

ARCHAEOLOGICAL RESEARCH 2: TEHUACAN

THE PREHISTORY OF THE TEHUACAN VALLEY. Volume 5, Excavations and Reconnaissance. Edited by RICHARD S. MACNEISH. (Austin: University of Texas Press, 1975.)

Searching for the Origins of Agriculture

Agriculture is the basis of civilization. So fundamental is this truth that it has been recognized by both modern archaeologists and at least some of the ancient peoples they have studied. The mythical histories of the Aztecs, for example, frequently describe the lowly life style of the Chichimecs, a nonagricultural people who were dependent upon hunting and food collecting for their sustenance: "They lived among the peaks and in the harshest places of the mountain where they led a bestial existence. They had no human organization but hunted food like beasts of the same mountain, and went stark naked. . . . Their whole life was reduced to a quest for food. . . . These people slept in the hills inside caves, or under bushes. . . . They adored no gods, and had no kind of ritual, nor did they recognize any ruler" (Durán 1964:11–2). According to the native historian Ixtlilxochitl (1891:103–4), the splendors of Aztec culture were achieved only after the savagery of the Chichimecs had been blended with the more advanced civilization of the Toltecs who already followed an agricultural way of life.

Without question, the work of Richard S. MacNeish and his associates in the Tehuacan Valley, Mexico, has been the most important attempt to deal with the problem of the origins of agriculture in Mesoamerica. During the years 1960–63, MacNeish and his collaborators spent three field seasons in the Tehuacan Valley, completing extensive excavations in thirteen prehistoric sites, testing twelve additional sites in a more abbreviated manner, and recording the locations and surface remains of 480 additional sites discovered in the course of archaeological reconnaissance. The accumulated data represent a twelve-thousand year span of prehistoric human occupation in the Valley from the first small bands of terminal Pleistocene hunters to the highly stratified city-state polities of the sixteenth century. The subject of this review is volume 5 ("Excavations and Reconnaissance") of the projected six-volume final report of the Tehuacan Archaeological-Botanical Project.

It is evident that this volume is not intended for the nonarchaeological specialist in Latin American studies. This is not to say that the problems investigated by the project are lacking in broad significance, nor that the archaeologists working on the project failed to collect data relevant to those problems. It is simply that this volume is devoted to describing archaeological remains as observed during excavation and survey and to interpreting those remains at the lowest level of inference. The result is five hundred pages of rather tedious

prose: "Activity Area A occurred in the northwest corner of the excavation roughly from N1 to N6 between W7 and W9; it undoubtedly extended still farther west into the unexcavated portion of the cave. Here were found end-scrapers, scraper-planes, blades, side-scrapers, fragments, a chopper, mortar, muller, and pestle, and a Flacco projectile point, many chips and cores, in association with two deer bones. It may have been a food preparation and skin-working area where flint-knapping also occurred" (p. 263).

The final eight pages do present, in summary form, the more general conclusions concerning the origins of agriculture and the development of socio-political complexity in the Tehuacan Valley. But on the whole, these matters have been deferred; they will be the focus of the sixth and concluding volume of the project's final report. I would guess that this last volume will interest a much wider reading audience; it has been eagerly anticipated since the publication of the first preliminary reports. Still, volume 5 presents the data upon which the more general conclusions will rest, and it seems appropriate at this point to attempt an evaluation of the techniques of data collection and interpretation employed by members of the Tehuacan project. The handling of data as evidenced in this volume will surely affect the quality of the summary volume that follows.

The Research Strategy

According to MacNeish and Nelken-Terner, the Tehuacan project participants set for themselves a series of objectives that were to be fulfilled in sequential order: "First, data collection, then, description of chronology, to be followed by description of cultural contexts using terms that would facilitate the next objective, the making of cultural-historical integrations [i.e., phase by phase reconstructions of the ancient cultural systems]" (p. 8). It was only after all of the above tasks had been accomplished that the project would attempt to reach its final goals of deriving hypotheses to account for the beginnings of agriculture and the evolution of cultural complexity, and testing these hypotheses against bodies of cultural-historical data from other parts of the world.

The practice of constructing hypotheses only after completing data collection and interpretation has been criticized in certain archaeological circles, basically on the grounds that archaeologists are not likely to collect data that will enable them to test specific hypotheses unless they have those hypotheses in mind *before* they enter the field. As Fritz and Plog (1970:410) state: "In the absence of some specific problem, archaeologists collect those data which they have been taught to perceive. But there is no guarantee that these data will be sufficient for solving more than a limited number of problems which might occur to the researcher after he has collected his data." Or as Watson, LeBlanc and Redman (1971:10-1) write: "*Hypotheses are necessary to give direction to research. . . . One is unlikely to collect relevant data without knowledge of the hypothesis to which the data are to have relevance.*"

In spite of these rather grim pronouncements, the Tehuacan project has generated a large body of highly valuable archaeological data that is relevant to a great number of specific hypotheses concerning the origins of agriculture and civilization in Mesoamerica. This is, I believe, due to the fact that MacNeish and his associates entered the field with a number of implicitly held, broadly defined hypotheses in mind such as: the origins of agriculture and/or civilization had something to do with climatic change, or population growth, or the administrative problems of water control, or interregional exchange, or some combination of these variables. Thus, although MacNeish has waited until the final pages of volume 5 to present these hypotheses in an explicit form, the collection of data from the Tehuacan Valley had a more theoretical focus than MacNeish and Nelken-Terner would lead us to believe.

On the other hand, volume 5 does not entirely escape the consequences of the formal research strategy outlined by MacNeish and Nelken-Terner. For example, most of the data are presented without mention of the hypotheses upon which they have bearing, which makes for tedious reading regardless of literary style. Deferring the presentation of hypotheses until the very end also accounts, in part, for the length of the text, for in the absence of hypotheses there are no criteria for deciding which data should be included in the presentation and which should be relegated to appendices, or, perhaps, a series of independent papers published elsewhere.

The primary concern of the volume is the translation of raw archaeological data (the characteristics and locations of artifacts and features) into a phase-by-phase reconstruction of prehistoric life styles. In general, this has been skillfully accomplished, but certain aspects of the reconstructions suffer from defects in the methods of data collection and analysis. To illustrate this point, there follows a discussion of the handling of three aspects of the prehistoric cultures of Tehuacan: demography, subsistence, and settlement systems.

Population Estimates | Archaeological survey is the most practical method of obtaining information on the demography of prehistoric populations. In such a survey, the archaeologist thoroughly covers the entire region under study, or a representative sample of it, recording the size and location of each concentration of archaeological materials encountered. A collection of artifacts is made at each site so that the date of occupation may be determined. If the artifacts indicate that the site was occupied during two or more temporal phases, several systematic collections may be necessary to determine the areal extent of occupation during each of the phases. Normally too, the remains of prehistoric construction (e.g., houses, mounds, walls, canals, etc.) are recorded.

Once this procedure has been carried out, the archaeologist should be able to calculate the total area covered by prehistoric occupation during each temporal phase. Such figures provide a rough estimate of the size of the population during each phase relative to population sizes during the other phases. Thus, broad demographic trends may be delineated. If there is some basis for establishing the density of population per unit area (e.g., the density of houses in excavated sites or the density of modern settlements analogous to the

prehistoric settlements under study), the total area of occupation may be translated into estimates of the absolute size of the populations in each of the various phases.

The Tehuacan project participants followed this general methodology; their results are presented in table 1. It should be noted, by way of explanation, that MacNeish et al. made certain allowances for temporal differences in the density and duration of site occupation so that the ratio of population to hectares of occupation varies from phase to phase. Population size during the Purron phase is something of a mystery. Only three sites were found that could be attributed to the 2300–1500 B.C. time period; but rather than postulate massive depopulation for this phase, I would suggest (and I think that MacNeish would agree) that this is due to some technical difficulty such as the poor definition of Purron-phase time markers or one of the methodological problems discussed below. The existence of such problems does affect the degree of confidence that the reader might have in any of the population estimates for the various temporal phases.

TABLE 1 Population Estimates for Prehistoric Tehuacan

Phase	Dates	Ha. of Occupation	Estimated Population
Late Venta Salada	A.D 1150–1550	955.68	80,000–120,000 people
Early Venta Salada	A.D 700–1150	382.84	25,000–35,000 people
Late Palo Blanco	A.D 300–700	385.48	15,000–25,000 people
Early Palo Blanco	150 B.C.–A.D 300	675.89	20,000–30,000 people
Late Santa Maria	500–150 B.C.	57.27	5,000–8,000 people
Early Santa Maria	900–500 B.C.	11.16	1,800–3,600 people
Ajalpan	1500–900 B.C.	5.15	600–1,200 people
Purron	2300–1500 B.C.	?	? people
Abejas	3400–2300 B.C.	17.46	300–600 people
Coxcatlan	5000–3400 B.C.	9.73	100–400 people
El Riego	7000–5000 B.C.	5.00	100–150 people
Ajuereado	10,000–7000 B.C.	0.19	1–5 families

First, any demographic study of this type assumes that *all* surface concentrations of prehistoric materials within the survey area have been found and duly recorded. If some but not all of the sites are found, certain biases may creep into the analysis. If, for example, the survey procedure is such that large sites have a better chance of being found than small sites, even relative population estimates will be biased in favor of the phases when a greater percentage of the population lived in large settlements. What are we to think when MacNeish et al. state: “In the initial survey 87 occupations, 21 specialized sites, and about 103 indeterminate occupations were discovered that pertained to [the] Late Venta Salada [subphase]. . . . Now, our Coxcatlan Project under the direction of Edward Sisson, then of the R. S. Peabody Foundation, has netted an additional

100 or so sites of this subphase" (p. 470)? The admission that the survey netted only two-thirds of the available sites must surely call into question both the relative and absolute population estimates based upon it.

The passage quoted above raises a second issue. The "indeterminate occupations" mentioned are from multicomponent sites, that is, sites occupied during two or more temporal phases. The method of translating these multicomponent sites into phase-specific population figures is not explained in the text of volume 5, but I infer from the figures presented that each site of this kind was assigned to the phase accounting for the greatest proportion of occupational debris, only. In other words, no matter how abundant the debris from other temporal phases, that site was not included in the computation of the total areas of occupation for these other phases.

This introduces a second source of bias into the Tehuacan population estimates; when the settlements of any particular phase are patterned in the same fashion as settlements from earlier or later phases, population will be underrepresented to a greater or lesser degree in the hectares of occupation estimate. I would guess that the number of "indeterminate occupations" recorded for each phase was given some consideration in moving from the hectares of occupation estimate to the population estimate, but the possibilities for error in treating sites of this type appear to have been great.

Finally, I wish to make one minor comment upon the translation of the area of occupation estimate into the absolute population estimate. From the excavation of Ajalpan-phase living floors at the Coatepec site in Tehuacan, MacNeish concluded that the houses of this phase were packed onto the site with the density of one house per ninety square meters. However, the work by Winter (1972, 1976) at a village of contemporary date in the Valley of Oaxaca suggested that houses on that site were packed with a density of one house per three-hundred square meters. Flannery (1976:32) found a similar spacing of residential structures at a site of approximately the same date on the Pacific Coast of Guatemala, though in one case, a cluster of three houses rather than a single structure occupied the center of a four-hundred square-meter area.

Flannery (1976:370) suggests that a site density of one household per c. three-hundred square meters may have typified Mesoamerican settlements of the 1500–850 B.C. period all the way from the Valley of Mexico to Guatemala. MacNeish's excavation data from Coatepec, which were not broad enough to reveal more than two or three house foundations at a time, could be interpreted as revealing the center of a cluster of houses separated from other such clusters by a considerable area of open space rather than a representative portion of a densely packed village. If this were done, then the absolute population estimates provided by MacNeish and his collaborators would have to be substantially reduced, at least for some of the earlier phases of village life.

Dietary Data / Table 2 presents MacNeish's reconstruction of the subsistence of the prehistoric Tehuacanos. It is based directly upon the food debris recovered

TABLE 2 *The Contribution of Wild Game, Wild Plants, and Cultivated Plants to the Prehistoric Tehuacan Diet*

Phase	Dates	Wild Game		Wild Plants		Cultivated Plants	
		Liters of Food	% of Diet	Liters of Food	% of Diet	Liters of Food	% of Diet
Venta Salada	A.D 700–1550	256.0	16*	120.3	8	1192.8	75
Palo Blanco	150 B.C.–A.D 700	314.2	16*	330.9	17	1247.9	65
Santa Maria	850–150 B.C.	149.5	24*	103.1	17	352.4	58
Ajalpan	1500–850 B.C.	22.0	24*	16.6	18	49.6	55
Purron	2300–1500 B.C.	?	?	?	?	?	?
Abejas	3400–2300 B.C.	200.8	30	331.3	49	144.5	21
Coxcatlan	5000–3400 B.C.	334.6	34	500.7	52	139.9	14
El Riego	7000–5000 B.C.	487.8	54	372.6	41	40.3	5

*Remaining percentage of the diet composed of meat from domesticated turkey and dog.

from excavated dry caves and rock shelters in the Tehuacan Valley. The contribution of wild game to prehistoric diets, for example, was derived by calculating the minimal number of animals of a particular species represented by the bones recovered from each living floor and multiplying that number by the liters of meat that each animal would yield. The total volume of meat represented by these bones was then compared to the volumes of wild plant food and agricultural produce, which were calculated in a similar fashion, the volume of vegetal food having been estimated from the various seeds, fruit pits, seed pods, chewed quids, leaf stems, corn cobs, and squash-gourd rinds recovered from the same living floors. These matters are covered at greater length in MacNeish's article "A Summary of the Subsistence" appearing in volume 1 of the final report (pp. 290–309).

The dietary information supplied by MacNeish is extraordinary from the archaeologist's point of view; the combination of excellent preservation conditions in the dry caves of Tehuacan and extremely well-controlled excavations in those caves during which the preserved botanical remains were recovered is almost unprecedented in the annals of archaeological research. However, no matter how intriguing the dietary information is, it must be handled with a certain degree of restraint for three reasons.

First, the estimated contributions of wild game, wild plants, and agricultural produce would have been more accurately represented by the calories that each supplied to the diet than by their contributions by volume. Estimates of the caloric value by weight of foods, such as chupandilla fruits and setaria seeds, are not easy to come by, but if this information were obtained through additional research, it would be a simple enough matter to convert volumes into weights and weights into calories. The fact remains, however, that the proportion estimates supplied are based upon volumes and not calories and for this reason may be misleading.

The second point has to do with sampling. The dietary information is, of necessity, based upon the materials recovered from dry cave excavations. For many phases of prehistoric occupation, these caves represent only a small portion of known archaeological sites in the Tehuacan Valley, and either because of their locations or the restricted seasonality of their occupation, they may not present a representative picture of the proportional importance of hunting, gathering, and agricultural activities. For instance, from Late Santa Maria times onward, MacNeish and Cook suggest, the occupation of Purron Cave may have been restricted to short seasonal visits in the late spring and early fall for the purpose of planting and harvesting maize and orchard crops. The eating habits of its inhabitants during these brief visits may or may not be an accurate reflection of their diet during the rest of the year.

Finally, conditions of natural preservation distort the data upon which MacNeish's estimates are based. We may suppose that every incident of animal butchering, maize preparation, and fruit consumption is liable to have yielded relatively durable remains in the form of bones, cobs, and pits. However, the consumption of other types of foods, particularly edible greens and seeds such as setaria, amaranth, and beans, cannot be counted upon to produce comparable types of well-preserved refuse. Thus, although amaranth and beans are known to have been important components of the Central Mexican diet at the time of Spanish conquest (cf. Barlow 1949), and although the ratio of beans to maize (by volume) is as high as 1:7 in the diets of people in at least one modern Central Mexican community (Lewis 1951:192), both amaranth and beans are poorly represented even in the materials from the most recent living floors of the Tehuacan caves. This particular bias would appear to have affected the estimates recorded in table 2, probably resulting in an overestimation of the importance of wild game and altering the ratio of wild plants to agricultural produce to an unknown extent.

Settlement Patterns / By far, the bulk of volume 5 is devoted to the presentation and analysis of data concerning the distribution of archaeological features in time and space. The distribution of artifacts and features in each excavated living floor is beautifully presented in a series of computer-drawn plots (beautiful in the eye of this beholder); the presentation and discussion of these plots occupy the first 340 pages of text. The phase-by-phase distribution of sites within the Tehuacan survey region as a whole is the subject of the subsequent 150 pages. Both types of information are essential in reconstructing the patterning of prehistoric settlement.

The study of prehistoric settlement patterns in archaeology is rarely undertaken as an end in itself. Generally, the distribution of human settlement is analyzed because it provides clues to a number of other variables such as demography, subsistence strategy, and sociopolitical organization. To repeat, the raw data for a settlement pattern study come from both archaeological survey and site excavation. The distribution of settlements with respect to environmental zones is suggestive of the strategy of resource utilization, while excavation data pertaining to the temporal aspects of settlement (seasonality,

duration of stay, incidence of reoccupation) indicate the scheduling of various subsistence activities. Analysis of the spacing between sites (as recorded on the survey maps) and of residential features within sites (as revealed in survey or excavation) is an important means of estimating the size, composition, and relationships among social segments of a prehistoric population.

Using both the survey and excavation data from Tehuacan, MacNeish and his associates make some attempt to deal with all of the topics listed above. For example, the Tehuacan Valley is divided into five environmental zones, and evidence for the changes in the abundance of sites per zone over time is duly presented. However, they make little attempt to infer what the differential distribution of sites by zone means in terms of changing subsistence strategies or even if the zones delineated by the archaeologist are significant in terms of differential exploitation by the prehistoric populations. The conclusion that "all in all, site locations show definite trends in time and are good time markers, or modes, and must be elements included in any settlement pattern types" (p. 348) is a weak statement, betraying a concern with the problems of chronology to the exclusion of other important considerations.

The seasonality factor in prehistoric settlement is treated much more extensively; the same plant materials that enable MacNeish and his collaborators to deal with questions of diet with such authority also permit them to treat the topic of seasonality with unprecedented rigor. Many of the food remains recovered from the dry caves (e.g., many species of fruits, deer and peccary fetuses, fish, migratory birds, iguanas, lizards, and snakes) can only be gathered during certain seasons of the year. Since it is unlikely that these foods were stored by the prehistoric inhabitants of the caves, their presence on the living floors is an excellent indicator of the season of occupation.

In dealing with the season of occupation at open-air sites, however, the issue is much less secure. The analysis relied upon the presence or absence of durable artifacts such as mortars, metates, choppers, and scrapers that would have been used in processing seasonal-specific foods. Although the inferred functions of these tools (and thus their seasonal association) is probably correct, it is possible that a detailed study of food remains and tool types on the dry cave living floors might reveal very tight associations between certain tool types and certain food species. This, in turn, would permit a more narrow specification of seasonality on open-air sites where the tools, but not the food remains, were recovered. Such an analysis has not been attempted in volume 5.

In general, there appears to have been a reluctance to use any statistical methods to aid in data analysis, though this would have been helpful in dealing with a number of questions. For example, MacNeish and Peterson present a fascinating hypothesis: that the differential distribution of figurine types by household during the Ajalpan phase indicates the existence of kin-specific cults appropriate to a segmentary, egalitarian, kin-based society. On the other hand, the more homogeneous distribution of figurine types by household during the Santa Maria phase indicates the emergence of "some sort of religious phenomena separate from and above the more basic kin-aggregate units" (p. 192). A con-

tingency table comparing the distributions of figurines by household might have conclusively demonstrated that the Ajalpan figurine distribution was significantly heterogeneous and the Santa Maria distribution significantly less so. If so, it would have added strength to their assertion.

There are also a variety of statistical techniques available for dealing with the clustering of artifacts on excavated living floors and the clustering of sites within a regional occupation. MacNeish et al. present the reader with clusters of both types, but they are all of the "eyeball" variety. The importance of clusters in determining the division of labor within sites and the sociopolitical ties between sites would seem to imply that the most rigorous analytical techniques available be utilized.

A Final Evaluation

The objective of this review has been to give nonarchaeologists a general view of the types of work that have been accomplished in the Tehuacan Valley, and perhaps, to warn them from taking some of the figures cited in archaeological publications too literally. The many comments and criticisms of the methods of data collection and analysis presented above should not reflect unfavorably upon the professional skills of MacNeish and his associates. It is a tribute to their industriousness and integrity that their data have been published in extensive enough form to permit detailed scrutiny; few of the site reports published to date can approach the quality of volume 5. Besides, hindsight is always 20/20, and many of the analyses suggested above will probably be carried out in the future. It is much to the credit of the coauthors that the excavation data presented in the volume are so clear and so complete that they may be reworked at will. Further utilization of the survey data will probably have to await the completion of complementary studies.

Standing back from the critical evaluation of volume 5 and viewing the Tehuacan Archaeological-Botanical Project as a whole, we must recognize that it has been an undertaking of major scale concerning problems of critical importance for our understanding of human culture and its evolving complexity. It is an ongoing project for which the summary has yet to come.

Before the inception of this project, Mesoamerican archaeology tended to focus upon the excavation of impressive examples of civic-ceremonial architecture. If the stage-by-stage publication of the Tehuacan final report has inspired archaeologists to pose new questions about the process of culture change and to demand new kinds of data and analytical techniques in order to answer them, then the work of MacNeish and his associates at Tehuacan has certainly advanced the cause of science in a major way.

ELIZABETH M. BRUMFIEL
Eastern Michigan University

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