CA-RIV-3508-H PALYNOLOGY

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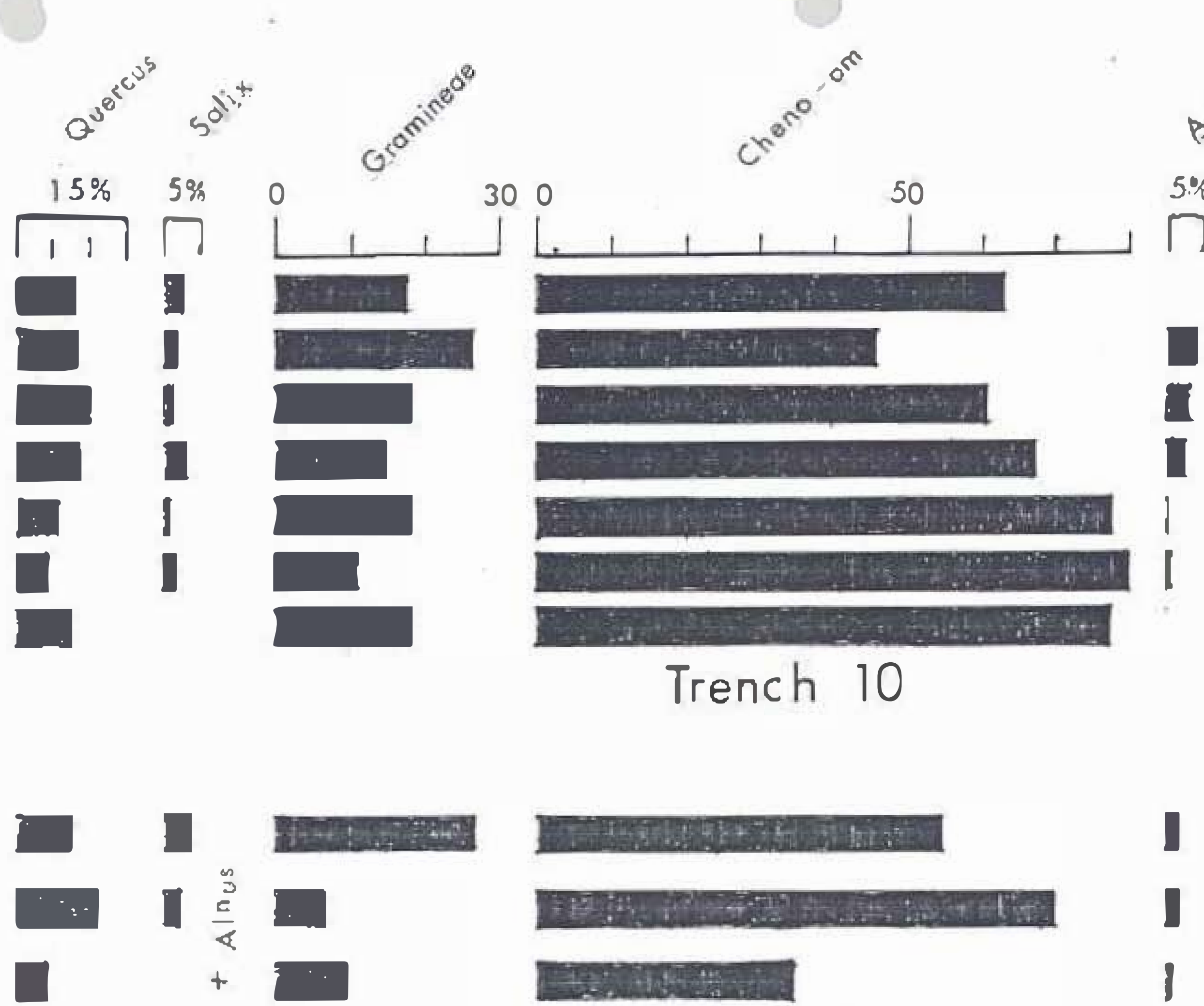

cm. depth b.s.	% Ceralia	% Zea	% Frag's	Pollen /cc	Pollen /ml
0-10	6.0	1.5	45.0	6600	120 000
10-20	10.0	1.0	35.0	3015	9 600
20-40	1.5	1.0	31.0	2345	192 000
40-60	2.5	0.5	36.0	5280	482 000
60-80	1.0	1.5	28.0	1760	240 000
80-100			37.5	2640	120 000
100-120	0.5	0.5	38.0	3520	160 000

Trench 10

cm. depth b.s.	% Ceralia	% Zea	% Frag's	Pollen /cc	Pollen /ml
0-30	10.0	3.0	55.0	8800	160 000
30-70	3.0	2.5	64.0	2100	96 000
70-110	12.5	35.0	20.0	1770	160 800

Structure 2

Project History

The Palynology Laboratory received a request to undertake analysis of ten members of a series of 23 sediment samples from CA-RIV-3508-H, the Billingsley Dairy site, early in March 1989. No specific research objective was defined for the study; a subset of ten samples was to be selected and the pollen they contained was to be evaluated in relation to previous pollen studies conducted at historic sites in the Prado Basin.

The submitted samples ranged from 15 to 35 cubic centimeters volume. The pollen extraction procedure normally employed at this laboratory is designed for samples of 75 - 150 cc volume, and our normal expectation is that samples of ca. 500 cc volume will be submitted to provide lee-way for laboratory error and to allow curation/retention of a potentially re-analyzable sample. To accomodate the analysis, some samples from segregate stratigraphic levels of Trench 10 and Structure 2 were combined. Pollen extraction, identification and counting were completed by Ms. Alice H. Whallin. I am responsible for the interpretation of data so provided, and for preparation of this report.

Results of the Analysis (Figure)

The pollen spectra of all samples are dominated by Cheno-am pollen, with the exception of the sample collected at greatest depth in the fill of Structure 2. In that sample, the amount of Cheno-am pollen is comparable to the amount of maize pollen but the latter is very obviously overrepresented as a result of human modification of local pollen rain. If the constraining effect of local overrepresentation by maize and cereal pollen is mathematically eliminated, all the samples yield statistically equivalent pollen spectra. The variety of observed pollen taxa is unusually low for the number of observations and samples analyzed. Alternatively, the amount of damaged pollen is unusually high. Identifiable pollen which occurred in the form of fragmentary grains averaged 39.5 percent of the observed pollen, with the range of such observations varying from 20 to 64 per cent in individual samples. Non-identifiable pollen fragments ranged from 13 to 35 per cent of the identified pollen.

Interpretation and Comparisons

The Billingsley Dairy site pollen samples contain what appears to be a badly deteriorated and depauperate pollen record. This suggests differential pollen preservation, and that some of the pollen the deposits once contained has been destroyed. However, neither the frequency of deteriorated pollen nor the pollen concentration value is progressively reduced with depth -- a characteristic feature of pollen sequences in which spectrum alteration occurs as a result of differential preservation processes (Hall 1981). Nor is the pollen concentration value normally below the standard (2500 grains/ cc) Hall suggests is too small to support interpretation. The likelyhood that the pollen record is so altered as to be uninterpretable thus seems significantly lower than first appears. There is little doubt, however, that a "normal" pollen rain is not represented by these data. The inference that will accomodate all the facts most conformably is that the spectra have been behaviorally, rather than naturally, induced.

This interpretation is also consistant with previously determined information regarding the character of normal pollen rain: vegetation relationships in the Prado Basin. Analysis of a suite of samples collected from the present land surface at plots supporting different vegetation patterns has allowed recognition of patterned relationships of various sorts (Gregory and Schoenwetter 1987:161-163). None of the patterns so identified is represented in the Billingsly Dairy sample data. Plots heavily overgrown by weedy vegetation dominated by Cheno-am pollen producers, for example, do not yield similarly high values for Cheno-am pollen or Gramineae pollen; pasturage plots yield similarly high values for Gramineae pollen, but much higher values for Ambrosieae, Tubuliflorae and Liguliflorae pollen. Also, each of the definable vegetation: pollen rain relationship patterns documented by surface samples is expressed within a range of variability; no two plots of the same vegetation type produce surface sample pollen records which are statistically equivalent. One of the characteristic features of the Billingsly Dairy pollen record is that all ten samples have yielded statistically identical pollen spectra.

The question of greatest research interest that follows from this interpretation, then, is not what vegetative environment is represented by the sort of pollen record observed. Rather, it is why the behavioral event so represented is represented in this particular way.

Discussion and Conclusions

The behavioral context of the samples recovered from Structure 2 is identifiable on the basis of both archaeological field and laboratory observations and historical record. The sampled deposit was created during demolition and earthmoving operations which destroyed the standing structures located on the property and levelled and graded the locale prior to its incorporation within the floodpool of the Prado Basin. Pollen contained in deposits created in this fashion can only have three possible sources: pollen which "rained" upon the deposit from the atmosphere as it aggraded, pollen which was already trapped within sediments that were mixed with building rubble to create the deposit, and pollen which was clinging to the rubble and so was buried with it as the deposit was created.

While the amount of pollen available as pollen rain at the location may have been considerable, the volume of deposit which aggraded at the Structure 2 location within a few hours was so great that very little atmospheric pollen could have been trapped per unit of deposit volume. The amounts of pollen recovered from the samples are far greater than could have "rained" onto the aggrading deposit in the course of months, no less weeks or days. Thus a small fraction of the observed pollen could have such a source, but that source could not account for the characteristic features of the pollen record that has been recovered from the Structure 2 samples.

The rubble of the structures which stood at the site at the time of demolition probably contained a fairly copious amount of pollen -- especially the rubble of the barn, where large quantities of feed grains and hay were stored and pollen-laden dust would have been allowed to accumulate. Indeed, the local overrepresentation of maize and cereal pollen in two of the Structure 2 samples could be fairly interpreted as a product of incorporation of such dust. However, the deposits infilling Structure 2 contain a significant material culture record suggesting incorporation of rubble from the demolished residence, not the barn. In any event, the amount of the sampled deposit which is reasonably likely to represent pollen clinging to incorporated rubble cannot constitute a large fraction of the deposit volume. If this were the only source of pollen in the celler infill, we should not have been capable of extracting a minimum of 1700 grains per cubic centimeter of sample; if it were the principle source of pollen in the samples, we would anticipate a much wider range of pollen taxa and more variability in the pollen frequency values than occurs.

It is reasonable to presume that the pollen originally contained in a sediment will be transported with that sediment if it is moved from one place to another in a fashion that will not systematically winnow the pollen it contains. The pollen record one would anticipate to recover in such a case, however, would be that trapped as one or more normal pollen rains during the period of aggradation of the deposit prior to its transportation. The data of the Billingsley Dairy samples is not such a record. However, the probable source of much of the transported sediment is not likely to have trapped a normal pollen rain.

Prior to demolition, the site was an area devoted to feedlot landuse. One would expect both animal and human impact on such an intensively exploited landscape to produce an abnormal pollen rain with a relatively high degree of areally localized variability. Most likely, it would be palynologically characterized by the local overrepresentation of taxa adapted to a heavily disturbed ecosystem and the consistant occurrence of pollen of exotic taxa which were introduced to the locale to further human objectives. One would also expect such a landscape to be actively aggrading because of the masses of manure being deposited yearly, and it might be anticipated that the richly organic character of the surface would provide a very favorable environment for pollen preservation.

The quantities and frequency values of the pollen records obtained for the sediment samples analyzed from the deposits exposed at both Structure 2 and Trench 10 are fully consistant with those expectations. It thus seems probable that the pollen observed is primarily that which was incorporated in the uppermost depositional stratum at the site, created during the period of its use as a location where cattle were penned and fed. Though the collapsed rubble of the residence constitued a sufficient fraction of the volume of the deposit sampled there to allow recovery of a significant number of items of material culture, the pollen record suggests that the greater fraction of volume of the celler infill deposit came from the land surface of the feedlot district of the site. Presumably, this pollen-rich material was mixed with demolition rubble and substrate sediment and then transported to the Structure 2 celler cavity in bulk for additional fill.

Two qualities of the Billingsley Dairy pollen record are not fully explained by the interpretation just offered, however. One is the statistical consistancy with which a pollen rain which was expectably locally variable is expressed in the samples. The other is the very high degree of observed pollen deterioration. The former quality is perhaps adequately explained by the probable scale of earthmoving operations undertaken at the site with bulldozers and other heavy machinery. Areal localization of pollen variations was very likely scaled to territories on the order of three to five dozens of square meters, at most. Earthmoving operations which took place at the site probably were scaled to territories on the order of quarter hectares.

Though extreme, pollen deterioration seems not to have had an altering affect on the character of the pollen spectra. That is, it seems to have affected the pollen of different taxa equally, so the relative pollen frequencies which have been observed are likely to be those of the pollen rain incorporated originally into the feedlot area deposit. This is not a normal affect of pollen deterioration. However, one of the more interesting, and yet unexplained, realities of the study of pollen contained in archaeological site context deposits is their tendency to contain either very little pollen at all (often too little for profitable analysis) or pollen which dates to the horizon of sediment deposition. Since most sediments contain pollen, one would expect that when a sediment is transported the pollen it contains would be retained. In archaeological context, then, one would expect samples of floor or wall plaster, sod roof rubble, earthen mound construction fill, or the fills of grave pits to contain quite different sorts of pollen records than occur in contemporary midden deposits. They often are different in the sense that they more frequently contain too little pollen for study. But when they are analyzable, they rarely illustrate the expected level of distinction.

The pollen of the Billingsley Dairy Site samples is likely to have been transported to the locations in which it was observed. The pollen rain involved, however, was trapped less than 100 years ago in a depositional environment extremely favorable for pollen preservation, and was moved to its present location only about 55 years ago. I suggest that the degree of deterioration the pollen record of these deposits has undergone is a measure of the amount of time that has passed since transportation has occurred. If this interpretation is accurate, controlled studies relating the degree of deterioration and alteration of pollen records to the amount of historic time elapsed since sediment transportation might provide the data for explanation of a presently unresolved problem in archaeological pollen analysis.

Commentary

1. The pollen records of the Billingsley Dairy Site are not comparable to those recovered from the Aros-Serrano Adobe location, CA- RIV-2802 or the Rincon Townsite. Basically, this seems to occur because none of the deposits sampled at the different locations were created in comparable ways. There is no reason to expect obvious comparabiltv among the such pollen records, even if the depositional events involved occurred contemporaneously. Comparabilty might occur if depositional context parameters or microenvironmental factors (including behavioral patterns) had no affects on the pollen rains

trapped in the deposits. To presume this as a general case, however, is unwarranted. Interestingly, though, the major constraints imposed upon a search for interpretable comparable and non-comparable characteristics of these pollen data sets lie not in the pollen records themselves but in logistical parameters were established for the various studies contractually.

The pollen deposited in a sediment sample at any given time represents and reflects the complete set of ecosystem variables and ecosystem relationships occurring at a range of geographic scales in the environs of the sample location. One might profitably conceive of the palynological content of a sample as a box of jigsaw puzzle pieces one may arrange in order to reconstruct an image of a prior ecosystem that expresses the complete range of its complexity. However, when the box is opened one observes all of the pieces as a single mass held together with a variety of glues, tapes, elastic bands and fasteners. Disentangling the pieces to segregate the ones and the groups that display different features of the image is a much more complex problem than assembling them once they have been pried loose of the mass. One must apply mechanical devices to the fasteners, different chemical solvents to the different glues, scissors of distinctive designs to the different tapes, etc., if the pieces of the mass are to be segregated with sufficient care that the patterns they display are not damaged or their edges modified, for that would result in a false image. And one must disentangle and reconstruct the images of a number of such puzzle boxes simultaneously, in the same ways, to determine what portions of the image of any one of them is truely representative of all and what portions are unique to that particular puzzle box.

An archaeological site is also a puzzle box, and some of the pieces are similarly joined in fashions which make their disengagement a delicate and painstaking process. But the significant problem faced by the archaeologist is that time and the character of human behavior have destroyed more pieces of the puzzle than are left in the box when it is opened, and the fact that the act of opening the box itself affects many of the characteristics of the puzzle pieces that remain. The pollen analyst's puzzle box always contains more pieces than the analyst can examine, and they are always accessable for re-examination. They even can be assembled and re-assembled in whatever combinations imagination will allow. Thus, the data base potentials of any pollen sample are finate, but practically unlimited. Observation may proceed as long as desired, the same data base may be reobserved repeatedly to discern features previously passed over, and almost any required number of replicate samples may be recovered from the same deposit.

An expert pollen analyst keeps a full range of types of unfastening devices, varieties of scissors and kinds of solvents on his laboratory shelf -- though he or she may prefer to employ only those that are most familiar, and some require more time and energy than he or she is prepared to invest in solving the puzzle. They are different methods for organizing and identifying relationships among the different pollen taxa observed in a sample; certain methods are designed to act in ways that will generate pollen data sets likley to express more of the particular image features of some ecosystem variables while other methods, or combinations of methods, generate pollen data sets likely to express more of the image features of other variables.

This pollen study was contractually limited to analysis of ten samples and 200-grain observations of each sample. Statistical pattern search techniques allow data base comparisons to be made which will identify the comperable and non-comparable features of populations of pollen records, and methods may be created which would employ these techniques on available and collectable populations of Prado Basin samples to determine what ecosystem characteristics might be so represented. But those methods would require amplification of the data bases from each site, employment of significant quantities of computerized computation time, and recovery and study of additional kinds of modern surface sample controls. Implementing methods of sample comparison which explore less-than-obvious qualities of their pollen records, then, was both technically more challenging and more expensive than the contractual parameters of this study allowed.

2. The comparability of pollen records recovered from the deposits sampled at Structure 2 and Trench 10 is best explained as an expression of comparable depositional processes and events. This implies that the uppermost 1.2 meters of sediments encountered at the Trench 10 location were emplaced by the grading and filling operations employed about 1936. Such a conclusion is surprising and unexpected because of the depth and volumes of deposit involved, and the lack of field observations one would expect to suggest earthmoving operations at this location. Explaining or reconciling the conflict of archaeological and palynological interpretations of the deposits, and attempts to understand what if any cultural resources management significance the conflict may have is,

unfortunately, no longer possible. The program to mitigate impact on the significant cultural resources of the site has been completed, and this conflict does not constitute a reason for its re-establishment or extension. Had the palynological character of the Trench 10 deposits been recognized and interpreted prior to the initiation of mitigation activity, however, the character of the mitigation program might have been adjusted to allow full exploration of the conflict and its possible significance.

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Though musing on "what might have been" is normally unproductive, in the present situation it suggests rather strongly that pollen study should be regularly exploited as a potentially important source of information relevant to archaeological testing operations at historic sites in the Prado Basin. Prior work has documented the potential of palynological research to establish pollen chronologies that allow intra-site temporal correlation of depositional episodes (Gregory and Schoenwetter 1987), and this study documents its potential to reveal site formation process information. Such conclusions help to control and extend scientific understandings of the cultural heritage expressed at a site location, so are normally perceived as a valued product of cultural resource mitigation activity. But they also can be seen as a source of information which can control the sorts of strategic decision-making that takes place subsequent to site testing. Pollen work at the Billingsley Dairy Site was not expected to yield a highly significant body of information about the cultural character of the site, and in fact it did not. But it demonstrated that pollen study could have been effectively integrated into testing phase activities as a form of remote sensor to reveal the locations and character of deposits more or less likely to yield quantities of the sorts of material culture information it is profitable actively to seek at the site. This lesson should not be ignored as future testing phase operations are undertaken. Indeed, significant investments in the study of the pollen of sediment cores recovered [illegible] might often be repayed by an overall reduction in the coats of units of cultural heritage information recovered during the mitigation phase.

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