

THIN ORANGE POTTERY AT TEOTIHUACAN

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Previous Studies of Thin Orange Ware<sup>1</sup>

Many interpretations concerning human culture and its dynamic aspects made by students of prehistory are ultimately based on artifactual remains, since these represent direct material evidence of man's activities. This paper concerns a diagnostic ceramic ware of the Classic Period found in quantity in numerous sites of the Mesoamerican highlands. This pottery, first described by Seler (1915), was called by him dünnwandiger hellgelber ("thin-walled bright yellow" ware), but has acquired other names, including "yellowish-red" pottery (Linné 1934, 1942a, 1942b, 1947), "egg-shell orange ware" (Longyear 1940), "Thin Orange" ware (Vaillant 1938, Shepard 1946), and cerámica anaranjada delgada (Armillas 1944b). Thin Orange is unquestionably one of the most important and at the same time most interesting Mesoamerican wares.

The ceramic was spatially distributed from Teotihuacán and Calpulalpan in the north of the Meseta Central of México southward as far as Kaminaljuyu and Copan. Abundant occurrences have been reported in the Mexican states of Colima (Kelly 1947:67); Hidalgo, at Tula (Linné 1934:103); Puebla, at Huachinango, Cholula, Tehuacán, Chalchicomula, Ixcaquixtla, Jalapazco, Aljojuca and Acatlan (Seler 1915:500-504, figs. 145-147; Linné 1947:134; Leonard 1954; Tolstoy 1958:20); western Guerrero (Linne 1947:134; Grove 1969: personal communication); and Oaxaca, at Monte Albán (Bernal 1949:135). In the Mayan area the pottery has been reported at the Isla de Jaina (Linné 1947:134) and in both the Guatemalan highlands and lowlands (Kidder, Jennings and Shook 1946:193ff.; Woodbury and Trick 1953:139; Sanders 1969: personal communication). A distributional summary by Kidder in 1946 presented additional information known at that time (Kidder, Jennings and Shook 1946:193ff.).

References to this ware appeared first in the literature as early as 1890 (Peñafiel 1890:1:74-75), and since then more detailed studies have been carried out by Linné (1934, 1942a), Anna O. Shepard (Kidder, Jennings and Shook 1946), Tolstoy (1958), and Sotomayor y Castillo Tejero (1963). A partial, non-exhaustive list of other investigators includes: Armillas (1944a, b); Bernal (1949); Gamio (1922:1); Instituto Nacional de Antropología e Historia (1966ms); Kelly (1947); Kolb (1965 ms); Leonard (1956-1957); Linné (1934, 1942a, b; 1947); Longyear (1940); Millon (1954); Müller (1956-1957); Müller et. al. (1963); Noguera (1940a, 1965); Sejourne (1956-1957, 1966); Seler (1915); Tozzer (1921); Vaillant (1938, 1944); and Woodbury and Trick (1953).

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<sup>1</sup> A preliminary version of this paper was read at the Society for American Archaeology 34th Annual Meeting, Milwaukee, Wisconsin, May, 1969. All laboratory studies and first draft writing were carried out in the Department of Anthropology, The Pennsylvania State University. Miss Anna O. Shepard has read this report and offered valuable comments. I am, of course, responsible for the content and conclusions.

The analysis of Thin Orange ware has proven to be an intriguing ceramic problem (regarding its origin of manufacture and subsequent distribution), similar to the studies previously done on Mayan Fine Orange (Sayre 1959) and Post-Classic Plumbate wares (Shepard 1948). Technological reports in the literature include those by Dr. Gunnar Beskow (Linné 1934:213-214), Dr. Nils Zenzén (Linné 1947:135), and Anna O. Shepard (Kidder, Jennings, and Shook 1946:193-199). Results of these analyses concluded that while Thin Orange was undisputably Teotihuacán pottery, it was also an import and constituted evidence of trade relations (Linné 1934:213-214; Kidder, Jennings and Shook 1946:197; Linné 1947:135-136; Tolstoy 1958:20).

Carmen Cook de Leonard has postulated the center of the origin of the ware as Ixcaquistla, Puebla, and noted that Thin Orange comprised one hundred per cent of the ceramic assemblage at that site (1956). Armillas believed the source to have been Acatlan, Puebla (Millon 1954:179). Shepard also was an adherent toward placing the source of Thin Orange in southeastern or east-central Puebla (Kidder, Jennings and Shook 1946:197), confirming Linné and Beskow's belief that the yellowish-red pottery was manufactured in a foreign area and traded into the Basin of Mexico (Linné 1934:67, 102-103, 213-214; 1942a:176-178, 181, 195; 1947:134-135). Linné stated "The yellowish-red ware seems in all possible probability to have been imported" (1942a:181).

Linné recovered sixteen vessels and an unknown quantity of sherds from his excavations at Xolalpan (1934:67, 69-70, 73), of these Beskow examined four thin sections of pottery (Linné 1934:213-214). In the Tlamimilolpa monograph, Linné reported recovering five vessels and an unknown quantity of Thin Orange potsherds (1942:133, 140, 143), and additional petrographic analyses were reported as underway at that time (1942:176). Shepard's analyses of Thin Orange ware from the Kaminaljuyu excavation was reported in the Kidder, Jennings, and Shook monograph (1946:198-201). A total of sixteen vessels were recovered from these excavations. She studied small chips from six of these and "several hundred" sherds from sites in Guatemala and Mexico, of which forty-seven were thin sectioned for aplastic analysis (1946:199). Later, 139 sherds from the Calpulalpan area were examined and an additional fifteen thin sections prepared (1946:200). Discrepancies in nomenclature were clarified between Beskow and Zenzén's studies and Shepard's results, and the "misunderstanding was resolved" (Linné 1947:136).

Only one other study of Thin Orange, petrographic in nature, has been found in a search of the literature. A twenty-one page paper entitled "Estudio Petrográfico de la Cerámica 'Anaranjado Delgado'" by Sotomayor y Castillo Tejero, published by the Instituto Nacional de Antropología e Historia in 1963, offered some additional data on forty-six samples of the ware. These specimens were primarily from the Basin of México region, but included material from as far north as El Cópore, Guanajuato, as far south as Monte Albán, Oaxaca, and also from Kaminaljuyu, Guatemala.

One of the more complete studies on the ware in México which has appeared in the literature is by Tolstoy as a part of his monograph (and dissertation), Surface Survey of the Northern Valley of México: The Classic and Post-Classic Periods (1958:19-20, 56-59, 66-67). He typologically analyzed a sample of

854 Thin Orange sherds obtained by surface collecting at fifteen locations in the northern Valley of México. These locations and phasing were (1958:71-74):

- 1 Ciudadela at Teotihuacán, (Early Teotihuacán III)
- 2 Ciudadela area at Teotihuacán, (Teotihuacán III)
- 6 Atetelco at Teotihuacán, (Teotihuacán III)
- 25 El Corral I at Tula, (Teotihuacán III)
- 37 Cerro Portesuelo, (Teotihuacán I)
- 52 San Andres near Chiconcoac, (some Classic)
- 65 El Risco, (Teotihuacán III)
- 83 Tulpetlac, (Late Early Aztec)
- 86 San Cristobal Ecatepec, (some Classic)
- 87 San Cristobal Ecatepec, (some Classic)
- 90 Coacalco, (some Classic)
- 104 Teoloyucan, (some Classic)
- 106 Zumpango, (Teotihuacán IV)
- 110 San Francisco Mazapán at Teotihuacán, (some Classic)
- 111 San Francisco Mazapán at Teotihuacán, (some Classic)

Only five of these sites were from the Teotihuacán Valley, center of the dominant Mesoamerican culture during the Classic Period.

#### The Teotihuacán Valley Project Collections

The Teotihuacán Valley Project of The Pennsylvania State University, directed by William T. Sanders, has produced voluminous data on rural Classic Teotihuacán. A preliminary monograph has been issued on these data (Sanders 1965), and a six-volume final report is presently being prepared. A total of 126 Classic sites, ranging from one having seventy-three tlateles (mounds) to "traces" (represented by Classic Period potsherds), were identified, and 516 artifact samples, primarily composed of ceramic materials, were collected. Nearly 12,000 artifacts were collected, of which 8,624 were rim and decorated sherds of the Classic Period suitable for chronological phasing.

In addition, extensive excavations were conducted in the Santa María Maquixco Bajo site (TC-8:1, 2, 3) located in the Lower Teotihuacán Valley Region [excavated 1961, 1962 by William T. Sanders, Maurice A. Mook, Thomas Krajci, Barbara J. Price, and Charles C. Kolb]. Excavations of more limited scope were made at the Classic sites Cerro Mixcuyo (TC-5), located in the Lower Teotihuacán Valley [excavated by Jeffrey R. Parsons]; Venta de Carpio (TC-10:B), located in the Delta Region, and at Tenango (TC-49), situated on the Cerro Gordo North Slope [both excavated by John A. Senulis]; and at Tlatenco de Santa María Maquixco Alto (TC-46:1, 2) also located on the Cerro Gordo North Slope [excavated by Thomas H. Charlton]. These excavations produced in excess of 120,000 Classic sherds, of which 23,109 were rim and decorated body fragments or whole vessels suitable for chronological phasing. These pottery sherds have undergone intensive chronological/typological analyses from 1962-1968.

Of the 8,624 Classic surface sample sherds, 1,480 were Thin Orange ware, and of the 23,109 sherds in the excavated sample, 2,890 were Thin Orange ware, for a total of 4,370 sherds for analysis versus the 854 surface collected sherds studied by Tolstoy (1958:19). The ware itself presented no sorting problems and was easily differentiated from Aztec Plain Orange, defined by Parsons (1966:133-210), in terms of decoration and aplastic constituents. The paste and its inclusions were readily identified, and some variations in firing noted. These characteristics will be discussed in a subsequent section of this paper.

Because of the quantity of sites involved and the size of the ceramic sample, it was felt that technological, typological, and chronological characteristics could be discerned for the ware. The unstratified excavated sites were multicomponent in nature but served to lend chronological controls. One stratified site at Oxtotipac (TT-82), an initial Post-Classic Period settlement in a "cave-quarry", was excavated by Gerald Obermeyer in 1961, and produced some pure Late Teotihuacán (Metepéc) materials under a series of Metepéc-Oxtotipac, and pure Oxtotipac levels (Obermeyer 1962). This site was used as a control for the period of transition between Classic and Post Classic. The ceramic sequence was being restudied in 1969 by Miss Kate Trout, who permitted me to examine the Thin Orange ware in this excavated sample. A total of 188 sherds of the ware were discerned.

Table I, which follows, notes the phases represented at the various excavated sites.

TABLE I  
TEOTIHUACAN VALLEY CLASSIC SITE EXCAVATIONS

Phases:

	TC-8	TC-10	TC-46	TC-49	TT-82
Late Tzacualli	X		X	X	
Miccaotli	X	X	X	X	
Early Tlamimilolpa	X	X	X	X	
Late Tlamimilolpa	X	X			
Early Xolalpan	X	X			
Late Xolalpan	X				
Metepéc	X				X
Oxtotipac (Post-Classic)					X

During 1964, I was employed by the Teotihuacán Mapping Project of the University of Rochester, directed by René Millon, and was able to study their extensive surface sample collections of Classic pottery from the urban center of Teotihuacán, through the courtesy of James A. Bennyhoff. Archaeologists from the Instituto Nacional de Antropología e Historia, particularly Dra. Florencia Müller, Juan Vidarte de Linarés and Robert Chadwick, permitted me to examine collections from the Miccaotli ("Avenue of the Dead") and La Ventanilla B excavations obtained during reconstruction and salvage archaeological operations (1962-1964).

Personnel from the I.N.A.H., Rochester, and Pennsylvania State University participated in an informal, extensive ceramic seminar from August through November 1963. From these sessions, a generalized ceramic typology and chronology were developed for the Teotihuacán Valley, and a twenty-seven page typewritten manuscript of results was issued (Müller et. al. 1963).



During 1964, a second informal and intensive teaching ceramic seminar, directed primarily by James A. Bennyhoff, was held from June through July, and intermittently from August through October, with the same three institutions participating. Thin Orange ware was one of the pottery types discussed at these meetings.

Based on Linné's published monographs (1934, 1942), Tolstoy's report (1958), Müller's manuscript (1963), notes from the 1963 and 1964 ceramic seminars (Kolb 1963ms, 1964ms), analyses of the pottery from the seven previously cited excavations, and studies of the surface samples from the 126 Classic sites, I was able to write a preliminary manuscript, A Tentative Ceramics Classification for the Teotihuacán Valley (Patlachique through Aztec V Phases) (Kolb 1965), which concentrated on the Classic Period. Additional recent studies, including ceramic attribute analyses, have been conducted on the Penn State collection, and a new report on Teotihuacán pottery excavated by I.N.A.H. in residential zones of the urban center has been published by Séjourné (1966).

### Type Descriptions

The following characteristics and attributes will be considered in subsequent sections: Physical properties (color; hardness; texture; temper and other aplastic inclusions; and "firing" variations) and cultural properties (methods of manufacture; surface treatment, surface finish and decorative techniques; forms of rims and vessel shapes, vessel sizes and thicknesses-averages and ranges; and functions of the pottery containers).

#### Physical Properties:

1. Color: Table IV graphically depicts the range of colors found in the Pennsylvania State University collections of excavated Thin Orange sherds. The surface and paste colors were nearly always identical.

A total of twenty-two distinct colors were recognizable, plus a category labeled "unknown color". Nearly all of the sherds (99.46%) were classifiable either as reddish yellow (83.48%) or yellowish red (15.98%), and the Munsell Soil Color Charts (1954) hue 5YR accounted for 99.61% of the 2,890 sherds analyzed. "Rare colors" (00.63%) and "very rare colors" (00.04%) were numerous (sixteen of twenty-two), but were attributed primarily to firing errors (reduction, firing clouds, and unoxidized cores) or had been subjected to some post-firing cultural action (such as burning or fire-smudging) which rendered color analysis impossible in 00.02% of the sample. The most frequently encountered, and probably the desired color was reddish yellow, 5YR 6/8 (31.45%), and reddish yellow, 5YR 7/8 (26.67%).

Kidder, Jennings, and Shook (1946:193-197) employed the Ridgway volume Color Standards and Color Nomenclature (1912), and reported nine vessels of Vinaceous Cinnamon, six vessels of Pinkish to Vinaceous Cinnamon, and one of Orange Cinnamon. These colors generally conformed to reddish yellow (fifteen of sixteen vessels) or light reddish yellow (one) on the Munsell color standard (1954). Anna O. Shepard in "Technological Features of Thin Orange Ware" (1946:198) observed that: "...the majority of sherds approximate

Ridgway's 13"b (Vinaceous Cinnamon). The principal variations are toward clearer and redder hues, 9' (Rufous), 9'i (Ferruginous) and 11" (Vinaceous Tawny), produced by a surface coat differing in composition from the paste rather than by fluctuations in firing condition". Shepard (1969:personal communication) used the Ridgway system which was the standard extensively employed before the development of the Munsell system, but recommends the latter. Tolstoy (1958:19) reported the Thin Orange colors as: "Orange (5YR 7,6,5/8). Reduced sherds have greenish grey (10G 8,7/2) paste" in his sample of 854 sherds. Similar color results were noted by Sotomayor y Castillo Tejero (1963: Cuadro 1); thirty-nine of forty-two sherds were of Munsell hue 5YR, and twenty-eight of these were reddish yellow (amarillo rojizo). Linné (1934, 1942a, 1942b, 1947), has, to my knowledge, never reported using a color standard for subjectively determining the color of his Thin Orange Ware.

2. Hardness: The degree of hardness is expressed in terms of Mohs' Scale, the simplest and most economical method which may be employed. Shepard has commented that "as a criterion of classification, hardness is of limited value, because of the ranges of many types" (1963:114). The mineral scratch test for hardness was used, but has a further disadvantage of unevenness of scale. Thin Orange sherds were always highly fired and indicated well-controlled oxidation during firing. The vast majority of the excavated sherds (98.50%) were 5 to 6 in hardness, while the remainder (1.50%) were 4 in hardness; as seen in the following table:

TABLE II THIN ORANGE HARDNESS RANGES		
<u>Mineral</u>	<u>Mohs' Scale</u>	<u>Percentages</u>
Fluorite	4	1.50
Apatite	5	48.35
Orthoclase	6	<u>50.15</u>
		100.00

3. Texture: Paste texture was considered in terms of Wentworth's Size Classification (1933), recommended by sedimentary petrologists. The paste itself was universally uniform in both the excavated samples and in the collections from surface reconnaissance. Over ninety per cent of the sherds examined were within the "silt" category (1/16-1/256mm. range) in terms of the clay, with the remainder mixed "silt" and "very fine" (1/8-1/16 mm. range). This would appear to indicate that a finely washed raw clay was especially sought for the manufacture of this ware.

Since relatively few temper fragments were exposed on the surface, it would seem more probable that a thin "self-slip" of untempered raw clay was applied to the vessels. This thin coat was noted in over three-fourths of the sherds from Kaminaljuyu examined by Shepard, which she determined by examination with a binocular microscope (50x magnification) (Kidder, Jennings and Shook 1948:198). Tolstoy's monograph noted Thin Orange texture as: "Granular, compact, vertical fracture, lamination infrequent" (1958:19), terms better applied to the aplastic content of the sherds rather than paste texture.

Of the 2,890 sherds in the excavated sample from the Teotihuacán Valley Project, 70.5% demonstrated a thin "self-slip" of untempered clay when examined using a binocular microscope (60x magnification). (See page 327 and editor's note on same page.) The examination revealed that most bowls (both plain and decorated), all boxes, all cylindrical vases (both plain and decorated), all goblets, all effigy forms, some jars (decorated only), all miniature vessels, all saucers/dishes, and all tecomates had this slipped surface. Basins/craters, undecorated jars, Coarse Thin Orange vases and jars, and Thick Thin Orange jars appeared never to have been slipped. In other words, utilitarian or culinary and storage vessels of large size were unslipped, whereas "special" and "table" wares and unusual forms were almost without exception slipped with the same clay. No definite distinction could be observed chronologically, but it would seem that self-slipping had begun at least by Miccaotli times and peaked during Late Xolalpan (Maquixco), declining rapidly thereafter.

4. Temper and Other Aplastic Inclusions: Aplastics, culturally added as pottery "temper" or present as impurities in the raw clay, were analyzed in terms of Wentworth's Size Classification (1933). The nonplastic materials were always coarser in texture, and ranged from "fine" (1/4-1/8 mm. range) to "granule" (4-2 mm. range), although size was directly dependent upon the kinds of nonplastics. These will subsequently be considered in some detail.

Linné, in Appendix 12 of Archaeological Researches at Teotihuacán, reported Dr. Beskow's examination of four thin sections of Thin Orange Ware (numbered I, I<sub>A</sub>, II, III) as follows (Linné 1934:213):

With the detailed mineralogical description left out, the preliminary results of Dr. Beskow's examination are as follows:

Nos. I and I<sub>A</sub> are of such close agreement as to be almost identical, and are therefore here dealt with as one entity. The other two, however, differ considerably from each other and from the former.

Nos. I and I<sub>A</sub> are composed of isotropic (not birefringent) clay mass and relatively coarse sand. A characteristic weathering. Among the smaller particles grains of carbonate (probably calcite) are comparatively numerous.

No. II differs from I and I<sub>A</sub> in that the clay mass is distinctly birefringent. The sand is on the whole of a considerably finer grain. The proportion of carbonates is very high, especially in the smaller-sized grains.

No. III is above all characterized by its comparatively fine-grained sand being remarkably well-preserved (not weathered). This applies in a particularly noteworthy degree to the coloured minerals. For another thing, there are no calcareous particles present. The clay mass itself is isotropic (not birefringent).

The composition and especially the unweathered condition of the mineral particles in No. III indicates that -- when, as in the present case, it is a question of pottery derived from tropical regions not touched by the late quaternary glaciation -- the material with certainty is referable to some very late volcanic formation. The locality where the find was made being, according to information, noted for recent volcanism, what has been adduced above lends support to the supposition that the pottery here dealt with is of local origin.

No other mineralogical report has apparently been published by Linné, Beskow or Zenzén.

Shepard, in Kidder, Jennings, and Shook (1946:198-201), has presented one of the most detailed descriptions of Thin Orange temper that has appeared in the literature. She observed that "the temper of thin orange ware is no less distinctive than its style, and therefore, affords a valuable criterion for the identification of small fragments....." (1946:199). Her further observations included (1946:199):

The temper consists of sharp and relatively coarse rock fragments showing the laminated structure and certain textural characteristics of metamorphic rock. The shape of the fragments and their friability indicate that the source of the temper was a disintegrating rock rather than sand containing some metamorphic constituents. Metamorphic rock has rarely been found in the Mesoamerican pottery examined to date....

Her description of Thin Orange aplastics was based upon forty-seven thin sections from nine Mesoamerican sites (sixteen from Teotihuacán itself), plus an "unrecorded number of sherds" examined with a hand lens at Teotihuacán, and 139 sherds from Calpulalpan examined with the binocular microscope.

Part of the analysis was as follows (1946:199-200):

The paste is essentially the same in all sections. The temper consists of medium- to coarse-textured, angular to sub-angular rock fragments, many of which are long thin slivers. The majority of grains are between 0.5 and 0.6 mm. in length, the largest fragments are over 1.00 mm. in length, and there are also numerous fine grains between 0.08 and 0.15 mm. The rock fragments include fine-grained quartzite having a sutured texture, cloudy gray cryptocrystalline quartzose material resembling a metamorphosed shale, finely crystalline or cryptocrystalline quartz, and micaceous fragments consisting of a very fine scaly white or occasionally brown mineral which may have been altered in firing. Some of the micaceous fragments are distorted. The rock is heavily stained with hematite, which often occurs in streaks and also as free particles in the paste. Cryptocrystalline calcite is present in many pastes and is frequently light brown or olive-colored in transmitted light as though impure or marly. The nature of the inclusions and contacts between the different kinds in larger rock fragments indicate that they came from the same parent rock, which is tentatively classed as a mica schist. The term is used tentatively because it is not always possible to distinguish a schist from a gneiss after it has been comminuted. The principal difference noted in the sections studied is in the ratio of micaceous and calcareous to quartzite fragments. ...The micaceous fragments are much less common than the cryptocrystalline quartzose material but are present in all pastes. A banded structure of the parent rock would account for these variations in the proportion of the different constituents. Calcite was not noted in some sections, although in others, it is abundant as the quartzite. Among the thin sections, it was more prominent in sherds from Teotihuacán than in those from other sites--a deviation possibly owing to the small sample. The calcite may represent a deposition in seams and fissures of the rock, in which case it would be unequally distributed. The quantitative differences between the pastes would naturally occur with this class of temper, and the identity and distinctiveness of the principal components in all sections indicate rock from a single source.

Shepard also noted that the calcite and quartzite aplastics had been "...modified by human agency, perhaps ground and mixed with other materials, then possibly altered in some degree in firing the pottery" (1946:201).

Tolstoy's superficial analysis of his own sample concluded (1958:19): "Temper: Fairly abundant, medium and occasionally coarse particles, including whitish ones which Shepard [1946:199] identifies as calcite and quartzite".

Sotomayor y Castillo Tejero (1963) were able to define three basic groups of Thin Orange ceramics based on aplastic content in forty-six thin sections, and designated these as Groups A (with subgroups 1, 2, 3), B and C. I have translated and summarized these below:

Grupo "A" (Group "A"): isotropic with an index of refraction the same as Canada balsam: esquitos cuarcíferos, esquitos cloríticos sericíticos, esquitos cuarcíferos con óxidos de fierro (hematita), cuarcita, cuarzo y hematita (1963:10) [quartziferous schists, "silky-like" chlorite schists, quartziferous schist with iron oxides (hematite), quartzite, quartz and hematite]. These particles were peculiar to metamorphic rocks. Subgroup 1 contained abundant calcite (six of forty-six thin sections), Subgroup 2 had scanty calcite (twenty-eight thin sections), while Subgroup 3 had no calcite (nine thin sections).

Grupo "B" (Group "B"): with an index of refraction less than Canada balsam: andesina, ortoclasa, hiperstena, hornblenda, biotita, magnetita, titanita, cuarzo y andesina (1963:12-13) [andesine, orthoclase, hypersthene, hornblende, biotite mica, magnetite, titanite, quartz and andesine]. Only two thin sections, both from San Lorenzo Xochimanca, D.F., were classified as having these minerals.

Grupo "C" (Group "C"): with an index of refraction greater than Canada balsam: cuarzo ondulante, cuarzo, biotita, andesina, abundantes fragmentos de cuarzo diorita y ortoclasa (1963:13) [banded quartz, quartz, biotite mica, andesine, abundant fragments of diorite quartz and orthoclase]. Only one thin section, from El Cópore, Gto., was reported.

The source of origin for the three groups was entirely different. Group A tempers were considered as the "ideal type" and were composed of materials that had come from "una zona de terrenos metamórficos compuestos principalmente por rocas foliadas y rocas de textura granoplástica" (1963:13) [a metamorphic zone composed principally of foliated rocks and rocks of grainy texture]. The ideal area would be a hot and humid one in the vicinity of sedimentary rocks, perhaps adjacent to a volcanic region. Group B aplastics indicated an area of predominately volcanic origin, while Group C was also suggestive of a volcanic region (but not necessarily the same one as Group B). Employing the Carta Geológica de la Republica Mexicana (1960) Sotomayor y Castillo Tejero were able to discern ten areas in central México where metamorphic, sedimentary and igneous rocks were in conjunction so as to suggest possible centers of Thin Orange manufacture (1963:18-19, Mapa 2). All of these locations were in either southern Puebla or northern Guerrero and Oaxaca.

Only seven of their forty-six thin sections were derived from potsherds from the center of Teotihuacán itself, and were analyzed as follows: four A-1, two A-2, and one A-3. No information was given as to the actual provenience of these sherds in the center or as to their method of collection or cultural affiliation with other materials.

Approximately one half of the excavated sample of Thin Orange sherds (1,300 of 2,890) obtained by the Teotihuacán Valley Project (Pennsylvania State University) were examined in order to discern the kinds, quantities, and sizes of aplastics. The analysis was conducted with the aid of a binocular microscope (60x magnification) and tangential lighting. "Fresh" edges were made by breaking a small fragment from the sherds with a pair of pliers, and, in addition, the edges of a representative sample of two hundred sherds were cut (trimmed) with a motorized diamond saw.

The sherds exhibited a calcareous matrix when tested with a solution of dilute (10%) hydrochloric acid. Most aplastics were soft, having a hardness of 3 on Mohs' Scale (microhardness 126-135.0, average 129, *i.e.* calcite), while some had hardnesses of 7 (microhardness 2066.0-3906.0, average 2700, *i.e.* quartz). Many aplastics could be recognized with nothing more than a good 8x hand lens. The light colored clay was thickly strewn with opaque, translucent, lustrous, and crystalline aplastics; few clear grains were found. Twenty-one representative sherds were also selected for thin sectioning and analysis by petrographic microscope and polarized monochromatic light (see Appendix III). Initial sections were cut with a motorized diamond saw in the Anthropology Laboratory, Pennsylvania State University, and the final mounted and ground sections were prepared by Rudolf von Huene, Pasadena, California. The technical assistance of Dr. William Crawford (Department of Geology, Bryn Mawr College), and the financial assistance of the Madge Miller Research Fund (Bryn Mawr College) is gratefully acknowledged. Binocular and petrographic microscopic observations indicated that the major constituents included: quartzite, calcined calcite, talc, quartz, muscovite mica, and hematite. Minor inclusions were: feldspars, hornblende, chlorites, and scoria. No vegetable fiber or seeds of any kind were observed.

The sherds examined could be divided into two distinctive groups, Type Alpha and Type Beta, described below.

Type Alpha sherds always contained the following minerals, in descending order of occurrence (percentages given are approximate): angular and subangular quartzite (35-25%), angular calcite (25-20%), talc (15-10%), angular and rounded quartz (10%), muscovite mica (10-5%), and lumps and crystals of hematite (5%). Lesser quantities of angular feldspar, hornblende, and various chlorites (schists) were often present, as were occasional minute fragments of scoria or basalt. Other unidentified minerals were present as traces. Scoria is essentially "pyroclastic ejecta, usually of basic composition, characterized by marked vesicularity, dark color, heaviness, and partly crystallized" (American Geological Institute 1960:439). "Basalt" is here defined as a fine-grained dark-colored igneous rock composed mostly of microscopic calcium-sodium (plagioclase) feldspar, pyroxene and olivine (Pough 1955:15-16, American Geological Institute 1960:41). Scoria and basalt particles may have been natural to the raw clays, or accidentally added during the crushing of the clay or grinding of temper when the abraiding surfaces of the implements (manos and metates of basalt, and mortars and pestles of tezontil, a scoria) wore away.

Type Beta sherds generally contained the same minerals as Alpha sherds, in different quantities. These minerals are listed in descending order of occurrence (percentages given are approximate): muscovite mica (75-30%), angular and subangular quartzite (35-20%), angular and subangular calcite (10-0%), talc (10-0%), angular and rounded quartz (10-5%), and lumps and crystals of hematite (5-0%). Lesser quantities of hornblende, angular feldspar, and various chlorites (schists) were occasionally present, as were occasional minute fragments of scoria or basalt and some minor unidentified minerals.

The major mineral constituents identified were as follows:

Alpha and Beta sherds always contained large quantities of opaque particles, cryptocrystalline quartzose fragments, and translucent quartzite which was grayish in color. The quartzite graded into translucent cryptocrystalline quartz particles (chalcedony or possibly chert) sometimes white, gray or yellowish in color. "Quartzites are among the hardest of the most resistant of all rocks" (Pough 1955:24), and the particles attained values of 5, 6, or 7 on Mohs' Scale of hardness. Quartzite is abundant and widespread in igneous and metamorphic rocks, especially if the metamorphic class rocks were derived from sedimentary rocks (Sinkankas 1966:443). Quartz crystals were occasionally observed as translucent, rarely opaque, and hexagonal in pattern. Hardness on Mohs' Scale was judged as 7. Most examples were colorless or white, but some were tinted by impurities or had inclusions (especially mica and hematite), rendering the particles cryptocrystalline. The general chemistry was essentially silicon dioxide,  $\text{SiO}_2$ , and crystals were insoluble in hydrochloric acid (Larsen and Berman 1934:69, Pough 1955:231-233; Sinkankas 1966:436-446). The quartzite and quartz fragments ranged in size from "very fine" (1/8-1/16 mm. range) through "fine" (1/4-1/8 mm. range), "medium" (1/2-1/4 mm. range), "coarse" (1-1/2 mm. range), "very coarse" (2-1 mm. range), and occasional "granules" (4-2 mm. range). The grades "medium" and "coarse" were predominant, based on Wentworth's Size Classification (1933).

Calcite, nearly always in its calcined form, with a general chemistry of calcium carbonate,  $\text{CaCO}_3$ , was moderately abundant. This mineral was calcined due to the firing of the ceramic vessels, indicative of firing temperatures from 650°C, when carbon dioxide is first released, to 898°C, when calcination is complete (Shepard 1963:22). The mineral exhibited typical physical properties of rhombohedral cleavage, was transparent to translucent, and was nearly colorless (sometimes yellowish or grayish, probably due to impurities). Dilute hydrochloric acid dissolved crystals with resultant effervescence. Some examples had traces of hematite interstices. Calcite is "very common and abundant in all classes of rocks except granitic types and pegmatites; less abundant in diabases, basalts, and related flow rocks except in cavities and fissures" (Sinkankas 1966:361). Preserved crystals exhibited a typical hardness of 3 on Mohs' Scale (Larsen and Berman 1934:229, Pough 1955:157-159, Sinkankas 1966:359-364). Calcite fragments ranged in size from "very fine" (1/8-1/16 mm. range) through "fine" (1/4-1/8 mm. range), "medium" (1/2-1/4 mm. range), "coarse" (1-1/2 mm. range), into "very coarse" (2-1 mm. range) on Wentworth's grading system (1933). Most dominant were the grades "medium" and "coarse".

Various amounts of talc, the softest known mineral, were recognizable. This mineral, a phyllosilicate,  $\text{Mg}_3(\text{OH})_2(\text{Si}_4\text{O}_{10})$  in pure form was white

or whitish green in color, and was fine grained. Particles were insoluble in hydrochloric acid (Larsen and Berman 1934:164). It is a secondary mineral formed by the alteration of various magnesium silicates (Pough 1955:251), and is often embedded in micaceous flakes and may be associated with quartzites. Talc particles ranged in size from "very fine" (1/8-1/16 mm. range) to "fine" (1/4-1/8 mm. range) on Wentworth's Size Classification (1933), with the former predominant.

Small quantities of muscovite mica were always present in Alpha sherds, but dominant in Beta sherds. It is a common rock-forming mineral with its general chemistry considered potassium-sodium hydroxyl alumino-silicate,  $(K,Na)Al_2(OH)_2(AlSiO_3)_2$  (Sinkankas 1966:481). The mineral was most often light yellow or colorless, translucent, and easily cleaved into elastic sheets. Hardness on Mohs' Scale was 2-2 1/2, and the mineral was insoluble in hydrochloric acid (Larsen and Berman 1934:163, Pough 1955:258-259). Muscovite is "abundant in many kinds of granitic rocks and in siliceous metamorphic rocks but good specimens are obtained only from granitic pegmatites, frommiarolitic cavities in granites, or from cavities in some quartz veins" (Sinkankas 1966:481-482). Particles of muscovite graded on the Wentworth system (1933) were always in the "silt" (1/16-1/25 mm. range), "very fine" (1/8-1/16 mm. range), or "fine" (1/4-1/8 mm. range) grades, with the former two grades most dominant.

Very small quantities of hematite, present as free tabular crystals or in association with quartzite or calcite, were found in all Alpha and Beta sherds. Hematite, with a general composition  $Fe_2O_3$  (ferric oxide), is a common substance of general occurrence and was most often dark red or opaque black in color with a variable hardness on Mohs' Scale of 1-6 1/2 (Pough 1955:124, Sinkankas 1966:326). Particles were found to be soluble in concentrated hydrochloric acid (Larsen and Berman 1934:95, Pough 1955:124). The mineral normally occurs in large beds of sedimentary origin, in some metamorphosed sedimentary rocks, and in veins in igneous class rocks (Sinkankas 1966:326-327), and "in its many varieties hematite is one of the commonest minerals we are likely to encounter" (Pough 1955:125). Particles in terms of size were classified on the Wentworth grade system (1933) as "very fine" (1/8-1/16 mm. range). Lumps of reddish-brown hematite were conspicuous, but long thin fragments were also distinctive. This was also noted by Shepard (1946:200).

Feldspars, especially orthoclase and the plagioclase group of oligoclase and andesine, were noted. Orthoclase,  $K(AlSi_3O_8)$ , and oligoclase and andesine,  $Ca(Al,Si)(AlSi_2O_8)$ , were not well represented. Feldspars are the principal constituents of igneous and plutonic rocks (see Pough 1955:235-239 and Sinkankas 1966:449-459 for further descriptions and properties). Hornblende,  $Na,Ca_2(Mg,Fe,Al)_5(OH)_2(Si,Al)_8O_{22}$ , is another mineral abundant in igneous rocks, but is also found in metamorphics as well (see Pough 1955:265-266 and Sinkankas 1966:489-490 for further descriptions and properties). Hornblende, like the feldspars, was present (if at all) in minute quantities.

Minerals in the chlorite series were present in variable minute quantities. Chlorite,  $(Mg,Fe,Al)_6(OH)_8[(Al,Si)_4O_{10}]$ , is normally dark green in color, but reddish-brown varieties (presumably containing manganese) were sometimes found. Chlorites are common in many kinds of rock and mineral deposits, usually are of secondary origin, and are especially common in metamorphosed siliceous rocks as in schists or partly altered igneous rocks as basalts (Pough 1955:254-255, Sinkankas 1966:385-386).

Type Alpha (with substantial quantities of quartzite, calcite, talc and



quartz, with lesser quantities of muscovite mica and hematite) corresponded with previous mineralogical studies of Thin Orange ware done by Beskow (Linné 1934:213-214) and Shepard (1946:198-201). Sotomayor y Castillo Tejero's Group A classification (1963:10) would apparently fall within the Alpha description. Type Beta (with substantial quantities of muscovite mica, quartzite, and calcite, with lesser quantities of quartz, talc, and hematite) has no parallel. Type Beta corresponds to a kind of Thin Orange ware culturally referred to as "Coarse Thin Orange". The type may readily be discerned with a hand lens. Shepard reported micaceous fragments present in all pastes, but failed to note if there were quantities as great as one-third of the total aplastic content (1946:200). She, too, found sherds without calcite content, but reported calcite as abundant as quartzite in some sherds, which was also noted in both Alpha and Beta types.

A preliminary examination of Classic sherds from urban and rural Teotihuacán indicated a radical difference in aplastic inclusions when compared to the Thin Orange pottery. The temper of these sherds was predominantly volcanic ash or volcanic sand with considerable quantities of quartz and epidote. The quartz was generally angular and averaged 0.5 mm. in size, i.e. "medium" on the Wentworth scale. Quartz fragments, silicon dioxide,  $\text{SiO}_2$ , were found in the slips and throughout the paste cross-sections of other Teotihuacán wares. Epidote, chemically  $\text{Ca}_2(\text{Al,Fe})\text{Al}_2\text{O}(\text{OH})(\text{SiO}_4)(\text{Si}_2\text{O}_7)$ , was always present in the slip and paste cross-sections of Teotihuacán wares. The mineral appeared as dark green or blackish green to dark brown, had a hardness on Mohs' Scale of 6-7, and was transparent to translucent. This mineral is very common according to Pough (1955:298-299), occurring in low and medium grade metamorphic rocks, often in fine crystals in cavities, associated with actinolite (Byssolite), feldspar, quartz, chlorite, axinite, apatite, sphene, and black tourmaline. In addition, it may occur as small crystals in contact-metamorphosed limestones, and in altered igneous rocks, in some granitic rocks where it forms large crystals in pegmatite, or may occur in traprocks with zeolites (Pough 1955:298, Sinkankas 1966:518-520). Epidote was present in 0.2-0.5 mm. sizes in Teotihuacán sherds, or in the "fine" (1/4-1/8 mm. range) and "medium" (1/4-1/2 mm. range) size grades (Wentworth 1933). Mica, quartzite (rounded and subangular), and obsidian fragments (angular) were also found, as were occasional plant impressions. Other minerals occasionally present in the Teotihuacán sherds included: quartzite, olivine, vesicular rhyolite(?), ferruginous clay, gypsum/talc, basalt(?), felsite, and various mafics.

In summary, Type Alpha, with quartzite, calcite, talc, and quartz aplastics in substantial quantities, paralleled Sotomayor y Castillo Tejero's Group A (1963:10) and Shepard's Thin Orange collection (1946:198-201). Type Beta, with substantial quantities of muscovite mica schist, quartzite and calcite, has no parallel mineralogically defined in the literature, but has been called "Coarse Thin Orange" to differentiate it from "normal" Thin Orange (Kolb 1965ms). Classic sherds from Teotihuacán urban and rural sites, probably manufactured locally, contained a different group of aplastics, including volcanic ash, volcanic sand, quartz and epidote. This strongly suggested that Thin Orange ware of the Classic Period was not manufactured at Teotihuacán and was indeed an import, a conclusion reached by Linné (1942:176, 1947:136) and Sotomayor y Castillo Tejero (1963:17-20). A.V. Kidder and Shepard stated "we have as yet no direct evidence of the place of manufacture of thin orange ware" (Kidder, Jennings and Shook 1946:201). Shepard,

recognized as the leading authority in archaeological ceramic technology, has reached the following conclusions about Thin Orange ware (1946:201):

It occurs in sufficient quantity at Teotihuacán to have led some archaeologists to conclude that it was made locally, whereas others have considered it intrusive. Linné believed that it was intrusive--because of the improbability that the temper which Beskow reported would occur in a volcanic region. It is even more improbable that the schist temper which we have identified would occur there. Another line of evidence is afforded by the temper of the common Teotihuacán wares. If thin orange were being made by local potters, one would expect that they would use schist temper for other pottery types also. Through the courtesy of Dr. Vaillant, the American Museum sherd collections from Teotihuacán, Zacatenco, and Ticomán were examined with the binocular microscope for comparison with thin orange. The temper of the majority of sherds is either volcanic sand or volcanic ash. A single sherd in the entire collection has a temper comparable to that of thin orange. It is plain, well smoothed, and gray but too small to show vessel shape. It is extremely unlikely that potters would reserve a particular kind of temper and clay for vessels of one style. Consequently, technological analysis lends strong circumstantial evidence to the theory that thin orange was imported at Teotihuacán. Temper may also afford a means of eventually establishing the source of the ware because we may expect to find schist in the common wares of the site where thin orange was made.

The Meseta Central is composed primarily of andesitic and basaltic ejecta over older rhyolitic and andesitic rocks, with the presence of scoria and cinder cones, according to West's study of the surface configuration and geology (1964:42, 44). Obsidian (rhyolitic), red tezontle (an andesitic breccia), and gray chiluca (trachytic andesite) are also present (1964:47-48). The Valley of México is basically Quaternary volcanic extrusive with Tertiary volcanic extrusion in the north (Teotihuacán area), while the south has Mesozoic sediments with Paleozoic to Cenozoic schists, gneisses, granites, metasediments, and intrusives (Carta Geológica de la Republica Mexicana 1960, West 1964: Fig. 4). This would appear to substantiate Sotomayor y Castillo Tejero's contention (1963:18-20). Further comments on the "origin" of manufacture of Thin Orange ware will be made in a later section of this paper.

5. "Firing" Variations: The term "firing" refers to the apparent heat of firing as revealed by the sherds and is not related to absolute temperatures. It is assumed that brownish or reddish clays imply a lower firing temperature than light or greenish-buff clays; that unoxidized cores imply lower temperatures, and that badly warped and greenish almost vitrified examples result from the higher temperature ranges.

"Reddish yellow" and "yellowish red" Thin Orange sherd colors could result from raw clays originally yellow, red, brown, gray, or black in color (Shepard 1963:17). "Hematite and the hydrated forms of ferric oxides, goethite and limonite, produce reds, brown, buffs and yellows", according to Shepard (1963:16). Therefore, it seems impossible to determine the color of the natural clay before firing. Few sherds with a greenish or gray cast were found, indicating that the normal firing was a well-controlled oxidation. Firing clouds and unoxidized cores were extremely infrequent in the samples

of the Teotihuacán Valley Project (Pennsylvania State University) and Teotihuacán Mapping Project (University of Rochester), and concurred with Shepard's findings (1946:198).

Surface and cross-section paste colors were similar whether "self-slipped" or unslipped. The finished vessel surfaces were smooth and even, rarely showing evidence of spalling by particles of calcite or other carbonate-based minerals. Calcite and limestone heated to temperatures above 650°C begin to decompose into carbon dioxide and calcium oxide; complete disintegration occurs at 898°C (Shepard 1963:22). Magnetite oxidizes when heated in air to 400°C, but the ferric oxide formed on the surface acts as a coating to prevent further oxidation. This evidence would suggest that Thin Orange ware was fired in oxidizing atmospheres at temperatures at least 400°C and not more than 850°C, with a temperature of 750-800°C probably most desirous. No pottery-making areas (either "workshops" or barrios) have been reported in the archaeological literature for the Meseta Central, therefore, we do not know whether closed "kilns" were made and used or whether "open firing" (done in fire pits covered with discard sherds, sod, etc.) were used. Simple wood fires built around pottery can attain temperatures of up to 962°C, but depend upon the kinds of combustibles and presence or absence of a draft (Shepard 1963:83). Contemporary Mesoamerican potters in "marginal areas" today still employ the "open firing" technique, without a kiln (Foster 1967:116; see also Shepard 1963:82-86, for further detailed observations).

Thin Orange sherds almost always showed an even and thorough oxidation, with few firing accidents noted. Very few sherds appeared to have been reduced or showed incipient vitrification (possible accidental refiring after discard). These conclusions parallel those of Shepard (1946:198) and Tolstoy (1958:19).

### Cultural Properties:

1. Methods of Manufacture: Thin Orange ware was manufactured without the use of the potter's wheel, although a turning slab or tournette may have been used. Even today true wheel throwing in Mesoamérica is nearly always a "non-Indian commercial-workshop urban enterprise" (Foster 1967:106). Foster has reported five major contemporary techniques: (1) segmental building, (2) hand modeling from a lump of clay, (3) the mobile base, (4) convex pottery molds, and (5) concave vertical-halves pottery molds (1967:106). A number of techniques including coiling, slab-building, modeling, etc. may conceivably be employed during the manufacture of a single vessel. Even the distinction between "handmade" and "wheelmade" pottery loses its significance as a criterion of ceramic technology and description; for example, which is being turned or is moving, the pot or the potter? Manufacturing by the coil method without a wheel or turning slab, or with irregular movement on a slab during the molding operation, and continuous or discontinuous movement of the vessel during the smoothing and final finishing phases of work present important problems in technological interpretation. Balfet (1965) has noted some of these considerations in her ethnographic observations of North African potters, and Matson (1969) observed similar occurrences throughout the Mediterranean countries and in the Near East. The use of a pivoted turning slab, the tournette, "mushroom" molds, and kabal by the potter are additional considerations.

The Thin Orange pottery examined by Linné (1934, 1942, 1947), Armillas (1944b), Shepard (1946), Tolstoy (1958), and Sotomayor y Castillo Tejero (1963) has been described as "well-made" or "finely-executed", with little regard as to the actual techniques of manufacture. An examination of the sherds in the collections at Pennsylvania State University revealed that only twenty sherds (of 4,370) demonstrated clear evidence of the coiling or slab-building technique. These examples were universally found on basins/cajetes, jars, and other "utility" forms. The tripod supports on cylindrical vases were modeled and attached, and various elements were sometimes applied on vases, jars and bowls. Ring and annular bases on hemispherical bowl forms were modeled and applied. No sherds evidenced the use of any kind of mold. Segmental building, hand modeling and the use of a mobile base (slab, tournette, kabal, etc.) are suggested as methods used by Thin Orange ware artisans.

2. Surface Treatment: The surfaces of 70.5% of the 2,890 sherds examined showed evidence of the use of a "self-slip". In these instances a fine, dilute clay of the same type was applied (evenly for the most part) to the surfaces of the vessels prior to firing.\* This may have been an effective means of improving surface color and texture, while rendering the pottery less permeable. Three-fourths of the Thin Orange sherds examined by Shepard had been similarly treated (1946:198). Tolstoy (1958) and Sotomayor y Castillo Tejero (1963) failed to report any evidence of slipping. The surface finish was even and smooth, although cases of thin and streaky application were noted.

In addition, many surfaces were burnished at least slightly, as evidenced by faint tool marks, presumably from polishing pebbles or bone or wooden implements. Burnishing may be defined as a surface treatment whereby a "leather hard" ceramic vessel is rubbed with a polishing tool before firing in order to compact the clay particles. On Thin Orange, polishing was apparently executed to produce a slightly satiny gloss, but never to the point of a luster. We retain the term polishing for cases where vessels have an even lustrous appearance. Again, Shepard reported nearly identical surface treatment (1946:198).

Vessels with restricted orifices (such as jars and certain effigy forms) had only finger-smoothed interior surfaces, while having burnished exterior surfaces. Undecorated large jars, both Types Alpha and Beta ("Coarse Thin Orange") and undecorated basins/craters normally had exterior and interior surfaces less finely burnished than the "table" wares. Spalling was extremely rare, which was indicative of carefully controlled firing.

3. Decorative Techniques: Decorative techniques observed included various methods of plastic decoration: appliqué, channelling, grooving, incising, punctating, and stamping. Painting and fresco painting were extremely rare.

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\* Editor's Note:

Frederick R. Matson, in reading this manuscript, makes the following statement with respect to the use of the term, self slip: "However, I rather wonder if he is correct. One can achieve this effect by dipping the hand in water, and wet-smoothing the surface. A slip would not have to be intentionally added".

Linné (1942:177) found one vase with traces of "green paint", and Kidder reported two vases with green-painted "stucco" (thin lime plaster) exteriors (Kidder, Jennings, and Shook 1946:194). Appliqué here means the addition of a decoration created by the hand modeling or molding of plastic clay in order to create high relief, bossing, nodding or attachment of geometric motifs or anthropomorphic figures. Either the surface of the prefired vessel was worked (rarely) or the elements were made separately and welded to the vessel. Channelling includes the creation of furrows or flutes in a distinctive arrangement (usually parallel to one another) in a prefired surface. Grooving is a type of freehand decoration created by pressing lines wider than 0.2 cm. with a tool into a ceramic surface while the paste is plastic or "leather hard". Incising is a variant of freehand decoration created by pressing or cutting lines up to 0.2 cm. wide with a tool into surfaces whose paste is plastic or "leather hard". The term engraving would be synonymous with post-fired incising. Punctation is a freehand decoration created by pressing or indenting the plastic or "leather hard" ceramic surface with a pointed implement. Punctation and incision often were found in association as a decorative combination. Stamping is defined as the result of a mechanical method of imprinting patterns or textures with a stamp or die on prefired ceramics.

Table V summarizes the decorative techniques and defines subdivisions and combinations, by chronological phase, as discerned from the collections studied and from the existing literature.

Researches in the Xolalpan residential complex by Linné resulted in the discovery of sixteen complete vessels, all of which were decorated (preslip incision and punctation being most common) plus "quantities" of Thin Orange sherds (Linné 1934:67, 69-70, 73). The decorations (if any) on the potsherds were not further considered in his monograph. Later excavations in the Tlamimilolpa ruin revealed five more Thin Orange vessels, either in burials or caches, all of which were decorated (preslip incision and punctation) (Linné 1942:133, 140, 143). No mention was made of other Thin Orange sherds, which certainly must have existed in quantity in the room complex. Former "veteran" workers for Linné recalled large amounts of Thin Orange sherds in the excavated area (Reyes 1966).

Armillas (1944:7) noted that cerámica anaranjada delgada characteristically had incised decoration. His early summary of the state of knowledge of the ware had eleven illustrations showing form and decoration (two punctation and incision, four incision only, one channelling, one effigy, one appliqué, two plain with appliqued supports). The Kaminaljuyu report had a discussion of sixteen complete vessels recovered at that site, of which thirteen were decorated, again primarily by prefired preslip incision and punctation. Tolstoy (1958:19) observed that in his sample of 854 sherds "approximately 10 per cent of sherds of this type bear some kind of incised and/or punctate decoration on the outer vessel wall. Commonest is a single row of curvilinear punctations, or a combination of these with curvilinear incised lines". Sotomayor y Castillo Tejero summarized the kinds of decorations on Thin Orange pottery in a single sentence (1963:7), but did not state whether any of the sherds from which their thin sections were made had originally been decorated, therefore, no correlation of decoration and aplastic was available for consideration.

Thin Orange sherds obtained by the Teotihuacán Valley Project showed higher percentages of decoration occurrence than those collected by Tolstoy. An analysis of the sherds from the Maquixco excavation showed that twenty-six per cent (1,136 of 4,370) were decorated. A complete breakdown is presently unavailable, but the vast majority of the sherds were decorated by preslipped incision, punctation, and combinations of these. Appliqué and grooving were less often found and channelling and stamping were rare decorative types. From the other excavations, analysis of the Thin Orange sherds showed twenty-four per cent to be decorated, predominantly by the combination of preslipped incision and punctation. Eighteen per cent of the Thin Orange pottery in the surface sample collections were decorated, again primarily by combinations of incision and punctation.

Figure 1 illustrates most of the thirty-nine different decorative types (exclusive of plain or undecorated) which have been discerned for Thin Orange ware, and which were enumerated, with chronological phasing, in Table V. In terms of the occurrences of decorative types, plain (undecorated) vessels were found in all eight chronological phases. Thin Orange was first known from Late Tzacualli phase sites, where only plain (undecorated) vessels of the ware were apparently used. In Miccaotli, three types of incision (interlaced lines, horizontal parallel lines, and wavy lines) were introduced in addition to the retention of plain (undecorated). Thirteen distinct decorations were recognizable for the Early Tlamimilolpa phase, including: plain (undecorated); appliqué (hand-made pictorial adornos, "scales" or overlapping plates, and sea shell or scallop); channelling (horizontal); grooving (banded parallel lines and undulating wavy lines); incising ("cumulus" cloud, interlaced lines, lazy "S", multiple scallop, horizontal parallel lines, and horizontal wavy lines). Twenty-six individual decorations have been discerned for the Late Tlamimilolpa phase, including: plain (undecorated); appliqué (hand-made pictorial adornos, "coffee-bean", dot or button, basal ridge molding, and sea shell or scallop); channelling (horizontal, vertical or fluted, and diagonal); grooving (multiple scallop and banded parallel lines); incising ("cumulus" cloud, interlaced lines, lazy "S", linear "S", multiple bar, multiple double-dash, multiple scallop, multiple slash, horizontal parallel lines, wavy lines, and zoned [panel abraded]); and punctation ("comb" [descending sized dots], dot [with parallel grooves], dot [with lazy "S"], and dot [with linear "S"]).

It would appear that Late Tlamimilolpa and the succeeding phase, Early Xolalpan, were periods of extreme experimentation in decoration and design variability. Twenty-eight different decorations were recorded for Early Xolalpan, including: plain (undecorated); appliqué (mold-made pictorial adornos, "coffee-bean", dot or button, effigy figure/pictorial, basal ridge molding, medial ridge molding, and basal plus medial ridge molding); channelling (horizontal and vertical); grooving (multiple scallop, banded parallel lines and undulating wavy lines); incising (lazy "S", linear "S", multiple scallop, horizontal parallel lines, stepped multiple "S", and wavy lines); and punctation ("comb" [descending sized dots], conical [with parallel grooves], dot [with parallel grooves], dot [continuous, no grooves], dot [with lazy "S"], dot [with linear "S"], oval [with parallel grooves], triangular or wedge [with grooves], and tubular [reed/hollow bone]). With the Late Xolalpan (Maquixco) phase, there began a decline in the number of decorations, with twenty-two discernible, including: plain (undecorated); appliqué (mold-made

pictorial adornos, dot or button, effigy figure pictorial, basal ridge molding, medial ridge molding, and basal plus medial ridge molding); channelling (horizontal and vertical or fluted); grooving (banded parallel lines); incising (lazy "S", horizontal parallel lines, stepped multiple "S", and wavy lines); and punctation (conical [with parallel grooves], dot [with parallel grooves], dot [continuous, no grooves], dot [with lazy "S"], dot [with linear "S"], dots in groups of "S's", oval [with parallel grooves], and tubular [reed/hollow bone]).

By the Metepec phase, there had been a drastic decline in decorative types of Thin Orange with only six definitely known, including: plain (undecorated); appliqué (mold-made pictorial adornos, basal ridge molding, medial ridge molding, and basal plus medial ridge molding); and stamping (glyphs and symbols). Channelling, grooving, incising and, the punctating of Thin Orange have disappeared as techniques of decoration. In the post-classic Oxtotipac phase, only plain (undecorated) vessels of the ware are found.

Engraving (post-fire incising) occurred on only six sherds, and generally represented "grafitti", although one outline of a patolli game board and the outline of a four-footed animal with horns/antlers (probably a deer) were also found. Fifteen Thin Orange sherds had biconically drilled holes near broken edges, suggesting that vessels were occasionally repaired by the lacing method. The holes were from 0.2-0.4 cm. in diameter, and appeared always to have been started from the exterior wall (to judge from the fact the larger of the two cones was universally found on the exterior). Only eleven sherd disks of Thin Orange ware were found, two of which bore central biconical drilling perforations. The regular disks may have been gaming peices or "men" in the patolli game, or served some other purpose. There is no evidence to suggest that the perforated disks had been utilized as spindle whorls. Three additional sherds had abraded surfaces, apparently being utilized as ready-made scrapers. Only three other Classic sherds from the Maquixco excavations showed use as scraping tools. None of the Thin Orange sherds were decorated, precluding attempts at deriving chronology, but all seemed to come from thin-walled vessels (hemispherical or other bowls seem most likely).

Thirty-one annular base exteriors from hemispherical bowl forms showed evidence of having been utilized as pigment grinding palettes. Each basal area showed traces of abrasion and had a dark reddish pigment adhering to the exterior vessel walls. The pigment was identified as ferric oxide,  $\text{Fe}_2\text{O}_3$ , hematite with small mica-like tabular crystals steel-gray in color and with a brilliant metallic luster (e.g. specularite). This mineral was often used in pottery decoration (red painting on buff ceramics, such as some Classic Teotihuacán Red/Buff wares), for monochrome painted walls, for the reds in polychrome al fresco murals, and perhaps even as a cosmetic.

4. Vessel Shapes and Rim Forms: Eleven major vessel forms have been recognized for Alpha Thin Orange ware, one for Alpha "Thick Thin Orange" (wall thickness over 1.0 cm.), and two for Type Beta, "Coarse Thin Orange". Data concerning the vessel forms and their chronological occurrences have been tabulated as Table VI. A correlation of data from Table V, Thin Orange Decorations, and from Table VI, Thin Orange Vessel Forms, has been made and is presented in Table VII. Generalized vessel forms are illustrated in Figure II, and rim profiles in Figure III.

Basins and craters first occurred during Late Tlamimilolpa and continued through the Oxtotipac phase. Rim forms were found to be square/flat, with a tendency for rims to have medium (1.5-2.5 cm.) and occasionally wide (2.5+ cm.) lip eversion during both Xolalpan phases. Craters and basins apparently had simple, flat bases, lacked any sort of appendages, and were devoid of decoration.

Nine different bowl forms have been identified. The most popular bowl seemed to have been the hemispherical form with ring or annular base. The hemispherical bowl with a ring base chronologically ranged from Late Tzacualli through Late Xolalpan, whereas the annular base form began during Early Tlamimilolpa and continued through Oxtotipac phase. Rim forms were most often the direct tapered lip type (about eighty per cent), with the direct rounded lip type accounting for the remainder. Ring base forms have seven associated decorations, whereas the annular base form had twenty-seven. No appendages were associated with hemispherical bowls.

The second most frequent bowl form was the recurved rim (composite silhouette) bowl, which began during Late Tzacualli and continued through Early Xolalpan. Rim forms were predominantly the direct tapered lip type, although about forty per cent were of the direct rounded lip type. Everted rim bowls were recorded for four phases, Early Tlamimilolpa through Late Xolalpan. Rim forms were almost always in the medium everted (1.5-2.5 cm.) category, with some examples in the slightly everted (less the 1.5 cm.) category. The outcurved rim bowl (palangana) was found in four phases, Early Tlamimilolpa through Late Xolalpan. Rim forms were dominantly of the direct rounded lip type, with perhaps ten per cent of this bowl form having the direct tapered lip type. The outflared rim bowl form chronologically ranged through three phases, Early Tlamimilolpa through Early Xolalpan. This form universally had rims of the direct rounded lip type.

The following three bowl forms were found only in one of the eight possible chronological phases, and therefore represent time-markers in terms of vessel shape. The bevelled rim bowl, found only in the Early Tlamimilolpa phase, had an exterior bevelled rim, and was a rarely encountered form. The flat/square tipped bowl was recorded only for the Miccaotli phase, and always had a squarish or flat lip. The shouldered bowl form occurred only in the Late Tzacualli phase, had a direct tapered lip rim form, and was infrequently found in the samples.

The rectangular compartmented "box" and lid vessel form was reported by Linné (1934:103, Fig. 133; 1947:131, Fig. 27), and chronologically has been placed in the Early Xolalpan phase. No examples could be discerned in the excavated or surface sample collections of the Teotihuacán Valley Project (Pennsylvania State University). Linné (1934:103) commented that:

The box is divided into two compartments by a partition wall, inserted after the completion of the tray. The walls must by then already have become fairly hard, and the partition was put into its place by being pressed down in grooves cut out in the walls of the box. The cover, which is about 0.5 cm. wider and 1. cm. longer, than the tray, is ornamented with incised lines running along the edges, in addition to which the two long sides and one of the ends are decorated with plain, wavy,



incised lines. The knob-shaped handle is provided with a slit in its upper part, and has rattlers in its interior.

The box and lid always had square rims. I know of no other examples of this form published in the literature.

The diagnostic Teotihuacán culture vessel is the tripod supported cylindrical vase. The form first occurred during the Early Tlamimilolpa phase both in Monochrome Brown and Purplish-brown Black wares, and infrequently in Thin Orange ware. The Thin Orange cylindrical vase chronologically ranged from Early Tlamimilolpa through Metepec phases, peaking (in terms of quantity) during Early and Late Xolalpan. Thirty-one distinct decorations have been recorded for this vessel form, making it the most highly variable in decorative possibilities (see Tables V and VI, and Figure I).

Early Tlamimilolpa cylindrical vases had eight possible decorative variations, primarily incision and appliqué. Rim forms were predominantly of the direct tapered lip type. Appendages included either three small, flush nubbin supports; or three large, hollow semi-globular supports.

Late Tlamimilolpa cylinders had ten possible decorative variations, primarily incision and appliqué. Rim forms were mainly of the direct rounded lip type, although the direct tapered lip type was noted. The only appendage was apparently the hollow perforated or unperforated rectangular tripod support.

The Early Xolalpan cylindrical vase had eleven decorative possibilities, including incision, appliqué, and punctation. Rims were predominantly of the direct rounded lip type, but the direct tapered lip type did occur in about fifteen per cent of the cases. Appendages on the flat base were quite variable, and included hollow perforated or unperforated rectangular tripod supports, hollow grooved nubbin tripod supports.

Late Xolalpan phase Thin Orange cylindrical vases were found to have sixteen different decorative variations, primarily appliqué, incision, and punctation. Rim forms were most often of the direct rounded lip type, although twenty per cent of the sample had the direct tapered lip type. Appendages, as in Early Xolalpan, were variable, including hollow rectangular perforated or unperforated tripod supports (the latter sometimes grooved or incised), and tripod hollow grooved nubbin supports.

The Metepec phase cylindrical vases were found to have only five decorative possibilities. Thin Orange vases for this phase were not often discernible in the collections. Rim forms were universally of the direct rounded type. Appendages included both solid mold made slab tripod supports or tripod "tab" supports (especially on smaller vessels).

Vase lids for the cylindrical vases apparently occurred only during Late Tlamimilolpa and Early Xolalpan. Examples in the Teotihuacán Valley Project collections were meager, and were infrequent in the Teotihuacán Mapping Project (University of Rochester) samples. Lindé (1947:131, Fig. 30) and Séjourné (1966:160, Fig. 143) have illustrated vase lids. Characteristically the lids have raised centers and knobbed handles. Late Tlamimilolpa forms have a

narrow cover overhang and various applied hand-made adornos as decoration on the overhang or top edges. The knobbed handle types were simple, but at least one suggested that a rattle may have been placed within the hollow knob. Early Xolalpan lids had a wide cover overhang (over 0.7 cm.) and variable applied mold-made adornos as decoration on the overhang and/or top of the edge. Knobbed handles were often of an effigy form (eagle, etc.), but simple knobbed handles were also observed. Rim overhangs terminated in simple direct rounded lips.

Goblets, cups and copas were found represented in three phases, Late Tlamimilolpa through Late Xolalpan, but generally were infrequent in rural sites. These vessels had a cultural peak during Early Xolalpan, and afterwards were exceedingly rare. Goblets or copas had pedestal/annular bases, were always thin-walled, and had standing heights, greater than the exterior rim diameter. Cups had annular bases, were likewise thin-walled, but had standing heights less than the exterior rim diameter (i.e. these were squat copas). Only plain (undecorated) goblets, cups, and copas exist. The form apparently was a direct copy of Tan Monochrome Copoid Ware vessels.

Effigy forms in Thin Orange ware have been reported by many archaeologists, including Seler (1915:500-504); Linné (1934:103-103, Figs. 135, 135A; 1947: 131; Figs. 25, 26, 28, 29, 31-33, 35); Armillas (1944:11, Fig. 7); Kidder, Jennings and Shook (1946:195-196; Figs. 192A, 193); and Séjourné (1966:159, 170, 171; Figs. 141, 152, 153; Lams. 42, 43). These vessels often were anthropomorphic in character, but zoomorphic forms (birds, ducks, dogs, and monkeys) often were depicted. Effigy vessels chronologically range from Late Tlamimilolpa through Late Xolalpan, with a peak in frequency during Early Xolalpan. Linné (1934:102) has described a unique effigy form which appeared to be:

...a representation of a recumbent, oblong fruit, in the upper side of which a large aperture has been cut out. With a view to enhancing the realistic effect, the edges of the aperture have been left untrimmed. On one of the sides of this naturalistic fruit has been placed a small, monkey-like figure, looking down into the vessel. This combination produces a droll effect, and removes the vessel from the ordinary run of ceramics consisting of utility vessels or vases decorated strictly according to tradition. In this case, the artist has given rein to his fancy, and with a certain playfulness, modelled this amusing little thing. There is an air of art for art's sake about it. The vessel's "mouth" is placed at one end, which is elongated in sprout-form, and if the vessel was used for pulque-drinking, it may be that perhaps the figure is meant to represent the mental state in which the drinker might find himself. From a technical point of view the vessel is especially interesting inasmuch as it has been formed of two halves joined together.

Upon closer examination, I should like to suggest a different interpretation for this particular effigy vessel. The "naturalistic fruit" appeared to me to be a cacao pod with an additional cacao flower (for decorative purposes only, since the flower would have served its purpose before the development of the pod). Therefore, the pod, whose seed was an important pre-Hispanic Mesoamerican standard of exchange, native to the tropics, was

highly stylized as an effigy container. I concur with the interpretation of the "monkey-like figure" which seemed to be gorging itself on the pulp within the pod. If this was a cacao pod, might not the vessel have been used as a cacao-drinking container rather than one for pulque and be suggestive of some kind of cultural contact (perhaps exploitation or simply exploration) with the Gulf Coast?

Low necked jar forms have been discerned for three phases, Early Tlamimilolpa through Early Xolalpan. The form probably was found in Late Xolalpan, but clear-cut evidence still is lacking. The Early Tlamimilolpa jars always had flat bases and lacked appendages. Rims were normally outcurved terminating in direct rounded lips. Decorations included grooved parallel lines (banded), grooved undulating wavy lines, or horizontal channelling (infrequent). By Late Tlamimilolpa, the low necked jar acquired appendages and numerous types of decoration. Some examples were Type Beta in terms of aplastics, but these were rare, and primarily seemed to be an urban Teotihuacán characteristic. Bases were flat, but three large, solid or hollow nubbin supports (offset from the edge) were most often found. Rims were direct or outcurved or slightly outflaring and terminated in direct rounded lips. Decorations included appliqué ("coffee-bean", dot or button [indented slightly]); grooving (scallop); incising (lazy "S", linear "S"); punctation (dots in groups of "S's", and "comb" [descending size dots], and channelling (horizontal, vertical, or diagonal), as well as plain (undecorated).

Early Xolalpan low necked jars characteristically were thin-walled and had better-executed decoration and surface treatment. Bases were normally flat, but one example of a square base attached to a globular body was noted. Nubbin supports apparently declined in frequency or were absent. Rims were direct or outcurved to slightly outflaring and terminated in direct rounded lips. Decoration types included: plain (undecorated); channelling (all forms rare); grooving (parallel bands and wavy lines); and seven types of punctation.

High necked jar forms were restricted to the Late Tlamimilolpa and Early Xolalpan phases. A few of the earliest examples had Beta type aplastics. Bases were flat or characteristically had three large hollow nubbin supports (with plain or grooved decoration) offset from the edge. Occasional annular base forms were observed but may be considered as rarities. Rim forms were outcurved to slightly outflaring, and terminated in direct rounded lips. Some lips were thickened but did not approach a bolstered classification. Decoration consisted of appliqué ("coffee-bean"); channelling (horizontal, vertical or diagonal); incising (lazy "S" and linear "S"); and punctation ("comb"). In Early Xolalpan high necked jars had flat bases, and apparently lacked any appendages. Vessels were thin-walled and showed more care in the execution of burnish than earlier examples. Rims normally were flaring or slightly outcurving, and had direct rounded lips. Most jars were undecorated, although channelling (in all three varieties) was also found.

Miniature vessels first appeared in Late Tlamimilolpa and continued through Late Xolalpan. This form was extremely rare in the excavated samples and surface collections from rural sites, but apparently was more common in the urban center. Linné (1934:102, Fig. 134; 1947:Fig. 40) illustrated a miniature vase; Séjourné (1966: Figs. 135, 139, 142) has recovered miniature simple bowls, miniature outcurved rim bowls, and miniature vases from her

excavations. Eleven fragments were recovered by the Teotihuacán Valley Project, primarily in the excavated samples from the Maquixco site. Miniatures were extremely rare during the Late Tlaminilolpa phase, and were characteristically undecorated simple bowls, hemispherical bowls, and dish/saucer forms, all lacking appendages. Early Xolalpan miniatures included the same forms as the previous phase with the addition of outcurved rim bowls (occasionally with incised linear decoration) and globular jars (with vertical parallel grooving). By Late Xolalpan miniatures were again exceedingly rare, with simple bowls and globular jars (lacking decoration and appendages) the only recorded vessels.

Saucers/dishes/plates were restricted chronologically to Early and Late Xolalpan and were rare forms in both urban and rural sites. Saucers and dishes may be considered "shallow" vessels having unrestricted orifices with a height between one-third and one-fifth of the vessel diameter. Plates would be "very shallow" vessels having unrestricted orifices with a height less than one-fifth of the vessel diameter. No appendages or ring or annular bases were associated with these low side wall angle vessels. None were decorated, and the form cannot be easily confused with cylindrical vase lids. Rims appeared universally to terminate in direct tapered lips.

The tecomate (neckless jar), a form common during Aztec periods in Mesoamérica, was a rare form which occurred during Early and Late Xolalpan. Tecomates may be defined as containers having globular shapes and smooth hemispherical silhouettes, with occasional fairly sharp shoulders. In reality, they are pronounced incurved rim bowls or basins. The bases were flat or "semi-flattened", and the form lacked appendages or plastic decoration of any sort.

"Coarse Thin Orange" (Beta type, micaceous schist aplastics) was a characteristic of Metepec and Oxtotipac phases in the form of high necked jars, and in the former phase in the cylindrical vase form. The vase had a flat base and solid talud and tablero mold-made tripod supports or hollow rectangular mold-made tripod supports with tab-like side projections. Rims were always simple and terminated in direct rounded lips. Decoration was infrequent, but consisted of stamped ornaments (glyphs and symbols) or applied mold-made adornos. The high necked jar with micaceous schist aplastic was a common form in Metepec phase, and it was difficult to differentiate from Oxtotipac jars. Both had flat bases and were devoid of decoration, but the Metepec phase jar occasionally had strap handle appendages.

"Thick Thin Orange" pottery was Type Alpha in terms of aplastic content, and was differentiated from other Thin Orange ware simply because of the massiveness of the vessel walls (1.0-1.5 cm. thick). The ceramic occurred only during the experimental Early Tlaminilolpa phase in what appeared to be jar forms with flat bases. No appendages or decoration types have been discerned.

Thin Orange ware vessels may have the following bases or supports, some of which were chronologically diagnostic.

- 1) Annular footed base on hemispherical bowls (all phases, undiagnostic).
- 2) Angular base on cylindrical vase forms and high or low necked jars (undiagnostic).
- 3) Pedestal footed base only on goblets or copas (examples were too few for chronological inference).
- 4) Ring footed base on hemispherical bowls (most phases, undiagnostic).
- 5) Hollow rectangular unperforated support on cylindrical vase forms and some low-necked jars (probably Early Xolalpan).
- 6) Hollow rectangular perforated support on cylindrical vase forms (undiagnostic).
- 7) Hollow large grooved nubbin support on high-necked jars (Late Tlamimilolpa).
- 8) Hollow, tubular support on cylindrical vase forms (Early Xolalpan).
- 9) Hollow globular or semi-globular support on low-necked jar forms (Late Tlamimilolpa and Early Xolalpan).
- 10) Solid small nubbin supports on outcurved rim bowl form (tendency for Tlamimilolpa phases).
- 11) Solid large nubbin supports on jar forms (examples were too few for chronological inference).
- 12) Solid slab support on cylindrical vase form (probably Early Xolalpan).
- 13) Solid "tab" support on cylindrical vase form (Early and perhaps Late Xolalpan).
- 14) Solid "dish-shaped" support on cylindrical vase form (examples were too few for chronological inference).

5. Vessel Sizes and Wall Thickness: The Thin Orange ware sherds from the Maquixco site excavations have been studied to determine the ranges and averages of vessels (exterior rim diameters) and ranges and averages of vessel wall thickness for the forms enumerated in Table VI. The measurements have been tabulated in Table XI.

There was to be found a great range of vessel size in Thin Orange from the urban center. Miniature jars (2.8 cm. high and 2.0 cm. exterior rim diameter) and basins/crater (68.7 cm. exterior rim diameter) appeared to cover the entire size range, and have been noted by Linné (1942:158; 1947: Figs. 40, 41). Vessel dimensions observed by Kidder (Kidder, Jennings and Shook 1946:193-196) and by Tolstoy (1958:19) fit within the Maquixco sample Thin Orange ware vessel ranges.

Bowl forms ranged in height from 4.0-12.5 cm.; cylindrical vases (excluding supports) 6.5-10.0 cm. in height; basins/craters ranged from 15.5-28.5 cm.; and jars and vases from 16.5-40.5 cm. Insufficient data is presently available on other vessel heights.

Hemispherical bowl forms had ring base diameters from 5.0-12.0 cm., averaging 8.5 cm. The annular support variety ranged from 5.0-16.0 cm., and averaged 9.5 cm. in basal diameter. Miniature hemispherical bowl forms were excluded from this sample.

6. Functions of the Containers: Thin Orange ware had a wide distribution in Central México, occurring as ofrendas in the sub-floor graves of residential units (as at Xolalpan and Tlamimilolpa), in tombs (as at Tehuacán), in ceremonial "caches" (as at Tlamimilolpa and in the Moon Pyramid Plaza at Teotihuacán), and as a specialized pottery -- perhaps "ceremonial" in nature at most sites of the Classic Period. The ware was apparently a product intended for specific usages, and the style of the ware was characterized by simplicity and restraint in spite of the wide variety of forms and decorations. Shapes were generally plain and aesthetically pleasing, especially in the bowl forms.

The modeled effigy forms, elaborately decorated tripod support cylindrical vases, cylindrical vase lids, goblets/cups/copas, and the more highly decorated bowl forms appeared always to be associated in special contexts such as interments and caches. These vessels may have been manufactured with the express purpose in mind of using them as mortuary goods. Those vessels found in grave lots appeared to either never have been used or showed little wear or abrasion on the interior surfaces or supports. The infrequency of Teotihuacán burials is an archaeological problem in itself, and in addition not many Classic Period burials apparently had Thin Orange ware vessels associated. Unfortunately this statement remains an impression and cannot be statistically supported.

Actually there were few elaborately decorated or unusual vessels when compared to the total sample. Nearly eighty per cent of the excavated Maquixco, Tlatenco, Tenango, and Venta de Carpio Thin Orange sherds were bowls forms, primarily of the hemispherical bowl variety. Incised and incised with punctation decorative types occurred most frequently and were aesthetically pleasing elaborations. Statistically, the typical Thin Orange ware vessel was the annular based hemispherical bowl with incised parallel lines and lazy "S", and dot punctation.

Distributional evidence indicated that Thin Orange bowl forms (particularly the hemispherical variety) were common in urban and rural Classic sites down to the smallest settlement level (hamlet). It may be Thin Orange vessels were associated with a religious practice or ceremonial rite de passage in Teotihuacano households. Ritual breaking of vessels should be considered as a possibility accounting for the lack of whole specimens in an above-the-floor context, when compared to the Monochrome Brown Ware and Monochrome Black Ware samples. Religious and/or ceremonial meals may have been served in these vessels to individual household members. Perhaps the ceramic was used to serve ritual meals or food to household guests -- a sort of "Sunday table-service". Nearly all the bowl forms showed extensive usage abrasions on the interior. Basins/craters and low and high necked jar forms may well have been storage and serving containers during the ceremonial or ritualistic feasting.

#### Summary

Thin Orange Ware has been identified as an important and diagnostic Mesoamerican ceramic of the Classic Period, and has a widespread distribution in Teotihuacán culture sites in the Mesoamerican Central and highlands of Guatemala.

The pottery was first noted in the literature by Peñafiel in 1890, but it was only during the past thirty-five years that the ware has received the attention it deserved from archaeologists and ceramic technologists. Conclusions reached by the earlier investigators have been cited, and the Thin Orange Ware samples obtained by the Teotihuacán Valley Project (The Pennsylvania State University) were considered. Excavated Thin Orange sherds from five Classic Teotihuacán sites, primarily Santa Maria Maquixco Bajo (TC-8), provided 2,890 sherds for analysis. Surface survey in 126 Classic sites provided an additional 1,480 sherds of the ware. The ceramic was studied with regard to ceramic typology, chronology, and ceramic technology.

An intensive analysis was made and considered physical properties (color, hardness, texture, temper and other aplastic inclusions, and "firing" variations) and cultural properties (methods of manufacture, surface treatment, surface finish and decorative techniques, forms of rims and vessel shapes, vessel sizes and thicknesses, and functions of the pottery containers).

Twenty-two distinct colors were discerned, but 99.46% of the sherds could be classified either as reddish yellow or yellowish red in terms of the Munsell color system (1954). These results correlated with those published by other investigators.

In terms of the criterion of hardness, measured on Mohs' Scale, nearly fifty per cent were classified as having a hardness of 5, while most of the remainder was classified at a value of 6. Degree of hardness was of limited value, was difficult to quantify properly, and had an unevenness of scale.

Over ninety per cent of the sample had a clay in the "silt" category (1/16 - 1/256 mm. range) of texture with the remainder in the mixed "silt" and "very fine" (1/8 - 1/16 mm. range). "Special" and "table" wares and unusual forms were self-slipped, but utilitarian forms (basins/craters and various jar forms) were unslipped. Any finely-washed clay was apparently used by the artisans.

A detailed examination of the temper and other aplastic inclusions produced interesting results. Linné (1934), Shepard (1946), and Sotomayor y Castillo Tejero (1963) have published data on non-plastics found in Thin Orange sherds. Their data generally conformed to aplastic type Alpha. Alpha sherds always contained (in descending order of occurrence): angular and subangular quartzite, angular calcite, talc, angular and rounded quartz, muscovite mica, and lumps and crystals of hematite. Occasional quantities of feldspar, hornblende, chlorite schists, and scoria or basalt particles were also present. Beta sherds generally contained the same minerals as the previous type, but in different concentrations (in descending order of occurrence): muscovite mica, angular and subangular quartzite, angular and subangular calcite, talc, angular and rounded quartz, and lumps and crystals of hematite. Occasional quantities of minor aplastics (the same as Alpha) were noted.

Since Beta aplastics primarily occur in jars and bowls/craters (e.g. utilitarian and serving vessels), the addition of quantities of micaceous schist may have served to make the raw clay less plastic and retain its shape better, since these containers were always large in size. This temper

served to strengthen the vessel during the manufacturing process because the clay coils and slabs would then be less plastic and the artisan could more easily build the desired shaped container. The larger vessels because of their size and construction required a different temper and perhaps a different (but not recognizable) clay.

An examination of indigenous Teotihuacán-made Classic sherds from urban and rural sites indicated an important difference in aplastics when compared to Thin Orange. These sherds had volcanic ash or volcanic sand and considerable quantities of quartz and epidote as nonplastics. This would suggest that Thin Orange Ware was made outside of the Teotihuacán area, and a study of the regional geology indicated ten areas (in southern Puebla, northern Guerrero, and northern Oaxaca) as possible centers of manufacture to Sotomayor y Castillo Tejero (1963). Anna O. Shepard, and A. V. Kidder wrote in 1946 that "we have as yet no direct evidence of the place of manufacture of Thin Orange ware" (Kidder, Jennings and Shook 1946:201). Linné (1934, 1942a, 1942b, 1947) believed it to be intrusive, based on temper analysis by Beskow and Zenzén.

Thin Orange sherds nearly always had an even and thorough oxidation, and few firing accidents (reduction, incipient vitrification, etc.) were found. Judging from the color of the finished product, it was impossible to discern the original color(s) of the natural clay before firing. An oxidation temperature of about 750-800°C was suggested as most desirable.

The pottery vessels were manufactured by techniques of segmental building, hand modeling, and with the use of a mobile base (slab, tournette or kabal). There was no evidence for the use of ceramic molds, and the potter's wheel was not introduced until the Colonial Period by the Spanish.

Non-utilitarian Thin Orange vessels were self-slipped, and many sherds illustrated evidence of at least slight burnishing. Other investigators have found similar evidence.

Eight decorative techniques, exclusive of plain (undecorated), were discerned: appliqué, channelling, grooving, incising, punctation, stamping, and "painting" and engraving. The latter two techniques were extremely rare. The remaining six techniques have been subdivided into thirty-nine varieties and associated with eight chronological phases (Table V). The most frequently encountered decorations were incising and incising with punctation. A few sherd disks of Thin Orange and three sherds used as scraping tools were found. Thirty-one annular base exteriors from hemispherical bowl forms were used as hematite pigment grinding palettes.

Eleven major vessel forms were recognized for Alpha Thin Orange, one for Alpha "Thick Thin Orange", and two for Beta "Coarse Thin Orange". Vessel forms and chronological phases were tabulated (Table VI). Vessel decoration, vessel form, and chronological phase have been correlated in Table VII. A total of 201 possible combinations of decorations, vessel forms and chronological phases were found thus far. Additional ones may be recognized after more intensive study. Nine different varieties of bowls could be discerned, with the annular base hemispherical bowl by far the most frequent. Effigy forms, miniature vessels, goblets/cups/copas, "tecomates", boxes and lids,



saucers/dishes/plates, and cylindrical vase lids were infrequent forms. Basins/craters, bowls, cylindrical vases, and various jar forms were frequent in most all Classic sites.

Ranges and averages of vessel exterior rim diameters and wall thicknesses have been tabulated in Table VIII. The rim diameters for vessels ranged from 2.0-68.7 cm. while thickness varied from 1.5-18.5 mm., depending upon the particular vessel form and location of measurement.

Elaborately decorated containers, effigy forms, and unusual forms (boxes, miniatures, etc.) occurred most often in interments or in sub-floor caches. A ritual/ceremonial connotation was suggested for the ware in general.

### Discussion

Thin Orange Ware has been examined by a number of previous investigators, but this paper presents much new data on this important and diagnostic Mesoamerican ceramic. This pottery was widely distributed in highland Mexican and Guatemalan archaeological sites of the Classic Period. The ware has been attributed to Teotihuacán society, a pan-Mesoamerican culture (Sanders and Price 1968:29-31), but some authorities do not believe it was made by the resident artisans at the urban center of Teotihuacán and constituted an import from pottery-making centers south of the Valley of México (Linné 1934:103, 213; 1942a:163-164; 1942b:181, 195; 1947:133-135; Armillas 1944b:9; Leonard 1956-1957; Armillas, quoted by Millon 1954:179; Tolstoy 1957:20; Sotomayor y Castillo Tejero, 1963:18-20). The new evidence reported in this paper appears to substantiate the conclusion that Thin Orange was imported into the Teotihuacán Valley. The entire argument rests upon the fact that geologically/petrographically the clay-aplastics from Thin Orange found at Teotihuacán do not match the aplastic constituents of wares which were apparently made locally at Teotihuacán (including Monochrome Black Ware, Monochrome Brown Ware, and Tan Monochrome Copoid Ware, to name only a few).

The Teotihuacán Mapping Project (University of Rochester) reputedly has located a "pottery-making area" in the vicinity of the Moon Pyramid (Sanders 1969: personal communication), and if so this would be the first confirmed pre-Hispanic ceramic workshop known for this Classic culture. Various modern pottery-making areas (San Sebastian, Santa María Coatlan, and San Francisco Mazapan) were ancient barrios of urban Teotihuacán, and may aboriginally also have been ceramic craft areas. Unfortunately no ethnographic study of these modern potters has ever been made, so little is actually known about the acquisition of raw materials (aplastics and raw clay) or manufacturing techniques. An ethnographic analysis of these craft producers would be invaluable for both archaeology and ethnography, since the production of pottery vessels is becoming a "dying art" and should be documented before the information is completely lost to anthropology.

An analysis of sherds from Teotihuacán, Zacatenco and Ticomán, all in the Basin of México, from the collections of the American Museum of Natural History by Shepard revealed that the local sherds did not have a similar

aplastic content in comparison to Thin Orange sherds from the Valley or elsewhere (Shepard 1946:201). All evidence would seem to point to a Thin Orange manufacturing center outside of the Basin of México.

Let us examine several possibilities: 1) the raw clay may have been local or itself imported to Teotihuacán where it was made into the various forms previously considered; 2) the aplastics (both Alpha and Beta) may have been local or themselves been imported to Teotihuacán; and 3) the pottery artisans may have been local Teotihuacanos, emigrants from "foreign" areas to Teotihuacán, Teotihuacanos who migrated to "foreign" areas, or "foreigners" who made the ware in their own locales. Classes of potters each producing different wares would be another possibility. With these in mind and considering the conclusions reached in technological-typological analyses by Shepard (1946), Sotomayor y Castillo Tejero (1963), and in this paper, several of these possibilities are eliminated.

Perhaps any finely-washed, strong, high-grade plastic clay (either domestic or foreign) could have been employed in making Thin Orange Ware, although clay that would make a ware as strong as Thin Orange must have had special properties (Shepard 1969: personal communication). The search for, and identification of the clay source(s) would be an important future research project. As Shepard noted: "Mrs. Leonard seemed to be on the right track" (1969: personal communication). However, the aplastic content (both Alpha and Beta types) strengthened the argument for importation of the pottery to Teotihuacán in spite of the quantities of sherds in urban and rural sites in the Teotihuacán Valley. Design motifs which appeared on Thin Orange vessels, and their method and technique of execution, supported the supposition that non-Teotihuacanos ("foreigners") made the ware, because these were infrequently duplicated on known indigenous Teotihuacán wares. When similar design motifs (such as the incised "cumulus" cloud, interlace lines, and multiple scallop) appeared on Thin Orange Ware and the Teotihuacán Monochrome Brown, Black or Tan Copoid Wares, the former seemed always to be earlier chronologically, suggesting that the local Teotihuacán Monochrome Ware producers duplicated these "new" designs on their own craft products. This generally occurred from Early Tlamimilolpa through Early Xolalpan phases. The hemispherical bowl form with ring or annular base had no antecedent at Teotihuacán, and also appeared to have been introduced. Only a few hemispherical bowl forms in local Monochrome Wares at Teotihuacán are presently known. A summary of Thin Orange Ware by chronological phase appears as Appendix II.

There appeared to be some contact between the two pottery-producing artisan groups. As Kidder has suggested, the makers of this [Thin Orange] ware were certainly in intimate touch with the potters of Teotihuacán" (Kidder, Jennings and Shook 1946:198). Linné, long an advocate of the importation theory, postulated two centers of manufacture-distribution (1942:176), an argument that Shepard has refuted by technological analyses (1946:198-201). Some archaeologists believe that Thin Orange was made at Teotihuacán because of the quantities of the ware found there but this argument may also be rendered invalid by technological studies. Shepard has pointed out that "if thin orange were being made by local [Teotihuacán] potters, one would expect that they would use schist temper for other pottery types also" (Shepard 1946:201). I have been unable to find any instances in the ethnographic literature concerning pottery-makers that stated that a particular aplastic was reserved for the manufacture of a single ceramic ware. Matson has also

never encountered this phenomenon during his ethnographic researches of Mediterranean and Near Eastern potters (1969: personal communication). Importing raw "foreign" clay into Teotihuacán for pottery-making would seem illogical considering the quantity of material involved, and the means of pre-Hispanic transportation improvement devices. Ethnographic parallels for this level of societal evolution carrying out such an activity are also infrequent.

Lacking ethnographic data on modern Teotihuacán potters, and without technological studies of other ceramics from the areas suggested as centers of Thin Orange manufacture (southern Puebla, northern Oaxaca, northern Guerrero), the following would appear to be feasible explanations of the occurrence of Thin Orange at Teotihuacán. A problem of chronological depth cannot be resolved, and undoubtedly there was change over time in terms of the attitudes and behavior of the ceramic artisans.

The first explanation is that during the Tzacualli-Miccaotli phases of Teotihuacán culture, non-Teotihuacano ("foreign") ceramicists residing at the developing urban center produced Thin Orange Ware using indigenous raw clays, imported aplastics, and methods of manufacture from their "home" areas. This would account for the introduction of new vessel forms (such as the hemispherical bowl), decorative techniques (self-slipping), and design motifs (incised "cumulus" cloud, etc.). These potters may have constituted an elite or special class (or perhaps caste?) of artisans separate from the Teotihuacano pottery-makers, and both groups produced their respective wares simultaneously. If Thin Orange were reserved for ceremonial, ritual and/or religious occasions, as has been suggested, these potters could have had a special status position above the local ceramicists. The locals copied the "new" design motifs infrequently on outflaring wall flat-bottomed bowls, since the designs were reserved for certain wares and/or artisans, and the motifs could have had a kind of prehistoric "copyright". Eventually local potters may have been integrated into the elite Thin Orange Ware producing group.

A second, distinct possibility would be that Thin Orange Ware was entirely a foreign ceramic produced in a southern area by artisans from that locale, who had little contact with Teotihuacán pottery-makers. These "foreign" potters utilized local clays, indigenous aplastics, and local manufacturing and decorative techniques. This could account for the introduction of the new vessel forms (particularly the hemispherical bowl with an annular base) and decorative motifs into Classic Teotihuacán culture. Teotihuacanos may have had no hand making Thin Orange, but could have constituted the merchant importers and consumers of this ware. Local Teotihuacán potters eventually adopted the design motifs of this popular import.

Thirdly, some Teotihuacán potters resided in the "foreign" area and produced Thin Orange Ware using local clays and aplastics. New vessel forms and decorative techniques may have been "copyrighted" by this class of potters, which would account for the infrequency of making the hemispherical bowl form and using the "new" design motifs at Teotihuacán itself.

As a last proposition, Teotihuacán potters could have made Thin Orange from local clays tempered with imported non-plastics. Vessel forms and decorative techniques could have been reserved for certain potters or were "copyrighted" by a particular group or class of ceramic artisans. The producers of Alpha and Beta Thin Orange may have been of different artisan classes. Different aplastics and possibly different clays may imply a different pottery-making group was involved in the manufacture of each of these subtypes.

Unfortunately these suppositions remain unsupported and unproven because of a lack of data on the ware. I would suggest that more ethnographic studies be carried out among indigenous Mexican potters, their techniques of production and particularly the ways of obtaining raw materials, and means of distributing the finished product. An additional avenue of investigation would be to examine quantities of Thin Orange and other local wares from the southern centers of manufacture proposed by some archaeologists. By intensive survey operations in southern Puebla, northern Oaxaca and northern Guerrero, conducted in the manner of the Teotihuacán Valley Project (Sanders 1965), we may learn more about the distribution of Thin Orange Ware and eventually more precisely locate its place of manufacture.

FIGURE I: THIN ORANGE DECORATIVE TYPES: LEGEND

- A Appliqued adorno (non-mold-made pictorial)
- B Appliqued sea shell or scallop
- C Appliqued adorno (mold-made pictorial)
- D Appliqued "coffee-bean"
- E Appliqued dot or button
- F Appliqued medial ridge
- G Channelled horizontal-diagonal
- H Grooved multiple scallop
- I Grooved parallel lines (banded)
- J Incised "cumulus" cloud
- K Incised interlaced lines
- L Incised lazy "S"
- M Incised lazy "S"
- N Incised linear "S"
- O Incised multiple bar
- P Incised multiple double-dash
- Q Incised multiple scallop
- R Incised stepped multiple "S"
- S Incised stepped multiple "S"
- T Incised zoned (panel abraded)
- U Punctated "comb" (descending sized dots)
- V Punctated conical (with parallel grooves)
- W Punctated dot (with lazy "S")
- X Punctated dot (with linear "S")
- Y Punctated dots in groups of "S's"
- Z Punctated dots in groups of "S's"
- AA Punctated oval (with parallel grooves)
- BB Punctated triangular or wedge (with grooves)
- CC Punctated tubular (reed/hollow bone)
- DD Stamped glyph or symbol

FIGURE 1 : THIN ORANGE DECORATIVE TYPES

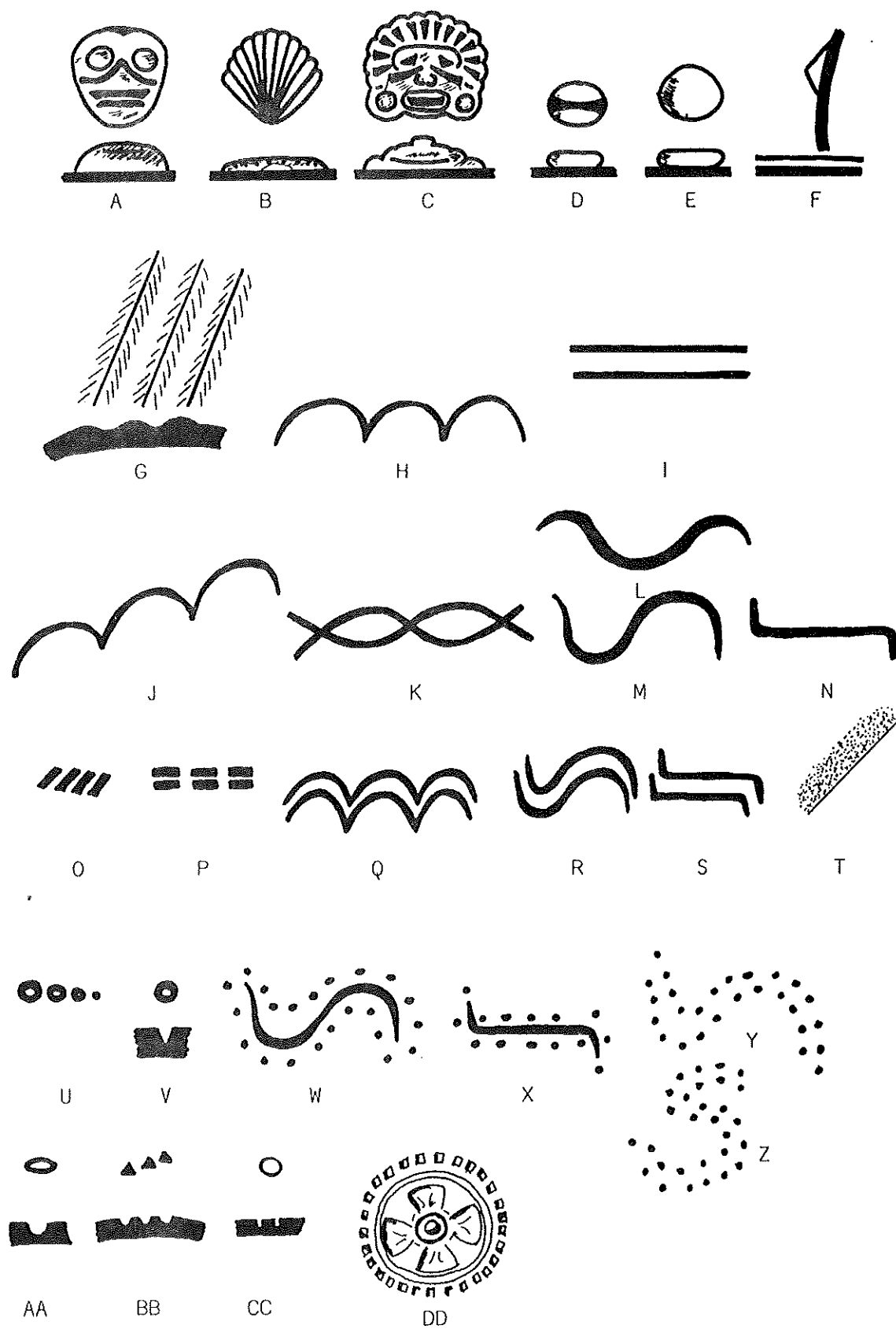


FIGURE II: THIN ORANGE VESSEL FORM PROFILES\*

- A Basin/Crater
- B Bowl, basal incurved simple bowl
- C Bowl, bevelled rim bowl
- D Bowl, everted rim bowl
- E Bowl, flat/square lipped bowl
- F Bowl, hemispherical with annular base bowl
- G Bowl, outcurved rim (palangana) bowl
- H Bowl, outflared rim bowl
- I Bowl, recurved rim (composite silhouette) bowl
- J Bowl, shouldered bowl
- K Box and Lid (rectangular, compartmented)
- L Cylindrical vase (tripod supports: solid unperforated)
- M Cylindrical vase (tripod supports: hollow perforated)
- N Cylindrical vase (tripod supports: solid talud and tablero)
- O Cylindrical vase (tripod supports: hollow perforated)
- P Cylindrical vase (tripod supports: solid unperforated)
- Q Cylindrical Vase Lid
- R Cylindrical Vase Lid
- S Goblet
- T Cup or Copa
- U Copa
- V Effigy Vase
- W Jar, low necked
- X Jar, low necked (large hollow nubbin supports)
- Y Jar, high necked
- Z Jar, high necked
- AA Saucer
- BB Dish/Plate
- CC "Tecomate"

\* Illustrative, no scale intended.

FIGURE 11 : THIN ORANGE VESSEL FORM PROFILES

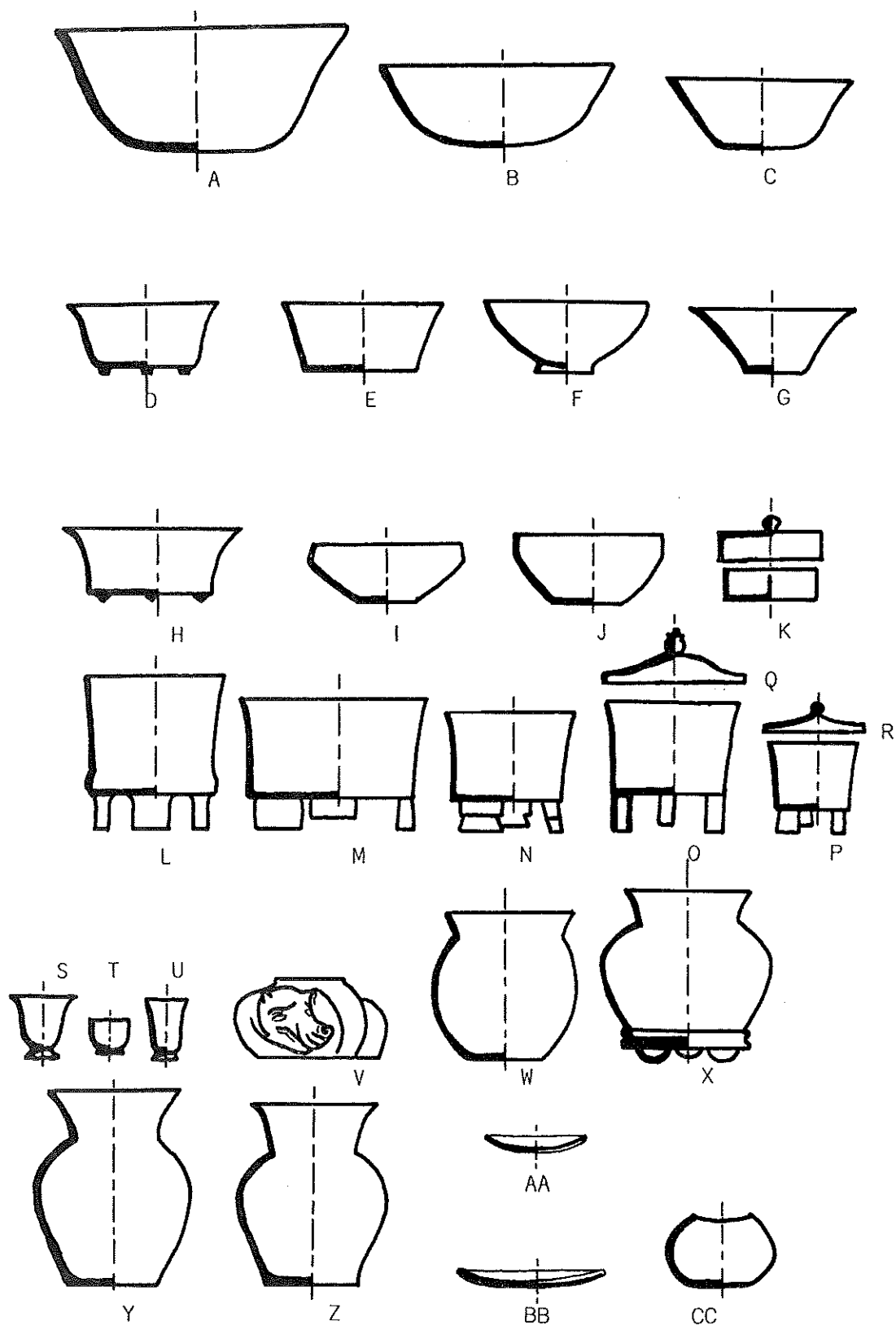
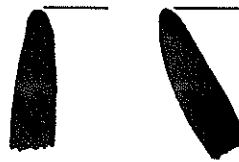




FIGURE III : THIN ORANGE RIM FORM PROFILES



Direct Rounded Lip Rims



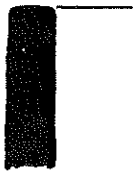
Direct Tapered Lip Rims



Slightly Everted Lip Rim



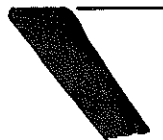
Moderate Everted Lip Rim



Square/Flat Lip Rim



Slightly Thickened Unbolstered Lip Rim



Bevelled Lip Rim

TABLE III

BASIN OF MÉXICO CHRONOLOGICAL SEQUENCE<sup>1</sup>

Teotihuacán Valley Sequence			Published Basin of México Sequence	
	Periods	Phases	Periods	Phases
AD				
1500	Aztec	Teacalco	Aztec	IV-Tlatelolco
1400		Chimalpa		III-Tenochtitlán
1300		Zocango		II-Tenayuca
				I-Culhuacán
1200	Toltec	Atlátongo	Toltec	Mazapan/Culhuacán
1100		Mazapan		Mazapan
1000				
900		Xometla		Coyotlatelco
800		Xometla-Oxtotipac		
700	Teotihuacán	Metepec	Teotihuacán	IV
600		Maquixco(L. Xolalpan)		III-B
500		Early Xolalpan		III-A
400		Late Tlamimilolpa		II-III
300		Early Tlamimilolpa		II-III
200		Miccaotli		II
100	Terminal	Apetlac (E. Miccaotli)		II
0	Formative	Teopán		
100		Oxtotla	Tzacualli	I
200	Late Formative	Tezoyuca-		
300		Patlachique	Ticomán	
400				Atoto-Cuautepec (A-C)
500		Cuanalán	.....	
600		.....		
700	Middle	Chiconautla	Zacatenco	Totolica-La Pastora (T-P)
800	Formative	.....		
900	Early	Altica		Iglesia-El Arbolillo (I-A)
1000	Formative	(probably at least two sub-phases)		
1100				
1200			Ixtapaluca	
1300				
BC				

<sup>1</sup> Sanders, William T.

1965 The Cultural Ecology of the Teotihuacán Valley: A Preliminary Report of the Results of the Teotihuacán Project. University Park: Department of Sociology and Anthropology, The Pennsylvania State University. (September). p. 16.

Based upon a seminar on the Basin of Mexico chronology whose members included staff from: Instituto Nacional de Antropología e Historia, Teotihuacán Mapping Project (The University of Rochester), and Teotihuacán Valley Project (The Pennsylvania State University).

Tolstoy, Paul and Louise I. Paradis

1970 Early and Middle Preclassic Culture in the Basin of Mexico. Science 167: 344-351. (23 January) Fig. 1, p. 348.

Revised and amended to February, 1973.

TABLE IV

## THIN ORANGE COLOR RANGES

<u>Color Names</u> (Munsell)	<u>Color Designation</u> (Munsell)	<u>Percentage*</u> (Excavated Sample)	<u>Occurrence</u>
Reddish yellow	5YR 6/6	12.22	light
Reddish yellow	5YR 6/8	31.45	moderate
Reddish yellow	5YR 7/6	13.14	light
Reddish yellow	5YR 7/8	26.67	moderate
Yellowish red	5YR 4/6	00.16	rare
Yellowish red	5YR 5/6	09.57	light
Yellowish red	5YR 5/8	06.25	light
Light reddish yellow	5YR 6/4	00.10	rare
Red/light red	2.5YR 5.5/6	00.07	rare
Yellow	2.5Y 7/6	00.06	rare
Yellow	5Y 7/6	00.06	rare
Yellow	10YR 7/6	00.06	rare
Yellow	10YR 7/8	00.05	rare
Pink	5YR 7/4	00.03	rare
Pink	7.5YR 7/4	00.04	rare
Pinkish gray	5YR 7/2	00.01	very rare
Light reddish brown	5YR 6/3	00.01	very rare
Olive/pale olive	5YR 5.5/3	00.00x	very rare
Green	10G 7/2	00.01	very rare
Green	10G 8.2	00.01	very rare
Gray	5Y 5/1	00.00x	very rare
Light gray	10YR 7/2	00.00x	very rare
"Unknown color"	-----	00.02	-----
		99.99	

\*N = 2,890 = 100.00%

x = sample less than 00.01%

TABLE V

## THIN ORANGE DECORATION

Decoration	Chronological Phases								Occurrences
	Late Tzac	Micc X	Early Tlam X	Late Tlam X	Early Xol X	Late Xol X	Met X	Ox X	
Plain: undecorated	X	X	X	X	X	X	X	X	8
Applied:									
adorno (non-mold made pict.) . . .			X	X					2
adorno (mold-made pictorial) . . .					X	X	X		3
"coffee-bean" . . . . .				X	X				2
dot or button . . . . .				X	X	X			3
effigy figure/pictorial . . . . .					X	X			2
molding (basal ridge only) . . . . .				X	X	X	X		4
molding (medial ridge only) . . . . .					X	X	X		3
molding (basal+medial ridges) . . . . .					X	X	X		3
"scale" or overlapped plates . . . . .			X						1
sea shell or scallop . . . . .			X	X					2
Channelled: horizontal . . . . .			X	X	X	X			4
vertical or fluted . . . . .				X	X	X			3
diagonal . . . . .				X					1
Grooved: <u>prefired or leather hard surface</u>									
multiple scallop . . . . .				X	X				2
parallel lines (banded) . . . . .			X	X	X	X			4
wavy lines (undulating) . . . . .			X		X				2
Incised: <u>prefired or leather hard surface</u>									
"cumulus" cloud . . . . .			X	X					2
interlaced lines . . . . .		X	X	X					3
lazy "S" . . . . .			X	X	X	X			4
linear "S" . . . . .				X	X				2
multiple bar . . . . .				X					1
multiple double-dash . . . . .				X					1
multiple scallop . . . . .			X	X	X				3
multiple slash . . . . .				X					1
parallel lines (horizontal) . . . . .		X	X	X	X	X			5
stepped multiple "S" . . . . .					X	X			2
wavy lines . . . . .		X	X	X	X	X			5
zoned (panel abraded) . . . . .				X					1
Punctated: <u>prefired or leather hard surface</u>									
"comb" (descending sized dots) . . . . .				X	X				2
conical (with parallel groove) . . . . .					X	X			2
dot (with parallel grooves) . . . . .				X	X	X			3
dot (continuous no grooves) . . . . .					X	X			2
dot (with lazy "S") . . . . .				X	X	X			3
dot (with linear "S") . . . . .				X	X	X			3
dots in groups of "S's" . . . . .						X	X		1
oval (with parallel grooves) . . . . .						X			2
triangular or wedge (w. grooves) . . . . .						X			1
tubular (reed/hollow bone) . . . . .						X			2
Stamped: <u>prefired surface</u> . . . . .								X	1
glyphs and symbols . . . . .									
Occurrences of decorations	1	4	13	26	28	22	6	1	= 101

TABLE VI

## THIN ORANGE VESSEL FORMS

THIN ORANGE VESSEL FORMS

Vessel Forms

X = Presence of form

Late Tzac

Micc

Early Tlam

Late Tlam

Early Xo1

Late Xo1

Met

Ox

Occurrences

Basin/Craters

Bowls: Basal incurved simple bowl

Bevelled rim bowl

Everted rim bowl

Flat/square lipped bowl

Hemispherical bowl

Outcurved rim (palangana) bowl

Outflared rim bowl

Recurved rim (comp. silh.) bowl

Shouldered bowl

Boxes and Lids (rectangular, compartmented)

Cylindrical Vases (Tripod Supports)

Cylindrical Vase Lids

Goblets/Cups/Copas (Pedestal Base)

Effigy Bowls or Vases, etc.

Jars: Low Necked

High Necked

Miniatures (Jars, Saucers, Bowls, etc.)

Saucers/Dishes/Plates

"Tecomates"

"Coarse Thin Orange": Cylindrical Vases

Jars, High Necked

"Thick Thin Orange": Jars (Form?)

Number of forms:

3

3

10

15

15

10

5

3

64

TABLE VIII

## THIN ORANGE VESSEL FORM FREQUENCY

<u>Vessel Form</u>	<u>Frequency of Form</u>	<u>Percent</u>
1. Basin/Crater	5	2.0
2. Bowl: basal inc.	7	2.8
3. bevelled rim	1	0.4
4. everted rim	4	1.6
5. flat/sq. lip	3	1.2
6. hemis. ring	17	6.7
7. hemis. annular	45	17.9
8. outcurved rim	5	2.0
9. outflared rim	23	9.1
10. recurved rim	5	2.0
11. shouldered	1	0.4
12. Box and Lid	3	1.2
13. Cylindrical Vase	54	21.4
14. Cylindrical Vase Lid	2	0.8
15. Goblet, Cup, Copa	3	1.2
16. Effigy Bowl/Vase	16	6.3
17. Jar: Low necked	27	10.7
18. High necked	13	5.2
19. Miniature: Bowl	3	1.2
20. Jar	3	1.2
21. Saucer	2	0.8
22. Saucer/Plate/Dish	2	0.8
23. "Tecomate"	2	0.8
24. C.T.O. Vase	3	1.2
25. C.T.O. Jar	2	0.8
26. T.T.O. Jar (?)	1	0.4
	<u>252</u>	<u>100.1</u>

TABLE VII EXPLANATORY NOTES

The information presented in Table VII correlates data on Thin Orange decorative types (numbered 00-81), vessel forms (numbered 1-26), and occurrence by chronological phase (numbered 1-8). The IBM Coding Designations are explained in Appendix I. Various statistical analyses were conducted with the aid of an IBM 360/67 computer (Fortran IV language) at The Pennsylvania State University.

An N-Digit Frequency Analysis (NDFA) produced the following results:

<u>Chronological Phase</u>	<u>Frequency in Phase</u>	<u>Percent</u>
1. Late Tzacualli	3	1.2
2. Miccaotli	6	2.4
3. Early Tlamimilolpa	38	15.1
4. Late Tlamimilolpa	67	26.1
5. Early Xolalpan	77	30.6
6. Late Xolalpan	41	16.3
7. Metepec	17	6.7
8. Oxtotipac	3	1.2
	<u>252</u>	<u>99.6</u>

TABLE VII

355

TABLE VII

Plain-undecorated	IM Code	Basin/Crater	Bowl, Basal Incurve simple	Bowl, bevelled Rim	Bowl, everted rim	Bowl, flat/square Lipped	Bowl, Hemispherical Ring Base	Bowl Hemispherical Annular Base	Bowl, Outcurved Rim	Bowl, outflared Rim	Bowl, reurved rim (cont. til 1)	Bowl shouldered	Box and lid	Cylindrical vase	Cylindrical vase lid	Goblet, cup, vase	Effigy bowl, vase jar	Jar, low necked	Jar, high necked	Miniature bowl	Miniature jar	Miniature saucer	Daucer/dish/plate	Tecomate	C.T.O Cylindrical vase	C.T.O jar high necked	T.T.O. jar
Adorno (M)	10																										
Coffee Bean	11							7																			
Dot/Buton	12							4																			
Effigy Fig.	13									4																	
Holding (B)	14							7																			
Holding (H)	15																										
Holding (B+H)	16																										
Scale	17																										
Shell/Scallop	18																										
Channel-Horizontal	19																										
Vertical	20																										
Diagonal	21																										
Grooved-W. Scallop	22																										
Parallel line	30																										
Wavy lines	31																										
Inclined-Cloud	32																										
Inter-lace	40																										
Lazy S	41																										
Linear S	42																										
Mult. Bar	43																										
Mult. E. Band	44																										
Mult. Scallop	45																										
Mult. Slash	46																										
Parallel line	47																										
Step Mult. S.	48																										
Wavy lines	49																										
Zoned	50																										
Punctate-Comb	51																										
Conical	60																										
Dot+Str.	61																										
Dot, Cont.	62																										
Dot, Lazy S	63																										
Dot, Linear S	64																										
Dot, Group	65																										
Dot, Group	66																										
Ovoid	67																										
Triangular	68																										
Tubular	69																										
Stamped, Glyph	80																										
Symbol	81																										



TABLE IX

## THIN ORANGE DECORATION FREQUENCY

Vessel Decoration		Frequency of Decoration	Percent
10.	Appliqued: adorno	5	2.7
11.	adorno (mm.)	9	4.8
12.	"coffee-bean"	4	2.1
13.	dot/button	5	2.7
14.	effigy fig.	6	3.2
15.	molding b.	5	2.7
16.	molding m.	3	1.6
17.	molding bim.	3	1.6
18.	scale	2	1.1
19.	shell/scallop	2	1.1
20.	Channelled: horizontal	8	4.3
21.	vertical	6	3.2
22.	diagonal	6	3.2
30.	Grooved: m. scallop	3	1.6
31.	parallel lines	12	6.4
32.	wavy lines	4	2.1
40.	Incised: "cumulus" cloud	4	2.1
41.	interlace	8	4.3
42.	lazy "S"	15	8.0
43.	linear "S"	6	3.2
44.	mult. bar	2	1.1
45.	mult. d. slash	1	0.5
46.	mult. scallop	3	1.6
47.	mult. slash	1	0.5
48.	parallel lines	10	5.3
49.	stepped mult. "S"	2	1.1
50.	wavy lines	12	6.4
51.	zoned	1	0.5
60.	Punctated: comb	6	3.2
61.	conical	6	3.2
62.	dot w. gr.	3	1.6
63.	dot cont.	2	1.1
64.	dot lazy "S"	3	1.6
65.	dot linear "S"	3	1.6
66.	dots group "S"	2	1.1
67.	ovoid	3	1.6
68.	triangular	3	1.6
69.	tubular	4	2.1
80.	Stamped: glyph	2	1.1
81.	symbol	3	1.6
		188	100.4
00 Plain: undecorated		64	

Plain frequency 25.4% in 252 = 64

Decorated frequency 74.6% in 252 = 188

Scattergram graphs of the variables of decorative type, vessel form, and chronological phase (time) were computed. The results were as follows for the sample of 252:

A) X = Decoration                      Mean X = 14.9                      CV of X = 82.7  
      Y = Vessel form                      Mean Y = 11.6                      CV of Y = 46.0

Correlation  $r = -0.11$

B) X = Time (phase)                      Mean X = 4.6                      CV of X = 28.0  
      Y = Decoration                      Mean Y = 14.9                      CV of Y = 82.7

Correlation  $r = 0.05$

C) X = Time (phase)                      Mean X = 4.6                      CV of X = 28.0  
      Y = Vessel form                      Mean Y = 11.6                      CV of Y = 46.0

Correlation  $r = 0.21$

In scattergrams A and B the  $r$  correlations were not statistically significant, with significance acceptable at the 0.05 level of probability. However in scattergram C (Time-Phase and Vessel Form) with 250 degrees of freedom, the  $r$  correlation was 0.21 and was statistically significant at the 0.01 level of probability. Scattergram C has been reproduced on the following page.

TABLE X  
THIN ORANGE PHASE AND VESSEL FORM SCATTERGRAM

X = Time (1-8) Mean X = 4.647 CV of X if 28.0  
Y = Form (1-26) Mean Y = 11.647 CV of Y if 46.0

Sample number = 252

Corr = 'R' = 0.20485

Reg = 'B' = 0.84256

Corr = 'R' = 0.181 (two variables over 200 sample)

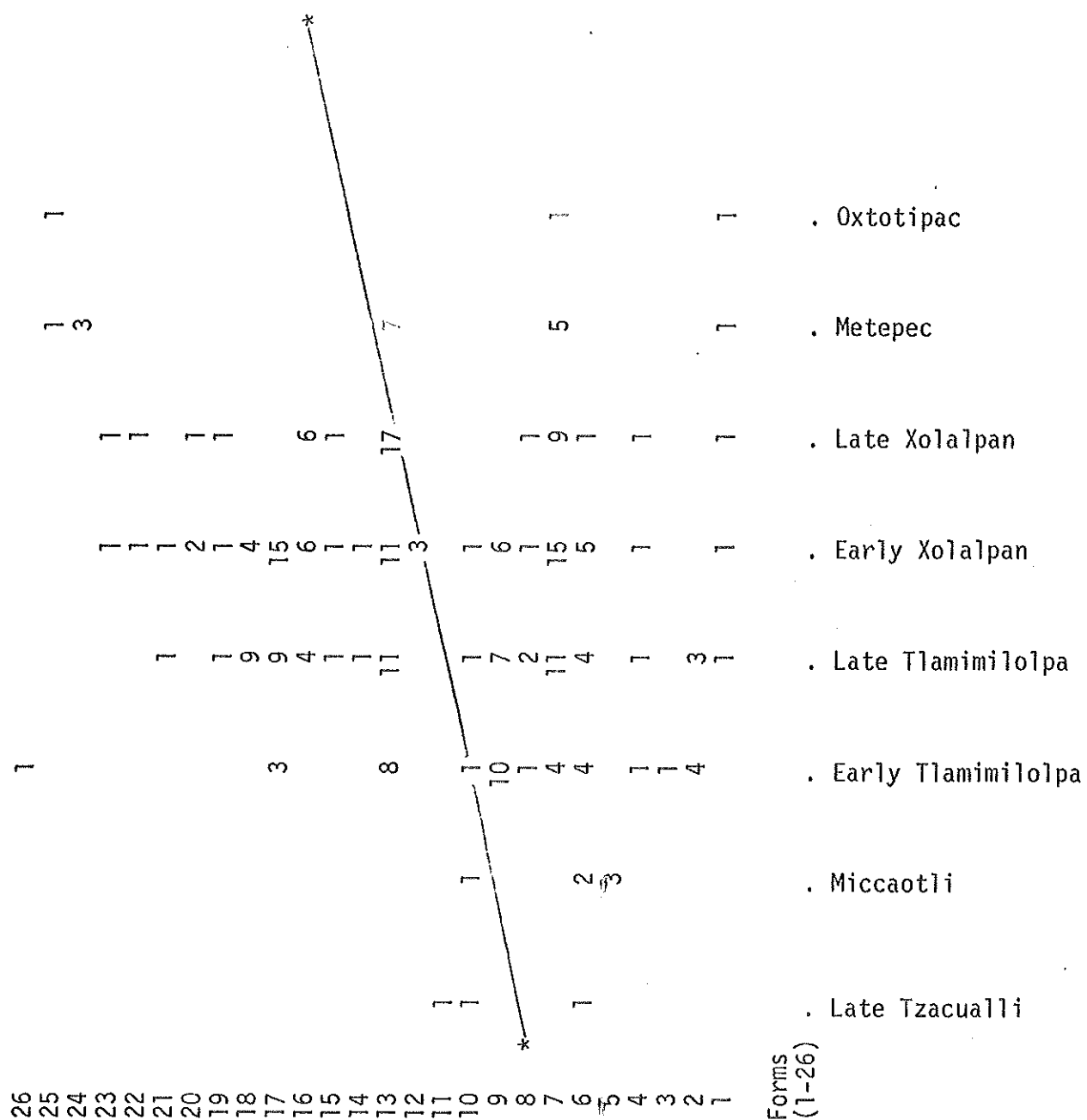


TABLE XI  
THIN ORANGE VESSEL SIZES AND WALL THICKNESSES

Form	Sample Size Example	Exterior Rim Diameter range (cm.) average (cm.)	Side Wall Thickness range (mm.) average (mm.)
Basins/Craters	50	22.0 - 35.5	6.0 - 8.5
Bowls: basal incurve simple	70	15.0 - 18.0	3.0 - 5.2
bevelled rim	25	13.0 - 24.5	2.5 - 5.0
everted rim	35	14.5 - 28.0	2.5 - 7.0
flat/square rim	20	16.5 - 25.0	2.2 - 6.0
hemispherical	850	3.5 - 62.5	1.5 - 5.5
outcurved rim	30	12.5 - 32.0	2.5 - 6.0
outflared rim	50	14.0 - 29.5	2.5 - 5.5
recurved rim	25	18.0 - 34.0	2.5 - 6.0
shouldered	20	12.5 - 18.5	3.5 - 6.5
Boxes and Lid	2	---	3.0 - 3.5
Cylindrical Vases	125	5.5 - 58.0	2.5 - 6.5
Cylindrical Vase Lids	5	15.5 - 17.2	3.0 - 7.5
Goblet/Cup/Copa	15	5.5 - 8.5	2.0 - 4.5
Jars: low necked	25	9.5 - 14.5	4.0 - 9.0
high necked	35	12.5 - 17.0	4.0 - 10.5
Miniatures	5	2.5 - 7.5	2.0 - 4.5
Saucers/Dishes/Plates	10	14.0 - 20.0	3.0 - 5.0
"Tecomates"	2	22.5 - 28.0	5.0 - 8.0
Coarse Thin Orange: cyl. vase	15	18.0 - 25.0	6.5 - 8.5
jar, high neck	15	12.0 - 28.0	7.5 - 8.5
Thick Thin Orange: jar (?)	10	10.5 - 24.0	10.0 - 18.5

## APPENDIX I

THIN ORANGE WARE  
IBM CODING DESIGNATIONS

## Column 1: Chronological Phase

<u>Designation</u>	<u>Definition</u>
1	Late Tzacualli
2	Miccaotli
3	Early Tlamimilolpa
4	Late Tlamimilolpa
5	Early Xolalpan
6	Late Xolalpan (Maquixco)
7	Metepec
8	Oxtotipac

## Columns 11-12: Vessel Form

<u>Designation</u>	<u>Definition</u>
01	Basin/Crater
02	Basal incurved simple bowl
03	Bevelled rim bowl
04	Everted rim bowl
05	Flat/square lipped bowl
06	Hemispherical bowl ring base
07	Hemispherical bowl annular base
08	Outcurved rim ( <u>palangana</u> ) bowl
09	Outflared rim bowl
10	Recurved rim (comp. silh.) bowl
11	Shouldered bowl
12	Box and Lid (rectangular, compartmented)
13	Cylindrical Vase (Tripod Supports)
14	Cylindrical Vase Lid
15	Goblet/Cup/Copa (Pedestal Base)
16	Effigy Bowl, Vase, Jar
17	Jars: Low Necked
18	Jars: High Necked
19	Miniature Bowl
20	Miniature Jar
21	Miniature Saucer
22	Saucer/Dish/Plate
23	"Tecomate"
24	Coarse Thin Orange: Cylindrical Vase
25	Jar, High Necked
26	Thick Thin Orange: Jar (Form?)

## Columns 21-23: Vessel Decoration

<u>Designation</u>	<u>Definition</u>
00	Plain: undecorated
10	Appliqued: adorno (non-mold made pict.)
11	adorno (mold-made pictorial)
12	"coffee-bean"
13	dot or button
14	effigy figure/pictorial
15	molding (basal ridge only)
16	molding (medial ridge only)
17	molding (basal + medial ridges)
18	"scale" or overlapped plates
19	sea shell or scallop
20	Channelled: horizontal
21	vertical or fluted
22	diagonal
30	Grooved: multiple scallop
31	parallel lines (banded)
32	wavy lines (undulating)
40	Incised: "cumulus" cloud
41	interlaced lines
42	lazy "S"
43	linear "S"
44	multiple bar
45	multiple double-dash
46	multiple scallop
47	multiple slash
48	parallel lines (horizontal)
49	stepped multiple "S"
50	wavy lines
51	zoned (panel abraded)
60	Punctated: "comb" (descending sized dots)
61	conical (with parallel groove)
62	dot (with parallel grooves)
63	dot (continuous no grooves)
64	dots in groups of "S's"
65	dot (with lazy "S")
66	dot (with linear "S")
67	oval (with parallel grooves)
68	triangular or wedge (w. grooves)
69	tubular (reed/hollow bone)
80	Stamped: glyphs
81	symbols

APPENDIX II

THIN ORANGE VESSELS BY CHRONOLOGICAL PHASE

Late Tzacualli

- hemispherical bowl with ring base (rare form)
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, ring base
- recurved rim bowl with flat base (rare form)
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none
- rim shouldered bowl (rare form)
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base(?)

Miccaotli

- flat-lipped bowl with ring base (rare form)
  - characteristic: sharp inner neck angle, form terminates with Miccaotli
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated; incised interlace (diagnostic trait), incised parallel lines (horizontal)
  - appendages: none, flat base
- hemispherical bowl with ring base (rare form)
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated; incised wavy lines
  - appendages: none, flat base
- recurved rim bowl with flat base (rare form)
  - finish: horizontal-burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base

Early Tlamimilolpa

- basal incurved simple bowl with flat base
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated; "cumulus" cloud incision, wavy line incision, incised multiple scallop (rare)
  - appendages: always three flush small nubbin supports
- beveled rim bowl with flat base
  - finish: horizontal burnish interior and exterior
  - decoration: plain, undecorated
  - appendages: none; flat base
- everted rim simple bowl with flat base
  - characteristic: variable neck angles and degree of eversion
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base
- hemispherical bowl with ring or annular base
  - characteristic: ring base most common, well-fired
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated, interlaced line incision, incised lazy "S", incised parallel lines (horizontal)
  - appendages: none, ring or annular base



## outcurved rim bowl (palangana)

characteristic: slight thickening of lip (marker)  
 finish: horizontal burnish on interior and exterior  
 decoration: plain, undecorated  
 appendages: none, flat base

## outflared rim simple bowl with flat base

characteristic: less than half have a basal incurve  
 finish: horizontal burnish interior and exterior  
 decoration: plain, undecorated; incised "cumulus" cloud,  
 incised wavy line, incised interlaced lines,  
 incised lazy "S", horizontal channelling, broad  
 horizontal grooved bands, non-mold-made applique,  
 appliques "scale" design or overlapping plates,  
 grooved wavy lines  
 appendages: none, flat base

## recurved rim bowl (composite silhouette) with flat base (rare form)

finish: horizontal burnish interior and exterior  
 decoration: plain, undecorated  
 appendages: none flat base

## cylindrical vase

finish: horizontal burnish on base and interior, vertical  
 polish on exterior walls  
 decoration: plain, undecorated, incised interlaced lines,  
 incised "cumulus" clouds, incised wavy lines,  
 incised lazy "S", broad horizontal yet grooved  
 bands, appliqued "scale" design or overlapping  
 plates, appliqued sea shell or scallop  
 appendages: three small flush nubbin supports, large  
 hollow semiglobular supports

## jar, low-necked

finish: horizontal and vertical burnish not always well-  
 executed on exterior, finger smoothed interior  
 decoration: grooved parallel lines (banded), grooved undulating  
 wavy lines; horizontal channelling (rare)  
 appendages: none, apparently flat base

## jar (?)

characteristic: 10-12 mm. thick walls (Thick Thin Orange)  
 finish: horizontal burnish not always well-executed on exterior,  
 finger-smoothed interior  
 decoration: plain, undecorated  
 appendages: none, apparently flat base

Late Tlamimilolpa

## basin/crater with flat base

finish: horizontal burnish on exterior and interior, some  
 vertical burnish on exterior, exterior base finger-  
 smoothed (unburnished)  
 decoration: plain, undecorated  
 appendages: none, flat base

## basal incurved simple bowl with flat base

finish: horizontal burnish on interior and exterior  
 decoration: plain, undecorated; wavy line incision, "cumulus"  
 cloud incision  
 appendages: three small nubbin supports or none

- everted rim simple bowl with flat base  
 finish: horizontal burnish on interior and exterior  
 decoration: plain, undecorated  
 appendages: none, flat base
- hemispherical bowl with ring base (rare) or annular base  
 finish: horizontal burnish on interior or exterior  
 decoration: plain, undecorated, "comb" punctation, incised lazy "S", incised interlaced lines (rare), incised multiple bar, incised double dash; appliqued coffee-bean adorno, incised parallel lines (horizontal), dot punctation (with parallel grooving), dot punctation with linear "S", dot punctation with lazy "S"  
 appendages: none, ring or annular base
- outcurved rim bowl (palangana)  
 characteristic: slight thickening of lip  
 finish: horizontal burnish on interior and exterior  
 decoration: plain, undecorated; incised wavy lines (rare)  
 appendages: none, flat base
- outflared rim simple bowl with flat base  
 finish: horizontal burnish on interior and exterior  
 decoration: plain, undecorated; incised wavy line, incised interlaced lines, incised lazy "S", broad horizontal grooved bands, appliqued dot or button, non-mold-made applique  
 appendages: none, flat base
- recurved rim bowl (composite silhouette) with flat base (rare form)  
 finish: horizontal burnish interior and exterior  
 decoration: plain, undecorated  
 appendages: none, flat base
- cylindrical vase with tripod rectangular supports  
 finish: vertical exterior burnish, horizontal or vertical interior burnish  
 decoration: plain, undecorated (rare); basal molding with or without additional decoration; other decorations appliqued hand-made adornos (many forms) at the base, appliqued hand-made effigy figures at the base, "comb" punctation (descending size dots), incised multiple bar, incised multiple scallop, multiple slash, incised zoned (panel abraded), appliqued sea shell or scallop  
 appendages: flat base with hollow perforated or unperforated rectangular tripod supports always
- cylindrical vase lid  
 characteristic: knobbed handle, narrow cover overhang, raised center  
 finish: burnished interior and exterior  
 decoration: appliqued hand-made adorno (many forms) on overhang and/or on top edge  
 appendages: knobbed handle

goblet/cup/copa with pedestal/annular base

characteristic: very thin-walled and always with a pedestal/  
annular base

finish: vertical (primarily) and horizontal burnishing in  
various combinations on interior and exterior

decoration: plain, undecorated

appendages: none, annular/pedestal base

effigy bowls and vases (rare)

characteristic: few examples mainly bowls or jar, lack  
elaboration of Xolalpan forms

finish: horizontal and vertical burnishing in various com-  
binations on exterior (primarily) and interior  
according to contours

decoration: appliqued non-mold-made adornos, appliqued dot  
or button, grooved parallel lines (banded), some  
parallel line incision

appendages: unknown

jar, low neck

characteristic: may be micaceous aplastic

finish: vertical burnish on exterior, finger-smoothed interior

decoration: appliqued coffee-bean adorno at base, appliqued dot  
or button (slightly indented) at base, occasional  
scalloped grooving at neck, dot punctuation in groups  
of "S's", incised lazy "S", incised linear "S",  
"comb" punctuation (descending sized dots); hori-  
zontal channelled, vertical channelled, diagonal  
channelled

appendages: three large solid or hollow nubbin supports (if  
hollow plain or grooved decoration) offset at edge  
of flat base

jar, high neck

characteristic: may be micaceous aplastic

finish: vertical burnish (but varies)

decoration: appliqued coffee-bean adorno at base, grooved  
multiple scallop (heavy lines), horizontal channelled,  
vertical channelled, diagonal channelled, incised  
linear "S", incised lazy "S", "comb" punctuation  
(descending sized dots)

appendages: three large hollow nubbin supports (plain or grooved  
decoration) offset at edge of flat base, annular  
base (rare)

miniatures (bowls and saucers--rare)

characteristic: small simple bowl and hemispherical bowl and  
dish/saucer forms

finish: vertical and horizontal burnish on interior and exterior

decoration: plain, undecorated

appendages: none

### Early Xolalpan

basin/crater with flat base

finish: horizontal burnish on interior and exterior,  
exterior base finger-smoothed (unburnished)

decoration: plain, undecorated

appendages: none, flat base

- everted rim simple bowl with flat base
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base
- hemispherical bowl with ring or annular base
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated; conical punctation, oval punctation, triangular or wedge punctation, "comb" punctation, incised lazy "S", incised linear "S", incised multiple scallop, incised parallel lines (horizontal), incised stepped multiple "S", incised wavy lines, grooved wavy lines, grooved multiple scallop, grooved parallel lines (banded); tubular punctation (rare)
  - appendages: none, ring or annular base
- outcurved rim bowl (palangana)
  - characteristic: slight thickening of lip
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base
- outflared rim simple bowl with flat base
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated; incised wavy line, incised lazy "S", incised linear "S", broad horizontal grooved bands, grooved wavy lines (rare)
  - appendages: none, flat base
- recurved rim bowl (composite silhouette) with flat base (rare form)
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base
- box and lid (cover) (rare form)
  - characteristic: rectangular to square box body compartmented with a partition wall
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated; incised wavy lines, applied mold-made adornos
  - appendages: four small flush nubbins, hollow knobbed handle (with rattlers) on lid
- cylindrical vase with variable tripod supports
  - characteristic: cylindrical form with thick base and wall thinning toward rim
  - finish: horizontal and vertical exterior burnish, horizontal or vertical interior burnish, all well-executed
  - decoration: plain, undecorated (rare); applied basal or medial molding, applied basal and medial molding; conical punctation (common), triangular punctation; applied mold-made adorno, applied mold-made effigy/pictorial (masks, etc.), applied "coffee-bean", applied dot or button, tubular punctation
  - appendages: flat base with hollow perforated or unperforated rectangular tripod supports, hollow grooved nubbins tripod supports

## cylindrical vase lid

characteristic: knobbed handle or effigy handle (eagle, etc.),  
wide cover overhang, raised center

finish: burnished interior and exterior

decoration: applique mold-made adornos (many forms) on overhang  
and/or on top of edge

appendages: knobbed or effigy handle

## goblet/cup/copa with annular base

characteristic: very thin walled and always with an annular base

finish: vertical (primarily) and horizontal burnishing in various  
combinations on interior and exterior, and exterior base,  
interior base finger-smoothed (unburnished)

decoration: plain, undecorated

appendages: none, annular base

## effigy bowls and vases

characteristic: anthropomorphic or zoomorphic vessels parts

elaborately mold-made, climax of effigy tradition

finish: horizontal and vertical burnishing in various combinations  
on exterior (primarily) and interior according to contours

decoration: applique mold-made adornos, applique effigy/pic-  
torials: various grooving, incising and channelling  
(vertical)

appendages: variable depending on vessel

## jar, low neck

characteristic: thin-walled

finish: vertical and horizontal burnish on exterior, finger-  
smoothed interior

decoration: plain, undecorated; horizontal or vertical or diagonal  
fluting (all rare); "comb" punctation, conical punc-  
tation, dot punctation, continuous dot punctation,  
dot punctation with incised lazy "S", dot punctation  
with incised linear "S", oval punctation; grooved  
parallel lines (banded), grooved wavy lines

appendages: none, flat base, never slab tripod supports, square  
base attached to globular body (one example)

## jar, high necked

characteristic: thin-walled, high neck and flaring rim

finish: vertical and horizontal (primarily) burnish on exterior  
and rim interior, finger-smoothed interior

decoration: plain, undecorated; horizontal or vertical or  
diagonal channelling

appendages: none, flat base

## miniatures (bowls, jars, saucers--rare)

characteristic: small simple bowl, small hemispherical bowl,  
small globular jar with erect neck/rim (grooved),  
dish/saucer form

finish: vertical and horizontal burnish on interior and exterior

decoration: plain, undecorated; vertical parallel grooving (jar)

appendages: none, flat base

- saucers/dishes/plates (rare form)
  - characteristic: "flat" vessels with low side wall and angle; few examples known
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base
- tecomate (neckless jar) (rare)
  - finish: horizontal burnish on exterior and at neck on interior; finger-smoothed base (unburnished)
  - decoration: plain, undecorated; none known
  - appendages: none, flat base or semi-flat base

### Late Xolalpan (Maquixco)

- basin/crater with flat base
  - finish: horizontal burnish on interior and exterior, exterior base finger-smoothed (unburnished)
  - decoration: plain, undecorated
  - appendages: none, flat base
- everted rim simple bowl with flat base
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base
- hemispherical bowl with ring or annular base
  - characteristic: most common form, may have micaceous aplastics
  - finish: horizontal burnish on interior and exterior, may have a metallic hue
  - decoration: plain, undecorated; perfect circle dot punctation (hemispherical in cross-section, incised lazy "S", incised parallel lines (bands) (rare), dot punctation in undulating lazy "S" group isolated series (marker), incised wavy lines (rare), incised stepped multiple "S", dot punctation with linear "S" (rare), tubular punctation
  - appendages: none, ring or annular base
- outcurved rim bowl (palangana) (rare)
  - characteristic: slight thickening of lip
  - finish: horizontal burnish on interior and exterior
  - decoration: plain, undecorated
  - appendages: none, flat base
- cylindrical vase with variable tripod supports
  - characteristic: cylindrical form with thicker base (rare) and wall thinning toward rim, may have micaceous aplastics
  - finish: vertical exterior burnish, horizontal or vertical interior burnish, all well-executed; may have a metallic hue
  - decoration: plain, undecorated; appliqued mold-made (and retouched) basal adornos; appliqued basal or medial ridge (rare), appliqued basal and medial ridge (rare), appliqued dot or button; incised lazy "S", incised parallel lines (horizontal), grooved parallel lines (banded); conical punctation (rare), dot punctation with parallel grooves (rare), dot punctation (continuous), dot punctation with lazy "S", oval

- punctuation, applied effigy/pictorial (masks, etc.)  
(very rare); tubular punctuation, triangular punctuation.
- appendages: flat base with hollow rectangular perforated or  
unperforated (plain) supports, the latter sometimes  
grooved or incised, hollow grooved nubbin supports
- goblet/cup/copa with annular base (exceedingly rare)  
characteristic: very thin walled and always with an annular base  
finish: vertical (primarily) and horizontal burnishing in various  
combinations on interior and exterior and exterior base,  
interior base finger-smoothed (unburnished)  
decoration: plain, undecorated  
appendages: none, annular base
- effigy bowls and vases (exceedingly rare)  
characteristic: anthropomorphic or zoomorphic vessels, parts  
elaborately mold-made, few fragmented examples,  
may have micaceous aplastics  
finish: horizontal and vertical burnishing in various combinations  
on exterior according to contours  
decoration: applied effigy/pictorials, applied ornaments (ex-  
ample, San Martin Orange cooking basins held in hands);  
horizontal and vertical and diagonal channelling,  
applied mold-made adornos, grooved parallel lines  
appendages: variable depending on vessel
- miniatures (bowls, jars--exceedingly rare)  
characteristic: small simple bowls and globular jars  
finish: little, if any, horizontal burnish on exterior (bowls and  
jars) and interior (bowls only), poorly executed  
decoration: plain, undecorated  
appendages: none, flat base
- saucers/dishes/plates (exceedingly rare)  
characteristic: "flat" vessels with low side wall and angle; few  
examples known  
finish: horizontal burnish on interior and exterior poorly executed  
decoration: plain, undecorated  
appendages: none, flat base
- tecomate (neckless jar) (exceedingly rare)  
finish: horizontal burnish on exterior and at neck on interior,  
finger-smoothed base (unburnished); or completely finger-  
smoothed  
decoration: plain, undecorated  
appendages: none, flat base or semi-flat base

### Meteppec

- basin/crater with flat base  
finish: horizontal burnish on exterior and interior carelessly  
executed, exterior base finger-smoothed (unburnished)  
decoration: plain, undecorated  
appendages: none, flat base
- hemispherical bowl with annular base (common)  
characteristic: roughened basal interior  
finish: horizontal burnish on interior and exterior

- decoration: plain, undecorated; stamped (poorly executed, but a marker) emphasizing glyphs and symbols; applied mold-made pictorials (rare)  
 appendages: none, annular base  
 cylindrical vase with tripod slab or tab supports  
 characteristic: micaceous schist aplastic (occasionally)  
 finish: vertical burnish on exterior and interior, exterior base finger-smoothed (unburnished)  
 decoration: plain or undecorated; stamped (poorly executed, but a marker) emphasizing glyphs and symbols; applied mold-made pictorials, applied basal or medial ridge (rare), applied medial and basal ridges (rare)  
 appendages: solid mold-made slab tripod supports or tripod tab supports  
 cylindrical vase (Coarse Thin Orange) up to 68 cm. diameter  
 characteristic: micaceous schist aplastic (normally)  
 finish: vertical burnish, carelessly executed rough exterior base  
 decoration: plain, undecorated; stamped ornaments, applied mold-made adornos  
 appendages: solid talud and tablero tripod supports (mold-made), hollow rectangular tripod supports (mold-made) with tab-like side projections  
 jar, flared rim (Coarse Thin Orange)  
 characteristic: common form representing 90% of the coarse ware, micaceous schist aplastic  
 finish: vertical burnish, carelessly executed, rough exterior base  
 decoration: plain, undecorated  
 appendages: no supports, strap handles, frequently encountered

### Oxtotipac

- basin/crater with flat base  
 characteristic: flat lipped  
 finish: vertical and horizontal burnish on interior and exterior, finger-smoothed base  
 decoration: plain, undecorated  
 appendages: none, flat base  
 hemispherical bowl with annular base (rare)  
 characteristic: micaceous aplastics  
 finish: horizontal polish on interior and exterior  
 decoration: plain, undecorated; possibly others not yet discerned  
 appendages: none, annular base  
 jar, high neck (Coarse Thin Orange)  
 characteristic: micaceous aplastics, difficult to distinguish from Metepec flared rim jar  
 finish: vertical burnish carelessly executed or horizontal and vertical burnish, rough exterior base  
 decoration: plain, undecorated  
 appendages: none, flat base



## APPENDIX III

## THIN ORANGE SHERDS SELECTED FOR THIN SECTIONING

<u>Number</u>	<u>Vessel Form</u>	<u>Part</u>	<u>Decoration</u>	<u>IBM Coding</u> <sup>1</sup>	<u>Maquixco Sherd Lot</u>
1	Hemishperical bowl	rim	punctation	108080100	3372
2	Cylindrical vase	body	plain	110080300	3529
3	Basin	rim	plain	113080900	3668
4	Hemispherical bowl	body	plain	110080300	3512
5	Globular jar	body	plain	101080300	3518
6	Hemispherical bowl	rim	plain	108080100	8772
7	Hemispherical bowl	rim	plain	108080100	8173
8	Hemispherical bowl	rim	plain	108080100	8812
9	Hemispherical bowl	rim	plain	108080100	8774
10	Hemispherical bowl	rim	plain	108080100	8700
11	Hemispherical bowl	rim	punct./incision	108080108	1719
12	Cylindrical vase	rim	incision	105080202	1707
13	Cylindrical vase	rim	plain	105080200	8569
14	Flaring wall bowl	rim	plain	105080200	8338
15	Hemispherical bowl	annular base	plain	110080100	1637
16	Hemispherical bowl	annular base	plain	110080100	7657
17	Hemispherical bowl	annular base	plain	110080100	8204
18	Hemispherical bowl	annular base	"hematite grinding"	110080100	1709
19	Hemispherical bowl	annular base	plain	110080100	8691
20	Hemispherical bowl	ring base	plain	110080100	1673
21	Tecomate	rim	plain	109081000	1806

## BIBLIOGRAPHY

- American Geological Institute  
 1960 Dictionary of Geological Terms. Garden City, N.Y.: Doubleday and Co. (second edition).
- Armillas, Pedro  
 1944a "Exploraciones recientes en Teotihuacán, México", Cuadernos Americanos, 1944: 4.  
 1944b El problema de la cerámica anaranjada delgada. México: Escuela Nacional de Antropología, Publicación No. 1.
- Balfet, Helene  
 1965 "Ethnographical Observations in North Africa and Archaeological Interpretation: The Pottery of the Maghreb", In Ceramics and Man (Frederick R. Matson, editor). Chicago: Aldine Press, 161-177.
- Bernal, Ignacio  
 1949 La cerámica de Monte Alban, III-A. México. Mimeographed.
- Carta Geologica  
 1960 Carta Geológica de la Republica Mexicana. México.
- Foster, George M  
 1967 "Contemporary Pottery and Basketry", In Handbook of Middle American Indians, Vol. VI. Austin: University of Texas Press, 103-124.
- Gamio, Manuel  
 1922 La población del valle de Teotihuacán, Tomo I. México: Secretaría de Agricultura y Fomento, Dirección de Antropología.
- Grove, David  
 1969 Personal communication.
- Instituto Nacional de Antropologia e Historia  
 1966ms Secuencia cerámica de Teotihuacán. México. Mimeographed.
- Kelley, Isabel T.  
 1947 Excavations at Apatzingan, Michoacan. Viking Fund Publications in Anthropology. No. 7. New York.
- Kidder, Alfred V., Jesse D. Jennings and Edwin M. Shook  
 1946 Excavations at Kaminaljuyu. Carnegie Institution of Washington, Publication 561. Washington.
- Kolb, Charles C.  
 1963ms Field Notes: Classic Teotihuacán Site Survey and Ceramic Seminar.  
 1964ms Ceramics from Teotihuacán, México. Notes of an informal seminar, June-July. Participants from the Instituto Nacional de Antropología e Historia (Proyecto Teotihuacán), The Pennsylvania State University (Teotihuacán Valley Project), and University of Rochester (Teotihuacán Mapping Project).

Kolb, Charles C. (continued)

- 1965 A Tentative Ceramics Classification for the Teotihuacán Valley (Patlachique through Aztec V Phases). University Park, Penna.: Department of Sociology and Anthropology, The Pennsylvania State University. Mimeographed.
- 1967 "Classic Teotihuacán Ceramics of the Teotihuacán Valley, México", Paper presented at the American Anthropological Association Annual Meeting, Washington, D.C.
- 1969 "Anaranjada delgada at Teotihuacán", Paper presented at the Society for American Archaeology Annual Meeting, Milwaukee, Wisconsin.
- 1970 "Methodological Problems of Latin American Ceramic Ecology", Paper presented at the XXXIX Congreso Internacional de Americanistas, Lima, Perú. In press, Actas y Memorias del XXXIX Congreso Internacional de Americanistas, Lima, Perú, 55 pp., 1972.
- nd "The Concept of Ceramic Ecology and the Study of Pottery Vessels and Figurines", Paper to be presented at the International Congress of Anthropological and Ethnological Sciences, Chicago, Illinois, 1973.

Larsen, Esper S. and Harry Berman

- 1934 The Microscopic Determination of the Nonopaque Minerals. Washington: United States Department of the Interior, Geological Survey Bulletin 848 (second edition, reprinted 1964).

Leonard, Carmen Cook de

- 1956- Algunos antecedentes de la ceramica tolteca. Sociedad Mexicana de Antropologia, 6ª Mesa Redonda.
- 1957 Revista Mexicana de Estudios Antropológicos, 14(2): 37-44.

Linné, Sigvald

- 1934 Archaeological Researches at Teotihuacán, México. Ethnological Museum of Sweden, New Series, Publication No. 1. Stockholm.
- 1942a Mexican Highland Cultures. Ethnological Museum of Sweden, New Series, Publication No. 7. Stockholm.
- 1942b "The Yellowish-red Pottery: A Problem of Mexican Trade Relations", Ethnos, 7(4): 156-165 (October-December).
- 1947 "Thin Orange Pottery of México-Guatemala", Ethnos, 12(4): 127-136. (October-December).

Longyear, John M. III

- 1940 "The Ethnological Significance of Copan Pottery", In The Maya and Their Neighbors. (Clarence L. Hay, et.al., editors). New York: D. Appleton Century. 268-271.

Matson, Frederick R.

- 1968 Ceramic Aspects: A Preliminary Report. (The National Geographic Society-Smithsonian Institution Reconnaissance Expedition to Afghanistan, Iran, and Turkey; August-September, 1968). University Park, Penna. Mimeographed.

- Millon, René F.  
1954 "Irrigation at Teotihuacán", American Antiquity, 20(2): 177-180.
- Müller, E. Florencia Jacobs  
1956- Atzacapotzalco: Estudio tipológico de su cerámica. Sociedad  
1957 Mexicana de Antropología, 6ª Mesa Redonda. Revista Mexicana  
de Estudios Antropológicos, 14(2): 25-32.
- Müller, Florencia J. et. al.  
1963 Mesa Redonda de la cerámica de Teotihuacán. Typed transcript  
of 13 sessions.
- Munsell Color Company, Inc.  
1954 Munsell Soil Color Charts. Baltimore: Munsell Color Co., Inc.  
(1954 edition).
- Noguera, Eduardo  
1940 "Excavations at Tehuacán", In The Maya and Their Neighbors.  
(Clarence L. Hay, et. al., editors) New York: D. Appleton  
Century. 306-319.  
1965 La cerámica arqueológica de Mesoamérica. México: Universidad  
Nacional Autónoma de México, Instituto de Investigaciones  
Históricas.
- Obermeyer, Gerald  
1962 A Stratigraphic Trench and Settlement Pattern Survey at  
Oxtotipac. University Park: The Pennsylvania State University.  
Unpublished M.A. thesis.
- Parsons, Jeffrey R.  
1966 The Aztec Ceramic Sequence in the Teotihuacán Valley, México.  
Ann Arbor: University of Michigan. Unpublished Ph.D. dis-  
sertation.
- Peñafiel, A.  
1890 Monumentos del Arte de México, Tomo 1. Berlin;
- Pough, Frederick H.  
1955 A Field Guide to Rocks and Minerals. Boston: Houghton  
Mifflin Co. (second edition).
- Reyes, Porfirio  
1966 Personal communication.
- Ridgway, R.  
1912 Color Standards and Color Nomenclature. Washington: The author.
- Sanders, William T.  
1965 The Cultural Ecology of the Teotihuacán Valley. University Park:  
Department of Sociology and Anthropology, The Pennsylvania State  
University.  
1968 Mesoamérica: The Evolution of a Civilization. New York:  
Random House, Studies in Anthropology AS9.

Sanders, William T. (continued)

1969 Personal Communication.

Sayre, Edward V., Alexander Murrenhoff and Charles F. Weick

1959 The Nondestructive Analysis of Ancient Potsherds Through Neutron Activation. Upton, N.Y.: Brookhaven National Laboratory.

Séjourné, Laurette

1956- Estudio del material arqueológico de Atetelco, Teotihuacán.

1957 Sociedad Mexicana de Antropología, 6ª Mesa Redonda. Revista Mexicana de Estudios Antropológicos, 14(2): 15-24.

1966 Arqueología de Teotihuacán: La Cerámica. México: Fondo de Cultura Económica.

Seler, Edward

1915 Die Teotihuacán-Kultur des Hochlands von Mexico. Gesammelte Abhandlungen zur Amerikanischen Sprachund Alterthumskunde. Bd. V, 405-585. Berlin.

Shepard, Anna O.

1946 "Technological Features of Thin Orange Ware", In Excavations at Kaminaljuyu (Kidder, Jennings and Shook, editors). Carnegie Institution of Washington, Publication 561, 198-201. Washington.

1948 Plumbate, a Mesoamerican Trade Ware. Carnegie Institution of Washington, Publication 573. Washington.

1963 Ceramics for the Archaeologist. Carnegie Institution of Washington, Publication 609. Washington.

1969 Personal communication. Letter of November 1, 1969.

Sinkankas, John

1966 Mineralogy: A First Course. Princeton: D. Van Nostrand Co., Inc.

Sotomayor, Alfredo y Noemi Castillo Tejero

1963 Estudio petrográfico de la cerámica "Anaranjado Delgado". México: Instituto Nacional de Antropología e Historia, Departamento de Prehistoria, 12.

Tolstoy, Paul

1958 Surface Survey of the Northern Valley of México: The Classic and Post-Classic Periods. Transactions of the American Philological Society, 48(5). Philadelphia.

Tozzer, Alfred M.

1921 Excavation of a Site at Santiago Ahuizotla, D.F., México. Bureau of American Ethnology Bulletin, No. 74. Washington.

Vaillant, George C.

1938 "A Correlation of Archaeological and Historical Sequences in the Valley of México", American Anthropologist, 40(6): 535-543.

Vaillant, George C. (continued)

1944 Aztecs of México. Garden City: Doubleday Doran.

Wentworth, C. K.

1933 "Fundamental Limites to the Sizes of Clastic Grains", Science,  
77: 633-634.

West, Robert C.

1964 "2. Surface Configuration and Associated Geology of Middle  
America", In Handbook of Middle American Indians Vol. I.  
Austin: University of Texas Press, 33-83.

Woodbury, Richard and Aubrey S. Trik

1953 The Ruins of Zaculeu, Guatemala. Richmond: United Fruit Co.

