical parameters imposed by S.A.R. justified limiting the study to the eighteen first priority samples. Extraction of pollen of all eighteen samples was accomplished. Time allowed, however, only the observation and counting of pollen of twelve of the specimens.

The principal concern of S.A.R. was use of the pollen spectra to elucidate functional distinctions among different feature types occurring at AR4. "Functional" is used here in its anthropological sense, denoting cultural or behavioral patterns of significance in the utilization of the features. Four types of cultural context were sampled in the sediment series analyzed: floors, hearths, middens and feature fills. The issues were two fold: (A) do the pollen spectra provide evidence of distinct use of different types of features, and (B) do the pollen spectra provide evidence of similarity in usage of two or more forms of cultural context. All of the sediment samples selected represent a single horizon in the occupation of the site.

The assumption underlying the analytic procedure used to investigate these issues is that human activity patterns at a given location are reflected palynologically by the disturbing (skewing) effect they have upon the pollen rain which would occur if no human actions of any sort were performed. Thus one may anticipate that there exists a normal, modal, pattern of pollen frequency values which occurs at a given locus at a given time. If the locus is one at which human activities occurred, those behaviors would cause deviations from the modal pollen rain. One must recognize, of course, that other phenomena than human behavior condition pollen rain frequency values, so all observable deviations need not be interpreted as the result of human activity. But one may take the position that all observed deviations require some form of interpretation; that is, no deviation is immaterial. Then the issue is one of determining testable hypotheses which would function to explain observed deviations. When considering a locus where human activities are known to have occurred, such hypotheses may be drawn from ethnographic analogies and other mechanisms archaeologists utilize for this purpose.

One way to identify deviations from a modal pollen rain would be to make qualitative comparisons between the pollen frequency values observed at AR4 and those observed at deposits representing a contemporary non-site context. Unfortunately, this approach cannot be achieved. We may only date non-site deposits to the approximate horizon of occupation ± 100 or 200 years. This degree of precision is not tolerable for present purposes. Also, it is known that the physio-chemical characteristics of a depositional environment affect pollen preservation and thus pollen frequency values. Distinctions between on-site and off-site sediment samples would, therefore, not necessarily reflect human occupancy of the location but the physio-chemical modifications of on-site deposits which are an indirect byproduct of that occupancy.

I chose a statistical approach towards identification of the modal, normal, pollen values expectable at the site if human activities were of no effect in establishing the pollen record. This was accomplished through the identification of the mean frequency value for each pollen type observed in the samples and its standard deviation. Skewing was arbitrarily identifed as the occurrence of pollen frequency values exceeding one standard deviation from the mean.

Pollen Type	Mean Frequency	Standard Deviation	Unskewed Frequency
Picea	.1667	.019	.019 - .186
Pinus edulis	43.0833	17.404	26.043 - 60.490
P. ponderosa	1.5833	3.067	0.0 - 4.650
Juniperus	2.8333	2.034	.800 - 4.900
Quercus	2.7500	3.217	0.0 - 6.000
All AP	50.4167	20.922	29.495 - 71.139
Chenopodinneae	38.8333	20.215	18.618 - 59.050
Artemisia	.0250	.433	0.0 - .440
All Compositae	8.4167	3.925	4.492 - 12.342
Gramineae	.3333	.850	0.0 - 1.183
Ephedra	.5000	.645	0.0 - 1.150
cf. Leguminosae	.0250	.595	0.0 - 0.670
cf. Lilliaceae	.0417	.640	0.0 - 0.681
Zea	.0833	.276	0.0 - 0.041
Platyopuntia	.0833	.276	0.0 - 0.041
Unknown	.6667	.624	0.430 - 1.294

TABLE I: Pollen statistics of the 1200-grain total of observations

	$\bar{x}$ of 4 Fill Samples	$\bar{x}$ of 2 Hearth Samples	$\bar{x}$ of 3 Midden Samples	$\bar{x}$ of 3 Floor Samples
Picea	.25	.50	0.0	0.0
Pinus edulis	33.25	54.00	55.00	37.00
P. ponderosa	4.00	.50	0.0	.67
Juniperus	1.50	3.50	5.00	2.00
Quercus	.25	2.50	6.33	2.67
All AP	39.25	61.00	66.33	42.33
Chenopodinneae	49.25	29.00	23.67	46.67
Artemesia	.50	0.50	0.0	0.0
All Compositae	8.50	7.50	8.67	8.67
Gramineae	1.00	0.0	0.0	0.0
Ephedra	.50	.50	.33	.67
cf. Leguminosae	0.0	1.00	.33	0.0
cf. Lilliaceae	.75	.50	0.0	.33
Zea	0.0	0.0	0.0	.33
Platyopuntia	0.0	0.0	0.0	.33
Unknown	.75	..50	.67	.67

TABLE II: Pollen frequency values of the feature types.

The use of one standard deviation as an identification value, rather than two standard deviations or some other number, is justified by the size of the pollen counts of individual samples. Because time was limited for accomplishment of this research, only 100 pollen grains were observed in each of the twelve samples analyzed. Given twelve 100-grain samples, skewing would rarely be identified at all if more than one standard deviation were used. Those pollen types having low frequency values are too poorly represented and those having high frequency values are over-represented; in either case it is likely that the pollen value of a given sample would fall within one and two standard deviations of the mean. This would also be true if 200-grain or even 300-grain counts had been made. Use of one standard deviation allows skewing to be easily identified, but it makes statistical evaluation of the significance of the skewing more difficult to discern. However, statistical evaluation of skewing is not a practical issue in this study. Skewing is in all cases required to be evaluated in palynological and behavioral terms; its statistical properties are of no particular interest.

The test used to determine whether samples of a given feature type possess palynologically unique characteristics was comparison of the mean pollen values of each feature type against the standard deviations of those values for the pollen record as a whole. Only skewed values were taken into consideration, since only such values are assumed to be the result of human cultural or behavioral patterns. Fill samples are uniquely skewed in a positive direction for Picea and cf. Lilliaceae values, hearth samples are uniquely skewed positively by the cf. Leguminosae value; midden samples are uniquely skewed by positive Juniperus and Quercus values; and floor samples are uniquely skewed by postive Zea and Platyopuntia (prickly pear) values.

The test used to determine whether 2 or more forms of features produce palynological evidence of similarity of function was comparison of skewed pollen values. Two indications of functional similarity occur: Artemesia values are positively skewed in both fill samples and hearth samples, and Picea values are negatively skewed in both midden and floor samples.

None of the skewing identified in these tests is of statistical significance. That is, the probability that the skewing may have occurred as a result of chance is not greater than the .05 level of confidence. Proceeding to evaluation of the results on the basis of ethnographic analogies and ecological parameters, however, a case may be made that the skewing observed is culturally significant and reflects particular patterns of behavior.

The floor samples evidence skewing towards uniquely positive values for Zea and Platypuntia. The inference one may draw is that maize and prickly pear were plants towards which behavior was directed in a unique fashion at floor locations relative to other locations on the site. Ethnographic analogy suggests the testable hypothesis that the floors of rooms were locations of food processing behavior in the present case.

The midden samples are uniquely skewed for positive values of juniper and oak pollen. Though both plants produce edible fruits, maturation processes are such that pollen would not be harvested with the fruits nor disposed as waste products in food preparation. The human behavior indicated by the skewed values, then, is not related to the subsistance significance of these plants. Ethnographic analogy suggests the testable hypothesis that the trunks and branches of juniper and oak were brought to the site for use as fuel and construction materials. The foliage would contain quantities of pollen if collected during the pollination season. If the foliage were stripped from living plants and disposed of at the midden location, juniper and oak pollen values would be positively skewed by the activity of disposal. The cultural inference drawn from these palynological results is that wood harvesting during early spring involved living plants rather than deadwood. Though such harvests would be more difficult and less conservative of the natural resource, they would provide a more efficient fuel if the deadwood soaked by winter and spring precipitation had not yet air dried.

Hearth samples evidence positive skewing of cf. Leguminosae pollen values. This result is unevalueable because of the problems of taxon identification which support the diagnosis of the pollen type involved. The Leguminosae constitutes a plant family of many genera and species; some have ethnological and ecological significance and others do not. While some genera can be identified on the basis of pollen morphology, most genera and species of the Papillionoidae and Cesaelpinoideae sub-families are not normally distinguishable. These groups are characterized by a highly variable pollen morphology which -- though normally tricolporate and reticulate -- is often not well preserved in inorganic sediment context. Lacking more precise botanical identification of the pollen, generation of testable hypotheses and inferences cannot be based upon the evidence available.

Fill samples evidence positive skewing of Picea and cf. Lilliaceae pollen values. The Lilliaceae pollen observed cannot be more precisely identified botanically because of poor preservation. I have encountered morphologically similar pollen, however, in contexts of association with well preserved Lilliaceae pollen identifiable more specifically to the genus Yucca. I believe -- but cannot confirm -- that the Lilliaceae pollen from AR4 is Yucca pollen. Yucca is an insect-pollinated genus, and thus not adapted to wide dispersal of its pollen upon foliage or soil surfaces. It generally pollinates in April to May. Since a large quantity of pollen is produced, pollen probably clings to the inflorescence and fruit casings in some quantity throughout the life of those structures. Picea is a wind-pollinated genus well adapted for long-distance dispersal of pollen grains by air movements and also by water transport across soil surfaces, as prodigious quantities of Picea pollen are produced and released each season. I think it unlikely, in view of the distinctions in ecological parameters affecting dispersal of the two pollen types and those affecting the locations in which the parent plants can grow and mature, that the skewed values of both pollen types result from the same cultural or behavioral activities.

The ethnographic record provides few clues I can identify that refer to types of human activities affecting the fill of abandoned architectural features. Abandoned features are used as waste dumps, but if this were the case at AR4 one would expect the fill pollen records not to be unique but rather to parallel the midden records. Alternatively, the prior existence of an architectural feature creates a unique depositional environment which is aggraded by slope wash from the surrounding use surfaces and eolian depostion. I suggest that the cf. Lilliaceae pollen actually derived from the area surrounding the features and may represent processing of Yucca fruits for food outside the boundaries of room floors. It could have then have washed into feature fills as those deposits developed subsequent to abandonment of the features. The Picea pollen may derive from spruce foliage utilized in the site for some purpose. However, it is equally likely that it derives from the long-distance wind transportation of spruce pollen and is uniquely skewed in fill deposits because they are uniquely capable of trapping large quantities of wind-blown materials.

This argument is reinforced by the negative skewing of Picea pollen values in both floor and midden deposits, which aggrade solely or primarily through human construction activities. I believe it also accounts for the similarity between feature fill and hearth fill deposits as regards positive skewing of Artemisia pollen values.

In summary, pollen analysis of twelve samples representing four distinctive cultural contexts at AR4 were examined to discern palynological reflections of prehistoric activity patterns. It appears likely that palynological indices of similarity in function which occur are only indirectly related to human behavior, as they result from the existence of conditions of depositional environment which are created subsequent to the abandonment of features through transformation processes. Had the human behavior of construction of the features not occurred, however, certain unique palynological characteristics would not have occurred either. Each of the various cultural contexts may be uniquely identified by palynological characteristics. In the case of middens, these may reflect the harvesting of wood from living trees during the early spring. In the case of floors, they may represent food processing activities directed towards both cultivated and wild plant foods.