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Early Sedentary Economy in the Basin of Mexico

New data suggest significant variants in early post-Pleistocene human occupations in Middle America.

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Summary. Artifactual and nonartifactual evidence from the lacustrine shores of the Chalco-Xochimilco Basin suggest the existence of fully sedentary human communities in the Basin of Mexico from at least the sixth millennium B.C.

Evidence from archeological excavations in the last two decades has widened our knowledge concerning early post-Pleistocene human communities and the economic strategies, cultural practices, and technological development that led to the establishment of village life.

Curiously enough, the Basin of Mexico, which gave rise to a massive literature on its Pleistocene prehistory and its Classical period (*1*), has been largely ignored with regard to the time period between 10,000 and 2000 B.C. The general opinion that during that interval it represented a cultural desert or a marginal zone was implicitly or explicitly adopted, as frequently happens when the evidence for a determinant period is lacking. Archeological excavations at the fossil lacustrine site of Zohapilco (*2*), in the southern part of the Basin of Mexico, provide new perspectives. They have yielded numerous paleobotanical and paleozoological remains, as well as evidence of human industries, which constitute the first testimony for occupations in the southern part of the Basin of Mexico between the sixth and the second millennia B.C.

In this article I describe the work conducted at the Zohapilco site and discuss hypotheses concerning the processes and conditions under which sedentary life was established in this region. In particular, I examine the possibility of a preagricultural sedentary way of life and attempt to define some significant points in the progressive development and change in man-plant relationships in the Basin of Mexico from the sixth millennium onward.

Theoretical Background

Only the two earliest phases of the long archeological sequence (*3*) uncovered at the Zohapilco site will be discussed here: the Playa phase, dated from 6000 to 4500 B.C., and the Zohapilco phase, dated from 3000 to 2200 B.C. (*4, 5*). Both raise several points of interest.

Specifically, this first discovery of a pre- and protoceramic post-Pleistocene occupation reduces a gap in our knowledge of a crucial period and allows us to explore the regional antecedents of agrarian preurban societies in the Basin (*6*). It shows the theoretical weakness of simple diffusionist models that explain the emergence of ceramic cultures in the Basin of Mexico through the sudden intervention of external factors. Such interpretations, which call for a late settlement or colonization, are actually recurrent in the history of research in this region.

Within a more general context, the Playa phase provides evidence that may lead us to discern various trends toward the establishment of a sedentary way of life among Middle-American communities. Especially relevant to this aspect is the fact that the paleoecological characteristics of the southern part of the Basin of Mexico differ radically from those of the semiarid Valley of Tehuacan (*7*) and of the Sierra of Tamaulipas (*8*) that have, until now, provided the most important archeological data published on the subject.

Recent archeological syntheses dealing with the transition from a predatory to a production economy have drawn attention to the fact that semiarid bioclimatic contexts alone have furnished data for the geographically varied zone of Middle America. Moreover, these syntheses stress the difficulty of understanding the early processes that led to plant domestication in regions where annual rainfall seems not to have exceeded 500 millimeters (*9*). Although these considerations may have somewhat disregarded the specific resources of semiarid regions and the seasonal fertility of restricted ecological niches, such as wet barrancas and valley floors, they have the advantage of demonstrating that, until now, only xerophytic contexts and a priori unfavorable areas have been seriously surveyed. It has been noted (*9*) that researchers such as Sauer and Braidwood (*10*), Binford (*11*), Meyers (*12*), Bronson (*13*), and Flannery (*14*), whose theoretical leanings are often divergent, agree in placing the gradual drift toward plant domestication in optimal bioclimatic zones, where sedentary life and the use of a wide range of plant resources tend to become established early. In another context, an examination of the state of our knowledge on early ag-

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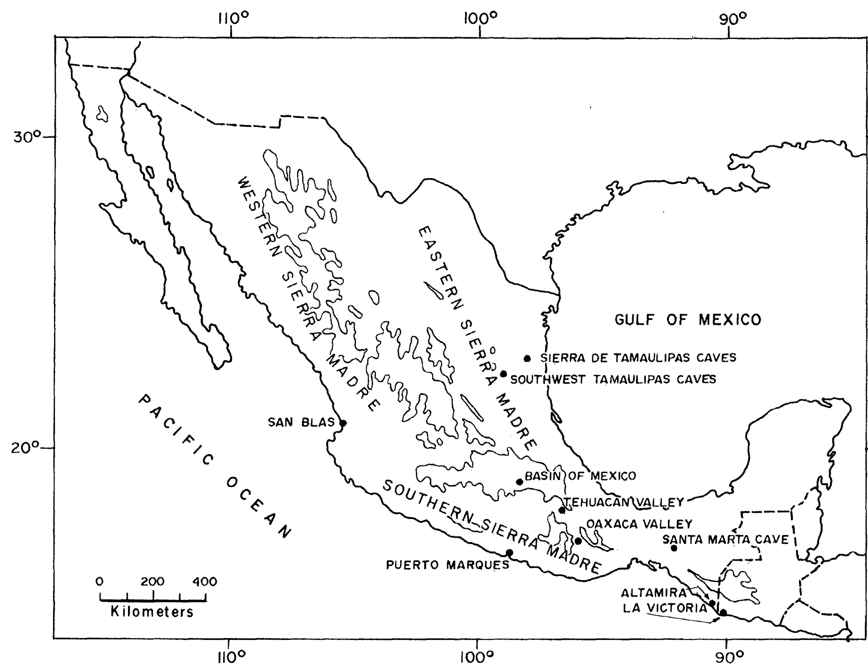

Fig. 1. Principal known preceramic and early ceramic zones in Middle America.

riculture led Higgs and Jarman (*15*) to suggest that our current opinions and interpretations have been biased by the discoveries made in very restricted areas in the Americas and the Near East, which, in the opinion of these authors, leads to "a need for a reconsideration of the situation as a whole" (*15*, p. 3).

Data from the Zohapilco site, situated at an altitude of more than 2200 meters in the temperate highlands (Fig. 1) should contribute to attempts to review the conventional evolutionary scheme of nomadic hunter-gatherers becoming sedentary farmers or herders (*16*), a scheme often considered as an "inappropriate rigid stadial model" (*17*). The new data should help to highlight the diversity of processes which gradually led to large permanent settlements in post-Pleistocene times.

Geographical Setting

The southern part of the Basin of Mexico once was filled by a freshwater lake that was divided in two parts, Xochimilco and Chalco, by the construction of a dike during historic times. Its fossil shores, surrounded by volcanic mountain ranges that are mostly basaltic and Quaternary in origin, are located at an altitude of about 2240 m.

Chalco lake covered an area of some 110 square kilometers in the southeastern depression of the Basin before it was completely drained at the beginning of this century. Its riparian soils, rich in peaty components, have preserved numerous archeological testimonies of pre-Hispanic life. Evidence for early Holocene and "Formative" (*18*) occupations is particularly dense on the fossil lake beaches that stretch along the foot of the eastern slope of the Tertiary andesitic volcano of Tlapacoya (Fig. 2). This ancient volcano, at present a conspicuous physiographic feature in the plain of Chalco, appears in cartographic documents of previous centuries as an island or a peninsula, depending on fluctuations in the level of the former lake.

Some residual stretches of the Xochimilco lake, which formerly covered the southwestern depression of the Basin of Mexico, remain today. Its willow-shaded canals and ponds provide a sample of the varied aquatic and riparian flora and fauna of the past, and its humiferous fertile shores, now under intensive horticulture (*19*), contrast strikingly with the generally eroded and deforested aspect of the Basin. Above the Xochimilco-Chalco lacustrine plains and the site of Zohapilco rises the imposing Sierra Nevada with its snow-covered volcanic peaks of Iztaccihuatl and Popocatepetl, over 5000 m high, closing the vast Basin of Mexico to the southeast.

Stratigraphy and Early Dates

During the last millennia, lake transgressions and recessions in the Basin of Chalco were numerous and of diverse magnitudes. For this reason a trench, 50 m in length, was laid out close to the zone of slope change and perpendicular to the contour lines. The aim was to expose the greatest possible number of successive beaches favorable to human activity. In contrast to most pre-1970 archeological excavations related to the Holocene in the Basin of Mexico, those at Zohapilco followed the natural stratigraphy of the sediments. These formations provide climatic, edaphic, and biotic data that are especially valuable in research related to paleoeconomy.

The stratigraphic column at the site of Zohapilco yields evidence of human communities that occupied the region during 6000 to 200 B.C. Before discussing the first part of the sequence I shall note briefly the principal volcanic episodes and lacustrine fluctuations that took place in the southern part of the Basin between 12,000 and 6000 B.C., as demonstrated by stratigraphic analysis.

The lowermost layer of the geopedological column examined at Zohapilco is a peat bed dated at 12,750 ± 280 B.C. (GX.0878). This is overlaid by a thick deposit of pumice and andesitic lapilli (Fig. 3, layer 33) that marks the beginning of intense volcanic activity that was rarely interrupted by lake or land sedimentation in the course of the following millennia. Within this volcanic sequence, there is a regional stratigraphic marker composed of a threefold deposit of pumitic ashes. This tripartite volcanic layer (Fig. 3, layer 30) has been indirectly dated by carbon-14 analyses at 7970 ± 220 B.C. (I-6897). At the conclusion of this series of volcanic episodes, an important lake transgression occurred in the Basin of Chalco, leaving a thick and uniform silt deposit (Fig. 3, layer 26) that was very rich in organic matter and diatom frustules.

On the beach that formed over this deposit (Fig. 3, layer 25) and that was composed mainly of oolites and freshwater ostracods, appears the first evidence of post-Pleistocene human occupation at Zohapilco. The 5090 ± 115 B.C. carbon-14 date (I-4405) associated with this beach is the oldest chronological reference for this ancient occupation of the site which I call the Playa phase. By extrapolation of the Clark dendrochronological correction curve (*20*), this ^{14}C date would give a sidereal date of about 5900 ± 120 B.C. Another ^{14}C date, 4250 ± 125 B.C. (I-4192), from a higher stratigraphic level (Fig. 3, layer 22) was obtained for this long-lasting Playa occupation. Application of the dendrochronological correction, following the Clark curve, gives this later radiocarbon date a sidereal date of 5115 ± 130 B.C.

Two subphases have been determined

within the Playa cultural phase. Expressed in sidereal years (*5*), their estimated range is 6000 to 5300 B.C. for Playa 1 and 5300 to 4500 B.C. for Playa 2.

The Playa Phase: Paleoecology

The Playa phase coincides with an exceptional flourishing of the biota in the southern part of the Basin of Mexico. Study of histograms of early Holocene pollen not only reveals that the southern part of the Basin of Mexico reached its bioclimatic climax between the seventh and fourth millennia, but also indicates the remarkable continuity and equilibrium of the biocenoses represented.

Although today the Basin of Mexico is deforested and subject to severe erosion, the pollen spectrum of the Playa levels shows that large areas were once covered by forests in which three genera predominated: pine (*Pinus*), oak (*Quercus*), and alder (*Alnus*), together with ash (*Fraxinus*), walnut (*Juglans*), liquidambar (*Liquidambar*), elm (*Ulmus*), hackberry (*Celtis*), and Aceraceae. Also represented in the pollen inventory are trees from the higher zones above the region, such as fir (*Abies*), or those associated with riparian soils, such as willow (*Salix*) and poplar (*Populus*). The estimated annual rainfall for this biotope, dominated by a temperate deciduous forest, is over 1400 mm, while the annual mean temperature, with but slight seasonal fluctuations, has been calculated at 20°C (*21*). Black haw (*Viburnum*) and elderberry (*Sambucus*) predominated in the shrubby layer. The grassy layer included essentially *Verbena*, *Oxalis*, *Sida*, *Myrica*, *Thalictrum*, *Mitella*, *Heliotropium*, and Acanthaceae.

The lake shores—habitat of fish-eating birds—were densely covered by Cyperaceae mixed with rushes (*Juncus*), cattails (*Typha*), and Sparganiaceae. Horsetail (*Potamogeton*), water lentil (*Lemna*), *Myriophyllum*, and *Epilobium* made up a large proportion of all the floating or submerged aquatic plants. The water of Lake Chalco was fresh, as shown by the presence in riparian sediments of freshwater mollusks of the following genera: *Physa*, *Torquis*, *Helisoma*, *Amnicola*, and *Pomatiopsis*. Also present were freshwater ostracods such as *Potamocypris*, *Cypridopsis vidua*, *Darwinula stevensoni*, *Candona elliptica*, *C. distincta*, and *C. hipolitensis*.

Alluvial soils, rich in humus and characterized by a high water table, were a favorable milieu for wild cereal clusters. Among the riparian plant cover, the Playa pollen spectrum indicates the presence of amaranths, chenopodiums, and the genus *Zea*, the pollen of which, at these levels, measures from 60 to 90 mi-

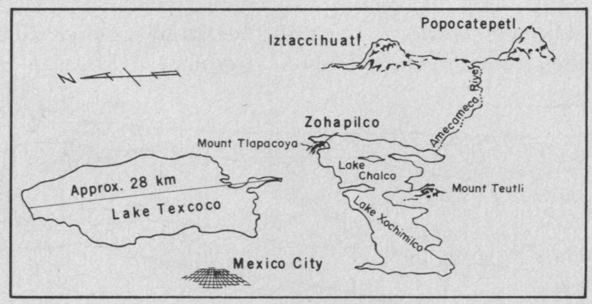

Fig. 2. The Basin of Mexico. An oblique perspective view of the central and southern parts of the Basin of Mexico, made in 1858 by Casimiro Castro. [Courtesy A.F.I.N.A.H.]

crometers in diameter. Certain properties of the humiferous alluvial deposits encountered at these levels have allowed the remarkable preservation, starting in layer 25, of abundant plant remains such as grains of teosinte (*22*)—a close relative of maize—now classified as *Zea mexicana* (*23*), carbonized seeds of *Amaranthus* (*24*), seeds of *Physalis* (*25*), and numerous wood fragments, both in a natural state and with traces of having been worked. The presence of certain plants, such as *Urtica*, in the floristic community of Playa is of archeological interest to the degree that it indicates, together with other evidence, human interference in the occupied area (*26*).

Mammal remains recovered from these archeological levels include white-tailed deer (*Odocoileus virginianus*), rabbit (*Sylvilagus cunicularius*), the genus *Canis*—dog or coyote, Mexican vole (*Microtus mexicanus*), small rodents of the Heteromyidae (*Liomys irroratus*), and cotton rats (*Sigmodon* sp.). The numerous bone remains of fish belong to three groups, all of them freshwater: that of the white fish and charales of the genus *Chirostoma*, that of the commonly called yellow fish of the genus *Girardinichthys*, and that of the cyprinids.

Among reptiles, the typical lake turtle of Chalco, genus *Kinosternon*, is well represented. Double-fine screening of the Playa sediments allowed us to obtain more than 3000 small bone remains of the amphibian *Ambystoma* (*27*), called axolotl by the Aztecs who liked its eel-flavored flesh. With the reduction or disappearance of the mountain lakes of Central Mexico, these neotenous amphibians have become scarce, although some specimens are still captured in the Xochimilco area and are prepared with maize dough.

Playa sediments also contain numerous remains of lake birds. Some, like the Mexican duck (*Anas diazi*), are indigenous, but most belong to migratory species that reproduce in the Alaskan deltas or the Canadian prairie provinces and, from November on, migrate south (*28*). The Chalco Basin was an important winter nesting ground during Playa times. Canada geese (*Branta canadensis*), numerous species of ducks—among which are shovelers (*Spatula clypeata*), redheads (*Aythya americana*), pintails (*Anas acuta*), mallards (*Anas platyrhynchos*), and cinnamon teals (*Querquedula cyanoptera*)—as well as pied-billed grebes (*Podilymbus podiceps*) and white grebes (*Aechmophorus* sp.) have been identified in these levels. The American coot (*Fulica americana*), a water hen of the rail family, is also well represented. Nowadays, this species winters in Middle America from September through March or April; however, part of its population remains throughout the year in the interior lakes of Mexico (*28*).

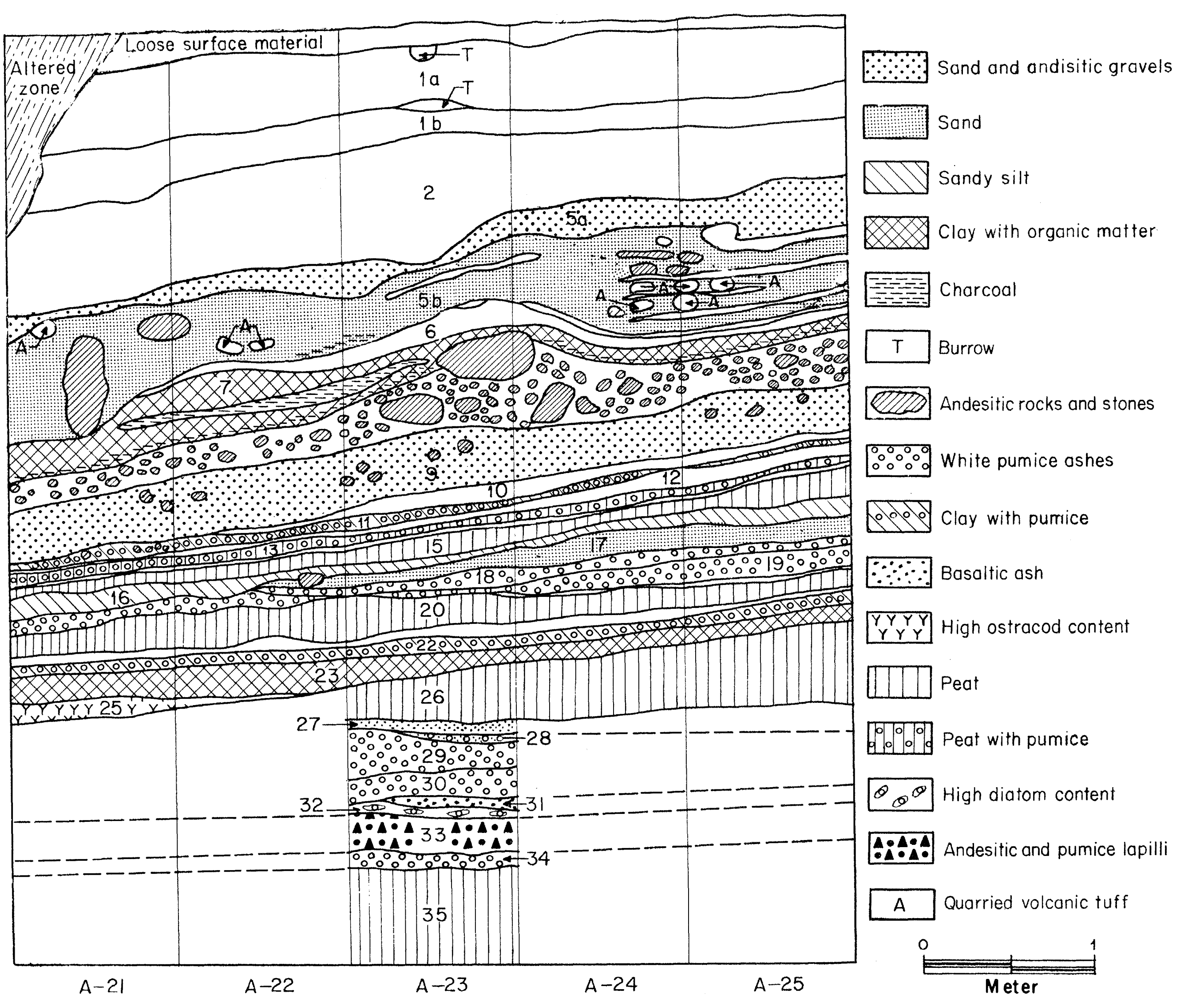

Fig. 3. Stratigraphy at the site of Zohapilco, Basin of Mexico. Partial profile of the southwest wall of trench A. The vertical numbers refer to natural geopedologic strata and excavation units. Only the stratigraphy sequence below layer 13 is discussed in this article.

Concerning the fauna in the Basin of Mexico, the 16th-century Spanish monk Bernardino de Sahagún (*29*) describes some unsuspected food resources from the lakes during Aztec times. This list includes algae, fly chrysalises, scarab larvae, and the eggs of an insect of the Corisidae family—from which a kind of bread was made—which were collected among the reeds (*30*). Sahagun's account underlines the fact that the archeological inventory of permanent or seasonal fauna of the Playa phase, although varied and long, is by no means exhaustive.

At the site of Zohapilco, as well as at numerous other points on the southern lake shores (*31*), there was a permanent spring of water which left numerous concretions of aragonite and acicular crystals of calcium sulfate in the sediments.

These characteristics of the soils, rainfall, and biotic associations of Playa between the seventh and fourth millennia place the southern part of the Basin of Mexico among the optimal ecological zones. These zones can be defined by the ratio of the number of species to the number of individuals—that is, a diversity index, which is very high; by a productivity per unit of area and unit of time which is also very high; and by a great stability or homeostasis (*32*).

Lithic Industries

The stone artifacts found on the sixth millennium beaches were fashioned from a variety of raw materials, especially trachytic andesite, the only local rock; in addition, basalt, volcanic tuff, obsidian, and chalcedony were directly or indirectly acquired from different deposits in the high plateau, both near to and far from the site (*33*). There are no sources of obsidian in the Chalco-Xochimilco region. Evidence now available indicates that this rock, which is exclusively a black, gray-banded type, comes from Otumba, in the northeast of the Basin of Mexico (*34*).

The local andesite is the most frequently used raw material in Playa levels. Because microliths and phenocrysts are embedded in its matrix, this rock is difficult to work, but its natural fractures furnish effective cutting edges. Nevertheless, this material was fashioned into standard shapes to make essentially heavy tools. These tools include large bifaces with a terminal bevel: hammerstones; natural slabs with a continuous bifacial retouch along the length of one edge; and large blades struck from elongated cores with a single striking platform. They are associated with numerous utilized flakes and smaller artifacts, also of andesite, among which notched tools and scrapers with a semicircular working area predominate.

With all types of raw materials, flakes were most frequently produced by what I call the "Zohapilquian" technique. Basalt and chalcedony cores and flakes provide good examples of this technique. Similar to the Old World Clactonian and pseudo-Clactonian techniques (*35*) that were in use until Neolithic times, the Zohapilquian technique resulted in irregular polyhedric cores being produced with multiple unprepared striking platforms (Fig. 4d), and in flakes whose usually plain butt ends slope toward the dorsal face.

Obsidian is found mostly in the form of small utilized flakes. In the earliest levels of Playa 1, all these flakes exhibit the characteristic Zohapilquian technique: their dorsal ridges form any type of angle with the plane of the butt. From Playa 2 levels come fragments of prismatic blades, which are diagnostic of a unidirectional technique of blade production in which a single striking platform is used. Obsidian projectile points are stemmed with a convex base.

An assemblage of well manufactured tools was made from olivine basalt, which was widespread in the perimeters of the ancient lake of Chalco and on the island of Xico (Fig. 4, a to c and e and f). Among these tools are notched artifacts, blunt-backed knives, thick scrapers that have a straight working edge and were made from exhausted cores, and keeled

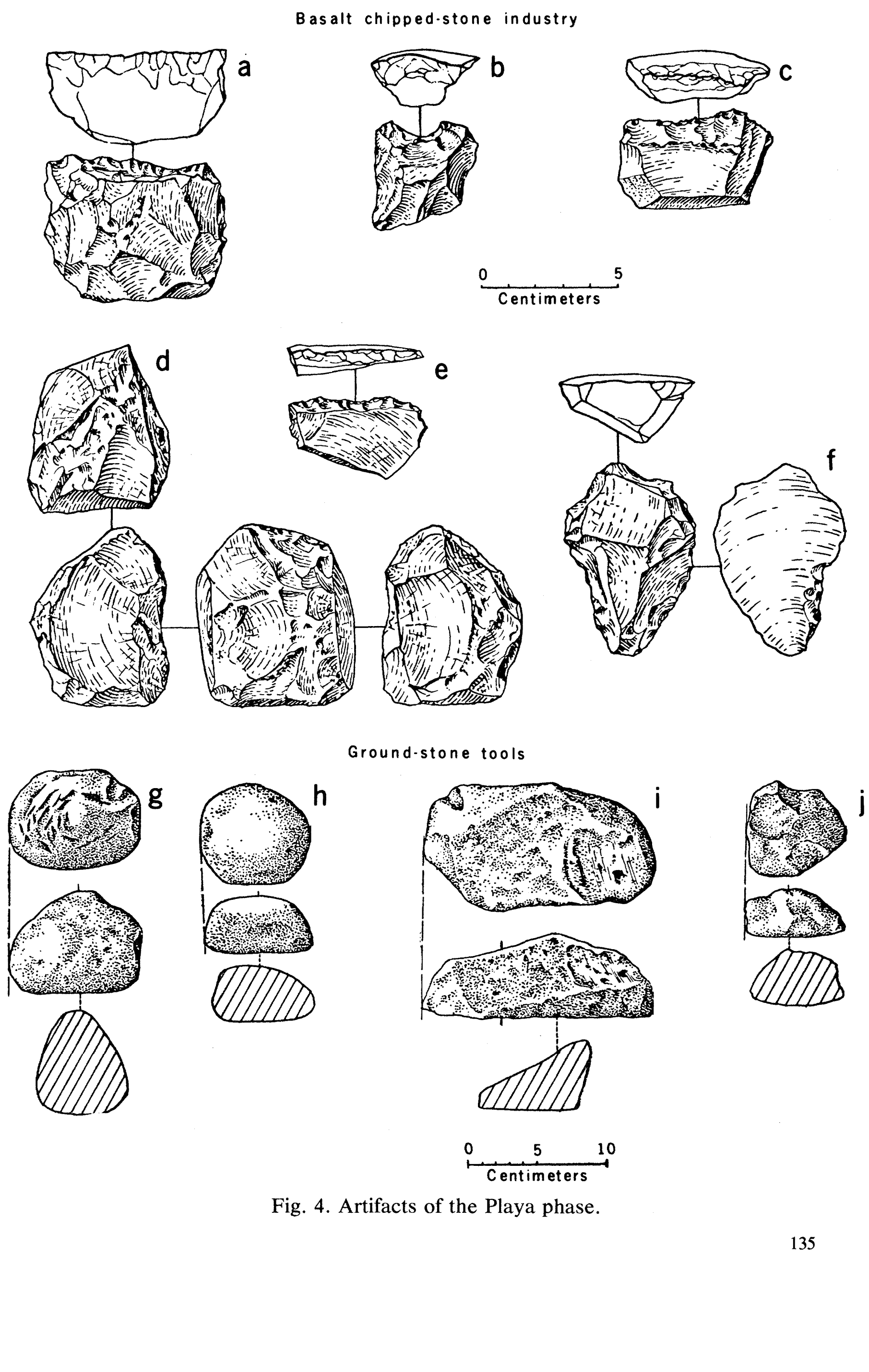

Fig. 4. Artifacts of the Playa phase.

and plano-convex scrapers that are subtriangular in outline. Scrapers are sometimes composite tools with a discontinuous proximal retouch forming a cutting edge.

Ground-stone tools related to the preparation of food plants are part of the Playa lithic assemblage. They are made of andesite, basalt, or volcanic tuff. Mullers or manos, the active grinding artifacts, are short; their working surface is flat or slightly convex with an irregular outline describing a circle of a somewhat elongated ellipse (Fig. 4, g to j). Wear patterns identified indicate a rectilinear movement. Milling stone or metate fragments can be classified in two groups: one with a flat grinding surface; the other with a slightly concave working surface. They are made on natural slabs or on artifacts fashioned by pecking. Other ground-stone implements, apparently not related to food processing, include small grinding slabs with rectilinear striations on their worn surfaces; hammerstones also used to pound and crush; abrasive implements; and a tiny effigy-like pisciform sculpture (*3*).

The lithic assemblage indicates that among the predominant techno-economic activities at the site were forest exploitation with locally quarried heavy bifaces and macro-blades; woodworking with notched artifacts; fine cutting and scraping; stone knapping with a particular skill on nonlocal basalt rocks; ground-stone pecking; vegetable food processing; other grinding and crushing activities; and manufacturing processes, including abrasive work. Fishing, trapping, and digging implements must have been fashioned mostly out of wood, since Playa levels contain numerous modified wooden fragments. Among them are two sticks with burnt and ground distal end, fragments with groove marks, a piece with terminal bevel, and a small burnished pointed stick, 4.4 centimeters long. Other fragments had the bark removed and show marks of cutting.

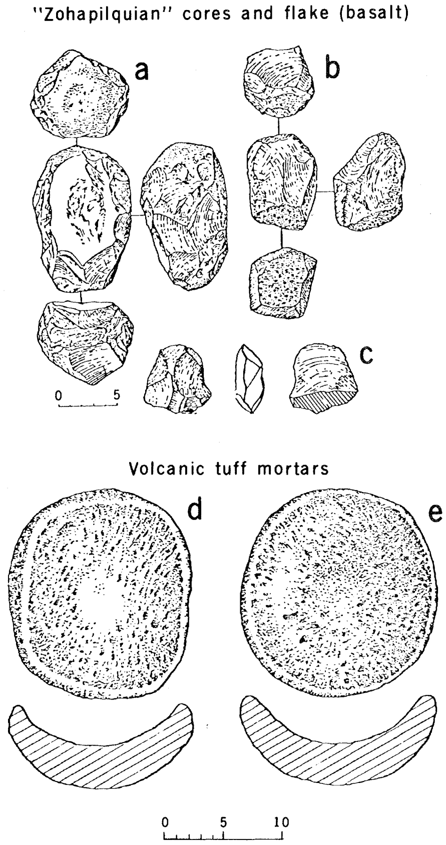

Fig. 5. Artifacts of the Zohapilco phase.

Economy and Settlement

Reconstruction of the paleoecology at the site reveals that three exploitable biotopes coexisted in the perimeter of the ancient lake of Chalco: (i) the forest environment, with its wild fruits and mammalian fauna; (ii) the alluvial and riparian zone, with its fertile soils and high water table, favoring the growth of wild grass and other exploitable plants; and (iii) the aquatic environment, rich in plant and animal resources. These biotic associations are remarkable both for the presence of regular resources and for the even distribution of periodic ones, especially between the two major divisions of the Middle-American year, the rainy season (May to October) and the dry season (November to April). They make possible a sedentary way of life well before the development of a truly efficient agriculture. Preagricultural human groups are subject to the same seasonal rhythms as are other polyphageous species (*36*). Two cases may be outlined: in the first one, the immediate environment may offer a limited variety of food resources or seasonal cycles. Thus, in the course of the year there are critical periods when residents must migrate either within the limits of the region, or beyond, in order to exploit other ecological niches. Such compulsory seasonal migrations in relation to the ripening of plants or the recurrence of game were characteristic of the preagricultural societies of the semiarid Tehuacan Valley (*37*) and the Oaxaca Valley (*38, 39*). In the second case, the nearby environment may provide a variety of resources available at different times throughout the annual cycle, thus offering the conditions necessary for territorial permanence. Such conditions were found on the shores of the lake of Chalco during the Playa phase; and probably also in some estuarian zones in the Middle-American lowlands at the same time level (*40*).

Various genera stand out among the numerous rainy-season cereals, oily seeds, and aromatic plants that could have been exploited in Playa levels (*41, 42*). These are mainly *Chenopodium*, *Amaranthus*, *Physalis*, and *Zea*. Their presence in the collection of grains that have been recovered points to the riparian region of the lake of Chalco as a possible zone of horticultural experimentation with certain edible plants at least from the sixth millennium on.

In the type of excavation we carried out, settlement features are limited essentially to hearth areas. Among the excavated zones with charcoal clusters that are particularly relevant for the study of rainy-season food-procurement systems during the Playa phase, mention can be made of unit A21, and its periphery, in layer 23. In this unit, an area with a high concentration of charcoal and fire-cracked andesite rocks was exposed. Around it were scattered different artifacts and chipped stone discards: two notched artifacts, one made from basalt, the other from andesite; two utilized flakes, one of andesite and the other of obsidian; an obsidian waste flake; and a basalt composite tool acting as end scraper (distal end) and knife (proximal lateral edge) (Fig. 4f). Nearby, and in the same level, were uncovered an oblong andesite mano with a flat grinding face and, on its top surface, a small concave passive working area (Fig. 4i); and a fragment of a narrow andesite grinding slab with a passive flat working surface marked with rectilinear wear pattern along its long axis. Well-preserved fragments of wood, including worked fragments of *Pinus*, were found in this area. Numerous burnt seeds mixed in with the sediment were later identified as *Amaranthus*. Other identified plant remains include seeds of *Portulaca*—a plant with fleshy edible leaves—and a seed of *Cucurbita* (*43*). Faunal remains include numerous bones of axolotl, which can be captured easily only during the rainy season, as well as snake vertebrae (*Thamnophis*), fragments of turtle shell (*Kinosternon*) (*44*), fish scales and bones, and two rodent remains identified as a *Sigmodon* femur and a *Microtus mexicanus* mandible. Although rainy-season products are predominant within the biotic assemblage, a multiseasonal occupation in the same area was suggested by the finding, between fire-cracked rocks, of bones of the duck *Anas diazi*, a permanent resident of the Basin, together with typical migratory waterfowl.

Returning now to a broader outlook, I

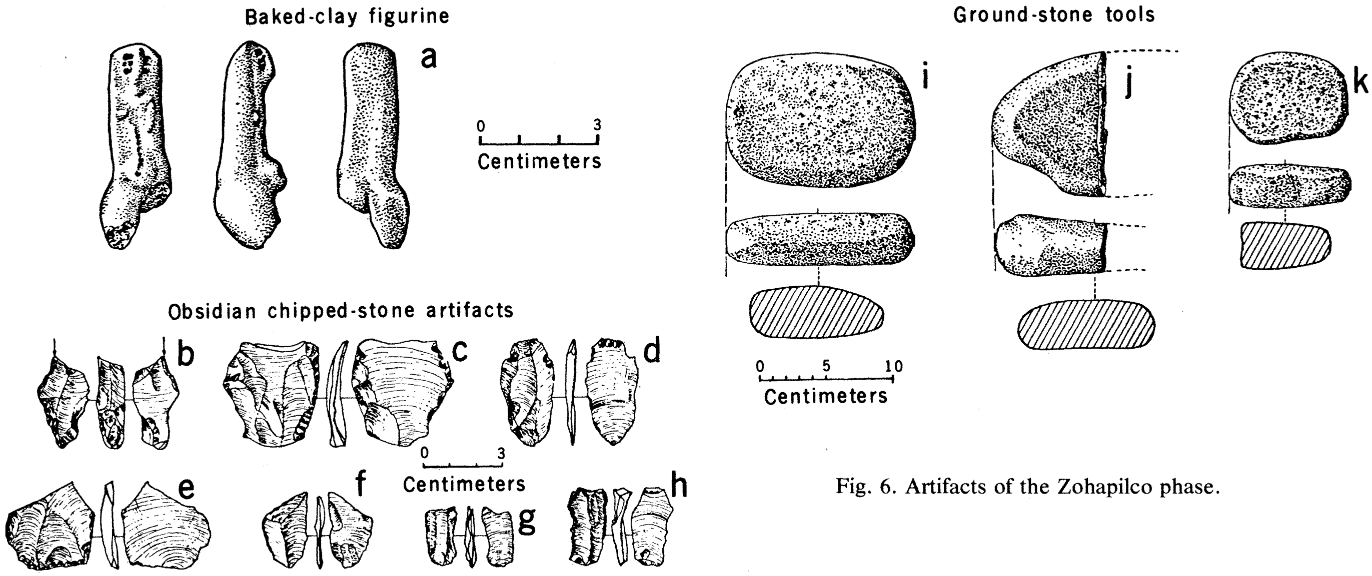

Fig. 6. Artifacts of the Zohapilco phase.

must underline a special trend with regard to *Zea*. In the Zohapilco phase, which follows the Playa phase in the archeological sequence, the average dimensions of *Zea* pollen grains are slightly larger and their frequency triples. This phenomenon, together with the recovery of teosinte seeds (*Zea mexicana*) from Playa levels, suggests the existence of a long-established practice of protection and selection of this rainy-season cereal. Nevertheless, *Zea* at that time constituted probably no more than a minor contributor to subsistence among a large number of plants the importance of some of which may escape us today. For example, wild rice (*Zyzaniopsis*), might have played, I believe, a role in ancient diet. This plant was recently discovered to have been exploited on the lacustrine shores of the Basin of Mexico in the course of the first millennium B.C. (*45*).

Winter occupation of the site during the Playa phase is clearly indicated by the presence in the kitchen debris of numerous small charred bones of migratory ducks, reliable indicators of dry-season subsistence. Among them, the most common are *Anas acuta*, *Spatula clypeata*, and *Aythya* species. Other waterfowl associated with lithic artifacts include teals (*Querquedula*) and geese (*Branta* spp.). Bones of these migratory birds have been excavated near remains of white-tailed deer.

Such seasonal foods were complemented by a wide range of resources that were available year-round, such as indigenous waterfowl, and freshwater fish of the genera *Chirostoma* and *Girardinichthys*.

From the quantitative study of ichthyological remains recovered from Playa levels, whether they were left by lacustrine fluctuations or brought by man (*46*), it appears that a considerable amount of high-quality protein food was available within the Chalco-Xochimilco lacustrine basin. This evaluation yields a direct insight into economic data relevant to Playa subsistence. From the 3473 fish bones recovered from Playa strata, 77 percent belong to the Atherinidae family, specifically identified as *Chirostoma humboldtianum*, *Ch. jordani*, and *Ch. regani*, 20 percent to the Goodeidae family represented only by one species, *Girardinichthys viviparus*, and 3 percent to the Cyprinidae including *Algansea tincella*, *Evarra* spp., and *Notropis aztecus*. The habitat of this latter group, known to favor crystalline waters, may have been the small streams that issued from springs overlooking the site.

Canid bones are also present in Playa archeological levels. Although evidence for osteological differentiation from coyote to dog has not been found, the possibility that canids had already started their symbiotic relationship with man during Playa times should nevertheless be considered (*47*).

In sum, Playa inhabitants had access to clustered diversified biotopes that could supply the whole spectrum of nutritional requirements as well as permanent sources of water. Humiferous and moisture-retaining alluvial soils could fulfill the demand for grasses, fruits, and leafy vegetables. The pine-oak-alder forest provided a productive small and large mammal habitat and an abundant raw material reserve for technological artifacts, shelters, and firewood, and could have played a major role in economic strategies. The occurrence of edible amphibians in the rainy season and the arrival of large numbers of migratory fowl in the dry season, as well as the permanent reserve of lacustrine resources, are all factors that would favor prolonged or permanent residency in the same site. That such permanent residency occurred is indicated, in particular, by the recovery of evidence of multiseasonal activity around hearth areas.

The existence of a sedentary way of life in an aceramic pre- or protoagricultural context is not inconsistent with recent archeological investigations showing that an agricultural economy is not a necessary condition for the establishment of village life. In this respect, the excavations of Van Loon and Cauvin at Mureybet in Syria, those of Perrot at Aïn Mallaha in Palestine, and those of Perkins and Daly at the village of Suberde in Turkey may be mentioned (*48*). The lake site of Zohapilco represents, in my view, an American example of territorial permanence within a pre- or protoagricultural context. It is important to specify what is understood here by pre- or protoagricultural: I do not mean that elementary horticultural practices were ignored, but rather that their product was economically negligible in the global subsistence system.

The Zohapilco Phase

A lacustrine transgression during the fourth millennium B.C. (sidereal time) seals the Playa levels and interrupts the cultural sequence at the site. In the southern part of the Basin, the end of this millennium was marked by a series of devastating volcanic eruptions. Sent forth in the form of nuées ardentes, they left thick deposits of white cinereous pumice (Fig. 3, layers 18 and 19). This volcanic series, associated perhaps with a slight climatic change, disturbed the equilibrium of the regional biocenosis. Particularly noticeable are the impoverishment of the flora and the consequent degradation of the slope soils which were then invaded by a secondary growth of cacti and xerophytic plants. *Hechtia*, *Opuntia*, *Zaluzania*, and *Yucca*, which are typical of rocky outcrops, appear for the first time as a significant component in the pollen inventory of these levels. A new biotic balance was restored in the region at the beginning of the third millennium as temperate deciduous forests recuperated part of their domain and a marked lake transgression took place. Riparian zones are still covered by Cyperaceae, Juncaceae, and *Typha*; willows (*Salix*), more frequent than in Playa times, sheltered an important plant community of Malvaceae, Liliaceae, and Umbelliferae.

The associated uncalibrated ^{14}C date for the first occupation of the Zohapilco phase (Fig. 3, layer 17) is 2300 ± 110 B.C. (I-4404), which corresponds, following Clark's correction curve, to a sidereal date of 2920 ± 120 B.C. The final occupation is dated indirectly by a ^{14}C date associated with the onset of the succeeding cultural period. This date of 1360 ± 110 B.C. (I-4406)—in sidereal time, 1675 ± 140 B.C.—comes from a peat bed (Fig. 3, layer 13) overlying the deposits with Zohapilco material. From these data, I estimate the temporal extension of the Zohapilco phase to have been between 3000 and 2200 B.C., sidereal time (*5*).

The archeological data that define this new phase suggest marked changes in the socioeconomic structures. Nutritional habits and economical behavior have been slowly modified by a long-term trend to produce and control plant resources. Certain relationships with plants that had undergone beneficial morphological changes through time seem to have reached an irreversible point at these levels. As noted above, *Zea* pollen grains from these levels are, on the average, of greater dimensions than those of the previous phase, and their frequency is trebled. Among the cultivated plant remains are found grains of *Amaranthus leucocarpus*, *Physalis*, and *Capsicum annuum*. Pumpkin (*Cucurbita*) and chayote, a plant of the genus *Sechium*, are encountered in the form of macroremains and pollen grains. *Salvia* pollen grains are also present. Slight changes can be perceived in the local faunal population, such as the complete disappearance of *Sigmodon* from the small mammals and the absence of Canada geese from the migratory avian fauna. However, hunting, fishing, and other faunal exploitation patterns do not show fundamental modifications. Bones of game animals, such as the white-tailed deer, remain relatively scarce. Of the abundant exploited local or migratory water fowl, American coots, pintails, mallards, and shovelers predominate. Double-fine screening of occupational sediments yielded numerous remains of axolotl, fish—mainly *Chirostoma* spp. and *Girardinichthys viviparus*—turtles, culverins, and small rodents, all typical of the riparian or lacustrine zoocenosis.

The most significant change in the chipped-stone industries of the Zohapilco phase in relation to those of the Playa phase is the increased proportion of obsidian tools. Although the black, gray-banded obsidian is still by far the most frequent type, a green obsidian of different provenience is also present. This indicates an expansion in the directly or indirectly exploited territory. Some prismatic blade fragments have been recovered from these levels, but the obsidian industry is predominantly represented by numerous microlithic flakes that usually show signs of wear. Some larger flakes were made into scrapers by a series of unifacial regular retouches on their proximal half (Fig. 5e). In others, the working edge was resharpened by bifacial continuous retouch on one or both sides (Fig. 5c). Notched tools and scrapers were also made from basalt as well as andesite. Andesite was used for large blades and hand axes. In all categories of raw materials, chipped-stone artifacts include a high proportion of irregular polyhedric cores and flakes characteristic of the Zohapilquian technique of flake production (Fig. 6, a and b).

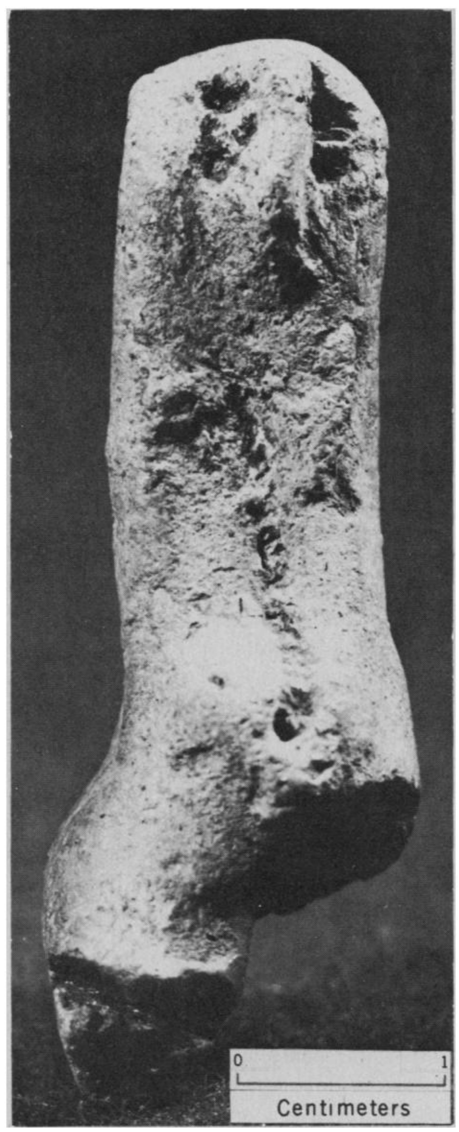

Fig. 7. Small anthropomorphic representation found in situ within an early level of Zohapilco cultural phase. This baked-clay figurine, associated with the sidereal date of 2920 ± 120 B.C., is the earliest known so far in an archeological context in Middle America.

A remarkable advance in the manufacture of grinding instruments occurs in the Zohapilco phase levels. These tools appear with a higher frequency and with fully standard shapes. They are represented essentially by bifacial manos, subrectangular in outline with two opposed and parallel working surfaces (Fig. 5, i to k) or with opposed worn surfaces that form a dihedral angle, by metate fragments, and by circular to oblong shallow stone mortars made from volcanic tuff (Fig. 6, d and e). Within a group of hearths exposed in an early level of the Zohapilco phase and showing evidence of multiseasonal activity were also found a small andesite crushing slab with a regular depressed area and a spheroid artifact used in manufacturing ground-stone implements. The groundstone assemblage of Zohapilco levels demonstrates particular skill in pecking work and suggests a marked tendency toward craft specialization.

No fragments of ceramic vessels were found at the site in these levels. Nevertheless, one of the notable events of work in the large hearth area was the discovery in situ of a small baked-clay anthropomorphic figurine (Figs. 5a and 7), indicative of the existence of new conventions in plastic expression and of practices related to a set of beliefs. Mineralogical and petrographic analyses of the paste show that this figurine was made at the site itself. The quality of the paste indicates the existence of nonrandom techniques for the selection, preparation, and firing of clay. It is difficult to find stylistic equivalents for it, since it belongs to a cultural level which, until now, has scarcely been studied. The head and body form a single armless shaft. The incipient contour that defines the forehead forms a T with the line of the prominent arched nose. Four depressions, which presumably represent the eyes, make up most of the mouthless face. It may be noted, from a strictly structural point of view, that similar anthropomorphic representations in baked clay are characteristic of homotaxial cultural levels in Eurasia and Africa (*3*). This figurine is the earliest found in an archeological context in Middle America; analysis of charcoal fragments, found in close proximity to the figurine, gave the sidereal date of 2920 ± 120 B.C. mentioned above.

In view of the evidence for the emergence of new sociocultural patterns and the presence of an economically important group of cultivated plants, it is difficult to avoid several questions. Of these, the most difficult is: What set of processes can account for the observed shift to food production and can explain how the incipient activities of planting and selection, probably practiced since at least Playa times, had become, by Zohapilco times, a deliberate strategy?

Several obstacles restrict the exploration of this question. There remain gaps in our knowledge of the early post-Pleistocene sequence in the Basin of Mexico, and the botanical analyses available for the region are still too general (*49*). There is also an enormous disparity in our knowledge of the different regions of Middle America likely to have played an important role in the development of agricultural economy: indeed, to attempt to understand the processes involved, it is necessary to go beyond isolated perspectives.

Prudent methodology leads one to exclude simple cause-and-effect mechanistic models that set forth either demographic pressure or changes in the biophysical environment as the sole cause of the emergence of agriculture. A more fruitful approach tends to dynamic equilibrium models of adaptation that bring into play numerous natural and cultural components, in constant and complex interaction (*42, 50*). As a consequence, and of special interest here, anthropologists and geographers, such as Harris, have stressed the existence of numerous possible itineraries leading to the crystallization of an agricultural economy (*51*).

Although a general view remains difficult to achieve for early Holocene Middle America, the first researches into the prehistory of some previously unexplored ecosystems, such as the high lacustrine Basin of Mexico and certain coastal estuary zones, attest to the variety of processes and rhythm leading to the establishment of a sedentary way of life in Middle America. An attempt to define this variety, and some of its implications concerning the development of an agrarian economy, will constitute the essential part of my final comments.

Conclusions

In this description of the southern lacustrine region of the Basin of Mexico I have stressed the importance of the coexistence of a variety of rich biotopes near the lake shores and the year-round

Early food resources recovered at the site of Zohapilco (about 5500 B.C.)	Month of availability											
	Dry season					Rainy season						
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
Ducks												
Aythya spp.	●	●	●	●	●							
Spatula clypeata	●	●	●	●	●							
Anas acuta	●	●	●	●	●							
Anas platyrhynchos	●	●	●	●	●							
Querquedula sp.	●	●	●	●	●							
Anas diazi	●	●	●	●	●	●	●	●	●	●	●	●
Grebes												
Podiceps caspicus	●	●	●	●	●							
Podilymbus podiceps	●	●	●	●	●	○	○	○	○	○	○	○
Aechmophorus sp.	●	●	●	●	●	○	○	○	○	○	○	○
Geese												
Branta spp.	●	●	●	●	●							
Coots												
Fulica americana	●	●	●	●	●	○	○	○	○	○	○	○
Amphibians												
Ambystoma						●	●	●	●	●	●	●
Turtles and snakes												
Kinosternon						●	●	●	●	●	●	●
Thamnophis						●	●	●	●	●	●	●
Fish												
Chirostoma spp.	●	●	●	●	●	●	●	●	●	●	●	●
Girardinichthys sp.	●	●	●	●	●	●	●	●	●	●	●	●
Cyprinids	●	●	●	●	●	●	●	●	●	●	●	●
Mammals												
Odocoileus virginianus	●	●	●	●	●	○	○	○	○	○	○	○
Sylvilagus cunicularius	●	●	●	●	●	●	●	●	●	●	●	●
Canids	●	●	●	●	●	●	●	●	●	●	●	●
Rodents						●	●	●	●	●	●	●
Plants from alluvial soils												
Zea	●									○	●	●
Amaranthus	●										●	●
Cucurbita	●							●	●	○	○	●
Physalis											●	●
Leafy vegetables	○	○					●	●	●	●	●	●

Fig. 8. Seasonal and perennial food resources available in the ancient Chalco-Xochimilco lacustrine basin. Closed circles indicate maximum availability; open circles represent minimum availability [see (*52*)].

distribution of potential resources (Fig. 8) (*52*). The joint study of paleozoological and botanical remains and of the evidence of human industries suggests the existence of territorial occupation patterns and food-acquisition strategies that are, in many aspects, different from those proposed for early post-Pleistocene human occupations in Middle America by the archeological researches carried out in the Tehuacan and Oaxaca valleys.

The Tehuacan model implies the existence of rainy-season macrobands (large communities) which were involved in an intensive exploitation of cereals and other plants in seasonally fertile biotopes, and dry-season scattered microbands dedicated to hunting and gathering within dispersed ecological niches (*37*). Although some early agricultural practices had been developed during the sixth millennium B.C. with plants such as chili pepper, amaranth, avocado, squash, bean, bottle-gourd, and maize (*53*), fully sedentary life is thought to have been established in the rainy-season camps at relatively late time levels, more than three millennia later. This interpretation resulted from fieldwork in Tamaulipas, the Valley of Tehuacan, and the Valley of Oaxaca, all situated at altitudes between 900 and 1900 m, in predominatly semiarid climates.

Large areas of Middle America may have followed the Tehuacan model in early post-Pleistocene times: however, at that time, some regions outside this altitude range or ecological framework may have developed different territorial occupation and social organization patterns. In fact, in the lacustrine environment of the temperate highlands, located at an altitude of more than 2200 m, and probably in some estuarian zones of coastal Middle America as well, it would seem that this scheme of socioeconomic evolution in post-Pleistocene times, from seminomadic mainly gathering groups to sedentary fully agrarian societies, is not applicable. Artifactual and nonartifactual evidence from the lacustrine shores of the Chalco Basin already suggest the existence of fully sedentary human communities in this region from at least the sixth millennium B.C. (Fig. 9) (*54*).

It is generally accepted today that there is no clear-cut division between a food-gathering stage and an early well-defined food-production stage in prehistory; rather, the first type of exploitation yields slowly to the progressive advance of the second. Moreover, in Middle America, gathering was still practiced to a significant extent in historical times within developed and dominantly agricultural economies; thus, early agricultural economies may better be studied in terms of the progressive weight and importance of agriculture in the total subsistence system.

In the Basin of Mexico from the sixth millennium onward, that is, in Playa phase times, agricultural experimentation with different plants, among them *Amaranthus*, *Zea*, and *Physalis*, seems to have been carried out in the humiferous riparian soils. Pollen grain measurements suggest that protection and selection, among other practices, carried out with *Zea* during the subphase Playa 1 were intensified during subphase 2. In addition, a wide range of perennial or seasonal wild plant and animal species that were geographically clustered were exploited, with an apparent preference for lacustrine resources of high nutritional value. The weight of agricultural products in the global subsistence system seems to have been economically weak at these levels. This mixed economy, with a predominance of gathering, hunting, and fishing activities, together with year-round occupation of the same site, suggests that the communities that settled on the Chalco shorelines repre-

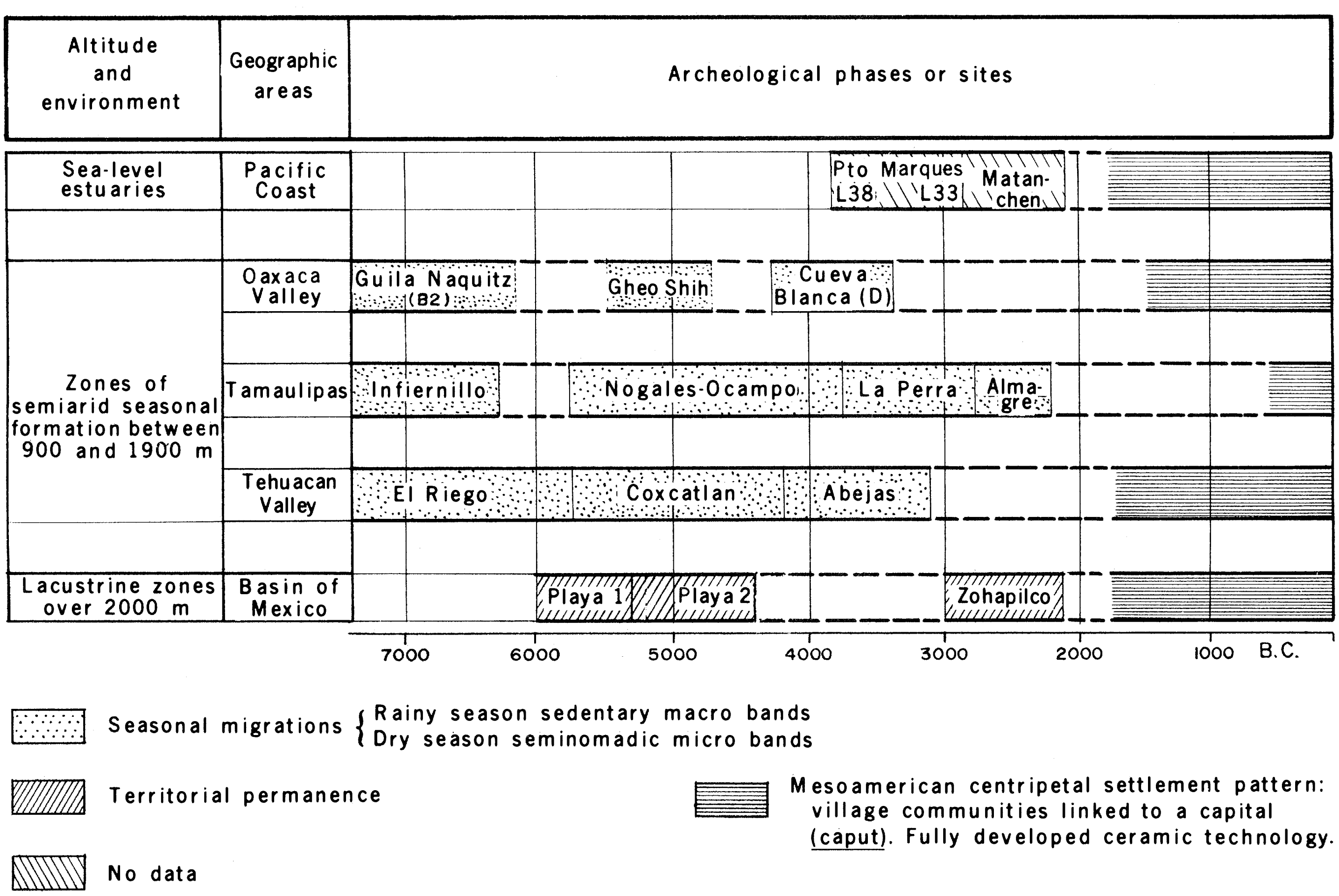

Fig. 9. Patterns of territorial occupation in Middle America between 7500 and 1000 B.C. (sidereal time) (*54*).

sent, within the general studies of sedentary processes, an American instance of territorial permanence within a pre- or protoagricultural context.

This early sedentary economy must have had significant cultural consequences which are difficult to appreciate at this stage of research. On a general level, certain constant and essential characteristics can be attributed to early sedentary settlements; a more acute sense of territorial rights, a systematic arrangement of the inhabited area, certain modifications in plastic expression, and a more integrated sociopolitical organization derived from a stable and centripetal vision of the inhabited space (*55*). It has also been argued that the curve of demographic growth rose significantly with the consolidation of a sedentary way of life (*56*). The sum of knowledge and practices acquired within the frame of a marked territorial stability would also tend to give increased significance to the incipient manipulations of certain plants, both at a general cultural level and with regard to the appearance of more productive plant races. Such interactions should certainly be considered an important point of departure for the processes leading to the irreversible development of an agrarian economy.

Very few sites are known for the time period corresponding to the Zohapilco phase in Middle America. Both in the long sequence of Tehuacan and in the archeological register of the Valley of Oaxaca, information decreases or disappears between 3000 and 1800 B.C. (sidereal time). Once this gap is filled by future research, it will be possible to place the Zohapilco phase, and the data still to be gathered from these levels, within a wider cultural context.

Work carried out on Zohapilco's fossil shores yields (i) a significant time-depth necessary to an inceptive understanding of the processes that led to the crystallization of a "Mesoamerican" way of life in the Basin of Mexico (*57*); (ii) a first insight on regional paleolandscapes and ancient food procurement scheduling and activities; and (iii) an attempt to examine the adequacy for all early Holocene Middle America, and specifically for the Basin of Mexico, of the model of seasonal moves that was set out in the basic pioneer works focused on semiarid regions. The hypothesis of an early sedentary economy in the Chalco-Xochimilco lacustrine basin may require further testing, but in view of the archeological evidence already obtained, it warrants keen attention in this area and in other favorable paleoenvironments of Middle America.

References and Notes

1. The Classical period is characterized by the development of the large urban center of Teotihuacan.
2. Excavations at Zohapilco were carried out during 1969–1970 under the auspices of the Department of Prehistory of the National Institute of Anthropology and History of Mexico (I.N.A.H.).
3. For details of this sequence, see C. Niederberger, *Zohapilco. Cinco milenios de ocupación humana en un sitio lacustre de la Cuenca de México* (Colección Científica, 30, I.N.A.H., México, 1976).
4. These dates are expressed in sidereal time. See (*5*).
5. In (*3*), the temporal extension of the Playa and Zohapilco phases was expressed not in sidereal time but in uncalibrated radiocarbon time, with an estimated range of 5500 to 4500 B.C. for the Playa 1 subphase, 4500 to 3500 B.C. for the Playa 2 subphase, and 2500 to 2000 B.C. for the Zohapilco phase.
6. Data for the preurban "Formative" period in the southern part of the Basin of Mexico have increased in the last decade through intensive surveys and excavations [see J. R. Parsons, *J. Field Archaeol.* **1**, 81 (1974); R. E. Blanton, *Science* **175**, 1317 (1972); P. Tolstoy, *J. Field Archaeol.* **2**, 331 (1975); ___ and S. K. Fish, *ibid.*, p. 97]. Recent excavations have also been conducted by the Department of Anthropology of the Universidad Nacional Autonoma de Mexico, near Tlaltenco. In the Zohapilco report (*3*), I showed that between 1200 and 800 B.C. (radiocarbon time), during the Ayotla phase and the subsequent phase that I named Manantial, Tlapacoya-Zohapilco became a regional capital in the sense of *caput*, not *urbs*.
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16. K. V. Flannery, in *Man, Settlement and Urbanism*, P. J. Ucko, K. Tringham, G. W. Dimbleby, Eds. (Duckworth, London, 1972), p. 23.
17. M. R. Jarman, "Animal Husbandry: The Early Stage," *Colloque XX, Pré-Tirage* (IX Congrès de Prehistoire, Nice, 1976), p. 22.
18. In 1967, a pit excavated by metric layers at the site of Zohapilco, by P. Tolstoy, yielded data that permitted essentially a first reappraisal of the early Formative chronology of the Basin of Mexico [P. Tolstoy and L. I. Paradis, *Science* **167**, 344 (1970)]. The uncalibrated radiocarbon date of 1070 ± 80 B.C. (Y-2354) corresponds to the earliest levels of this pit.
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24. J. D. Sauer [*Ann. Mo. Bot. Gard.* **37**, 564 (1950)] has stressed the economic and ceremonial value of amaranth in the Basin of Mexico during pre-Hispanic times. Playa phase amaranths represent the earliest recorded appearance of this plant in an archeological context in the Basin.
25. L. González Quintero, personal communication. The presence of grains of *Ruppia maritima* is yet unexplained (*21*).
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41. My purpose here is not to discuss morphological analyses of plants in Playa alluvial soils, nor to draw an uncertain chronological boundary below which a plant is classified as exploited, although wild in the phenotypic sense, and above which it may be defined as cultivated [see W. Bray (*42*) and K. V. Flannery (*14*)]. Also, I am not concerned here with the search for the orgin of domestication of economically important Middle-American plants because data so far recorded for the Basin of Mexico are not sufficient, and because thus stated, the question seems poorly framed; see B. Pickersgill [*Nature (London)* **268**, 591 (1971)]. My aim is to reconstruct the paleolandscape associated with a dated human occupation and to determine the calendar of potentially exploitable resources and the early food procurement systems.
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43. For these latest determinations, see L. González Quintero (*21*). The *Cucurbita* seed found in unit A21, layer 23, represents the only specimen of this genus identified in Playa levels.
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49. Thus, the finding of some seeds of wild teosinte (*Zea mexicana*) in Playa levels does not exclude the possibility that, in addition to their interest in wild teosinte, Playa people also disposed of an incipient form of manipulated *Zea*. More palynological studies would be beneficial; such studies have already shown an internally consistent, slow and steady growth in the size of *Zea* pollen throughout all of the Zohapilco site sequence. The early presence of *Zea* in the Basin of Mexico was indicated by the discovery of fossil pollen of this genus in late Pleistocene sediments [see E. S. Barghoorn *et al.*, *Bot. Mus. Leafl. Harv. Univ.* **16**, 229 (1954), and H. Irwin and E. S. Barghoorn, *ibid.* **21**, 37 (1965)]. The oldest archeological evidence for well-preserved *Zea* cobs, from the Valley of Tehuacan, dates to 5000 B.C. There has been continued debate concerning the phyletic position of these tiny inch-long cobs, interpreted either as coming from "wild maize," now extinct, or as representing a stage in the transformation of teosinte (*Zea mexicana*) to maize (*Zea mays*), through human selection; or, as evolved from a prototype, ancestral both to maize and teosinte [see P. C. Mangelsdorf, R. S. MacNeish, W. C. Galinat, in *The Prehistory of the Tehuacan Valley*, D. S. Byers Ed. (Univ. of Texas Press, Austin, 1967), vol. 1, p. 178]. See also (*14, 23*); W. C. Galinat and L. F. Randolph, *Proc. Am. Philos. Soc.* **121** (No. 3) 1977; R. S. MacNeish, *The Science of Archaeology?* (Duxbury, North Scituate, Mass., 1978), p. 148.
50. W. Bray (*42*); D. L. Clarke, *Analytical Archaeology* (Methuen, London, 1968).
51. D. R. Harris, "Alternative pathways towards agriculture," presented at the Symposium on Origins of Agriculture, Chicago, August 1973.
52. An integrated interdisciplinary approach, the first to have been applied to a late preceramic and Formative site in the Basin, yielded a rich body of data for the Playa, Zohapilco, Ayotla, and Manantial cultural phases. To interpret these data, in particular the annual distribution and seasonal availability of identified plants and animals, I relied on recent studies previously cited and also, to a great extent, on works carried out by naturalists in the Basin of Mexico at the end of the last century, before the occurrence of the ecological deterioration brought about by deforestation and drainage of large lacustrine expanses (C. Niederberger, in preparation). Among these naturalists are A. Herrera [*Naturaleza (Mexico)* **2a** (Ser. 1), 165 (1888): *ibid.*, p. 299 (1890)]; J. M. Velasco [*ibid.* **1a** (Ser. 4), 209 (1879)]; A. Duges [*ibid.* **2a** (Ser. 1), 97 (1888); *ibid.*, p. 205 (1889)]; S. M. Bustamante [*Mosaico Mexicano* **2**, 116 (1837)]. A simplified appraisal of the food resources available in the earliest levels of the Zohapilco sequence is shown in Fig. 8. The position of *Cucurbita* in Fig. 8, for example, implies that in early summer the flower petals could have been incorporated in the diet, as today, while in the second part of the annual cycle, seeds or fruits, or both, could have been consumed. In this case, it is assumed that the cycle was similar to that of the *calabaza de invierno* which grows at present in the Basin. During the 2 months following the end of the rainy season, the residual humidity of the alluvial soils could assure the survival of a large community of edible plants whose genera have not been detected yet, but which must integrate the various plant families registered in the pollen spectrum. Mammals such as the collared peccary (*Dicotyles tajacu*), tlalcoyote (*Taxidea taxus*), and the American pronghorn (*Antilocapra americana*), which are found in the later ceremic levels of Ayotla and Manantial, should probably be added to the regional resources available during the Playa phase, although they have not been recorded archeologically. Some of the edible invertebrates, including larvae and corixid eggs, which appeared in considerable amounts on the lake surface during the rainy season and which were widely consumed in historic times, could also have figured among the lacustrine resources, definitely predominant in the Playa inventory [see A. Peñafiel, *Memoria Sobre las Aguas Potables de la Capital del Valle de México* (Sria. Fom., Mexico, 1884); L. Coindent, *Le Mexique Considéré au Point de Vue Médicochirurgical* (Paris, 1867); F. E. Guérin-Meneville, *Moniteur Universel (Paris)* **330**, 1298 (1857)]. Thus, an attempt to calculate from archeological evidence the total biomass of available rainy-season food resources would certainly lead to a marked substandard appraisal. Remains of insects have been recovered in Playa levels (G. Halffter, personal communication).
53. See C. E. Smith, in *The Prehistory of the Tehuacan Valley*, D. S. Byers, Ed. (Univ. of Texas Press, Austin, 1967), vol. 1, p. 220; T. W. Whitaker and H. C. Cutler, *Econ. Bot.* **25**, 123 (1971); K. V. Flannery (*14*).
54. This diagram is based on chronological and cultural data given in: R. S. MacNeish *et al.*, in *The Prehistory of the Tehuacan Valley*, R. S. MacNeish, Ed. (Univ. of Texas Press, Austin, 1972), vol. 4; K. V. Flannery *et al.* (*39*): C. Niederberger (*3*); M. C. Winter, in *The Early Mesoamerican Village*, K. V. Flannery, Ed. (Academic Press, New York, 1976), p. 227; C. Niederberger, in *Historia de México* (Salvat, Barcelona, 1974), vol. 1; R. S. MacNeish [see (*8, 37*)]; D. F. Green and G. W. Lowe, *Pap. New World Archaeol. Found. No. 20* (Brigham Young Univ., Provo, Utah, 1967); M. D. Coe and K. V. Flannery, *Smithson. Contrib. Anthropol.* **3**, 1 (1967); C. F. Brush (*40*); J. B. Mountjoy (*40*). Radiocarbon dates have been converted to sidereal dates following R. M. Clark's correction curve (*20*). To broaden the scope of this diagram, two recent interpretations on early human occupations on the coasts of Middle America should be considered. One of them concerns the coast of Chiapas where the pattern of territorial occupation for the Chantuto phase, around 3000 to 2000 B.C. (radiocarbon time), is defined by B. Voorhies (*40*) as including "some permanent residences within the zone and periodic influxes of mainland dwellers that perhaps occurred on a seasonal basis." The other interpretation is related to the coast of northern Veracruz and the late preceramic occupation of the Santa Luisa site, in the Lower Tecolutla drainage. For the Palo Hueco phase, around 3600 to 2600 B.C. (radiocarbon time), the Santa Luisa site is considered to represent a year-round settlement in "a village whose economy is based upon collecting, fishing, and hunting in the estuarine, riverine, and forest environments surrounding the site" [see S. J. K. Wilkerson (*40*)].
55. A. Leroi-Gourhan, *Le Geste et La Parole* (Albin Michel, Paris, 1965), part 2.
56. R. W. Sussman, *Curr. Anthropol.* **13**, 258 (1972).
57. Concerning the trajectory of this Mesoamerican world within the regional perspective of the Basin of Mexico, see W. T. Sanders, *The Cultural Ecology of the Teotihuacan Valley* (Department of Sociology and Anthropology, Pennsylvania State University, University Park, 1965), mimeographed; J. R. Parsons (*6*); R. Millon, R. B. Drewitt, G. L. Cowgill, *Urbanization at Teotihuacan, Mexico* (Univ. of Texas Press, Austin, 1973), part 1; P. Carrasco, in *Historia General de México* (Colegio de México, México, 1976), vol. 1, p. 167.
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