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A PALYNOLOGICAL APPROACH TO A CHRONOMETRY PROBLEM ON THE COLORADO PLATEAU

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ABSTRACT.—Application of the Colorado Plateau Pollen Chronology (CPPC) addresses the issue of contradictory chronological reconstructions provided for the site of Nuvakwewteqa by Upham (1980, 1982), Brown (1982) and Coinman (1984). Coinman's concerns regarding assumptions basic to Upham's chronometry are supported by palynological information. Palynological support for an alternative chronometry, however, is frustrated by the distribution of samples with insufficient pollen for analysis.

INTRODUCTION

From early 1977 to late 1982 execution of the Chavez Pass Archaeological Project was administered through the Department of Anthropology at Arizona State University. As a result, the sediment samples collected during those years for pollen study as aspects of the surveys, tests, salvage and room excavation operations performed at the site of Nuvakwewtaqa and in its environs are curated at the Palynology Laboratory at ASU. Among other products, the Chavez Pass Archaeological Project has generated a distinctive processual model to account for the flourescence and abandonment of 14th century Pueblo communities on the Colorado Plateau (Upham 1980, 1982). This model has had significant impact upon modern assessments of Puebloan archaeology and culture (e.g. Cordell and Plog 1979; Upham 1983, 1984; Upham and Plog 1986). In some ways, however, specifics of the model are critically dependent upon interpretations Upham has made of the chronometry of cultural events at the site of Nuvakwewtaqa.

Normally, application of methods that allow development of "pollen dates" for archaeological contexts would be considered superfluous for a Colorado Plateau site as large and as complex as Nuvakwewtaqa. Generally speaking, the large, multi-storied peublos of the region contain an abundance of the Anasazi decorated ceramic styles that are well cross-dated to tree-ring patterns. Nuvakwewtaqa, however, is classified as a Sinagua culture pueblo (Wilson 1969; Batcho 1977; Upham 1980). Well cross-dated decorated ceramic materials are rarer in its artifact inventory and chronometric precision is far more difficult to achieve than is often the case in the American Southwest.

Grappling with this problem in the course of attempts to reconstruct the process of the establishment, development and abandonment of Nuvakwewtaqa, Upham (1980, 1982) employed a chronometric method (Mean Ceramic Dating, or MCD) that had been first documented as applicable to Colonial Period sites in the Eastern United States (South 1972). The processual reconstruction Upham achieved, which is in some ways critically dependent upon the MCD antiquity estimates for sites in the Chavez Pass district and for various portions of Nuvakwewtaqa, challenges conventional archaeological wisdom in a number of respects (McGuire 1983). Not surprisingly, perhaps, work performed at Nuvakwewtaqa subsequent to Upham's analysis has explored the possibility of error in Upham's chronometry. Brown (1982) suggested an alternative chronometry for events at the site based on chronometric dates and Coinman (1984) tested the applicability of

an alternative numerical method for estimating the antiquity of ceramic assembledges at this site.

Both alternative chronometries for the events of the process suggested by Upham are argued to be more consistent with radiocarbon and tree-ring information that was not available when Upham developed his processual model. Also, some of the assumptions that Upham employed in his application of the MCD method have been challenged. Thus Brown's and Coinman's work suggests that Upham's processual explanation of the development of the Western Pueblo from the 14th century to the ethnographic present may be flawed by chronological errors.

The CPPC, or Colorado Plateau Pollen Chronology (Schoenwetter 1970) was created to provide both a means of estimating the antiquity of archaeological materials directly associated with pollen records of the last 2000 years in this region, and to provide a reconstruction of paleovegetation responses to effective moisture variations over this period of time. It is not, and was never designed to be, a regional pollen chronology in the traditional sense of the Northwest European pollen sequence or Hall's (1985) synthesis of the Southwestern Quaternary palynological record. For one thing, the CPPC can *only* be applied to pollen samples collected from archaeological site deposits (see below). For another, the CPPC does not identify episodes of vegetational change; it identifies the temporal parameters of eposides in a sequence of changes in a single ecosystem variable: effective moisture. Critics of the CPPC assert that it must be biased by the realities of episodic sedimentation, poor preservation and questionable origin of the pollen of archaeological site deposits. The point is well taken. However, a number of independent tests of the chronology have been performed since it's publication, (e.g., Schoenwetter 1976; Rosenberg 1976; Buge' and Schoenwetter 1977; Scott 1977, 1978; Peterson 1983), which it has withstood, and a remarkable correspondence has been recognized between the antiquity of episodes of relatively higher and lower effective moisture conditions in the CPPC and those recognized on the basis of decadal averages in tree-ring growth records from the Colorado Plateau (Schoenwetter 1971; Dean in press). It may well be true that, in theory, the CPPC cannot be useful for the purposes for which it was designed. But the applicability of the CPPC is supported by evidence, and the assumption that traditional palynological theory in fact applies to the pollen of archaeological site deposits is not. Other palynological approaches to the problems of paleovegetation and paleoecosystem conditions reconstruction have been presented since publication of the CPPC (e.g., Euler *et al.* 1979; Hevly 1981), but the CPPC is the only palynological method advanced for the region that has the purpose of dealing with specifically chronometric problems. Application of the CPPC to assist resolution of the chronometric debate that has arisen at Nuvakwewtaqa, then, seems appropriate.

IMPORTANT CONSIDERATIONS

Character of the CPPC.—The Colorado Plateau Pollen Chronology is structurally distinct from most pollen chronologies in two significant ways. First, most pollen chronologies identify a sequence of pollen zones, each of which is characterized by a particular and unique set of palynological features. The CPPC identifies a sequence of temporal episodes during which effective moisture levels were equivalent to, or were lower, or were higher than a specified standard. The palynological character of an episode of lower effective moisture level which occurs early in the sequence is not different from that of an episode of lower effective moisture level which occurs late in the sequence. Assigning the pollen record of a particular sample to a particular temporal episode, then, requires consideration of it's contextual and stratigraphic relationship to other pollen records from the site and the temporal positions of associated artifacts.

Second, it is unusual because the chronological significance of a pollen statistic or relationship is normally a function of the character of that statistic or relationship, but this is not true of the CPPC. The pollen statistic having chronological value in the CPPC is the Adjusted AP frequency (Adj. AP%) value. However, in any given pollen spectrum this pollen statistic only has chronological value if the sample's stratigraphic and contextual relationships to other pollen records from that site can be evaluated, and if the associations it has to the archaeological records of the site are known. This body of information is required for assessment of the probability that the pollen record is a function of human behavior rather than the effective moisture level of the regional ecosystem.

In fact, the principal difficulty that arises when application of the CPPC is considered is not the technical one of determining a sample's Adj. AP% value, but the requirement to assess the likelihood that the pollen record one observes is an artifact of human behavior rather than an expression of the natural pollen rain. Aspects of archaeological and of palynological theory that are both long-standing and securely evidenced compel recognition that the sorts of pollen records to which the CPPC may be applied have a high prior probability of being behaviorally induced (Hevly 1981; Schoenwetter 1986). Yet the CPPC has been tested many times and it's success rate is no lower than is true of pollen chronologies based upon non site-context data. Apparantly, the CPPC is a chronometric method that works for the purposes for which it was designed, but which works far more effectively than existing palynological theory can account for. This has, apparently, created suspicion that application of the CPPC is either an unscientific excercise or an illusory one, for it has not been widely used.

As author of the CPPC (and as one who has received no more theoretical enlightenment from the progress of these tests than seems the case for others), I well appreciate and understand that suspicion. I also appreciate the value of caution in application of methodologies that have no clear theoretical rationale. For better or worse, however, archaeological research traditionally adopts the pragmatic view that the appropriate test of a method is not whether we understand it but whether or not it works to achieve what it is designed to achieve. Within its expressed limits (the probability of an innacurate chronometric estimate for any given sample = 12.5%) the evidence at hand is that the CPPC works well.

Site Structure and Chronometries.—The most recent succinct description of the site (Upham and Plog 1986) states:

> "Nuvakwewtaqa, a large site (more than 1,000 rooms) comprises three primary roomblocks, numerous smaller roomblocks and extramural features, as well as a vast system of agricultural terraces, linear grid systems, check dams, and isolated fieldhouses . . . Kivas are associated with each of the roomblocks, as are protected plaza areas. A Great Kiva is located in the largest of the three contemporaneous roomblocks and a possible ballcourt is nearby."

There are two principal habitation areas at the site, referred to as the North and the South Pueblos, with one roomblock at the former and two at the latter. Upham's information on the North Pueblo was derived from analyses of the surface collections of artifacts, salvage information on the highly disturbed burials, and some test pit and soil auger core data. He has suggested (Upham 1982:169, 190; Upham and Plog 1986:226) that all the roomblocks were occupied by A.D. 1100 but the principle occupation of the South Pueblo did not begin until a period of expansive construction of the South Pueblo was initiated about A.D. 1270. Upham concluded that the North Pueblo was abandoned about A.D. 1315, though occupation continued at the South Pueblo at least until 1425.

Coinman (1984) considered the results provided by additional excavation of rooms and other features at the North Pueblo, the body of new radiocarbon and tree-ring information provided by Brown (1982), and the vertical and horizontal distribution patterns of architectural features and associated decorated ceramic type clusters. She concluded that the North Pueblo territory was occupied some centuries prior to construction of the roomblock, but the roomblock itself was established no earlier than A.D. 1150. She argues that both the North and the South Pueblos are likely to have been constructed, occupied and abandoned about the same time, and she suggests that Upham's chronological reconstruction may be inaccurate because it is based upon weak assumptions and, possibly, the use of an inappropriate chronometric method (MCD) (Coinman 1984:121-123).

The two assumptions involved relate to the stratigraphic situation Upham considered adequately evidenced for the site. One is that the sequential deposition of differentiable middens occurred uniformly and coincidentally at both the North and South Pueblos (Upham 1982:169). The other is that the stratigraphic relationships of pottery assemblages recovered from a single room at the South Pueblo can be generalized to reflect the temporal relationship of ceramic assemblages recovered from other locations at the site and other sites in the district (Upham 1982:193).

The units of Upham's stratigraphic analysis are those I recognized for the site on the basis of inspection of exposures revealed by looters searching for collectible artifacts (Schoenwetter 1978). Five of the eight depositional strata I currently recognize (Units C-G of Table I), are middens that are differentiated by context, superposition, color and artifact density. Coinman properly recognizes that the criteria for definition of the units of Upham's stratigraphic sequence (superposition, color and artifact density) do not assure the comparability and contemporaneity of similar deposits across the site or even within the same part of the site. She therefore suggests that Upham's analysis lacks *a priori* credibility.

Upham faced the problem of establishing a relative ceramic chrononology for the Chavez Pass District at a time when the bulk of available information about the ceramic types associations was derived from surface collections. However, opportunity arose in the 1978 season to excavate a 2x2 meter test at the South Pueblo (east roomblock) in a room that had mostly been in-filled through the intentional disposal of trash. This excavation, at locus 33.8S, yielded a relatively large collection of decorated pottery assemblages in stratigraphic superposition that could be related to the mixed middens, red-brown midden and younger brown midden units of the site's stratigraphy. Upham documented the credibility of application of the MCD method with this case. He then confirmed that none of the information available from test pit excavations conflicted with the chronometry so devised. He assessed that result as justification for generalization of the chronometry from the 33.8S locus to the site as a whole and the Chavez Pass District, as well. Coinman's analysis of the vertical and horizontal distributions of the ceramic styles subsequently excavated at the North Pueblo provided evidence for a conflicting case. She therefore questioned the stratigraphic assumptions Upham used for determining the chronometry of events at the site or in the Chavez Pass District.

Appropriateness of the CPPC.—The CPPC can be applied to this conflict because field efforts were specifically directed towards the recovery of pollen samples controlled by contextual relationship to the units of the stratigraphic sequence at Nuvakwewtaqa *and* controlled by direct association with ceramic assembladges whose antiquity could be estimated by the MCD method. In 1977 I collected and analyzed pollen samples from exposures of the stratigraphic units and determined that they yielded palynological records that were potentially datable through application of the CPPC (Schoenwetter and Stewart

1978). In 1978 I established test pit excavations in various areas of the site that would allow recovery of both ceramic assemblages and stratigraphically superimposed pollen samples associated with the complete spectrum of stratigraphic units. Upham's excavation at 33.8S constituted another pollen sequence in which the relationship of the pollen samples to both stratigraphic units and ceramic assemblages was controlled. Yet another opportunity was provided when testing and trenching operations were performed at the possible ballcourt feature in 1980. In the latter two cases, however, the pollen samples were collected from profiled exposures after the ceramic assemblages had been collected in arbitrary 10 cm levels that could not individually be precisely correlated to the stratigraphy. The contextual identification of the pollen samples and stratigraphic units of these tests, then, is controlled in the same way as occurred in the other tests identified on Table I. But the association of the pollen records with the ceramic assemblages dated by the MCD method is indirect rather than direct.

A question that some readers may consider pertinent is the potential of the pollen spectra of these samples to be influenced by the occurrence of pollen which was introduced through downwashing subsequent to deposition, or which contaminates the sample for some other reason. The possibility of contamination certainly exists for any sample or set of samples, of course, but there are at least three reasons to accept the operating assumption that the Nuvakwewteqa pollen spectra are not contaminated until evidence is presented to the contrary. First, though downwash is credited as a major mechanism which structures the pollen sequences of archaeological sites (Dimbleby 1985:4-9), it is granted that status only in environments in which soil formation and rainwater leaching processes are quite active. Neither of these conditions occurs at archaeological sites on the Colorado Plateau. Second, one expects 12.5% of archaeological pollen records assigned by the CPPC to particular temporal intervals to be inaccurately dated. Actually, less than 5% can be demonstrated to be inaccurate. The empirically evidenced degree of temporal correspondence of changes in the CPPC with changes in the tree-ring sequence of the Colorado Plateau, and the evidence that the CPPC is regularly expressed under a variety of archaeological context situations, strongly argues that the pollen spectra datable by the CPPC do not display tendencies for contamination that affect chronological application. Third, the prior probability is that the pollen spectra characteristics observed in these samples are behaviorally induced, since the samples are of midden, which is a product of human behavior. If it is demonstrable that this prior probability does not in fact affect the spectra, and they seem datable by the CPPC, it is hardly likely that this is the fortuitous result of contamination processes. To assume so would violate some of the basic principles of biostratigraphic correlation upon which "pollen dating" is based at any location in the world.

Sampling strategy.—The strategy responsible for the collection and analysis of the samples arrayed on Table I focussed on recovery of sample series that offered opportunity to compare the Adj. AP % values of ostensibly contemporary pollen records from different parts of the site with each other, and to compare those of older spectra from the same locus against those of spectra that were necessarily younger. To the degree results were consistent in time and space, they could be evaluated as Adj. AP % values unaffected by human behavior, and thus datable by application of the CPPC. The strategy required study of 74 pollen samples, of which 18 (24%) yielded too few pollen grains for confident evaluation.

RESULTS AND DISCUSSION

Tables II-VII, taken in conjunction with the comparative information provided on Table I, specify the relevant results of this study. (Raw data is on file at the Arizona

State University and also at New Mexico State University.) The consistency of the Adj. AP % pollen statistic values of stratigraphically related samples from the different tests supports rejection of the operating assumption that that statistic is induced by human

Strati-Graphic Unit	Unit Description	416.7N	"Ballcourt" Backhoe Trench 1	22S	33.8S	121.3S	150S
A	Culturally sterile superficial layer	27 4104	4105 4104				
B	Artifact-rich slopewash layer		4103		0- 10 cm	37	
C	Younger brown midden pitfill				50- 100 cm		
D	Younger brown midden	26 25	4102 4101 4100	2	20- 90 cm		13 59 58
E	Red-brown midden (sometimes with brown midden lenses)	24 10 23 22 21 20 16	4099 4098 4097 4096 4095 4093	8	58, 80- 110 cm		28 57 56
F	Mixed middens				116- 148 cm, floor		53 52 39 40
G	Older brown midden	19				5 9 15 36 35 34 33 32 31 30 28	45 60
H	Primary clays derived from local bedrock	18	4092			26 25	51 50

Table I.—*Relative stratigraphic relationships of samples of the six controlled pollen sequences. Extramural samples are assigned specimen numbers by location.*

Strati-Graphic Unit	Sample Number	Adj. AP %	CPPC Date AD	MCD Date AD	N of Decorated Sherds
A	27	X		1300 ± 0	1
D	26	54.4	1275-	1252 ± 47	24
	25	53.9	1240		
E	24	63.8			
	10	77.0			
	23	64.3	1240-		0
	22	59.5	1215		
	21	66.0			
	20	62.4			
	16	58.5			
G	19	53.9	?1215-1125		0
H	18	53.0	?		S

Table II.—*Relevant chronometric data for the test at 416.7N, North Pueblo. S = culturally sterile, X = pollen yield insufficient for analysis.*

Strati-Graphic Unit	Sample Number	Adj. AP %	CPPC Date AD	MCD Date AD	N of Decorated Sherds
A	4105	59.0	?		S
	4104	54.5			
B	4103	X	1465-1425		0
D	4102	53.5			
	4101	48.0			NA
	4100	64.0	1425-1335		
E	4099	42.0	1335-1315	1350 ± 0	1
	4098	35.0		1327 ± 64	11
	4097	18.0			
	4096	40.0	1315-1275	1333 ± 32.8	5
	4095	20.0		1168 ± 0	1
	4093	30.0	1275-1240	1335 ± 34.3	23
H	4092	X		1348 ± 35	4

Table III.—*Relevant chronometric data from the "ballcourt" backhoe trench 1, South Pueblo. Pollen data from the samples collected at locus 56N. Ceramic data from the arbitrary 10 cm levels of test pit at locus 39N correlated by natural stratigraphy. NA = stratigraphic unit not exposed at 39N.*

Strati-Graphic Unit	Sample Number	Adj. AP %	CPPC Date AD	MCD Date AD	N of Decorated Sherds
B				1298 ± 86	5
D	2	53.8	1275-1240	1244 ± 106	2
E	8	57.8		1213 ± 88	4

Table IV.—*Relevant chronometric data from the test of 22S, South Pueblo.*

behavior at Nuvakwewtaqa. For example, Adj. AP % values in the 22.5 to 58.5% range occur at all the test locations. Pollen values of this range are dated to the A.D. 1240-1275 episode by the CPPC. Though episodes characterized by the same values occur earlier (A.D. 1125-1215) and later (A.D. 1315-1335), A.D. 1240-1275 is the most probable chronometric alternative represented in all of the tests from the site. If the 1240-1275 antiquity estimate is correct, the CPPC predicts that directly superimposed pollen records which have Adj. AP % values outside the 22.5 to 58.5% range will have values less than 22.5% , and pollen records directly superimposed by those attributable to the 1240-1275 episode will have Adj. AP % values greater than 58.5%. These predictions are observed in each of the six test pit cases. Such consistency is not expected if the Adj. AP % value pollen statistic were a product of human behavior, considering the variety of activity areas represented by the test pit locations.

With that concern allayed, it is clear from the tables that the chronometric estimates of antiquity provided by the CPPC for the various samples do not correspond to the estimates of relative antiquity that would be assigned to them by virtue of their contextual association with a particular stratigraphic unit. Though the variously colored sheet middens of the site were always observed in the stratigraphic order identified for them, both the MCD and the CPPC dates suggest that their deposition was not temporally uniform throughout the site. Younger brown midden samples are dated palynologically to the A.D. 1425-1335 episode at the ballcourt, to the A.D. 1315-1275 episode at 33.8S, and to the A.D. 1275-1240 episode at the tests at 22S and 150S. Similarly, red-brown midden is variously dated A.D. 1335-1315, 1315-1275 and 1275-1240 at different locations. MCD dates for both midden types overlap throughout the 13th and 14th centuries, also. Taken in the context of Coinman's analysis of the vertical distributions of ceramic type clusters at the North Pueblo, these results confirm her conclusion that the evidence which is now available suggests necessity for an alternative to Upham's chronology.

Coinman's concern regarding generalization from the MCD chronometric results in the room at 33.8S to the whole of the site and the Chavez Pass District also is justified by the results of application of the CPPC. Even discounting those situations in which MCD dating is constrained by very low numbers of decorated potsherds in the assemblage, the correspondence between MCD dating and CPPC dating of potentially concordant records is poor. There are nine cases in which MCD dating is based upon five or more examples of decorated pottery in the ceramic assemblage. In six of those cases the standard deviation of the MCD date is so wide that another Adj. AP % value could also be considered valid, since the span of time expressed by one standard deviation on either side of the MCD encompasses effective moisture episodes of two or three forms. In one other case, the concordance expected if the assumption is valid is not observed. Thus only two of the nine cases yield concordant MCD and CPPC dates consistent with the assumption upon which Upham's model was constructed.

The results of this pollen analysis, however, do not positively disprove Upham's chronometry for the process of establishment, development and abandonment of the North Pueblo, Nuvakwewtaqa and the Chavez Pass District nor do they provide positive support for either alternative chronometry. Five samples of floor deposits from as many segregate rooms excavated or tested at North Pueblo in 1981 and 1982 were selected for study on the basis of their stratigraphic positions and the temporal ranges of the

Strati-Graphic Unit	Sample Series/ Depth	Adj. AP %	CPPC Date AD	MCD Date AD	N of Decorated Sherds
B	1/0 cm	14.3			
	2/0 cm	19.1	?1595-1575		
	2/10 cm	17.6			
	1/10 cm	55.0			
C	3/50 cm	43.3			
	3/60 cm	19.0			
	3/70 cm	46.1	1335-1315		
	3/80 cm	25.3			
	3/90 cm	X			
	3/100 cm	26.1			
				1323 ± 36	147
D	2/20 cm	15.2			
	2/30 cm	14.1			
	1/35 cm	X			
	2/40	28.8			
	2/50 cm	8.5			
	1/55 cm	X			
	1/58 cm*	97.0			
	2/60 cm	0.1	1315-1275		
	2/70 cm	X			
	1/90 cm	X			
E	2/80 cm	0.8			
	2/100 cm	X			
	1/100 cm	20.7		1285 ± 31	51
	2/110 cm	17.7			
F	1/116 cm	0.6			
	1/120 cm	19.6			
	2/120 cm	X			
	1/130 cm	X			
	2/130 cm	5.6		1157 ± 146	4
	1/135 cm	X			
	1/143 cm	X			
	2/ floor	X			
	1/ floor	28.8	1275-1240		

Table V.—*Relevant chronometric data from room at 33.8S, South Pueblo. * = lens of red-brown midden.*

Strati-Graphic Unit	Sample Number	Adj. AP %	CPPC Date Ad	MCD Date AD	N of Decorated Sherds
B	37	52.7	1335-1315	1297 ± 53	20
G	5	51.3			
	36	X	1275-1240		
	35	56.7			
	9	61.8			
	34	75.0	1240-1215		
	33	66.7		1315 ± 26	6
	32	X	1215-1125		
	31	52.7			
	30	15.7			
	28	X			
			1125-1075		
H	26	X			0
	25	48.8	?		

Table VI.—*Relevant chronometric data from the test at 121.3S, South Pueblo.*

artifacts associated with them. Two were of younger and three were of older room floors, as judged by those criteria. Only one of these samples contained sufficient pollen for analysis. Since potentially older or younger pollen records of room floor context are not available from the North Pueblo for comparison, and since no independent chronometric estimate of the antiquity of this sample is available which would allow its comparison with contemporary samples from other parts of the site or other sites, the operating assumption that its Adj. AP % value is culturally induced cannot be tested. The CPPC, then, cannot be applied to establish the antiquity of the single North Pueblo room floor pollen record.

However, this pollen sample yielded an Adj. AP % value of the type which has been dated A.D. 1340-1425 elsewhere at Nuvakwewtaqa, depending upon stratigraphic position. If we were simply to assert the hypothesis that this date was accurate, we might suppose the hypothesis was amenable to testing through the analysis of additional pollen samples—dozens if necessary. Given the potential affect of the test upon the credibility and continued use of Upham's processual model, such a test would seem both a significant and a pertinent application of the Colorado Plateau Pollen Chronology.

But what is actually at issue in the debate over the chronometry of events at Nuvakwewtaqa is the affect the chronometry has on Upham's processual model. The problem is not whether *no* occupation occurred at the North Pueblo after A.D. 1315. Rather, it is whether whatever degree of abandonment of the North Pueblo occurred in the 13th century reflects a pattern of widespread political and economic destabalization affecting other Puebloan communities at that time.

There are two reasons why the CPPC cannot be employed to produce significant amounts of information relevant to this critical issue. One is that it is not designed to do so. Application of the CPPC informs one of the antiquity and the effective moisture value at the time of the deposition of a pollen record drawn from a Colorado Plateau archaeological context dating within the past 2000 years. It is not designed to do anything

else. The problem of significant archaeological interest is neither a chronometric nor a paleoenvironment description problem, but rather one of behavioral reconstruction. Methods of pollen analysis exist that allow behavioral reconstructions, but the CPPC is not such a method.

The other reason is that study of additional room floor samples from North Pueblo is likely to be inconclusive even if the research could be framed in relevant chronometric or paleoenvironmental terms. It was noted earlier that almost a full fourth of the samples used in this pollen study did not yield sufficient pollen for analysis, and of the eight room floor samples studied from the site (two from 33.8S and six from the North Pueblo), 72.5% failed to yield sufficient pollen. There is no reason to assume that study of additional room floor context samples would prove more productive. Even if as many as 70% of additional room floor samples from the North Pueblo produced sufficient pollen for analysis, however, it would not constitute an adequately large fraction of the rooms *potentially* dating to the 15th century to allow a test of the question of whether or not the North Pueblo had been fully abandoned by that date.

Strati-Graphic Unit	Sample Number	Adj. AP %	CPPC Date AD	MCD Date AD	N of Decorated Sherds
D	13	52.5			
	59	35.2		1270 ± 98	4
	58	X			
E	28	55.6			
	57	X		1281 ± 39	5
	56	X			
			1275-1240		
F	53	X			
	52	X		1279 ± 0	1
	39	39.2			
	40	45.7			
G	45	50.0		1103 ± 0	1
	60	41.7		1350 ± 0	1
H	51	77.8	?		0
	50	55.9	?		

Table VII.—*Relevant chronometric data from the test at 150S, South Pueblo.*

SUMMARY

The Colorado Plateau Pollen Chronology (Schoenwetter 1970) provides opportunity for a palynological test of two assumptions critical to a processual model which accounts for settlement pattern events of the 13th and 14th centuries in that region. When applied to relevant pollen samples from Nuvakwewtaqa, the results support criticisms of Upham's chronometry suggested by Coinman (1984). It would appear that the chronometry of strata deposition is not uniform across the territory of the site, even though the sequence of strata deposition may be. It also would appear that the

chronometry of ceramic assembled-stratigraphic superposition relationships which occurs at the test Upham considered "characteristic" for the site (Upham 1982:169) is not sufficiently replicated to be generalizable to the site as a whole or the Chavez Pass District.

This outcome, however, does not provide positive support for either of two published alternatives to Upham's chronometry of settlement events at Nuvakwewtaqa. On the one hand, this occurs because the critical archaeological issue involved is not answerable through production of the sorts of information the CPPC method is designed to produce. On the other hand, it occurs because the nature of the archaeological context from which the relevant samples can be collected seems unusually pauperized as regards preserved pollen. Thus the method probably cannot generate enough usable information to resolve the issue of the date of North Pueblo abandonment at Nuvakwewtaqa.

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