

REPORT TO: National Park Service

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TITLE: Site 222+50: Palynological Analysis

Three pollen samples were received, one from the surface of the site which presumably represents the modern pollen rain, and two from Room B. ~~Room B~~ One sample from room B was designated as a sample of the aboriginal floor, six inches below burned timbers; the other was of posthole fill. surface sample and the floor sample were more productive of pollen. Enough pollen was recovered from the posthole sample, however, to give reliable evidence that it was essentially like the floor sample.

Analysis

Because pollen analysis is a statistical technique, the system utilized in obtaining the statistics is of some importance. In calculating the percentage representations of the various pollen taxa, one need not deal the absolute frequency of a taxon. In European pollen studies, for example, it is general practise to base the percentages on the number of grains of tree pollen in the count and not on the total number of pollen grains observed. In this analysis I have excluded from the "base count" pollen of certain taxa. My intention in this regard is to de-emphasise the importance of pollen taxa which have little value for either dating or vegetation reconstruction purposes. By deleting the counts of these taxa from the base count, the percentages of other taxa necessarily increase.

This is not yet a standard practise in palynological analysis in the Southwest. The few published pollen records (Martin and Schoenwetter, 1960; Martin and Hevly, 1962; Martin, 1962; Martin, 1963; Schoenwetter, 1960; Schoenwetter, 1962) have all based their analyses of absolute frequency. I have tested the idea of adjusted pollen sums in two unpublished works (Schoenwetter, MSA and MSB) and feel that for the purposes of archaeological research it has much more value.

The reason for excluding the pollen of agricultural plants will be clear to prehistorians; the various ways in which agricultural plant parts (including

the pollen itself) are culturally handled would indicate that the distribution of pollen of these plants is not subject to the same controls as the distribution of the pollen of wild plants. By deleting agricultural pollen from the base count, its relationship to the other kinds of pollen is placed in a special category. Various other pollen taxa which have unusual distribution problems are also deleted from the base count: taxa which indicate special edaphic conditions, as pollen of cattail or pollen of greasewood. I have also deleted the pollen of the low-spined Compositae, a morphological pollen taxon involving the genera Iva, Xanthium, Hymenoclea, Ambrosia and Franseria. These genera are all indicators of disturbed soils, but some are indicative of wet and others of dry habitats. While they are common in palynological records (often lumped together under the rubric Ambroseae) the pattern of distribution of this pollen taxon seems quite locally controlled. I have somewhat arbitrarily excluded them.

Upon this analytic basis a pollen chronology for the Navajo Reservoir district of the San Juan basin has been proposed. (Schoenwetter, 196) I used the same analytic base for the samples from 222+50 for comparative purposes.

Results

The relevant pollen results are shown in the table:

	SURFACE (N=200)	FLOOR (N=200)	POSTHOLE (N=50)
% Arboreal pollen	81.5	28.5	28.0
% <u>Juniperus</u> pollen	32.0	21.0	12.0
% Chenopodiaceae pollen	8.5	43.5	50.0
% <u>Artemisia</u> pollen	3.5	14.0	14.0
grains <u>Zea</u> pollen	0	4	0

The percentage of arboreal pollen in the surface sample is that expected from a fairly dense woodland. Almost identical results have been obtained from woodland surface samples in the San Juan basin. According to Schroeder (pers. comm.) this is the sort of vegetation now existing at the site.

The percentage of juniper pollen in the surface sample is surprisingly

low, as the site is now some distance from trees of any other type. Though juniper trees compose the present woodland, the amount of juniper pollen in the sample is less than half of the total Arboreal Pollen (AP) frequency. The percentage of AP, then, is a reflection of coverage by trees, not the type of trees.

The differences between the posthole sample and the floor sample are not significant at the 0.95 level of confidence. The differences between the surface and the floor samples are all statistically significant.

The difference in % AP in the surface and floor samples indicates a far lesser quantity of arboreal coverage at the site during occupation. The difference between the proportion of juniper pollen in the AP frequencies of the two samples indicates that while there were less trees at the time of occupation, almost the only type of tree available for some distance was juniper.

The difference in the Chenopodiaceae record is quite revealing. The plant family Chenopodiaceae (the pollen taxon is sometimes called cheno-am, also) is mostly composed of species adapted to disturbed or saline soils. Typical representatives of the pollen taxon are pigweed, tumbleweed, lamb's quarters and saltbush. These plants all flower in response to summer rainfall. Significantly higher frequencies of this taxon in Southwestern pollen chronologies are attributed to an increase in the number of summer rainstorms and consequent erosion (Martin, 1963; Schoenwetter, 1962) It is not impossible that such increases may be due to the disturbance of soils occasioned by farming, but increases in this pollen taxon are found consistently on certain time horizons where not farming could be involved. The interpretation of increased summer storms seems to fit the observed data much better. This is not to say that there was an increase in total annual rainfall. The total annual rainfall cannot be accurately estimated from these data; an increase in summer rainfall may have been accompanied by no change in the winter rainfall, or by an increase or decrease.

The difference between the surface and floor samples in Artemesia (sagebrush) pollen would indicate that the lessened coverage by trees during the

period of occupation was mostly compensated for by an increase in sagebrush.

The occurrence of Zea (maize) pollen in the floor sample indicates the agricultural orientation of the occupants--an indication well supported by the archaeological evidence. The lack of Zea pollen in the posthole sample is not significant, considering the small number of pollen grains observed.

Conclusions

At present the site is located in fairly dense juniper woodland. During occupation it was located on the lower edge of a juniper-sagebrush ecotone. Pinyon was located quite a bit further from the site than at present. The climate was semi-arid, as at present, but the periodicity pattern of the rainfall seems to have been somewhat different, with more summer rain than at present.

The occupants of the site were maize farmers who no doubt made good use of the greater summer rainfall in their agricultural endeavors. However there are indications that there was more erosion and less ground water available for plant growth in general, which would have also affected the agriculture. The river, for example, was very likely entrenched and floodwater farming probably not dependable on its floodplain.

From the reduction in arboreal cover, I would estimate that there was at least no increase in total annual rainfall relative to present, and perhaps some decrease. If this was the case, and there was an increase in summer precipitation, it seems likely that winter precipitation was less than at present in the area.

At this latitude one can estimate only a 120 day growing season, if that much, which means that the farmers would have had to plant their maize before the summer rains which now arrive in mid-July. With less winter precipitation, the ground moisture reserve at the beginning of the planting season would have been low. Thus, unless the summer rains began much earlier than they do now or the first frost was much delayed, the occupants would have had some difficulty in germinating their crops as the soil would contain little moisture at the beginning of the planting season.

Even if there was no problem of germination of the crop, for one reason or another, there may well have been unusually limiting environmental controls of the agriculture. Summer rainfall, even in excellent years, is very inconstant; some areas often get no rain at all. Also, an increase in summer rainfall almost certainly would mean an increase in crop destruction, since summer storms are high energy storms which have the potential of beating crop plants down as well as washing out fields.

It thus seems highly likely that some cultural controls of water management were utilized. If these people knew nothing of irrigation they would probably have had to be quite selective in the areas they used for agriculture; they would have been almost forced to use areas of land where winter moisture was concentrated by subsurface flow and summer runoff could be collected from a relatively large drainage net. This would insure both germination of the maize and its watering from many of the summer rainstorms. The problem of ~~wi~~ germination could be controlled by hand-watering, but this would necessitate smaller plots and a consequently limited population. More complicated cultural controls of water management involve terraces, check dams, diversion ditches or other irrigation works. From a study of the archaeological evidence one or more of these possibilities may appear more probable than others.

Dating

Dating by pollen analysis is undertaken though comparison of the pollen record from an unknown horizon with a pollen chronology for which absolute and relative dates have already been worked out. For the Southwest three pollen chronologies have been constructed, each from an ecologically distinctive area and each with its own limitations.

In the pollen chronology offered by Martin (1963) the pollen spectrum of the floor at 222±50 fits in the most recent period, tentatively encompassing the last 500 to 1000 years. In the chronology developed for east-central Arizona and west-central New Mexico, the floor sample would be dated between AD 1000 ± 100 and AD 1200. At the earliest, in other words, 900 and at the latest, 1200.

(Schoenwetter, 1962). In the chronology developed for the Navajo Reservoir district the floor sample would date ~~xxx~~ between AD 900 and AD 1050, probably at 1000 ± 25 .

As none of these chronologies have been developed in the area of the site, none may be applicable. Martin's chronology, which is based on data mostly derived from the Sonoran desert, seems least likely to be useful. The "Mogollon" chronology is from an area devoid of sagebrush and thus might involve different phenomena than might be expected in Utah. While the archaeological evidence for dating of 222 ± 50 is far from optimal, present indications are that the Navajo Reservoir chronology is possibly applicable in Utah and, one hopes, the entire Anasazi area.

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