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# OTUMBA AND ITS NEIGHBORS

## *Ex oriente lux*

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### Abstract

Otumba is one of a few Late Aztec-period city-states in the Basin of Mexico whose central city or town is not obscured by post-Conquest occupation. Long-term research there began in the early 1960s, with more recent fieldwork between 1987 and 1989, and has been complemented by intensive laboratory and technical analyses that are still underway. Traditional typological analyses have been aided by neutron activation analyses providing strong evidence of economic linkages between the Otumba city-state and raw material sources, as well as evidence of tribute and market distribution channels for finished products within and outside the Otumba city-state.

Research on Otumba presented in the current set of papers, with complementary information from the Tepeapulco city-state to the east and the Teotihuacan city-state to the west, provide chronological, environmental, ethnohistoric, social, economic, and political contexts for the intensively developed craft-production activities (lapidary, core blade, bifaces, grinding tools, fibers and fabrics, figurines, censers, spindle whorls, ceramic vessels, and other clay products) and agricultural intensification centered in the Otumba city-state. These data are relevant for a general consideration of Late Aztec social, political, and economic structures throughout the Basin of Mexico. *Ex oriente lux*.

Between 1987 and 1989 the Otumba project undertook new archaeological investigations at the site of Otumba (TA-80), the capital of the Aztec city-state of Otumba, and several of its rural dependencies in order to investigate further the history and nature of agricultural practices and craft production in the city-state (Figures 1–3). These investigations were integrally related to an evaluation of alternative models of the evolution and organization of central Mexican city-states during the Middle and Late Postclassic periods (A.D. 1150–1519).

The first phase of the project began with a systematic re-survey of the Otumba site (TA-80) in January 1987 conducted by Thomas H. Charlton, Cynthia L. Otis Charlton, and Evaristo Tenorio Coronel. Based on this survey, they produced detailed maps of the site and its then-current condition. The 1987 survey and maps formed the basis for the second phase of the project, which included additonal fieldwork consisting of intensive surveys, systematic surface collections, and exploratory excavations directed by Thomas H. Charlton and Deborah L. Nichols between June 1988 and June 1989. Many of the results of these two phases of fieldwork have been described in previous publications and are described in the current series of articles. Analyses are continuing.

The specific investigations carried out included:

1. intensive and systematic surface survey of additional areas along the periphery of the Otumba site (TA-80) to define more precisely the extent of the Aztec occupation;
2. systematic surface collection within Otumba by using a combination of probabilistic and non-probabilistic sampling strategies;
3. intensive and systematic surface survey combined with systematic surface collection of a sample of extant rural sites that were tributary to Otumba;
4. excavations of workshops (figurine, obsidian core blade, and lapidary), and irrigation features and of residential and ceremonial constructions in the nucleated core of Otumba.

Both the previously available archaeological data (Charlton 1994; Mather 1968) and the results of the 1987–1989 investigations in the city-state of Otumba indicate that the intensity of craft production there differs in quantity and quality from that described for other recently investigated city-state centers in the basin such as Huexotla and Xaltocan. Otumba has the largest number and greatest variety of craft workshops yet identified archaeologically at any Aztec center, provincial or metropolitan. Excavations also confirmed the presence of a long sequence of agricultural intensification through floodwater irrigation at Otumba. Data from the nucleated core permit a correlation of craft and agricultural intensification with the development of the city-state center.

## THEORETICAL CONTEXT

When we began this research project in the late 1980s, two general models had been proposed to account for the initial development and functioning of Postclassic city-states in the basin (Charlton et al. 1991:98–99; Nichols and Charlton 1988). One, building on Sanders's concept of economic symbiosis and on Basin of Mexico survey results, as proposed by Sanders and his colleagues (Evans 1980; Sanders 1956, 1965; Sanders et al. 1979; Sanders and Santley



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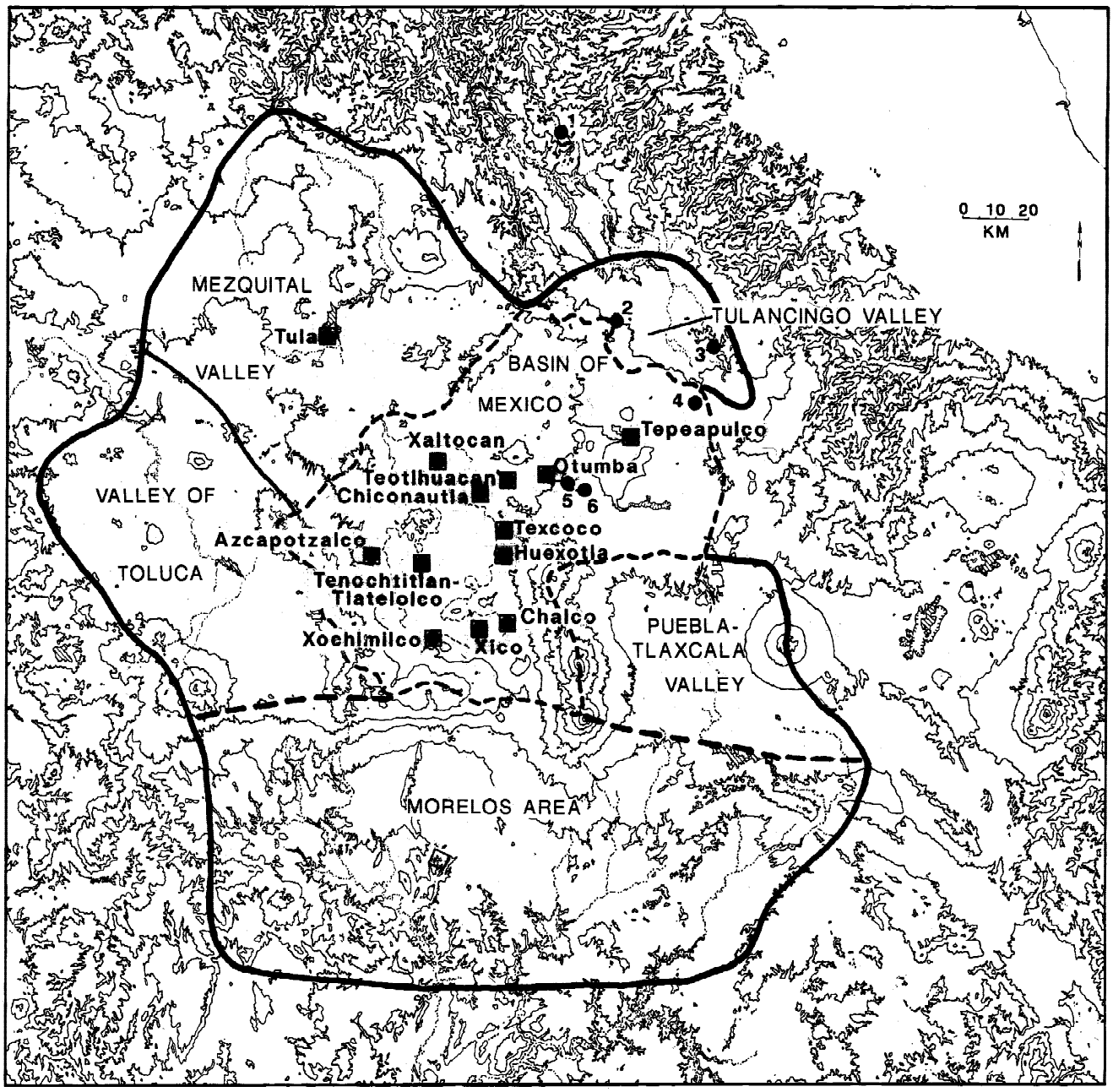



**Figure 1.** Central Mexican Symbiotic Region with sites mentioned. Obsidian source areas: 1, Zacualtipan; 2, Pachuca; 3, Tulancingo; 4, Tecocomulco; 5, Otumba; 6, Malapaís. Base map was derived from the Detenal 1:250,000 series maps NE 14-1 to NE 14-3 (1970), NE 14-4 to NE 14-6 (1979), and NF 14-10 to NE 14-12 (1970). Countour interval = 500 m.

1983) argued that initial city-state developments (A.D. 1150 to ca. 1350) were based on the role the city-state played in coordinating the production and the distribution of both agricultural and non-agricultural craft goods within their local area associated with an increasing population. In this model city-state, capitals in their function and organization foreshadowed, albeit on a much smaller scale, the imperial capital of Tenochtitlan-Tlatelolco. Subsequently (ca. A.D. 1350–1430), through warfare and alliances, these units became integrated into increasingly larger state systems that culminated in the Triple Alliance macro-state system, However, the city-state centers remained local centers for production and distribution.

The other model is based on Brumfiel's (1976, 1980, 1982, 1986, 1987a, 1987b) surveys and surface collections at Huexotla and Xico. Those surveys failed to recover evidence of intensive craft production. In order to account for this lack of correspondence between the cultural symbiosis model proposed and the data obtained in her research, Brumfiel raised important questions about the degree of economic differentiation within these centers and the significance of economic symbiosis with regard to both their de-

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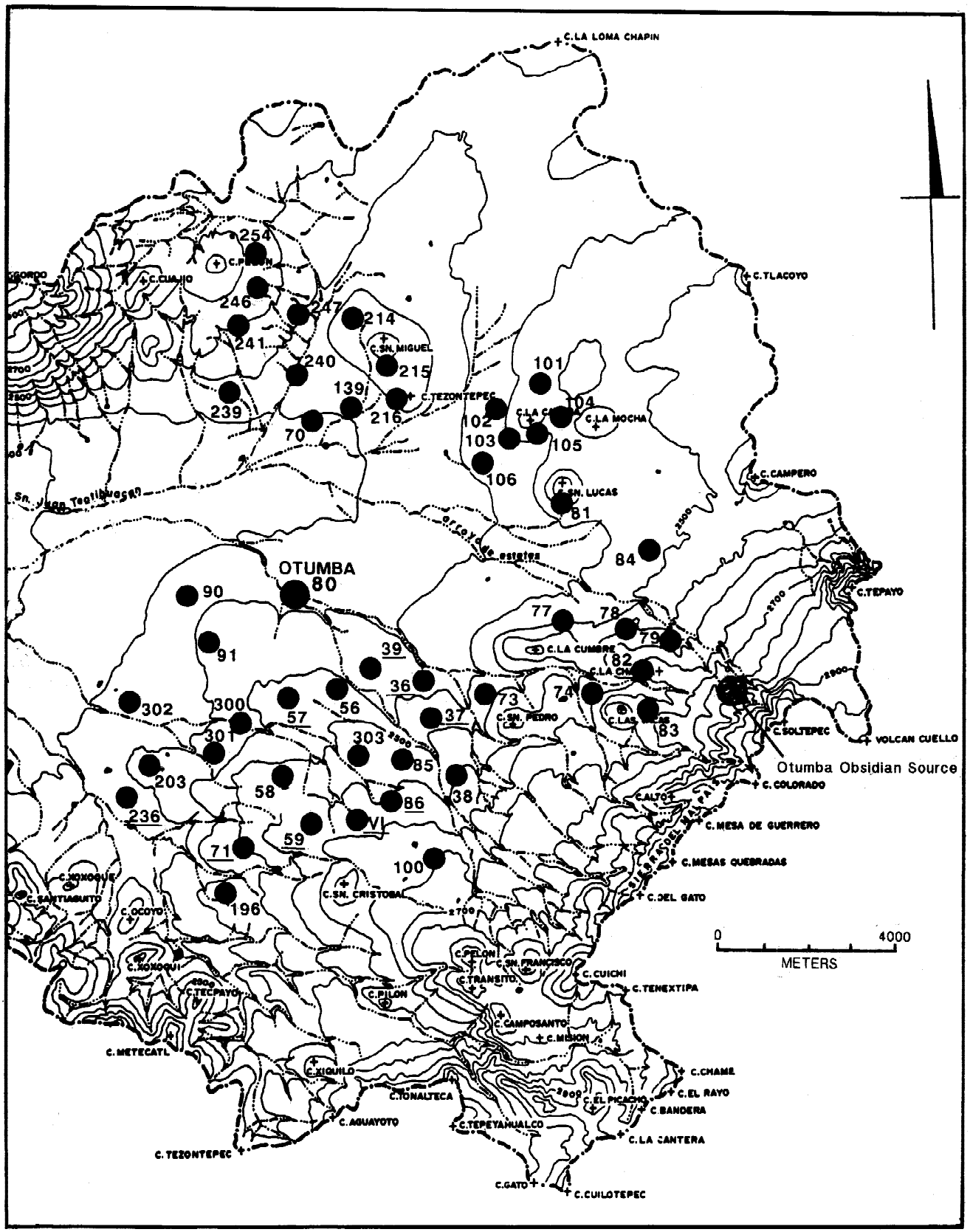



Figure 2. Late Aztec occupations in the Otumba city-state (Charlton 1972, 1973, 1994; Sanders 1965). Dependent sites sampled in 1988–1989 are underlined. Base map after Lorenzo (1968:Figure 3).

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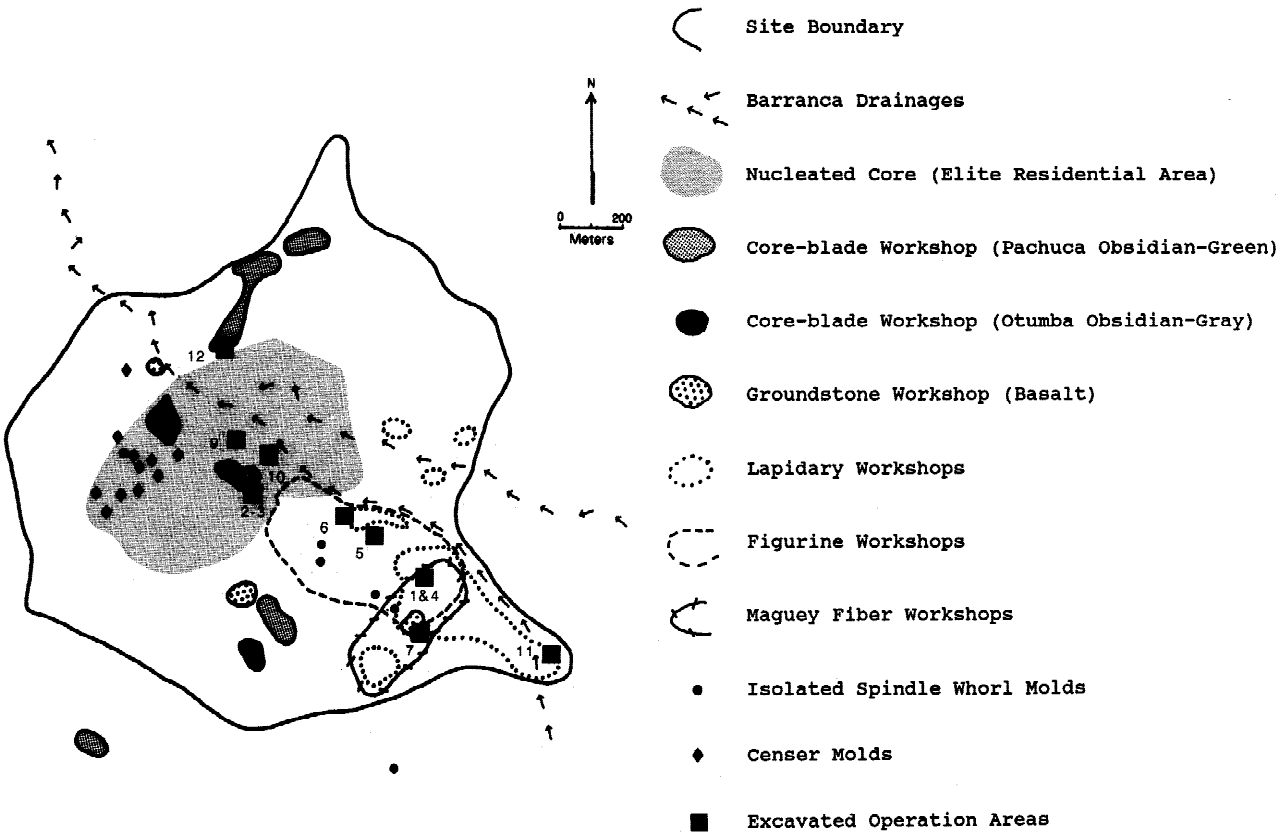



Figure 3. Aztec Otumba (TA-80) with site zones, areas investigated, and craft areas noted.

velopment and their roles within the Triple Alliance. To account for the lack of data supporting the economic symbiosis model, Brumfiel proposed an alternative hypothesis that craft activities were either non-specialized or only part-time activities at Huexotla and Xico, "an established pattern that the political integration of central Mexico during the Aztec period did little to alter" (Brumfiel 1987a:109). Within the Triple Alliance, additional city-state centers developed as a result of decisions from the top down to create local administrative units necessary for the administration of complex trade and redistribution networks (Sanders et al. 1979:156).

Although the city-state was the basic political unit both before and after the rise of the Triple Alliance, Brumfiel questioned the extent of its economic role during both periods. In this model, neither the initial development of autonomous city-states nor their subsequent incorporation into larger political units was associated with local symbiosis involving full-time specialization. She argued that the small city-states of the basin never had full-time craft specialists producing non-comestibles. Full-time specialization was restricted to the imperial capital and to the manufacture of elite or wealth goods.

The economic rationalization for such a situation during the post-A.D. 1428 period was conditioned by two proposed factors:

1. the dumping, into the market system, by the elite, of craft goods received in imperial tribute, which at lower-than-production costs, consequently depressed prices for such locally produced commodities and reduced the incentive for their local production;
2. the massive population growth, which, coupled with logistical limitations on the transport of comestibles (Cowgill 1993; Drennan 1984a, 1984b; Sluyter 1993), favored a local solution to food production attained by encouraging a reorientation of the rural core zone of the basin to specialize in agricultural production and to reduce craft production.

Rather than oversimplify the conceptualization of such models into an "either or" situation (see Brumfiel 1987a, 1987b; Smith 2000:588), we proposed a "both and" scenario that takes into account the multiple complexities of the Late Aztec economic and political situation. We have argued, as described below, that each model may describe different aspects of exceedingly complex developments, a "blind men and the elephant" scenario in which no single perceived "reality" describes the situation (Charlton et al. 1991:109; Charlton and Nichols 1997; Nichols and Charlton 1988).

State evolution in Postclassic central Mexico involved militaristic tributary city-states, the organization of alliances and confederacies, imperial expansion, intensification of primary production, economic specialization and exchange, along with population growth and movements, ethnicity, and dynastic struggles.

We have suggested that, during the Early Aztec period, political and economic functions were concentrated in city-state centers, each associated with a solar market system (Smith 1983; Hassig 1985:73; Hodge 1997). Local production and distribution of craft and agricultural products within each city-state may have been the rule at this time, with non-local goods such as obsidian, salt, and cotton entering each solar market system horizontally, circulating at a subregional (Charlton and Spence 1983; Nichols and Charlton

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1988) and possibly confederation level (cf. Hodge 1992, 1996; Hodge et al. 1992, 1993; Hodge and Minc 1990). Regional ratios of agricultural and non-agricultural production within each city-state varied, depending on the local natural resources present and the agricultural productivity of the land. City-states in the agricultural periphery and those with regionally restricted raw materials such as obsidian had a greater emphasis on non-subsistence craft production.

After the formation of the Triple Alliance and the associated increase in flow of agricultural products and luxury goods into the basin from tribute and long-distance trade, the basin economic system underwent significant changes. We have pointed out (Nichols and Charlton 1988) that the archaeological data suggest a core-periphery dichotomy focused on Tenochtitlan and possibly also on Texcoco. Excepting Tenochtitlan and possibly Texcoco, the city-states within a radius of 30–35 km of the center of Lake Texcoco in the central and southern lake system began to intensify agricultural production at the expense of craft production through increased labor input and the extension of terracing and irrigation technology. Such non-agricultural production remained focused on salt and other lacustrine resources, including comestibles.

Within the center of Tenochtitlan and possibly that of Texcoco, there were locally produced utilitarian and elite goods that entered the market system at that point, with similar goods obtained from tribute and *pochteca* (professional long-distance merchants) commerce. Such a development was reflected through an increased volume of regional goods such as obsidian at sites within the core (Charlton and Spence 1983:70–74). Thus, economic relations between city-state centers and their hinterlands became reoriented and redefined with reference to the politically important imperial cities that were also the largest market centers.

During the same time, population increased significantly in the agriculturally more marginal north central and northeastern Basin of Mexico. In this periphery, the Otumba city-state coped with such an increase in part through the intensification of agricultural production through xerophytic cultivation and terracing (Evans 1990; Parsons and Parsons 1990) and the elaboration of floodwater irrigation systems (Charlton 1990a, 1994). Similar expansion of hydraulic systems including *chinampas* has also been reported from Cuauhtitlan and Xaltocan (Armillas 1971; Nichols and Frederick 1993; West and Armillas 1950) in the north central Basin of Mexico, thus confirming initial observations at Otumba. Otumba's other strategy was to intensify production of utilitarian craft items such as obsidian cores and prismatic blades, groundstone tools, spindle whorls, figurines, ceramics, cloth, and elite lapidary craft items. A complex system of production and distribution focused on these activities (Charlton et al. 1996; Nichols 1994; Otis Charlton 1994; Otis Charlton et al. 1993).

## HISTORICAL BACKGROUND AND CULTURAL CONTEXT

From the breakup of Tula (ca. A.D. 1150) to the conquest of the Aztecs under the leadership of Cortés (1519–1521), complex and rapid evolutionary changes took place in central Mexico. By at least A.D. 1250, the Basin of Mexico was occupied by 15 to 20 militaristically competitive city-states (Brumfiel 1983:266, 268–270; Charlton 2000; Charlton and Nichols 1997; Hodge 1997; Sanders et al. 1979:154), some of whom, through alliances and leadership, built up small-scale Conquest "empires" in the Basin of Mexico and in surrounding regions that were unstable and short-lived (Bray 1977:376; Brumfiel 1983:268–270). Despite the political fragmentation, there is evidence for some degree of regional economic integration (Blanton 1996; Charlton 2000; Charlton and Spence 1983).

During the last half of the fourteenth century, "this period of political fragmentation ended with the formation of the Tepaneca and Acolhua hegemonies" (Sanders et al. 1979:150) and other poorly understood predecessors of the Triple Alliance or Aztec empire (Berdan et al. 1996; Hodge 1984:139; Offner 1979). Essentially, these two ethnically based polities began expansion on a grander scale than had been previously attempted. Nevertheless, they retained the political fragility and instability of their predecessors that all too often emerged during competition for leadership with the death of a *tlatoani*.

Their ultimate defeats, the Acolhua at the hands of the Tepaneca in A.D. 1418 and the Tepaneca at the hands of the Mexica Aztecs allied with Tlacopan, the Acolhua, Tlaxcala, and Huejotzingo in A.D. 1428, established the conditions that gave rise to the Triple Alliance. After A.D. 1430, the 15–20 city-states, along with about 35 new local centers, became semi-autonomous administrative units within the expanding domain of the Triple Alliance. Each city-state, governed by a hereditary ruler(s) (*Tlatoani*, pl. *Tlatoque*), consisted of rural dependencies, with the center of government and tribute collection in the capital town or city, with major temples, marketplace, palace, and occupational specialists and about one-third of the total population of the city-state (Berdan 1982; Bray 1972, 1977; Calnek 1978; Gibson 1964, 1971; Hodge 1984, 1996, 1997; Lockhart 1992:14–28).

## THE OTUMBA CITY-STATE

The Otumba city-state is located in the eastern end of the Teotihuacan Valley in the northeastern Basin of Mexico. The archaeological site of Otumba, the capital of the Late Aztec city-state, covers approximately 220 ha and lies on the edge of a gently sloping piedmont just above the alluvial plain, 12 km east of the Classic-period city of Teotihuacan (Figures 1–3). The site contains a nucleated core of about 40 ha, with large mounds and other indications of elite occupation (Charlton 1988; Charlton and Nichols 1992; Mather 1968; Pohlman 1995), and a dispersed residential zone that makes up the rest of the site, where most mounds have been reduced by erosion and plowing to concentrations of building rubble and domestic artifacts. Dependent tributary settlements and interspersed *calpixqui* districts under the control of Texcoco (Evans 1980:284) occur on the piedmonts to the north, east, south, and southwest of Otumba. The city-state territory includes the Otumba obsidian source area, one of the major sources of obsidian in central Mexico (Charlton and Spence 1983:39–50).

## PRE-CONQUEST AND EARLY COLONIAL ETHNOHISTORY

Documentary sources make only brief mention of Otumba and nearby communities (see Evans 1980, 2001). Few of the references place the communities earlier than the reign of Techotlalatzin (A.D. 1357–1409; Dibble 1980; Ixtlilxóchitl 1965:I, II; Offner 1979) who permitted Otomi refugees fleeing Xaltocan, defeated by Azcapotzalco in 1395, to settle at Otumba (Otompan; Gibson 1964:10; Ixtlilxochitl 1965:I:167–168, II:82–83). At least two battles took place in the area in the early A.D. 1400s (A.D. 1415 and 1418) as the Acolhua confederation, centered in the eastern Basin

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at Texcoco, Huexotla, and Coatlinchan, and the Tepaneca in the western basin, centered at Azcatpotzalco and Tenayuca, along with their allies from Tenochtitlan, vied for control of the area (Hassig 1988:146–140; Davies 1982).

The defeat of Azcaapotzalco in 1428 "set the stage for the formation of the Triple Alliance" (Hassig 1988:144; also Brumfiel 1983:271–276) and Nezahuacoyotl's subsequent consolidation of the Alcolha domain, including Otumba, in the early 1430s (Offner 1983:87–88). Details about Otumba and other small city-states are sketchy because documents written in the fifteenth and sixteenth centuries usually represent the viewpoint of the major Triple Alliance centers (Nicholson 1978), even though Otumba became the largest Late Aztec polity in both area and population in the Teotihuacan Valley (Evans 1980:281) and an important administrative center of Texcoco's domain (Offner 1983:110). The Otumba city-state persisted into the Early Colonial period but in modified form (Charlton 1991; Charlton and Fournier 1993; Charlton and Nichols 1997; Charlton and Otis Charlton 1994a, 1994b; Evans 2001; Genotte 1994, 2001; Gibson 1952, 1964; Lockhart 1991, 1992).

## IMPLICATIONS

On the basis of previous studies (Charlton 1994; Charlton and Nichols 1992; Mather 1968), two major residential areas had been identified at Otumba: (1) a small nucleated core (with remains of several large mounds, including a probable temple-pyramid and plaster floors) where the ruling elite resided and (2) a zone of dispersed residences. Along the northern edge of the nucleated core are irrigation features, some of which may date to 100 B.C. (Figure 3). Manufacturing areas are concentrated in the southeast section of the dispersed residential zone. Mather's (1968) surveys and collections indicated that the items produced there included obsidian cores and blades, ceramic figurines, and molds. Charlton's (1971, 1981a, 1994:233–236) surveys and collections confirmed and extended obsidian core-blade production to the nucleated core and the northwest corner of the Otumba site and added production of obsidian earspools and labrets, maguey fibers, and groundstone tools in the southeast section.

To find in a single Aztec site such extensive and abundant evidence of craft production is unique in archaeological research. These data suggested that craft production was a significant component of the economic system of Otumba. The Otumba project surface collections and excavations defined these craft industries in more detail and recovered evidence of additional craft industries.

## INTENSIVE SURVEYS AND SURFACE COLLECTIONS AT OTUMBA AND DEPENDENT SITES

The Otumba project had its roots in William Sanders's Teotihuacan Valley Project (Sanders 1965). Although Vaillant examined the northern edge of the site in 1934 (William J. Parry, personal communication 1999) and Tolstoy (1958:72) visited the archaeological site of Otumba in 1953–1954, making two collections there, Mather's survey in 1963 as part of the Teotihuacan Valley Project was the first to report evidence of craft specialization at this Aztec city-state capital and to make systematic collections there (Mather 1968:163; Sanders 1965). In addition to mapping the site, Mather recorded three obsidian core-blade workshops and one large area of figurine molds. Between 1968 and 1978, three projects directed by Charlton collected additional information on the Otumba city-state (Brodkey 1978; Charlton 1971, 1972, 1973, 1975a, 1975b, 1977, 1981a, 1994; Wiltfang 1975), indicating substantial craft production associated with the Late Aztec occupation and a long sequence of floodwater irrigation.

## 1987 OTUMBA RESURVEY

In January 1987 Thomas Charlton, Cynthia Otis Charlton, and Evaristo Tenorio Coronel carried out an intensive field-by-field resurvey of the Otumba site area (Charlton 1988). Although they took no collections, they did confirm the presence of a nucleated center and peripheral zone of dispersed residences and expanded the evidence of intensive craft production in both areas, including those previously noted and several additional areas.

Evidence of fiber spinning remained the same in extent but was noted to be associated with a heavy concentration of notched green obsidian prismatic blades and fragments of basalt *hachas* or *desfibradores* (Charlton 1988:10), suggesting the use of the latter in maguey fiber removal from *pencas* (see Montell 1937:308, 312; Serra Puche 1988:171–188; Serra Puche et al. 1987; Tolstoy 1971:289). The presence of the identified earspool workshop was confirmed, and additional evidence for lapidary production was noted both south and north of the *barrancas*.

The previously known core-blade workshops were also confirmed. In the dispersed residential zone, an additional three areas of heavy obsidian debris were noted north of *barrancas*. In the nucleated core, four similar concentrations were mapped. Outside of the site area, a concentration originally located in 1968 was added. The majority of these concentrations appeared to be from core-blade manufacturing.

The area of figurine production, with molds and heavy concentrations of figurines, was expanded to cover almost 10 ha, suggesting a *barrio* of households specializing in figurine manufacture.

Two previously unreported concentrations of chipped basalt flakes and fragments of groundstone pestles, mortars, manos, and metates were located, suggesting the presence of a new craft activity, groundstone-implement manufacturing.

Craft production was clearly important at Otumba, covering about 10% of the site area based on the 1987 survey. In addition, evidence from previous investigations documented agricultural intensification through floodwater irrigation. To relate this evidence to models of sociopolitical developments during the Postclassic period, however, we needed to go beyond the Stage I survey data. Additional information on the nature of craft activities and irrigation through time was required in relation to both population growth and decline in the city-state and the development of the nucleated core of Otumba. To obtain such data, systematic surface collections and excavations were carried out.

## SAMPLING RATIONALE

The purpose of the 1988–1989 program of surface collection was to obtain representative and comparable artifact samples from different, previously identified parts of sites (e.g., nucleated core vs. dispersed residential zone, workshops, and mounds) and to define more precisely the occupational history of the city-state and the significance of craft production during the Aztec periods, including relations between Otumba and its dependencies. Both the town site and its tributaries are well suited to this type of archaeological investigation. Vegetation is sparse and consists primarily of weeds and cacti or cultigens (maize, barley, beans, nopales, and maguey). In many areas, the soil cover is shallow (i.e., less than 0.5 m).

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Moreover, erosion and farming practices, including disc and chisel plowing, have brought artifacts to the surface. Finally, Otumba and its dependencies are primarily single-component Late Aztec and Early Colonial-period sites. This fact reduced substantially the problem of dating nonceramic artifacts in surface collections.

In addition to the surface collections, we carried out surveys in areas for which we had no recent information. At Otumba (TA-80), we expanded slightly the area resurveyed in 1987.

## SAMPLING DESIGN

The surface collection program involved a combination of probabilistic and purposive sampling. At the Otumba site, where most collections were made, a stratified, systematic, unaligned sampling design was employed, supplemented by non-randomly chosen samples where appropriate. We had intended to carry out an intensive survey and to make randomly chosen collections at three of the sites tributary to Otumba. When we examined the present condition of the rural sites, however, we determined that, for various reasons (site destruction primarily and very occasionally permission), we would not be able to follow the same survey and sampling strategy within the context of complete sites.

Many sites or large portions of sites have been destroyed in recent years by chisel plowing and reforestation. At outlying sites, the sampling design had to be modified, and a purposive rather than a probabilistic sampling program was used. For both the randomly selected samples at the Otumba site and purposive collections at dependent settlements, however, the size of the sampling units and collection procedures were identical, so the samples are readily comparable.

The intensive surface collection program at Otumba employed a stratified random-sampling design to ensure an even distribution of samples from all parts of the site. This method also controlled for differences in ground conditions (e.g., cultivated versus fallow fields) that, in addition to the experience of the collectors, can affect the visibility of artifacts. Moreover, new strata could easily be added to the sampling domain, and this was an important consideration along the boundaries of the site.

The site map, based on Charlton's resurvey of the site in 1987, was divided into 50- × 50-m sampling strata. This was a convenient size for the scale of the site map (made from a 1:5,000 aerial photograph) and small enough to control for different field conditions. One 5- × 5-m square (or a 1% sampling fraction) from each stratum was randomly selected using a table of random numbers. Each unit selected for the 1% sample received its own number between 1 and 999.

In the southeastern section of the site, where Charlton (1988) had noted that concentrations of artifacts from craft activities are heavy, we decided to collect an additional 4% random sample. Thus, the total sampling fraction for this part of the site is 5%. Squares collected as part of the additional 4% sample are numbered between 4,000 and 4,900. This sampling program provided additional data to permit a more precise definition of the industries (figurine, spindle whorls, pottery, maguey fiber, groundstone, and lapidary) concentrated in this part of the Aztec town.

Occasionally, mounds, workshops, or other unusual artifact concentrations were inadequately sampled by the randomly chosen squares. In these cases, we purposively selected additional squares to collect. The squares were the same size as the randomly chosen squares (5 × 5 m) and were collected in the same manner. Nonrandomly selected squares were assigned a number between 1,000 and 1,100 to distinguish them from randomly chosen collection units. In addition, we collected artifacts from the backdirt of four deep holes previously dug illicitly into the *tepetate* bedrock; these collections were designated as Surface Features 1–4.

Because we were unable to collect randomly chosen samples from three rural sites as originally proposed, we defined three zones at different distances and directions from Otumba that included substantial preserved sections of rural sites. Within these zones, we took purposive collections equivalent in size to those at Otumba from mounds and artifact concentrations.

A standard form was completed on each collection unit, and information was recorded on environmental conditions, land use, artifact types and densities, and the presence of mounds or any other special features.

## INTENSIVE SURVEY AND COLLECTIONS AT OTUMBA (TA-80)

From the 1987 survey by Charlton and the 1988 surface collection program, it became obvious that we needed to expand the areas surveyed around the Otumba site to confirm or adjust its boundaries. Survey procedures involved a crew of three to five persons systematically walking over the area in parallel transects about 5 m apart. Information on artifact densities was recorded on a 1:5,000 air photograph. A standard form was completed for each field. These surveys helped clarify the boundaries of the site.

A total of 1,150 different 5- × 5-m squares was collected at Otumba. One 1% collection square was collected twice (1,151). In addition, surface collections were made at four surface features, for a total of 1,155 collections (Table 1).

The site map was divided into 972 50- × 50-m sampling strata, each with one 5- × 5-m square (1%) randomly selected through a table of random numbers.Collections were made in 794 of the 972 units. The total of 798 5- × 5-m squares collected in the 1% sample includes, in addition to those 794 5- × 5-m squares collected twice, one stratum with a second 5- × 5-m square collected and one stratum with two additional 5- × 5-m squares collected.

The 794 strata collected, excluding the one duplicate and three extra collections that would add 100 $m^2$ to the total (19,950 $m^2$), mean that 1.985 $km^2$ of the site area was sampled and a total area of 19,850 $m^2$ was collected at the 1% sampling level. The sampling domain did not include all of Aztec Otumba, previously estimated to cover appximately 220 ha, because it was not always possible to make collections in occupied house lots or in some fields (principally in the south-central part of the site) due to occasional landowner recalcitrance and dense stands of *nopales*. Further, it was impossible to make collections in roads and *barrancas*. Alternative units within such strata were not chosen.

**Table 1.** 1988–1989 Surface collections from Otumba (TA-80), 5- × 5-m collection units

| 1% Random Sample | 4% Random Sample | Nonrandom Sample | Surface Features | Total |
|---|---|---|---|---|
| 798 | 296 | 58 | 4 | 1,155 |

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The collection of an additional 4% for a total 5% sample in the southeastern part of the site coincided for the most part with the strata sampled in the 1% sample. However, collections extending into 10 additional strata were not included by the 1% sample, thus resulting in 804 strata that were sampled (2.01 $km^2$) by randomly selected units at the 1%, 4%, or 5% level. An additional nine strata were sampled only through non-randomly chosen collection units, resulting in 813 strata, or 2.0325 $km^2$, sampled using various methods. Excluding only the surface features, 1,151 samples were collected from 813 strata with a total collected surface area of 28,875 $m^2$ from 2,032,500 $m^2$ (813 strata), for a total sampling fraction of 1.42% within the 813 strata accessible to us.

We recognized from the outset that a sampling fraction of 1–2% was not adequate for discovery-mode sampling of small localized artifact concentrations, but a higher sampling fraction would not have been feasible given our resources for fieldwork and analysis. Survey intensity, however, plays an equally important role in the identification of small archaeological remains (Nance 1981, 1983; Plog et al. 1978; Schiffer and Wells 1982). Mather's and Charlton's systematic surveys had already identified numerous workshop concentrations and mounds (Charlton 1994), and much of the area was rewalked during our collections. Indeed, few Aztec sites of this size have been subject to so many pairs of archaeologically trained eyes. Given the intensity of survey at Otumba, we thought our objectives would best be met by combining the surface collection program with excavations of workshop areas and deeper deposits in the nucleated core.

## SURVEY AND COLLECTION OF THE DEPENDENT SITES

Another objective of our investigations was to obtain comparable economic data from rural Aztec sites that were tributary to Otumba and thus to focus on the question of the economic relations between the *cabecera* and its *sujetos*. Our choice of sites to investigate was constrained by several factors, primarily the recent partial or complete destruction of many sites by chisel plowing and reforestation and the expansion of modern settlements, and very occasionally the opposition of landowners to our collecting even on those preserved site fragments. In essence, our proposed strategy to investigate three entire sites had to be modified to an investigation of three zones at different distances and directions from Otumba, each of which included substantial preserved portions of rural sites suitable for intentional collections.

Our surveys consisted primarily of systematically relocating mounds and artifact concentrations identified by previous projects. We also noted new data that had not been previously recorded. For each mound and artifact concentration, artifacts were collected from at least one 5- × 5-m square (the same size unit employed at Otumba); if the mound or artifact concentration was large, then more than one square was collected.

Surface collections were carried out at the following sites: TA-36, TA-37, TA-39, and TA-57 to the east of Otumba; TA-59 and TA-VI (a series of small dispersed Late Aztec sites), southeast of Otumba; and TA-71 and TA-236, which are situated south and southwest of Otumba (Table 2). The sites in our sample had all been surveyed, mapped, and collected in the mid-1960s as part of the Teotihuacan Valley Project (Sanders 1965; Evans and Sanders 2000) and during Charlton's (1972, 1973, 1978) Colonial and trade-route studies. Our goal was to supplement these earlier investigations and to obtain artifact samples comparable to those from Otumba. Additional excavated and surface collections had been made east, northeast, north, and northwest of Otumba during previous projects (Charlton 1972, 1975a, 1975b, 1976, 1994; Evans 1988).

**Table 2.** 1988 Surface collections made at outlying sites

| Site Number | Number of Collections |
|---|---|
| TA-36 | 2 |
| TA-37 | 66 |
| TA-39 | 49 |
| TA-57 | 22 |
| TA-59 | 1 |
| SS-VI | 23 |
| TA-71 | 23 |
| TA-236 | 3 |
| Total | 189 |

*Note:* In terms of our objective of obtaining information on specialized production at rural sites and rural consumption of goods, relatively little additional information would have been gained by sampling unoccupied zones.

Procedures for laying out the squares and recording them were identical to those at Otumba. Unlike the sampling procedures employed at Otumba, samples from the outlying sites were not randomly chosen because we lacked the necessary resources to undertake a comparable, large-scale sampling program at these sites. However, the Aztec occupation of these sites is dispersed, with mounds or mound remnants separated by areas of sparse artifact densities. In terms of our objective of obtaining information on specialized production at rural sites and rural consumption of goods, relatively little additional information would have been gained by sampling unoccupied zones

## EXCAVATIONS AND INTENSIVE SURFACE COLLECTIONS

We undertook a series of excavations as part of the interrelated research activities of the Otumba project. The excavation of manufacturing areas in the city-state center (Otumba) was carried out to clarify the organization, chronology, and importance of nonagricultural production to the city-state economy. The excavation of the hydraulic system at Otumba was carried out to reconstruct its morphology, development, and chronology, and its importance for agricultural production. Excavations within the nucleated core of the city-state center were conducted to clarify Otumba's occupational history and the nature of the articulation between Otumba, Texcoco, and the Triple Alliance.

Ten operations involving excavations were carried out (1–6 and 9–12). In two cases (1 and 11), these were supplemented by intensive surface collections. Where warranted (Operation 7), only such surface collections were carried out. Operation 8 was not used (Figure 3).

## CRAFT PRODUCTION-AREA EXCAVATIONS: OPERATIONS 1, 2/3, 4–6, AND 11

### Field Methodology

Operations 1 and 4–6 investigated figurine manufacturing, Operations 2–3 looked at obsidian core-blade production, and Operation 11 studied lapidary production.

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Each operation was set up with a separately established grid system. Each excavation began with a series of test pits, either 1 × 1 m or 2 × 2 m, that were usually amplified when in situ remains were encountered. In Operations 2–3, trenches 1 m wide and of different lengths and 3- × 3-m test pits were used. In other cases, test pits measuring 2 × 2 m were excavated with 1-m-wide trenches of different lengths. Excavation was carried out with trowels at levels of 10 cm (Operations 1, 4–6, and 11) or with one or more initial levels up to a depth of 50 cm from the surface, depending on results from preview pits, and followed by levels of 10 cm (Operations 2–3). With the exception of the upper levels of Operations 2–3, all soil was screened. Excavation proceeded in 10-cm levels or until natural or cultural features were encountered, whichever occurred first, thus applying a combination of arbitrary and natural or cultural strata according to the contexts. All excavations were continued until sterile soils were encountered and verified. We also took flotation samples from middens and from undisturbed contexts.

### Excavation Summaries

*Figurine barrio (Operations 1 and 4–6).* We focused our excavations on areas of deep deposits within the zone of figurine manufacture as defined by surface survey and collections. We wanted to determine whether the proposed workshops were associated with domestic residences, a finding that would support the organization of figurine production within a household context. Although we examined several sections of the proposed zone, or *barrio*, of figurine workshops, we found undisturbed Aztec/Early Colonial deposits associated with figuine manufacturing only in Operation 4. Several other excavations revealed that modern cultivation methods, chisel plowing and tractor discing, had greatly modified the archaeological deposits (Operation 1 *bancales*; Operations 5 and 6). These excavations provided data on figurine production but from mixed deposits. One other excavation, Operation 1, Mounds 14–15, revealed a Late Colonial-period ranch. with traces of Aztec occupation beneath it, and mixed Aztec/Colonial-period materials associated with it.

*Obsidian core–blade nucleated core workshop (Operations 2–3).* Because many of the concentrations of obsidian debris in Otumba derived from obsidian core-blade production were located in areas with demonstrably shallow soils, we selected a concentration within the nucleated core where deep soil contexts appeared to exist. The 1987 survey identified a zone directly south of several large mounds, in the western part of a modern field. Survey and collections in 1988 expanded the area of the concentration and confirmed its origins.

In addition to the obsidian concentration, basalt and *tezontle* building rubble were scattered over the field; in a retaining wall on the west and south edges of the field, there were some stones with red-and-white painted plaster still adhering. These remains suggested the possible presence of structures, some of high-status families, of importance in our quest to locate connections between obsidian craft production, domestic residences, and high-status individuals, as well as the development of the industry and the sequence of occupation in the nucleated core of the city.

Our test pit program revealed that, although many of the deep soil contexts were recent deposits made during the nineteenth and twentieth centuries that had been further disturbed by recent plowing, they had, nevertheless, covered and protected undisturbed archaeological deposits but of non-uniform extent. We gridded the proposed workshop zone into 3-× 3-m squares, excavated a 1- × 1-m preview pit within several of these, and expanded those excavations where deposits of interest were encountered. On the basis of the excavated test units, the surface collections, and the surveys, the archaeological remains encountered can be grouped into three distinctive zones.

Zone 1: concentration of debitage flakes from the production of cores (Operation 2)
Zone 2: concentration of cores, prismatic blades, domestic refuse, and an altar foundation (Operation 2)
Zone 3: residential zone (Operations 2–3)

*Lapidary workshop (Operation 11).* We focused our excavations on an isolated concentration of debitage from lapidary production found during the surveys and surface collections of 1988. Associated with Mound 41 and in areas immediately around it were basalt polishers with obsidian tools and debitage from lapidary production. The area had Aztec/Early Colonial ceramics (Aztec II-IV) but no earlier or later occupations. Nor were there traces of chisel plowing or recent cultivation. Our interest was in determining whether the workshop was associated with a domestic residence. A positive finding would support the organization of lapidary production within a household context. In addition, we wanted to determine the chronology of lapidary craft development as well as the tools, techniques, and stages of such production.

A grid of 2- × 2-m squares was laid out on and around Mound 41. One 2- × 2-m pit was excavated in each quadrant to locate precisely the major concentrations of subsurface cultural deposits. Subsequent excavations were concentrated in the northwest and southwest quadrants. In the northwest quadrant, two distinct and separate pits, each filled with various types of refuse, were located. One contained domestic refuse with Aztec II ceramics but no materials from lapidary production, and the other contained broken adobes and sparse Aztec III ceramics. In the southwest quadrant, lapidary production debitage and tools were associated with a small domestic structure, Aztec III ceramics with traces of Aztec II and IV, and a probable workshop activity zone (Otis Charlton 1990:177, 1993:232–233).

## FIELD METHODOLOGY

### Craft-Production Area-Intensive Surface Collections: Operation 1, Mounds 14–15, Operations 7 and 11

In addition to the surface collection program previously described, we took surface collections from each unit excavated or under consideration for excavation. In two instances, we expanded the surface collections to include a larger area around the excavated zones (Operation 1, Mounds 14–15; Operation 11) and in one instance substituted the surface collections for excavations (Operation 7; see Nichols et al. 2000).

*Operation 1, Mounds 14 and 15.* The 2- × 2-m grid system included 119 2- × 2-m squares, which were collected. Of these, 18 were subsequently excavated. A provenience and level form was filled in for each collection made. The collection techniques were the same as those used for the TA-80 and dependencies (the rural sites) surface collections.

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The artifacts indicated a mixture of Late Colonial and Late Aztec/Early Colonial materials, including clay working (figurines, molds, marbles), debris from lapidary working, and Type I spindle whorls.

*Operation 7.* Instead of excavating within this area of unusual artifact concentrations (spindle whorls, *desfibradores*, obsidian blades, and lapidary items), we made controlled intensive surface collections throughout the entire survey unit. We based this decision on our observations of the extent of preserved stratigraphy, which was minimal, and projections on the availability of personnel to direct excavations. The field was divided by rows of *magueyes* (*bancales*) into small narrow fields (*melgas*). To avoid damaging the *magueyes*, we laid out 5- × 5-m squares according to the angle of each *melga*. When necessary, squares smaller than 5 × 5 m were used (five units). We collected 398 5- × 5-m squares, two 2- × 5-m units, and four 2.5- × 5-m units. All collections were made with the same procedures as used those used in the TA-80 and dependencies surface collection programs.

The artifact collections indicate the Late Aztec/Early Colonial specialized production of maguey fiber and the spinning of maguey fiber thread. There is also evidence for spindle whorl and spindle production, figurine production, and lapidary production. A small concentration of basalt flakes suggests that basalt grinding tools were made in one part of the field. The field also had heavy rock rubble and associated domestic refuse.

*Operation 11.* The 2- × 2-m grid system included 481 squares from which surface collections were made. Of these, 67.5 2- × 2-m squares were also excavated. The collection techniques were the same as those used for the TA-80 and dependencies surface collections. Provenience and level forms were completed for the surface collections from each square excavated.

The analyzed artifacts indicate a dominant Aztec III ceramic assemblage, with some Aztec II and IV ceramics present. Obsidian and basalt fragments indicate the tools and debitage associated with lapidary production activities (Vásquez Lom 1995).

### Hydraulic System Excavations: Operation 12

We began this investigation with two separate trenches, each measuring 4 × 2 m, and one trench measuring 3 × 2 m. Subsequently, we extended the 3- × 2-m trench with an additional 3- × 2-m trench (total size, 6 × 2 m). These trenches were located so as to explore projected positions of irrigation features such as field surfaces and canals previously known from road cuts and roadside exploratory excavations.

We started at the surface of a relatively undisturbed field behind the road cut. Excavation was carried out with trowels, with one or more initial levels up to a depth of 50 cm from the surface, depending on the thickness of the plow zone. Below the plow zone, excavation proceeded in 10-cm levels or until natural or cultural features were encountered. Depending on the nature of the deposits, we used a combination of arbitrary and natural or cultural strata. With the exception of the upper levels, all soil was screened. All excavations were continued until sterile soils were encountered and verified. We also took flotation samples and samples to determine soil grain size for sedimentation studies.

### Nucleated Core Excavations: Operations 9 and 10

In these investigations, each operation was set up with a separately established grid base line. Investigations in each began with a series of preview pits 1 × 1 m, each placed within the corner of a 2- × 2-m square. These preview pits were expanded into the 2- × 2-m square or augmented with a complete 2- × 2-m square if in situ remains of interest were encountered. One trench (Operation 9), measuring 3.77 × 1.2 m, was used to clear a profile exposed by the construction of a modern floodwater irrigation canal.

Excavation was carried out with trowels, with the initial plow zone level being 20 cm deep. With the exception of the upper level, all soil was screened. Excavation proceeded in 10-cm levels or until natural or cultural features were encountered. Depending on the nature of the deposits, we used a combination of arbitrary and natural or cultural levels. All excavations were continued until sterile soils were encountered and verified. We also took flotation samples from middens and other undisturbed contexts.

## RESEARCH RESULTS

The 1988 surveys and collections at Otumba revised the site boundaries, expanded the areas of known craft activities, identified new production locales, and clarified the boundary between the Aztec town and the new Colonial settlement (Figure 3). Analyses of artifacts and other materials recovered from the surface collections and excavations began in 1988 (see Biskowski 2000; McClung de Tapia and Aguilar Hernández 2001; Nichols et al. 2000; Parry 2001). Under Charlton's direction, the technical analyses were expanded to incorporate materials collected during his earlier surveys of three major trade routes that connected the Teotihuacan Valley with regions to the north and east (Charlton 1978, 1994; Neff et al. 2000; Parry 2001). Susan Evans's (1988) project at Siguatecpan within the Otumba city-state provided additional information, as did Chris Garraty's (2000) project in the Aztec city-state occupation at Teotihuacan. Evans developed a paper based on her ethnohistorical research for her dissertation (Evans 1980), which places Otumba and other Teotihuacan Valley Late Aztec-period city-states within the native historical framework (Evans 2001). Jean-François Genotte (1994, 2001) researched in detail the *Mapa de Otumba*, which covers the central section of the Otumba city-state in the sixteenth century and discusses both pre- and post-Conquest aspects of the city-state.

### Occupational Chronology

The predominant pre-Hispanic occupation at Otumba occurred during the Late Aztec period (Nichols and Charlton 1996). Terminal Formative pottery occurs at very low frequencies in portions of the site, including excavated hydraulic features. Widely dispersed Mazapan ceramics in surface collections and excavated hydraulic features at Otumba represent a Middle Postclassic occupation beginning around A.D. 900. Aztec II ceramics are widely but sparsely distributed in the surface collections, although areas with heavy Aztec II ceramics were collected in 1968 (Charlton and Nichols 1992). Radiocarbon dates from an Aztec II trash-filled pit (Operation 11) are tightly clustered in the late A.D. 1200s. Aztec III ceramics dominate the surface collections and represent the main occupation of the town that, based on radiocarbon ages, dates to A.D. 1300 ± 50 to 1521. However, Aztec III ceramics continued in use into the Early Colonial period (A.D. 1521–1620), associated after the Conquest with the newly produced post-Conquest Aztec IV Black-on-Orange style.

Otumba continued to have a substantial occupation after the Spanish Conquest until the early seventeenth century (ca. A.D.

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1600–1620), when most of the Aztec town was abandoned and the focus of settlement shifted north of the *barrancas*, where the Spanish had built civic and religious structures. Three mounds in the northwest and two in the northeast sections of the site may have formed a colonial barrio, and a few scattered *ranchos* were located within the boundaries of the former Aztec site. It appears that there was no sudden disruption in settlement over much of the area in the years immediately after the Conquest, although there were significant ongoing declines in population and relocation of the reduced population. This is true of all sites examined throughout the city-state area.

### Radiocarbon Dating

In 1995 and 1997, we submitted 23 samples for radiocarbon age determination. These samples were selected to refine the site's occupational history and the development of its craft industries. They came from deposits containing Aztec II, Aztec III, or Aztec III and IV ceramics (Table 3 and Figure 4).

Based on the ceramic evidence, problematic obsidian hydration dates, and the 10 initial radiocarbon determinations in 1995, Nichols and Charlton (1996) proposed that the widely separated concentrations of Mazapan ceramics found at Otumba in surface collections represent a middle Postclassic occupation beginning at approximately A.D. 900. The cluster of radiocarbon dates from an Aztec II trash pit in Operation 11 and hydration and radiocarbon dates in the A.D. 1100s to 1200s from Operations 9 and 10 suggested that the Aztec II occupation might have begun as early as A.D. 1200 and lasted until A.D. 1400. We also proposed that Aztec III, the main occupation at Otumba and throughout the city-state, dated from A.D. 1350 ± 50 to 1521, and that Aztec III ceramics continued in use into the early Colonial period. The larger sample of dates now available from Aztec III contexts supports these conclusions, with some minor modifications.

The mean intercept age of all the Aztec III-associated dates is cal. A.D. 1361 (median is cal. A.D. 1352), just slightly later than the conventional starting date of A.D. 1350 for Aztec III in the Basin of Mexico. However, there is a possibility of partial chronological overlap between Aztec II and Aztec III ceramic complexes at Otumba. The intercept dates for one-half or eight of the 16 radiocarbon determinations from Aztec III contexts at Otumba date on or before A.D. 1300 and six dates have 2-sigma ranges that fall entirely before A.D. 1400 and completely overlap the dates from the Aztec II trash pit. These overlapping dates may also reflect a rapid replacement of Aztec II by Aztec III or a rapid build-up of an Aztec III-using population within the Otumba area.

Radiocarbon dates associated with Aztec III ceramics from the trash pit and submound and platform fill in Operations 9 and 10 indicate that construction in the nucleated core began during the A.D. 1300s. Obsidian core-blade production and lapidary working in household workshops there and in the dispersed residential zones probably also began by the same time as did other craft activities such as figurine production. There is limited evidence for craft production at Otumba and in nearby sites during the Mazapan and Aztec II occupations. Core-blade production occurred in some rural Mazapan sites, and in Operation 11 at Otumba there is evidence of a limited household-based biface industry in chert and a similar low-frequency production of ceramic vessels during Aztec II.

Aztec III ceramics and craft production at Otumba continued after the Spanish Conquest, at which time Aztec IV Black-on-Orange and Early Colonial red wares were added to the ceramic complex with minor amounts of Monochrome Glazed Aztec Plain Orange Wares. Associated was the introduction of similarly small amounts of Majolica, imported and locally made in New Spain. Quite late in the sixteenth century, minute amounts of Asian porcelains appeared.

## The Environment

The present-day Otumba city-state area is located in a dry region of the Basin of Mexico. Our archaeological investigations into the floodwater irrigation features (Operation 12) at Otumba (Charlton 1977, 1990b) suggest some modification of *barranca* depth by down-cutting after the Conquest, which lowered the present bed of the water flow well below the Aztec-period level, leaving the canals high and dry. Genotte's (2001) study of the *Mapa de Otumba* has documented several other potential hydraulic features such as canalized *barrancas*, canal systems, catchment basins, and one masonry dam. Together with the canal system excavated in Operation 12, the ethnohistorically documented dam confirms the use of the water from the two *barrancas* flowing through Otumba for floodwater irrigation during the Aztec period and possibly into the Early Colonial period.

Genotte also cited some glyphs that emphasize water and some toponyms that describe native flora, fauna, and mineral resources. Of the vegetation he noted (oak, river willow, *nopal*, thicket, and wild sorrel), oak and willow are much more restricted, whereas *nopal*, thicket, and sorrel are found widely throughout the area. Wheat, an introduced domesticate that is also mentioned, is not presently grown in the area because it requires more rainfall than is currently available.

McClung de Tapia and Aguilar Hernández (2001) suggested that Aztec-period environmental reconstructions of the Teotihuacan Valley place the Otumba city-state in a zone transitional between grassland and xerophytic scub to 2,400 m, which then gradually changed into oak and pine woodlands up to 2,600 m. This accords well with Genotte's data from the *Mapa de Otumba*, Colonial documentary descriptions (Charlton 1991; Evans 2001), and contemporary observations. Their analyses of macrobotanical remains are consistent with these descriptions and include an analysis of an environment very modified through millennia of cultivation. Although they express concern regarding the apparent downward migration of uncarbonized materials into the archaeological record, all flotation samples were taken from only well-sealted deposits in strict accordance with McClung de Tapia's instructions, and no other evidence supports an interpretation of mixture or disturbance within these deposits before or after being exposed.

The Otumba city-state environment appears to have been similar to the present-day environment with the exception of the severe down-cutting of the *barrancas* and the extensive sheet erosion on the piedmont and hills. The aridity was similar, but possibly less if wheat were actually grown. Floodwater irrigation was definitely used to direct water to the productive Middle Valley alluvial plain, as indicated by excavations in Operation 12 (Charlton 1990b) and documentary studies (Genotte 2001), even if the palaeoethnobotanical remains are elusive (McClung and Aguilar Hernández 2001). It is probable that either McClung de Tapia and Pérez Pérez missed the field surfaces located by Charlton (1990b) because of the nature of their excavations (personal communication

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**Table 3.** Radiocarbon dates from Otumba

| Lab Number | Context | Uncalibrated Age | C-13 | Calibrated Age[a] | Calibrated 1-sigma range | Calibrated 2-sigma range |
|---|---|---|---|---|---|---|
| | Aztec II ceramics | | | | | |
| Beta-80079[b] | TA-80 Sample 18: Op. 11 W20/N8, L. 12 loose charcoal from trash-filled pit | 970 ± 50 B.P. (A.D. 980 ± 50) | −9.6 | A.D. 1035 | A.D. 1015–1065 and A.D. 1075–1155 | A.D. 990–1195 |
| Beta-80080[b] | TA-80 Sample 19: Op. 11, W20/N8, L. 13 loose charcoal from trash-filled pit | 670 ± 60 B.P. (A.D. 1280 ± 60) | −24.6 | A.D. 1300 | A.D. 1285–1325 and A.D. 1340–1390 | A.D. 1260–1410 |
| Beta-80081[b] | TA-80 Sample 20: Op. 11, W12/N0 loose charcoal from trash-filled pit | 770 ± 60 B.P. (A.D. 1180 ± 60) | −25.3 | A.D. 1270 | A.D. 1225–1290 | A.D. 1175–1305 |
| Beta-80082[b] | TA-80 Sample 21: Op. 11, W12/N0, L. 7B loose charcoal from trash-filled pit | 730 ± 60 B.P. (A.D. 1220 ± 60) | −24.7 | A.D. 1285 | A.D. 1260–1300 | A.D. 1215–1325 and A.D. 1340–1390 |
| | Aztec III ceramics | | | | | |
| Beta-80075[b] | TA-80 Sample 7: Op. 9, E4/N12.15, L. 2B loose charcoal from platform fill | 840 ± 100 B.P. (A.D. 1110 ± 100) | −23.7 | A.D. 1220 | A.D. 1045–1105 and A.D. 1115–1280 | A.D. 1005–1310 and A.D. 1365–1375 |
| Beta-80076[b] | TA-80 Sample 8: Op. 9, E4/N12.15 L. 3 loose charcoal from platform fill | 900 ± 80 B.P. (A.D. 1050 ± 80) | −19.4 | A.D. 1170 | A.D. 1030–1235 | A.D. 995–1280 |
| Beta-80078[b] | TA-80 Sample 12: Op. 9, W52/N34.97, L. 8 loose charcoal from feature in subsoil at base of Aztec III/IV midden | 710 ± 60 B.P. (A.D. 1240 ± 60) | −24.7 | A.D. 1290 | A.D. 1270–1305 | A.D. 1225–1400 |
| Beta-80346[b] | TA-80-Sample 14: Op. 10, E19/N19.44, L. 7 loose charcoal from submound fill | 360 ± 100 B.P. (A.D. 1590 ± 100) | −25.0 | A.D. 1505, A.D. 1595, A.D. 1620 | A.D. 1440–1655 | A.D. 1410–1680 and A.D. 1745–1805 and A.D. 1935–1950 |
| Beta-80347[b] | TA-80 Sample 17: Op. 10, E18/N18.44, L. 8 loose charcoal from submound fill | 680 ± 190 B.P. (A.D. 1270 ± 90) | −21.3 | A.D. 1295 | A.D. 1270–1400 | A.D. 1205–1425 |
| Beta-105949[c] | TA-80 Sample 1: Op. 2, E6S18, L. 3, 2292-00-030 loose charcoal from small altar platform | 500 ± 50 B.P. (A.D. 1450 ± 50) | −26.7 | A.D. 1425 | A.D. 1415–1440 | A.D. 1400-1455 |
| Beta-105950[c] | TA-80 Sample 2: Op. 2, 2530/32, L. 7 loose charcoal from below room of house, floor destroyed | 1180 ± 130 B.P. (A.D. 770 ± 130) | −23.3 | A.D. 880 | A.D. 690–1000 | A.D. 635–1065 and A.D. 1075–1155 |
| Beta-105951[d] | TA-80 Sample 3: Op. 2, W2S20, L. 4. loose charcoal from midden | 440 ± 50 B.P. (A.D. 1510 ± 50) | −24.4 | A.D. 1450 | A.D. 1430–1475 | A.D. 1415–1520 and A.D. 1570–1630 |
| Beta-105952[d] | TA-80 Sample 4: Op. 2, 2250-00-070, L. 7 loose charcoal from midden | 400 ± 50 B.P. (A.D. 1550 ± 50) | −24.9 | A.D. 1470 | A.D. 1445–1515 and A.D. 1585–1625 | A.D. 1425–1640 |
| Beta-105953[d] | TA-80 Sample 5: Op. 2, 2530, Room 1 loose charcoal from below room wall | 610 ± 50 B.P. (A.D. 1340 ± 50) | −25.3 | A.D. 1325, A.D. 1340, A.D. 1390 | A.D. 1300–1410 | A.D. 1290–1425 |
| Beta-105954[d] | TA-80 Sample 6: Op. 2 E9S9, 2702-00-040, F. 1 loose charcoal from midden with concentration of obsidian cores | 680 ± 50 B.P. (A.D. 1320 ± 50) | −25.6 | A.D. 1295 | A.D. 1285–1310 and A.D. 1355–1385 | A.D. 1265–1400 |
| Beta-105957[c] | TA-80 Sample 13: Op. 9 W52/N34.97, F. 1, L. 8 maize cob from pit in subsoil at base of Aztec III/IV midden | 220 ± 40 B.P. (A.D. 1730 ± 40) | −25.8 | A.D. 1665 | A.D. 1665–1675 and A.D. 1770–1800 and A.D. 1940–1950 | A.D. 1640–1690 and A.D. 1735–1815 and A.D. 1925–1950 |
| Beta-105958[c] | TA-80 Sample 15: Op. 10, E18/N18.44, L. 7 loose charcoal from submound fill | 640 ± 80 B.P. (A.D. 1310± 80) | −26.5 | A.D. 1310, A.D. 1365, A.D. 1375 | A.D. 1285–1410 | A.D. 1250–1435 |
| Beta-105959[c] | TA-80 Sample 16: Op. 10, E19/N19.44, L. 9 loose charcoal from submound fill | 830 ± 100 B.P. (A.D. 1120 ± 100) | −24.7 | A.D. 1225 | A.D. 1055–1090 and A.D. 1150–1285 | A.D. 1010–1310 and A.D. 1355–1385 |
| Beta-105961[d] | TA-80 Sample 23: Op. 11, Mound. 41, W8S8 L. 7B loose charcoal from trash-filled pit | 470 ± 50 B.P. (A.D. 1480±) | −24.3 | A.D. 1435 | A.D. 1420–1455 | A.D. 1405–1495 |
| Beta-105969[c] | TA-80 Sample 22: Op. 11, Mound 41, W8/S10, L. 8 loose charcoal from midden/trash pit | 660 ± 90 B.P. (A.D. 1290 ± 90) | −24.5 | A.D. 1300 | A.D. 1275–1405 | A.D. 1220–1435 |
| | Aztec III/IV ceramics | | | | | |
| Beta-80077[b] | TA-80 Sample 11: Op. 9, W50/N33.97, L. 12 loose charcoal from midden | 330 ± 60 B.P. (A.D. 1620 ± 60) | −25.4 | A.D. 1525, A.D. 1560, A.D. 1630 | A.D. 1475–1650 | A.D. 1445–1670 |
| Beta-105955[c] | TA-80 Sample 9: Op. 9, W52/N32.97, L. 11B loose charcoal from midden | 320 ± 70 B.P. (A.D. 1670 ± 70) | −26.4 | A.D. 1535, A.D. 1545, A.D. 1635 | A.D. 1475–1655 | A.D. 1440–1675 and A.D. 1770–1800 and A.D. 1940–1950 |
| Beta-105956[c] | TA-80 Sample 10: Op. 9 W50/N33.97, L. 10 loose charcoal | 490 ± 50 B.P. (A.D. 1460 ± 50) | −26.1 | A.D. 1430 | A.D. 1415–1450 | A.D. 1400–1475 |

*Note:* F., feature; L., level; Op., operation.
[a]Calibrations determined by Beta Analytic, Inc., using the Pretoria Calibration Procedure Program.
[b]Standard radiocarbon determination made in 1995 (see Nichols and Charlton 1996).
[c]Standard radiocarbon determination made in 1997.
[d]AMS determination made in 1997.

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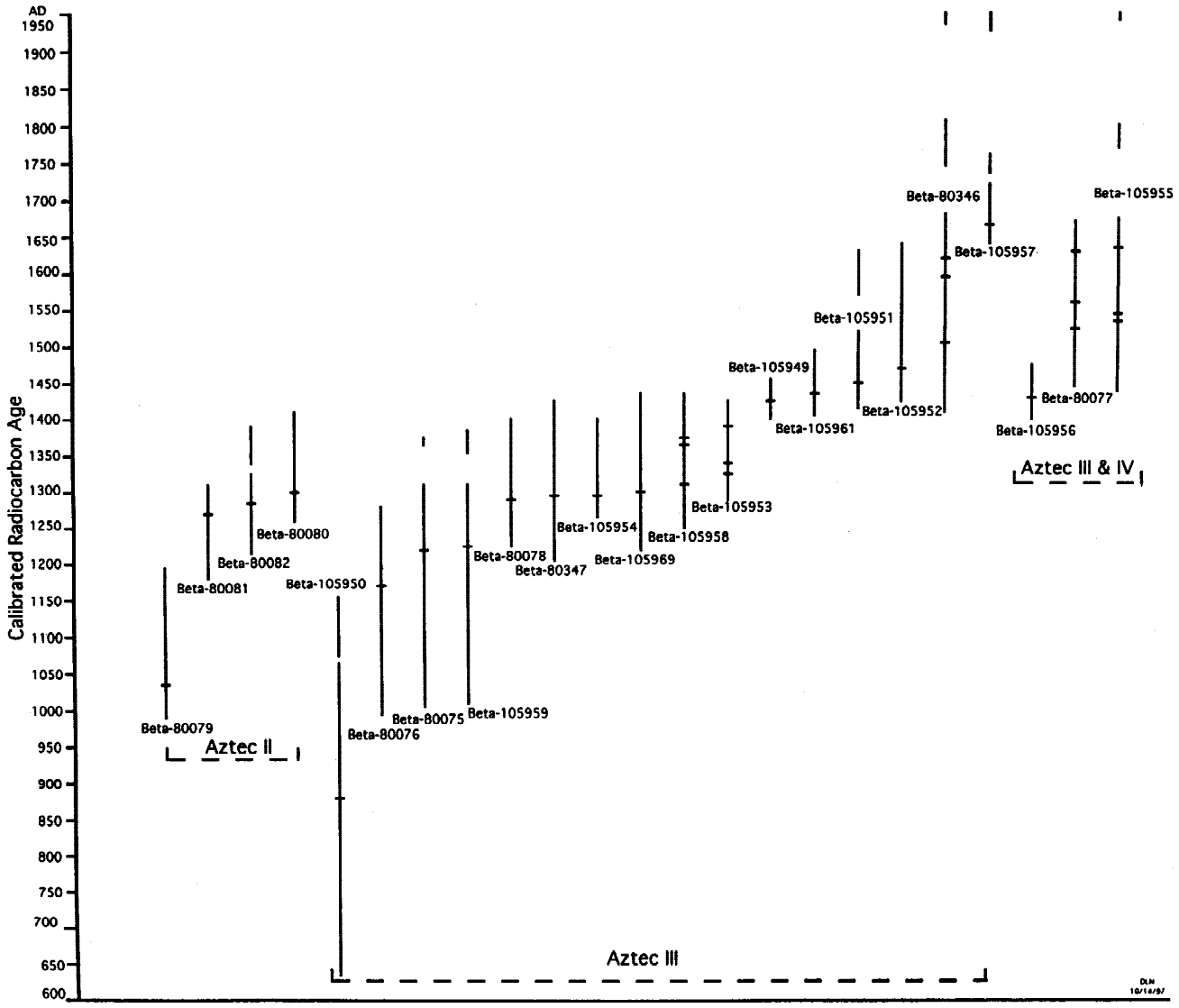



Figure 4. Otumba (TA-80) radiocarbon ages.

1999) or that, as McClung de Tapia noted previously (1980), irrigated areas are subject to disruption of sediments during and after their use. The presence of direct evidence for the presence of *nopales* and *agave* suggests the use of xerophytic vegetation. It is in the context of this unpromising area, a region that had never held a large population or independent political unit until Otumba developed, that we need to explore the growth, dynamics, and organization of the social, economic, and political structures.

## The Ethnohistoric Accounts

The studies by Evans (2001) and Genotte (2001) are complementary. Evans focused on the pre-Conquest developments, and Genotte focused on the sixteenth-century Early Colonial period. Evans has provided an excellent overview of Aztec city-state organization derived from available sources on the centers as opposed to the peripheries of the Triple Alliance. Source limitations and problems with fit between archaeological and documentary sources remain to be resolved (Charlton 1981b, 2000; Charlton and Nichols 1997). Otumba emerges from these histories in any detail only from Texcoco's point of view and only after A.D. 1300. Evans's Otumba essentially is a bit player controlled for most of its history by Texcoco until Ixtlilxóchitl's fateful rebellion in 1515. In accepting this point of view as accurate, then all of the craft production would have originated and have been structured within a preexisting, dominant polity's hierarchical, social, economic, and political structure and not have developed from the bottom up as a grass-roots formation of an independent city-state.

Both Evans and Genotte addressed the Early Colonial period. Evans traced the evangelization of Otumba and aspects of the fate of the craft industries during the sixteenth century, whereas Genotte evaluated a single document within the context of acculturative processes, evangelization, and the persistence of pre-Conquest or-

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ganization and agricultural practices. The *Mapa de Otumba*, possibly from the lost *Relación Geográfica de Otumba*, depicts Otumba at the crucial juncture of the Middle Valley alluvial plain with the *barranca* sources of floodwaters for irrigation and several dependencies to the east. Genotte documented the importance of water conservation and use in irrigation, the general nature of the environment, the routes for exchange between regions, the results of conquest and evangelization including organizational persistence and change, and the persistence of place names and identified areas in the city-state (Charlton 1969, 1972, 1991).

### Urban-Center Size and Layout

How big was the urban center and how was it organized? We have repeatedly used a figure of approximately 220 ha for the Otumba site (TA-80) based on the amount of land incorporated within the site boundaries as determined through Mather's and our survey data. Since the completion of the analyses of the 1% random collections from TA-80 and the non-random collections and an initial analysis of the 4% collections, we think it would be useful to examine the concentrations of ceramics and then attempt to delineate site area and zones within the site.

An initial attempt used the total Aztec ceramics from 782 collections with such pottery and applied the GRIDZO (Rockware) program to generate weighted frequency-density distributions. The 98,880 sherds are concentrated on the south side of the Barranca del Muerto, especially in the nucleated core that extends farther west than was noted on survey. Smaller and lighter clusters occur to the east and north of the *barranca* system.

The administrative center of the site, based on surface and excavated materials, appears to have been in the western section, south of the *barranca* system. Elite residences, administrative buildings, religious complexes, incense burner manufacturing, and obsidian core-blade workshops are found there. On the penninsula between the branches of the Barranca del Muerto, a ceremonial complex/residence is present, but relatively difficult to access from other areas of the site. We have not been able to identify any area as a market place. The roads that run into and through the city-state remain to be checked against known Aztec-, Colonial-, and Republican-period road systems.

Although one obsidian core-blade workshop, one heavy obsidian tool-consuming area (William J. Parry, personal communication 1990), and two lapidary workshops are located north of the *barranca* system, and one lapidary workshop is on the penninsula (Figure 3), the majority of such workshops stretch from west to east along the south side of the *barranca* system. Two well-defined core-blade workshops fall within the nucleated core, and three others are in the periphery to the southeast. Some of these latter workshops may be dumps. Incense-burner bowl molds are found in the southwestern part of the nucleated core. Other clay manufacturing (figurine, spindle whorls, toys, and musical instruments) took place in a large *barrio* of clay workers to the east, which slightly overlaps two other *barrio*-like concentrations of lapidary workshops and maguey-spinning workshops. One concentration of basalt flakes lies to the west of the nucleated core, and two others are in the southeast.

The small nucleated core of Otumba contains several well-preserved mounds, including Mounds 22–23, probably the main Aztec temple-pyramid with an associated residential compound. The presence of high-status residences is indicated by fragments of red-and-white painted plaster in the surface collections. Even within the nucleated core, settlement was not tightly packed. This impression is supported by the results of excavations in Operations 2–3, 9, and 10, where structural remains are widely scattered (Otis Charlton et al. 1993).

Outside the nucleated core is a zone of dispersed residences that contains most of the workshops. Erosion and plowing have leveled most mounds, but the presence of structures is indicated by scatters of *tezontle* and basalt rubble and localized artifact concentrations. To the north of the nucleated core, on the edge of the deep soil plain, where the Colonial/modern town of Otumba is centered, pre-Hispanic artifact densities are light except for a cluster of mounds in the northwest corner of the site. We have examined, whenever the opportunity presented itself, profiles exposed in sewer trenches in this area. In addition, we have excavated to a depth of 2 m in Operation 12. The few deposits containing Aztec-period pre-Hispanic artifacts were located just below the surface.

## FIVE CRAFT INDUSTRIES

In our discussions of craft production, we previously (Charlton et al. 1991; Nichols 1994; Otis Charlton 1993; Otis Charlton et al. 1993) presented both quantitative and qualitative data and analyses to support our identification of household-based craft production at Otumba. The papers dealing with craft industries in this volume continue this trend.

### Obsidian Tools

Parry (2001) used the metric and typological data derived from studies of the obsidian from the Otumba surveys and excavations, surveys in the Tepeapulco city-state area to the east, the initial instrumental neutron-activation analysis (INAA) of the obsidian from both areas, and his own ethnoarchaeological experiments. He described not only the manufacturing processes involved in core-blade and biface production but also the exchange relationships necessary for raw-material acquisition and finished-product distribution. There is a balance between local and Pachuca obsidian in each city-state. In both instances, core-blade production is urban and apparently takes place in a household-based workshop.

### Obsidian Lapidary Production

Otis Charlton (1993) presented the defining work on this industry based on the Operation 11 excavations. In the article by Neff et al. (2000), the initial results of INAA of obsidian used in the industry suggest that the number of sources available expanded from Early to Late Aztec—certainly a reasonable expectation given the spread of Aztec conquests. Nevertheless, Pachuca and Otumba obsidian remained the most important in numbers. One unknown source was identified, and recent fieldwork and INAA of obsidian samples were carried out in the Otumba and Malpaís areas. However, although the unknown source may be in the Otumba, source area fieldwork and analyses to date have not confirmed that hypothesis.

### Manos and Metates

Biskowski (1994, 1997, 2000) expands beyond simple *mano* and *metate* production within the Otumba urban area. He investigated

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the differential distribution of grinding implements in Otumba and noted the virtual absence of household-based maize grinding in the nucleated core. He had linked this distributional pattern to questions of elite occupancy and the composition of the core-area residents.

### Spinning

Nichols et al. (2000) focus on the relevance of spindle whorls from the surface collections at Otumba and its dependencies, from our recent research, and from Charlton's Colonial Project (Charlton 1971, 1973). Wiltfang (1975) identified and measured those spindle whorls and developed a form- and design-based typology used by Charlton and McLaughlin in 1990–1991 to analyze the spindle whorls. The article by Nichols et al. (2000) expands the database of spindle whorls used by Steve Lensink (1978) in the initial factor-and-cluster analyses applied to Wiltfang's measurements. Nichols et al. also examine spindle whorl designs as reflective of ideology, an important area for further investigation.

### Clay Industries

Neff et al. (2000) discuss the initial INAA results from limited ceramic samples from within the Otumba city-state and the trade routes including the Tepeapulco and Tulancingo city-states. The evidence supports the existence of a Otumba production zone for ceramic vessels and figurines during the Early and Late Aztec periods. There is also some evidence for figurines and incense burners being exported from Otumba to Tepeapulco. Tulancingo, however, appears to have its own production zone. Recent additional INAA of ceramics have clarified some of these production and distribution patterns, but interpretive frameworks need to be reviewed and strengthened.

## INTRAURBAN DIVERSITY AT OTUMBA AND TEOTIHUACAN

Part of the basic definition of city-state organization involves differential access to social, economic, and political power on the part of different sectors of the population. We have assumed a two-part split in the population at Otumba, a small elite with socioeconomic and political power and a much larger group of plebeians who had less power but who provided the bulk of the labor force. Such a division is reflected in the size and quality of house construction as shown by the nucleated core and the periphery of the site, but there is a distinct possibility that mutually exclusive residential zones may not have existed.

Garraty (2000) has carried out an interesting series of analyses based on Aztec ceramics in an attempt to identify status differences in occupants in Aztec Teotihuacan. His evaluation of not one but a series of indices provides for some very strong conclusions, even though his sample is relatively small. His results suggest a spatially decentralized distribution of powerful families.

Sarah Stanley (1996) ranked each of 290 Black-on-Orange sherds in 14 of the collections made at Otumba by William G. Mather in 1963. She followed Feinman et al. (1981) in the Production Step Index but also incorporated what Garraty calls the Decorated Index and the Motif Diversity Index. She evaluated vessel finish, firing quality, and the quality of execution of the painted designs and their complexity to arrive at a score for each sherd. Average values were calculated for all collections. She concluded that those collections in or adjacent to the nucleated core had higher average values than did those from more distant locations. This observation suggests that residents with different statuses were located in separate sections of the city.

Stanley's results are consistent with McClung de Tapia and Aguilar Hernández's findings (2001) of differences in the macrobotanical remains between Operation 9 in the core and Operation 11 in the periphery and with Hodge's (1997) position but inconsistent with the findings and inferences of Biskowski, especially with reference to the possibility of patches of lower-status households in the core and, as Pohlman (1995) has pointed out, the high status of lapidary workers in the periphery based on their ceramics but not on their architecture (Otis Charlton 1993). Pohlman used the percentage frequencies of various wares and types from Operations 2–3, 4, 9, and 11 as defined under the typology proposed by Jeffrey R. Parsons (1966), modified by Charlton, and used by the project. She also considered form-function categories, serving wares, utilitarian wares, and others to compare the complexes.

Pohlman (1995) found from cluster analyses that the ceramics fell into two recognizable groups based on differences in frequencies of serving as opposed to utilitarian wares and on the presence of trade wares. Operation 4, the figurine *barrio* workshop, was in one cluster, with low frequencies of both trade wares and serving wares. The nucleated core sites, Operations 2–3 and 9, were in the other cluster with Operation 11, the periphery lapidary workshop excavation.

We should mention that ethnicity, the elusive Otomis of the *Mapa de Otompan*, has not been systematically explored, although Otis Charlton has noted a high frequency of Ehecatl figurines and temples and Biskowski has suggested the possible correlation of an Otomi dietary preference with the *mano* and *metate* distribution pattern. Although Brumfiel et al. (1994) argued that the style of lip plug found at Xaltocan may indicate Otomi ethnicity, very few finished examples of this style occur at Otumba and those only from the excavated workshop (Otis Charlton 1993). There is no evidence of ethnic identification in the spindle-whorl designs (McLaughlin 1994; Nichols et al. 2000) or in the ceramics.

## CRAFT PRODUCTION AND CITY-STATE FORMATION

Otumba is an excellent example of concentrated intensified urban craft production during the Late Aztec period in the Basin of Mexico. Virtually all of such production is based on the household unit, either as dispersed units or within zones or *barrios* with other similar households. The only possible exception is to this pattern is the pattern of maguey spinning (and weaving) in Operation 7, where a supra-household- but subcommunity-based production organization may have been the norm. The economy of the city-state was intimately linked to the diversified set of activities needed to obtain raw materials for the linked industries and the conduits whereby the products entered the tribute or market systems for distribution (for detailed description, see Otis Charlton et al. 1993; Charlton et al. 1996). Although the growth of Otumba and its craft industries are tightly bound, the causal interaction seems to be less a linear sequence of temporal priority for either politics or crafts and more of a situation of mutual feedback in which each prospered as a result of the other.

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## RESUMEN

Otumba es una de pocas ciudades-estado aztecas del período Azteca tardío donde la ocupación post-hispánica no esconde las huellas de la ciudad central Azteca. Se iniciaron al sitio arqueológico de Otumba investigaciones arqueológicas de larga duración durante los años sesenta con investigaciones durante los años setenta y ochenta. Los más recientes trabajos de campo se llevaron a cabo entre 1987 y 1989 y los análisis del laboratorio y los análisis técnicos de los materiales encontrados están todavía en proceso. Los análisis tradicionales de tipología se aumentaron por Análisis de Activación Neutrónica que nos proveen huellas fuertes de redes de interacción entre la ciudad-estado de Otumba y los yacimientos de materias primas, además de los sistemas de distribución de productos terminados, tanto tributarios como comerciales (del mercado), dentro y fuera de la ciudad-estado de Otumba.

Los resultados intermedios de las investigaciones a Otumba se presentan por medio de la colección actual de artículos en que se incluyen datos pertinentes tanto de la ciudad-estado de Tepeapulco al este como de la ciudad-estado de Teotihuacán al oeste de Otumba. Tomando en cuenta la totalidad de los artículos ellos nos proporcionan contextos ambientales, etnohistóricos, sociales, económicos, y políticos para un entendimiento de la producción artesanal bien desarrollada a Otumba (producción lapidaria, núcleos y navajas prismáticas y artefactos bifaciales de obsidiana; útiles de basalto para moler, pulir y extraer fibras; el hilado de fibras de *ixtle* y de algodón para tejer; producción de figurillas, sahumadores, *malacates*, alfarería y otros objetos de barro) y la intensificación agrícola de la ciudad-estado de Otumba. Los datos contibuyen a un entendimiento general de las estructuras sociales, políticas, y económicas de la cuenca de México durante el período Azteca tardío. *Ex oriente lux*.



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