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TITLE OF THESIS
Pottery Ethnoarchaeology Among the Tzeltal Maya

UNIVERSITY
Simon Fraser University

DEGREE
Ph.D.

YEAR
1983

NAME OF SUPERVISOR
Brian D. Hayden

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POTTERY ETHNOARCHAEOLOGY AMONG THE TZELTAL MAYA

by

Michael Deal

B.A., Dalhousie University, 1975

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

in the Department

of

Archaeology

Michael Deal 1983

SIMON FRASER UNIVERSITY
August 1983

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Pottery Ethnoarchaeology Among the Tzeltal Maya

Author:

Lawrence Michael Deal

(date)
Abstract

In the past decade Mesoamerican archaeologists have become more concerned with the excavation of residential units. They have come to realize that a better understanding is needed of the individual household, as the basic social and economic unit, before inferences can be made about larger, more abstract social groups (lineages, clans, etc.), and before a clear understanding of the economic basis of Maya civilization can be attained. The primary goal of this thesis is to provide Mesoamerican archaeologists, who are working at the household level of analysis, with descriptive models based on ethnographic data as aids for interpreting archaeological pottery assemblages. Specifically, these models are concerned with the production, use, reuse and disposal of pottery in modern Tzeltal Maya communities. Emphasis is placed on the archaeological implications of the major factors contributing to the pottery variability (e.g. vessel frequency and type diversity) and patterning (spatial distribution) associated with each of these models.

The ethnographic data being used in this study was collected among the Tzeltal Maya of the villages of Chanal and Aquacatenango, Chiapas, during two field seasons (summer 1977 and winter 1979) with the Coxoh Ethnoarchaeological Project.
Ethnographic data, collected in 103 Tzeltal households, included interview information, detailed maps of household compounds, material culture inventories, and photographs.

Some conclusions of relevance to archaeological interpretation include, (1) the possibility of recognizing archaeological potting households based on raw materials storage and the location of features and artifacts used in pottery production, as well as the distinctiveness of pottery making tools, (2) the indication that the frequency and diversity of pottery are more closely associated with household social status and social and ritual roles than with economic rank, craft specialization or family size, (3) the indication that economic factors are more likely to play a role when imported industrial vessels are considered as pottery equivalents, and (4) that the provisional storage of damaged and fragmentary pottery, which results in single vessels and vessel clusters being distributed in and around structures, may wrongly be interpreted as activity areas in archaeological housesites. These, among other considerations, are of considerable applicability in terms of the formulation of both archaeological and ethnoarchaeological research designs.
AdcnouLe&cfemeats

Any study of this size cannot be completed without the assistance and encouragement of many agencies and individuals. To begin with, the data used in this thesis was collected by members of the Coxoh Ethnoarchaeological Project. Besides the author, project members have included, director Brian Hayden, Mike Blake, Susan Blake, Russel Brulotte, Aubrey Cannon, Marqot Chapman, Jane Deal, Huquette Hayden, Gayel Horsfall, Paula Luciw, Roxane Shaughnessey, Geof Spurling, Joanna Spurling, Cathy Starr, Olivier De Montmollin, Ben Nelson, and Peggy Nelson.

The Coxoh Ethnoarchaeological Project received financial support from the Canadian Social Sciences and Humanities Research Council, the Canada Council, and the Brigham Young University, New World Archaeological Foundation. In addition, the author received funding for the writing of this thesis in the form of a Doctoral Fellowship from the Social Sciences and Humanities Research Council of Canada, and two scholarships from Simon Fraser University (namely, a Ph.D. Graduate Stipend and an Open Graduate Scholarship). I would like to express my sincere gratitude to the referees who supported my applications for this funding, including professors Roy Carlson, Knut Fladmark, Brian Hayden and Philip Hobler of this Department, and Eric Segelberg of the Department of Classics, Dalhousie University.

I wish to acknowledge the assistance of several Mexican
officials, who supplied the Coxoh project with letters of
introduction to Maya communities, including, Alfonso Villa Rojas
and Felix Baez-Jorge (Jefes, INI); Jamie Litvak-King and Carlos
Navarrete (UNAM); Francisco Polo Sifuentes and Luis Lujan Munoz
(Directors, INAH); Jose Castaneda M. (Director, INI); and Marta
Turok (INAH, San Cristobal de Las Casas). Further, I would like
to acknowledge the many administrative officials of Chanal and
Aquacatenango, who supported our work. These people included:
in Chanal, Manuel Ensin Gomez (Presidente Municipal), and Timoteo
Gomez (First Regidor); and in Aquacatenango, Francisco Vasquez
Hernandez (Agente Municipal), and Jose Perez Hernandez (First
Regidor).

An immense debt of gratitude is owed to those individuals
who worked as interpreters in these communities, including, in
Chanal, Gilberto Gomez Hernandez (Chavin), Juan Gomez Lopez
(Chavin); and in Aquacatenango, Jose Perez Hernandez (First
Regidor), Augustin Hernandez Espinosa (Comisariado Ejidal),
Carmen Hernandez Jiron (Policia), Juan Aguilar Hernandez, Aucensio
Juroz Aquilar (Second Juez), Francisco Vasquez Hernandez (Agente
Municipal), Feliz Juarez Perez (Suplente), and Civilio Hernandez
Vasquez (First Juez). Special thanks is also extended to those
many individuals who received us in their homes and tolerated our
unusual interests (such as where they threw their garbage and in
which bed they slept).

Thomas Lee Jr., John Clark, and Douglas Bryant of the New
World Archaeological Foundation were especially helpful, and
provided me with information on pottery production in Tonalá and Amatenango.

I am deeply grateful to the members of my committee, Nicholas, David, Brian Hayden, Philip Hobler, and Richard Boyer for their careful editing and insightful suggestions concerning my thesis. It was Brian Hayden who encouraged me to undertake this study and who continually restrained me from lapsing into ethnographic detail at the expense of archaeological interpretation. My debt to Brian can never be fully repaid.

I would also like to acknowledge the encouragement of several friends and fellow graduate students, with whom I have discussed, over the years, various topics addressed in this thesis. These people include, Mike Blake, Russel Brulotte, Aubrey Cannon, Chris Ellis, Vivian Gotthilf, Gayel Horsfall, Ben Nelson, Marc Stevenson, Bryan Snow, Geof Spurling and Milt Wright. In particular, Aubrey Cannon has repeatedly advised me on statistical matters and has always been willing to discuss "non-archaeological" topics on occasions when my enthusiasm and sanity were ebbing. Further, I would like to thank Doug, Lou, Fred, and Bill of the Instructional Media Department, Simon Fraser University, for their advice and assistance, and to Lou, in particular, for redrafting figures 17, 19, and 20.

Finally, words are not sufficient to express my appreciation for the patience, support, and critical editing of my wife, Jane. It is to Jane, and our children, Peter and Rachel, that this thesis is dedicated.
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The present study represents the final pottery report of the Tzeltal segment of the Coxoh Ethnoarchaeological Project. The Coxoh Project was instigated by Dr. Brian Hayden, of Simon Fraser University, and was supported by the Canada Council (SSHRC) and the New World Archaeological Foundation (Chiapas, Mexico). The project was designed to work in conjunction with an already existing program of the New World Archaeological Foundation, namely, the Coxoh Archaeological-Ethnohistorical Project. The latter research project focused on archaeological and historical research concerning an extinct Maya-speaking group (the Coxoh) who were inhabiting the Upper Grijalva River drainage basin in Chiapas at the time of the Spanish conquest (see Figure 1). The Spanish forced the Coxoh to congregate into seven small communities: Coneta, Coapa, Cuxu, Escuintenanho, Aquespala, Comitan and Zapaluta (Trinitaria). The latter two communities slowly changed from an Indian to a ladino population, while the other five were occupied by the Coxoh until the early 19th century (Lee 1979a). Two of these communities had been mapped and excavated (Coneta and Coapa) and exhibited almost ideal archaeological preservation. Analysis of these sites concentrated on the problems of Coxoh settlement patterning, material culture variability, diet, and the processes of
Figure 1: Map of Chiapas, Mexico, indicating major linguistic areas (including the extinct Coxoh) and major communities.

The Coxoh Ethnoarchaeological Project carried the Foundation's archaeological fieldwork into the ethnohistoric present and sought to establish material culture links between the extinct Coxoh and modern Maya groups bordering the Coxoh area (specifically the Tzeltal, Tojolabal and Chuj). More recently, a linguistic study by Lyle Campbell (1978) has concluded that the Coxoh were probably a Tzeltal-speaking group.

Between 1977 and 1979, members of the Coxoh Project conducted ethnoarchaeological fieldwork in over 150 households in six Maya communities. Extensive investigations involved two Tzeltal communities (Chanal and Aquacatenango) and one Chuj community (San Mateo Ixtatan). Also, two regional surveys, one in Chiapas (M. Blake and S. Blake 1978, S. Blake and M. Blake 1979; S. Blake 1979), and one in western Guatemala (Shaughnessy and Luciw n.d.), were conducted to access communities suitable for future study.

Information collected at each household concentrated on family social structure, settlement patterning, economic background, pottery (production, use and disposal) and the variation in household material culture. This information has been established as a data base for the interpretation of Coxoh Maya archaeological remains, using a "direct historic approach" (Baerreis 1961; Hayden 1978:181-182). This type of analogy

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assumes a direct historical continuity between the past and present and is "generally considered to provide the highest probability of being correct because the conditions of time, space, and cultural affinity of the groups who produced the two sets of compared data are most analogous" (Stiles 1977:95).

Technically, despite their close cultural affinity with the Coxoh, the Tzeltal group studied are not occupying the same territory as the extinct Coxoh, so that the use of our data for the interpretation of Coxoh remains may be more appropriately termed "synthetic cultural description" (Bæerreis 1961).

Despite the close association of our project with the Coxoh research program, our data is more widely applicable and is especially suited for future research in the Central Highlands area. There are indications that this area has been inhabited by Tzeltal-Tzotzil speaking peoples since Classic times (Campbell 1978; Culbert 1965:82). For this reason, the present study does not concentrate on problems of Coxoh archaeology, but rather presents general models of pottery production, use and discard, which should be of use over a much broader geographical segment of the Maya area.

In general, the work of the Coxoh Project is representative of the developing trend toward the use of ethnographic data for reconstructing Maya prehistoric socioeconomic conditions and cultural practices (e.g. Adams and Smith 1981; Arnold 1971, 1978a, 1978b; Becquelin 1973; Freidal 1981; Gifford 1978; Gotthilf 1982; Green 1972; Hayden 1979; Holland).

The present study takes advantage of an abundant source of published ethnographic literature concerning the Tzeltal and Tzotzil Maya. Of particular interest here is the comparative literature on pottery making within the Central Highlands, specifically those dealing with the major potting centres of Amatenango (Collier 1975; Culbert 1959, 1965; Heyman n.d.; Hunt 1962; J. Nash 1970; M. Nash 1959, 1961, 1966; Rey 1976), Chamula (Howry 1976, 1978; Pozas 1977; Russ 1969) and Yocnajab (Basauri 1931; Howry 1978). Ethnographic sources included an extensive geographical and economic census of the Central Highlands (including Chanal and Aquacatenango), conducted by the University of Chicago, Man-In-Nature Project (U.C. 1959). The standard
ethnohistoric source for this area is Calnek's 1962 thesis. Most of the archaeological literature on the area appears in the series "Papers of the New World Archaeological Foundation." The standard source of information on archaeological pottery of the Central Highlands is Culbert's 1965 study, while Lee's 1979 paper was consulted concerning Colonial Coixch pottery.

Both Chanal and Aguacatenango had totally Maya populations. Chanal consisted of approximately 4000 residents (560 households), while Aguacatenango consisted of approximately 2000 residents (280 households). The community of Chanal was situated on a mountain slope about 2250 meters above sea level, in an area characterized by pine forest and sinkhole drainage. While the soil within the community was suitable for large garden plots, much of the area around the community was infertile. Therefore, corn fields (milpas) were generally located eight kilometers or more from the community and men spent much of the week away from the community. An important distinction was made between those who farmed highland (jamalitic) and lowland (alantic) milpas, which varied according to soil, climate and length of growing season (see Calnek 1959:2). Formerly, these groups formed two loosely arranged neighbourhoods (barrios) which regulated their own land use and marriage agreements, and claimed equal representation in the community government (see Calnek 1959:6-7).

In 1977, five separate barrios existed in Chanal, including Bajo (Naranjal), Montaña (Tamchay), Centro, Palma Aquil, and Nuevo.
Barrio affiliation was mainly associated with barrio school administration and public work group organization, such as committees for cleaning up streets before important festivals.

By contrast, Aguacatenango was situated in the fertile bottomland of the Amatenango Valley, about 2000 meters above sea level. While Chanal could only be accessed by a two hour ride over a rugged road, Aguacatenango could be reached via a paved highway and was less than one hour's drive from the markets of San Cristobal de las Casas, Comitan, and Pinola (Villa Las Rojas). While farming was still the basic subsistence activity, easy access to the local Ladino markets had encouraged craft specialization in carpentry and blouse making. Truck farming had also been introduced.

Both communities relied on corn, bean, and squash agriculture. Chanal garden plots and orchards also produced potatoes, chiles, cabbage, avocados, peaches, and apples (also see U.C. 1959:figure 9). Aguacatenango farmers cultivated avocados, custard apples (Anona), quayabas, chayotes, peaches, apples, and oranges. Both communities also raised chickens, pigs, and horses. Some Chanal farmers also raised sheep and goats, and several Chanal women made woolen blankets. Aguacatenango women organized fishing expeditions to the shallow lake between the community and the highway.

The household is the basic organizational unit in both communities. Most households consisted of a nuclear family or a
small extended family, and the average family size for both communities was seven. Polygyny was common in Chanal (also see Calnek 1959:13; Redfield and Villa Rojas 1939:115). The household head was generally the eldest male and interhousehold affiliation was based on his ancestry. Men of the same Tzeltal surname (i.e. denoting common ancestry) formed lineages, and one man would act as lineage head. He might be responsible for organizing cooperative work groups among lineage members and hosting lineage ritual gatherings. In Chanal, separate lineages were also grouped according to Spanish surnames into "clans." However, clan organization seemed to be non-existent in 1977.

Household units in Aguacatenango averaged just over 1000 square meters in area, while Chanal households averaged more than 3000 square meters in area. In both communities, household features might include a house structure, house altar, kitchen structure, storage structure, corn bin, sweatbath, garden, terraces, orchard, well, patio work area, and animal pens. The use of storage pits and refuse areas were of special interest (see Hayden and Cannon 1983). The basic household consisted of a house, kitchen, and sweatbath arranged around a patio work area. In Chanal, the remainder of the compound would be cultivated with corn, except for animal pens and pathways. Garden plots in Aguacatenango were generally small mixed vegetable and flower patches. Most Chanal houses were built from hand hewn or sawn planks with wooden shingle roofing, while Aguacatenango houses were generally built from wattle and daub with thatched roofing (see Blake and Blake 1979). Wealthier households might have metal or ceramic tile roofing, and generally
had more structures. High wooden fences were used to separate individual household compounds. Separate kitchens were usually less elaborate than houses. Both sweatbaths and corn bins were more common in Chanal.

Civil and ritual authority in Chanal was vested in a dual civil-religious hierarchy. Each hierarchy consisted of a "ladder" of public offices (cargos) and were generally mutually exclusive. The civil hierarchy was mainly responsible for the administration of community affairs, including police protection and the settling of local disputes. Varying versions were given of the actual structure of the hierarchy, but at least eight levels could be identified, as follows: (1) Presidente Municipal, (2) Sindico, (3) Juez Grande; Agente Municipal; Regidor Primero, (4) Presidente de Mejores Materiales, (5) Delegado Juez Chico; Comandante, (6) Comisiendo Ejidal/Vigilancia, (7) Presidente de Comite de Escuela; Regidor Chica, (8) Jefe de Militidor; Presidente de 16 de Sept.; Policia; Comite de Escuela. The religious hierarchy was responsible for keeping the Catholic saints, administration of the church and for the perpetuation of important public religious festivals. By contrast, the traditional religion was more closely tied to private rituals conducted at household altars, especially in relation to agricultural rites (Deal 1980). (Throughout the text, the term "ritual" is used to denote pottery used in either public or private religious contexts). The religious hierarchy basically consisted of the following seven cargo levels: (1) Presidente de Iglesia, (2) Gobernador, (3) Alferez Primero, (4) Regromal, (5) Alferez Secundo, (6) Mayor, and (7) Mayordomo (Junta de Iglesia)
The office of Alferez Primero, which was a prerequisite to the higher religious posts, involved a considerable outlay of money to provide food and drink, and equipment for certain festivals. Two Alferces were appointed for the festivals of Candelaria, San Pedro, Maria Obsilicadora, Corazon de Jesus, San Juan, San Antonio, and Guadelupe. Relatively wealthy household heads were prime candidates for such posts. Suitable candidates for cargo positions were appointed by previous officials with the approval of a group of elders (Principales). The latter group was a committee of former high civil and religious officials. In fact, the Principales have held the real authority in the community for some time (see Calnek 1959).

In Aguacatenango, the cargo system existed in a less elaborate form, with the civil hierarchy dominating. The civil offices included six levels: (1) Juez Primero, (2) Juez Secundo, (3) Agente, (4) Suplente, (5) Comiseriado Ejidal, Regidor Primero, Sindico, and (6) Policia. The religious offices consisted of one Principale and his assistants (Mayordomos). Unlike Chanal, many wealthier men opted not to participate in public office, and therefore household wealth differences tended to be more pronounced.

Of the two communities, Chanal must be considered the most traditional for a number of reasons. These include (1) the high degree of (Tzeltal) monolingualism, (2) the retention of Maya month names in relation to agricultural practices, (3) the retention of traditional dress by the women, and (4) the use of offertory pits in the construction of houses and municipal buildings. The relative
strength of the Chanal cargo system might also be a remnant of the traditional political structure of the Central Highlands. The apparent decline in traditional values in Aguacatenango might be directly linked to that community's recent involvement in the Ladino economy and a concomitant adoption of more Ladino values.
Chapter One

Introduction

"...a paraphrase from the canons of curbstone philosophy---the methods of studying pottery get better all the time, but the pottery stays about the same." (Burgh 1959:40)

In recent years archaeologists have begun to experiment widely with their pottery data from archaeological sites in order to derive explanations of behavioral traits and social organization reflected in the pottery remains of past cultural systems. For example, archaeological pottery data has been used (1) for demographic studies (e.g. Cook 1972; Kohler 1978; Turner and Lofgren 1965), (2) for measuring cultural uniformity (e.g. Bronitsky 1978), (3) for analyzing disposal behavior through time (e.g. Kobayashi 1974) (4) for interpreting intersite variability (e.g. Baumhoff and Heizer 1959), (5) for identifying elite households (e.g. Michels 1979), (6) for identifying craft specialization (e.g. Becker 1973; Kent 1981; Kroster 1974:139-140; Rice 1981), (7) for investigating social and political organization and interaction (e.g. Deetz 1968; Dickens and Chapman 1978; Hill 1970; Leone 1958; Longacre 1964; Plog 1976, 1978, 1980a, 1980b; Pyne 1976; Upham et al. 1981; Watson

A second approach, and the one utilized in this study, concerns the use of ethnographic pottery data for the interpretation of archaeological pottery assemblages. Variability and spatial distribution of pottery in modern Tzeltal households are dealt with by means of three descriptive models concerned with pottery production, use and reuse, and disposal. Special attention is given to the use of ethnographic pottery data to determine to what degree pottery inventories yield information on the socioeconomic and demographic characteristics of households, such as relative wealth, status, group size, occupation and kin makeup.

A number of pottery-related ethnographic studies focusing on archaeological problems have been published during the last two decades. Many of these have been conducted under the rubric of "ethnoarchaeology" and have concentrated on the manufacture, use and life expectancy of pottery vessels (e.g. Arnold 1971, 1980; Balfet 1965; Birmingham 1976; Culbert 1965:43-47; Daltabuit and Alvarez 1977; David 1972; David and Hennis 1972; Deboer 1974, 1982; Deboer and Lathrap 1979; Fontana et al. 1962; Foster 1960; Friedrich 1970; Hayden 1979; Longacre 1974, 1981; B. Nelson 1981; Pastron 1974; Reina and Hill 1978; Stanislawski 1969a, 1969b, 1979; R. Thompson 1958; Tschopik 1950; Weigand 1969).
Just as most recent ethnoarchaeological research has been of an exploratory nature, so too, the present study must be viewed as an exploratory treatment of ethnographic pottery data. The former includes a number of edited volumes (e.g. Donnon and Clewlow 1974; Gould 1978a; Hinton 1973; Hodder et al. 1981; Kramer 1979), as well as regional studies (e.g. Binford 1978; Gould 1980; Kramer 1982; Watson 1979; Yellen 1977). The history and scope of ethnoarchaeology have been discussed at length in the literature (e.g. Gould 1977, 1978b, 1980; Gould and Watson 1982; Hayden 1978; Hodder 1981; Salmon 1982; Schiffer 1978; Stanislawski 1976; Stiles 1977; Thomas 1979:398-410; Watson 1973, 1979; Wylie 1982), and will not be reviewed in the present study. Instead, the following discussion elaborates upon the goals, theoretical orientation and methodology of this study as an example of the current state of pottery-related ethnoarchaeological research.

**Thesis goals**

(i) Goals and models

From the inception of the Coxoh Ethnoarchaeological Project, a basic goal has been to provide a body of ethnographic data that is more extensive, of better quality, and more relevant to making archaeological inferences than is presently available for Mesoamerican archaeologists. In terms of pottery, there has been
relatively good information available concerning pottery production in Maya villages specializing in potting, but little or no information on non-specialist pottery production. Nor is there much information concerning the variability of pottery use from household to household, the secondary use (reuse) of pottery, or pottery discard behavior. The latter two types of behavior are particularly important for understanding the processes responsible for the formation of archaeological pottery assemblages at the household level.

The goal of the present study is to identify and evaluate the factors which contribute to patterning and variability in household pottery assemblages. This topic has wide-ranging implications for many pottery-related archaeological studies. For example, at the most basic level, an agriculturally-based subsistence economy requires special tools and facilities for food processing, consumption (both domestic and ritual), and storage. Pottery satisfies many of these needs, therefore pottery variability and patterning are of interest to those researching the technological needs of agricultural peoples (such as "agro-ceramic" studies: Lowe 1971) and the role of technology in cultural-environmental adaptation. The latter can be viewed as one of the most important goals of archaeological research.

At the household level of analysis, individual household pottery requirements can be thought of as varying according to socioeconomic conditions within the household. Therefore, pottery variability and patterning should reflect these
conditions. The recognition of household socioeconomic conditions is, of course, important for anyone studying intra-community socioeconomic or political organization. The distribution of fine quality, decorated pottery versus plainware pottery has often used by archaeologists as archaeological indicators of relative household wealth or economic status, and in reconstructing community organization (e.g. Michels 1979), however, no one has ever tested the strength of such associations.

Another source of pottery variability and spatial patterning is the intensity of pottery production itself. The intensity of production can strongly affect the frequency, diversity, and spatial arrangements of pottery within potting households. Such information can be important to the study of the development of craft specialization at both household and community levels.

Functional variation between formal pottery types, and the spatial distributions of pottery-related activities and features contribute further variability and patterning at the household level. Knowledge of how this variability and patterning is created in an ethnographic context (in terms of household functional requirements, potting activities, use and reuse strategies, etc.) is important for making inferences of pottery-related behavior and vessel function represented in archaeological assemblages.

Additional variability and patterning result from disposal and abandonment behavior prior to archaeological recovery.
therefore these factors are also of interest to those investigating household pottery assemblages.

The present study is framed around three descriptive models (outlining pottery production, use and reuse, and disposal). As used here, a model "seeks to represent or describe, in a more simplified form, a set of observed phenomena from the real world" (Stiles 1977:95). A discussion concerning each model explores the variation in behavior associated with these activities and facilitates predictions concerning the nature of the relationships between these activities and their archaeological representations (that is, pottery assemblages). Various statistical analyses are used to identify configurations of household pottery inventories which are related to different social and economic activities, and social contexts (such as family size, wealth, status, etc.).

The final two chapters of the thesis concentrate on: alternative methods of treating archaeological pottery remains in order to recover socioeconomic information; summaries of the archaeological implications of the models discussed; and implications of this study for future ethnoarchaeological and archaeological research in the Tzeltal Maya area.

(ii) The household level of analysis

It has long been recognized that a better understanding of individual households is necessary before reliable inferences can
be made about larger, more abstract social units (clans, lineages, etc.) and before a clearer understanding of the economic basis of Maya civilization can be attained (e.g. Kidder 1934:93, 100-101; Ricketson and Ricketson 1937; A. L. Smith 1929; Taylor 1948; Vauchope 1934, 1938, 1940). However, few attempts at the rigorous survey and excavation of residential (domestic) units were undertaken until the 1950s when work began at Mayapan (Pollock et al. 1962) and when settlement pattern studies began in areas such as the Belize Valley (Willey et al. 1965). In the past decade, Mesoamerican archaeologists have become increasingly concerned with the excavation of residential units (e.g. Ashmore 1981; Fauvet 1973; Flannery 1976; Hill 1982; I.C.A. 1979; Kirby and Kirby 1976; Lind 1979; Michels 1979; Puleston 1974; Sheets 1979; Wilk and Rathje 1982). The present study is timely, owing to this current importance of intensive excavation of domestic units to the research objectives of Mesoamericanists.

The Tzeltal are one of nine Maya-speaking groups in the Mexican State of Chiapas. During 1977 and 1979, members of the Cozoh Ethnoarchaeological Project surveyed 103 households in two of the more traditional Tzeltal communities in the southern Chiapas Highlands, namely, Chanal and Aquacatenango. Both communities have totally native populations, and consist of approximately 560 and 280 households respectively. Each household represents an economically independent domestic unit generally comprised of one or more nuclear families. The
household is also the spatial focus of the socialization of Tzeltal children, most socioeconomic activities, and the deposition of most refuse. Chanal compounds averaged 3360 square meters (s.d. = 2150) in area, while Aquacatenango compounds averaged 1124 square meters (s.d. = 949) in area. Most household compounds are completely enclosed by high wooden fences. Within each compound are one or more clusters of wooden and/or waddle-and-daub structures around a cleared patio area, as well as a garden plot and perhaps an orchard. Basic structural units of the household include a house, kitchen, and sweatbath.

Theoretical orientation

The present study began with a basic tenent of the cultural materialist paradigm: that techno-economic and demographic factors constitute the major determinants of sociocultural (and artifactual) variability and patterning (Harris 1979; Schiffer 1983a). Culture is viewed here in Binfordian terms, as systemic, dynamic, adaptive, and participatory (Binford 1962, 1964, 1965). Artifact variability and patterning are believed to result from behavioral, operational processes, especially in terms of production, use, reuse and deposition.

This general conceptual framework can be readily applied to the variability created by the need to produce pottery. Pottery production creates pottery variability through the diversity of
its products (variations in vessel form, paste, etc.) and creates patterning through the byproducts of production activities (such as the residues of forming and firing practices), the storage of drying or finished products and specialized pottery types and potting tools.

The finished products generally function within the technological or sociological subsystems and are constrained by them. For example, an incense burner functions in ritual contexts, while water-carrying jars function within a technological (resource-exploiting) context. Pottery variability, in terms of vessel frequency and type diversity, are conditioned by household use and reuse requirements, which are based on household socioeconomic conditions. The spatial patterning of pottery is directly affected by the association of different use and reuse, and storage activities within and around structures and other features (sweatbaths, patios, etc.).

Vessel degradation also affects vessel frequency and type diversity in terms of rates of breakage and replacement. These factors are also constrained by economic and practical considerations. In addition, disposal and abandonment behavior further alter the variability and patterning of pottery on a site prior to entering the archaeological record.

Thus, monitoring of changes in pottery variability and patterning from production to disposal within the ongoing cultural system is seen as a pre-condition to understanding and interpreting the "static" context of the archaeological record.
A decade ago, the late David L. Clarke (1973) suggested that the slow development of a comprehensive archaeological general theory was primarily due to the "infinity" (rather than lack) of kinds of theory which might be applicable to archaeology. The problem was viewed as one of making the proper choices from among the kinds of theory available. In the scheme presented by Clarke, the nucleus of archaeological theory consisted of a body of poorly developed theories of a philosophical nature (metaphysical, epistemological and logical theories) which overlaid and permeated a second body of theories (perceived as a hierarchy) which were involved in the archaeological interpretative process—from the excavated materials to the final report (Clarke 1972:238; 1973:12-17). Clarke's second body of theories, which are more mundane to the archaeologist's way of thinking, include the following (after Hodder 1981:2):

(1) Predepositional and depositional theory.
Relationships between human behavior and material culture.

(2) Postdepositional and retrieval theory. Theories of survival and recovery of the evidence: disturbance, sampling, field strategies.

(3) Analytical theory. The detection and analysis of pattern and structure in the surviving and recovered data.

(4) Interpretive theory. The relationships between patterns in the data and interpretations of the patterns: the use of models.
Of this second body of theories, perhaps the most poorly developed are those of predepositional and depositional theory. While ethnoarchaeological studies may contribute to the development of retrieval and analytical theories, and provide models for interpretative theory (which can be equated with middle-range theory building; Binford 1981:25, note 1), they function primarily within the realm of predepositional and depositional theories (see Figure 2). Predepositional and depositional theories can be related to specific ethnographic (living) contexts.

Methodological considerations

Methodology is the crucial link between data (as abstracted from the real world) and theory. The following discussion deals with specific ethnographic and archaeological techniques used in this study. These are arranged under the headings of data collection, classification and comparison.

(i) data collection

In order to collect data on traditional Maya material culture at the household level, it was first necessary to conduct a regional survey of Indian communities in order to locate communities retaining traditional values and material culture.
Figure 2: The relationship between the ethnographic present, ethnoarchaeology and archaeological theory.
Archaeological General Theory

Philosophical Theories:
(a) metaphysical
(b) epistemological
(c) logical

Theories of Interpretative Process:
(a) interpretative
(b) analytical
(c) retrieval
(d) postdepositional
(e) depositional
(f) pre-depositional

Ethnoarchaeological* models and hypotheses

(Méthodology)

(Reality)

Ethnographic Pre-depositional and Depositional Context

* includes ethnographic fieldwork, experimental studies and excavation within the ethnographic context.
Such communities would be most similar to those encountered in the archaeological record (also see Hayden and Cannon 1983). Once a community was selected, and permission was obtained to work in the community, it was necessary to find households willing to be included in our survey. Unfortunately, the possibility of acquiring a random sample of households within a "closed corporate" Maya community was remote (see Harris 1975:461-462; Hayden and Cannon 1983; Voqt 1962:649; Wolf 1957). Many householders were highly suspicious of any outsider, due to past experiences or for purely superstitious reasons (especially those involved in curing, sorcery, etc.).

Our procedure was, once established in a community, to ask a Tzeltal-Spanish speaking interpreter to inquire in the community about people who might be willing to be interviewed. Once some degree of co-operation was established, attempts were made to interview households with as varied social and economic backgrounds as possible. These included households in: a wide range of occupations (potters, weavers, carpenters, butchers, curers, merchants, etc.); both upper and lower echelons of the community civil and religious hierarchies; various types of sodalities; various barrios; and with various family compositions. These households also covered the complete range of community wealth and social status. The number of interviewed households in Chanal represented approximately 10% of the community (or 53 of 560 households), while the Aquacatenango sample represents approximately 18% of that community (50 of 280
In both Chanal and Aquacatenango local men were hired as interpreters for the project. The use of interpreters was necessary, since most of our informants were illiterate and spoke only Tzeltal. In Chanal, one of the interpreters was the Secretary of the community's municipal council and the other was a high school student on summer leave. In Aquacatenango, seven council members acted as interpreters on a rotating basis.

Initial interviews in each community were conducted at the households of our interpreters. This was done in order to prepare them for our interviews, which included four questionnaires (filled out by the investigator) concerning family census information, land use, economic information, and pottery use and manufacturing (see Appendix A). Any further observations deemed pertinent to the questionnaires (e.g., personal stories related) were noted, and inquiries were made concerning the use of specific materials and their locations of use, purchase, and use-lives. Besides the interviews, our procedures included mapping of structures and the compound layout, making a complete inventory of household material culture and photographing of interesting features (pits, altars, etc.), structures, and pottery.

All other interviews were arranged by the interpreters, one or two days in advance. The interpreters would approach prospective household heads and explain to them exactly what was involved in an interview (kinds of questions, inventory taking,
length of visit, etc.), why we wanted to interview them (that is, that we wanted to learn about the way they live today so that we could better understand the crafts of contemporary communities and the remains left by their ancestors), and that we would be reimbursing them for the loss of a day's work. Informants were also told that they did not have to answer anything which they did not want to answer, and that they could stop the interview whenever desired. Further, they were promised that the information we collected would only be used for our own research and would not be given to the Mexican government.

Interviews were conducted by two teams consisting of three investigators and one interpreter. During an interviewing session (which lasted from four to eight hours depending upon the size of the household and its material inventory, as well as the enthusiasm of the person being interviewed), one person asked questions from the questionnaires through the interpreter. Generally only the household head answered social and economic questions, although attempts were always made to ask females about pottery production and use. The distribution of potting and non-potting households is indicated in Figures 3 and 4. One other person drafted scale maps of each structure and the entire compound, adding the location of as many items of material culture as possible. A third person made a list of the items (number of chairs, pots of each type, etc.) in each structure and around the compound. Separate permission was requested for entrance to each structure. The first person to finish his or
Figure 3: Map of Chanal, 1977, indicating barrio divisions and surveyed households (potting households are opaqued).
Figure 4: Map of Aguacatenango, 1979, indicating barrio divisions and surveyed households (potting households are opaqued).
her task would take photographs, again, asking permission for each item photographed. Before leaving a household, a photograph was taken of the entire family and given to them.

Besides the household interviews, individual project members devoted as much time as possible to a number of specialized studies concerning pottery making, the local exchange of goods and services, glass-tool production, mano and metate production, the ethnobotany of local herbs, milpa working practices, work group organization, and community cargo organization. Also, several archaeological features (sweatbaths, storage pits and house or kitchen floors) were excavated at abandoned housesites within the communities and two Aguacatenango abandoned housesites were surface collected. Further, several field trips were made to local archaeological sites (including the Coxoh sites of Coneta and Coapa), local and regional markets, and other specialized pottery making communities (Amatenango, San Pedro, San Ramon, and Yocnajab). Finally, library research concerning the Tzeltal was conducted at the Nabalom Museum library in San Cristobal de Las Casas, and at the San Cristobal Las Casas and Instituto Nacional Indigenista (INI) archives.
(ii) Data classification

Introduction

According to Lewis Binford (1968:271), "...if archaeologists and ethnologists are to work with common problems, their observations must be geared toward gathering data on the same variables, despite the obvious differences in their fields of observations." It follows from this line of reasoning that if ethnologists (or ethnoarchaeologists) and archaeologists wish to compare data sets based on observations of the same variables, then (1) similar methods of measuring and analyzing these variables should be used whenever possible (see Chapter 5), and (2) a common classification system should be used when dealing with the same problems (also see Read 1982:57). In order to establish accord between this ethnographic pottery study and current Maya archaeological studies, Tzeltal pottery is classified here using the general structure and terminology of the type-variety approach of pottery analysis. This approach has been well established among Mayanists since the early 1960s (for discussion see Gifford 1976; Matheny 1970; Sabloff and Smith 1972; Willey et al. 1967). However, the present study differs somewhat from the standard type-variety approach in that it addresses production and socioeconomic questions and therefore uses formal-functional types rather than the customary stylistic types. The latter have been used primarily to address problems
of culture history and regional pottery exchange. This study does address some problems concerning stylistic variation, although these are dealt with under the concept of ware (see below).

a) The type concept

According to Hayden (1982:3) typology refers to systems of categorization which aim at revealing information (whether evolutionary, functional, technological, social, or other) about the nature of human behavior in relation to artifacts. The ultimate aim of any typology is "to classify objects in order to solve anthropological problems" (Hayden 1982:3; also see Brown 1982; Hill and Evans 1972; Rice 1976:539; Taylor 1948:127). The stated problem orientation of the present study deals with pottery variability and patterning at the household level of analysis. This variability and patterning is believed to be strongly affected by variations in vessel functional requirements of the household. These functional requirements are in turn largely dependent upon the socioeconomic and demographic needs of the household. Potters tend to gear their production to these respective needs, and to manufacture a range of functional classes of vessels to meet these needs. Therefore, in order to deal with the problem of pottery variation and patterning at the household level, it is important to use a typology which is sensitive to vessel function. Similarly, Lischka (1975:227)
suggests that functionally-relevant typologies are more useful than stylistic typologies for examining associations between pottery vessels and activity areas.

While working in the field it was found that emic types had consistent, dual formal-functional meanings. Similar conclusions were reached by Culbert (1959) during his study of the Tzeltal potters of Amatenango, by Howry (1978:252) during his study of the Tzotzil potters of Chamula, and by R. Thompson (1958:29) in his study of Yucatecan pottery making. In the field, it became obvious that the evolution of the Tzeltal emic pottery typology had developed due to the importance of factors involving vessel form and function; factors also of importance for many of the problems with which archaeologists deal and which were central to the concerns of this study. In such a case, it was felt that the emic typology provided a useful classification for dealing with household requirements and that it would be more useful than a purely archaeological typology (depending upon the degree of elaboration desired of the types). For this reason, it was decided to use the local emic typology as a working basis for the present classification. In order to facilitate comparison between modern and Pre-Columbian vessels, etic descriptive names (emphasizing formal attributes) were also given to the emic types (see Appendix B, and summary in Table 1).

Although formal-functional pottery type ascriptions seemed to be universal among the Tzeltal, some variation in the emic typology did occur between different informants, between producer
Table 1: Tzeltal form–functional types: frequency of each type (and percentage of total) for Chanal and Aquacatenango.

<table>
<thead>
<tr>
<th>Vessel types (Tzeltal names):</th>
<th>Chanal: Frequency</th>
<th>%</th>
<th>Aquacatenango: Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Domestic)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1    small hemispherical bowl</td>
<td>209</td>
<td>6.25</td>
<td>440</td>
<td>10.31</td>
</tr>
<tr>
<td>(poket)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2    small restricted bowl</td>
<td>16</td>
<td>.48</td>
<td>57</td>
<td>1.34</td>
</tr>
<tr>
<td>(sets')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3    small elliptical bowl</td>
<td>38</td>
<td>1.14</td>
<td>88</td>
<td>2.06</td>
</tr>
<tr>
<td>(chalton)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4    small frustrum bowl</td>
<td>44</td>
<td>1.32</td>
<td>8</td>
<td>.19</td>
</tr>
<tr>
<td>(sets')</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5    unrestricted plate</td>
<td>223</td>
<td>6.67</td>
<td>115</td>
<td>2.70</td>
</tr>
<tr>
<td>(samel)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6    frustrum solid</td>
<td>5</td>
<td>.15</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>(makil stli')</td>
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<td></td>
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<tr>
<td>7    small wide-mouth jar</td>
<td>1438</td>
<td>43.01</td>
<td>526</td>
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<tr>
<td>(exom)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8    single-handle jar</td>
<td>186</td>
<td>5.56</td>
<td>1706</td>
<td>39.99</td>
</tr>
<tr>
<td>(chikbin or chikpin)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9    large perforated jar</td>
<td>3</td>
<td>.09</td>
<td>96</td>
<td>2.25</td>
</tr>
<tr>
<td>(chinkajab'il)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10   narrow-mouth jar</td>
<td>343</td>
<td>10.26</td>
<td>389</td>
<td>9.12</td>
</tr>
<tr>
<td>(kib)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Ritual)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>11   large hemispherical bowl</td>
<td>49</td>
<td>1.47</td>
<td>110</td>
<td>2.58</td>
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<tr>
<td>(poket grande)</td>
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<tr>
<td>12   small unrestricted bowl</td>
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<td>406</td>
<td>9.52</td>
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<td>(porcelana)</td>
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<tr>
<td>13   single-handle bowl</td>
<td>9</td>
<td>.27</td>
<td>-</td>
<td>-</td>
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<tr>
<td>(necchab)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>14   pedestal-base bowl</td>
<td>108</td>
<td>3.23</td>
<td>58</td>
<td>1.36</td>
</tr>
<tr>
<td>(chik'rom)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15   pedestal cylinder</td>
<td>21</td>
<td>.63</td>
<td>3</td>
<td>.07</td>
</tr>
<tr>
<td>(sowjebal cantela)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16   large wide-mouth jar</td>
<td>200</td>
<td>5.98</td>
<td>81</td>
<td>1.90</td>
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<tr>
<td>(exom grande)</td>
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<td></td>
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<tr>
<td>17   large composite jar</td>
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<td>.42</td>
<td>64</td>
<td>1.50</td>
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<tr>
<td>(tenosha)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>18   small perforated jar</td>
<td>41</td>
<td>1.23</td>
<td>37</td>
<td>.87</td>
</tr>
<tr>
<td>(chinkajab'il chica)</td>
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<td></td>
</tr>
<tr>
<td>19   pedestal jar</td>
<td>10</td>
<td>.30</td>
<td>12</td>
<td>.28</td>
</tr>
<tr>
<td>(rahuiil nichim)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Spinning)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20   whorl</td>
<td>62</td>
<td>1.85</td>
<td>3</td>
<td>.07</td>
</tr>
<tr>
<td>(me'tet)</td>
<td></td>
<td></td>
<td></td>
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</table>
Table 1 continued:

<table>
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</thead>
<tbody>
<tr>
<td>21 tripod bowl</td>
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<td>.03</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>(none*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 effigy vessel</td>
<td>4</td>
<td>.12</td>
<td>5</td>
<td>.12</td>
</tr>
<tr>
<td>(none)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 figurine</td>
<td>5</td>
<td>.15</td>
<td>10</td>
<td>.23</td>
</tr>
<tr>
<td>(none)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 small composite jar</td>
<td>0</td>
<td>.30</td>
<td>10</td>
<td>.23</td>
</tr>
<tr>
<td>(tepocha chac)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 flaring-mouth dish</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>(none)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>26 single-handle cup</td>
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<td>.18</td>
<td>15</td>
<td>.35</td>
</tr>
<tr>
<td>(none)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>27 wide-mouth vase</td>
<td>4</td>
<td>.12</td>
<td>16</td>
<td>.38</td>
</tr>
<tr>
<td>(none)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 loop-handle bowl</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>.05</td>
</tr>
<tr>
<td>(none)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 incurving-rim bowl</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>(none)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Obsolete forms)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 cylindrical jar</td>
<td>3</td>
<td>.09</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(bahal oxom)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 pedestal vase</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>.12</td>
</tr>
<tr>
<td>(chinpin)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3343</td>
<td>100.00</td>
<td>4266</td>
<td>100.00</td>
</tr>
</tbody>
</table>

* "None" indicates that only a Spanish name is used.
and user, and between communities. Specifically, these included:

(1) Although their views might differ somewhat, producer and user had expectations about how a given vessel should look and the behavior associated with it (that is, how it is to be used; also see Culbert 1959:5). *emic* terminology for general domestic vessel-forms (especially bowl forms) were quite flexible, while major formal types (such as narrow-mouth jars) were highly standardized. For example, Culbert (1959:5) sampled several hundred narrow-mouth (water carrying) jars without noting a single deviant from the pattern of rolled rim, flat base, three body handles and a height/orifice diameter ratio between 2.5 and 3.5 cm.

The views of producer and user were more likely to differ concerning primary vessel function than concerning description of vessel form. For example, a large jar-form produced in Amatenango, was said by the producer to be a water storage vessel (Culbert 1965), but said by the Chanal users to be a beer-brewing vessel. Chanal and Aquacatenango users stored water in the same jar-form in which they carried it, and none of the jars intended (by the producer) for storage were actually observed being used for storage.

(2) Variation in formal attributes sometimes resulted in the lumping together or splitting up of certain *emic* types by different informants. For example, wide-mouth jars and single-handle (occasionally spouted) jars might be given the same emic type-name (*oxom* in Chanal and *pin* in Aquacatenango) because
they fulfilled similar functions and could be used interchangeably. It was more common, however, to separate the latter type of jar into the emic category of chikpin (or chikpin) which was a vessel used for the heating of water for coffee. This single-handle jar was completely interchangeable with handle-less forms in Aquacatenango, while in Chanal, where it occurred less frequently, it served almost exclusively as a heating pitcher. Aquacatenango informants generally lumped the two forms under the same name, while Chanal informants almost always used two separate names. These forms were generally viewed as separate classes in archaeological, etic typologies.

(3) Vessel proportions (size, neck width, etc.) were important criteria for emic type ascriptions (see Culbert 1959; Howry 1978:246). For example, a poket could be a large or small bowl, an oxom (or pin) could be a large or small wide-mouth jar, and a chixnajab'il (or chichina) could be a large or small perforated jar. However, the small poket and oxom, and large chixnajab'il served domestic functions while their opposite sizes served ritual functions. Howry (1978:249) noted a similar dichotomy in Chamula. These functional differences occurring between smaller and larger sizes of certain vessel-forms were not always clearly reflected in the emic terminology. The Spanish terms for small or large (chica or grande), rather than the Tzeltal terms, were often appended to the type-name to emphasize such functional differences (e.g. oxom and oxom grande).

Formal-functional categories might be difficult to isolate
archaeologically, unless there is a clear bi-modal distribution in sizes. Comparisons of modern Chanal wide-mouth jars (see Figure 5), indicated that such a distribution often existed at the household level, while a "blending affect" took place when the size (represented by vessel height) of wide-mouth jars was compared over the entire sample.

It is not unreasonable to assume that definite size and volume ranges within distinctive formal types (such as the wide-mouth jar and perforated jar) generally represent more than one primary function. In fact, this assumption is often made in the archaeological literature (e.g. Hatson 1973; Whallon 1969), especially for the identification of storage vessels (e.g. Bawden 1982:169; Sheets 1979).

The latter point brings up the problem of how archaeologists can recognize functionally-relevant types in archaeological assemblages. Mayanists have traditionally focused on decorative stylistic attributes (surface treatment and design elements) rather than formal attributes when classifying their pottery (e.g. Brockington 1967; Gifford 1976; Sanders 1961; R. E. Smith 1971). While detailed stylistic typologies may be useful for developing chronologies and for studying interactions on the inter-site and inter-regional levels, stylistic variation over time in the Maya area has little functional relevance (Shepard 1964a). In regions, such as the Central Highlands of Chiapas, where there is little stylistic variation, paste and temper can serve as the dominant variables in type classification (Culbert
Figure 5: Histograms of wide-mouth jar (oxo) height for five Chanal households and for the entire community.
Figure 5: Histograms of wide-mouth jar height for five Chanay households and for the entire community

1. HISTOGRAM FOR HOUSEHOLD 49

<table>
<thead>
<tr>
<th>HEIGHT</th>
<th>HIST</th>
<th>COUNT FOR POTHEIGHT (EACH X=1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.000</td>
<td>9.4</td>
<td>3 +XXX</td>
</tr>
<tr>
<td>19.000</td>
<td>18.8</td>
<td>6 +XXXX</td>
</tr>
<tr>
<td>24.000</td>
<td>21.9</td>
<td>7 +XXXXXX</td>
</tr>
<tr>
<td>34.000</td>
<td>9.4</td>
<td>3 +XXX</td>
</tr>
<tr>
<td>39.000</td>
<td>12.5</td>
<td>4 +XXXX</td>
</tr>
<tr>
<td>44.000</td>
<td>3.1</td>
<td>1 +X</td>
</tr>
<tr>
<td>49.000</td>
<td>6.3</td>
<td>2 +XX</td>
</tr>
<tr>
<td>54.000</td>
<td>12.5</td>
<td>4 +XXXX</td>
</tr>
<tr>
<td>59.000</td>
<td>3.1</td>
<td>1 +X</td>
</tr>
<tr>
<td>64.000</td>
<td>3.1</td>
<td>1 +X</td>
</tr>
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</table>

TOTAL: 32 (INTERVAL WIDTH=5)

2. HISTOGRAM FOR HOUSEHOLD 44

<table>
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<th>HEIGHT</th>
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<td>11.000</td>
<td>6.7</td>
<td>3 +XXX</td>
</tr>
<tr>
<td>16.000</td>
<td>22.2</td>
<td>10 +XXXXXXXXXXXX</td>
</tr>
<tr>
<td>21.000</td>
<td>17.8</td>
<td>8 +XXXXXXXXXXXX</td>
</tr>
<tr>
<td>26.000</td>
<td>8.9</td>
<td>4 +XXXX</td>
</tr>
<tr>
<td>31.000</td>
<td>20.0</td>
<td>9 +XXXXXXXXXXXX</td>
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<td>36.000</td>
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<td>41.000</td>
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<td>1 +X</td>
</tr>
<tr>
<td>46.000</td>
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<td>2 +XX</td>
</tr>
<tr>
<td>51.000</td>
<td>6.7</td>
<td>3 +XXX</td>
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<td>61.000</td>
<td>6.7</td>
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<td>71.000</td>
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TOTAL: 45 (INTERVAL WIDTH=5)
Figure 5 continued:

3. HISTOGRAM FOR HOUSEHOLD 40

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<td>11.4</td>
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</tr>
<tr>
<td>20.000</td>
<td>13.6</td>
<td>6 +XXXXXXX</td>
</tr>
<tr>
<td>25.000</td>
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<td>22.7</td>
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<td>4.5</td>
<td>2 +XX</td>
</tr>
<tr>
<td>40.000</td>
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<td></td>
</tr>
<tr>
<td>45.000</td>
<td>13.6</td>
<td>6 +XXXXXXX</td>
</tr>
<tr>
<td>50.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55.000</td>
<td>2.3</td>
<td>1 +X</td>
</tr>
<tr>
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4. HISTOGRAM FOR HOUSEHOLD 38

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<td>10.3</td>
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<td>20.000</td>
<td>27.6</td>
<td>8 +XXXXXXXX</td>
</tr>
<tr>
<td>25.000</td>
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<td>3 +XXX</td>
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<td>30.000</td>
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<td>1 +X</td>
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<td>3.4</td>
<td>1 +X</td>
</tr>
<tr>
<td>55.000</td>
<td>13.8</td>
<td>4 +XXXX</td>
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<tr>
<td>60.000</td>
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<tr>
<td>MISSING</td>
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<tr>
<td>TOTAL</td>
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Figure 5 continued:

5. HISTOGRAM FOR HOUSEHOLD 37

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<td>14.500</td>
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<td>8 *XXXXXXXX</td>
</tr>
<tr>
<td>19.500</td>
<td>14.3</td>
<td>8 *XXXXXXXX</td>
</tr>
<tr>
<td>24.500</td>
<td>21.4</td>
<td>12 *XXXXXXXXXXXXXXXXX</td>
</tr>
<tr>
<td>29.500</td>
<td>10.7</td>
<td>6 *XXXXXXXX</td>
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<tr>
<td>34.500</td>
<td>8.9</td>
<td>5 *XXXX</td>
</tr>
<tr>
<td>39.500</td>
<td>3.6</td>
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<td>44.500</td>
<td>1.8</td>
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<td>49.500</td>
<td>12.5</td>
<td>7 *XXXXXXXX</td>
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<tr>
<td>54.500</td>
<td>3.6</td>
<td>2 *XX</td>
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TOTAL 56 (INTERVAL WIDTH=5)

6. HISTOGRAM FOR ENTIRE COMMUNITY INVENTORY

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<th>HIST%</th>
<th>COUNT FOR POTHIEIGHT (EACH X=9)</th>
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<tr>
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<td>19.9</td>
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<td>20.000</td>
<td>21.4</td>
<td>327 +XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX</td>
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<td>.4</td>
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<td>1 +X</td>
</tr>
<tr>
<td>80.000</td>
<td>.1</td>
<td>1 +X</td>
</tr>
</tbody>
</table>

MISSING 106
TOTAL 1635 (INTERVAL WIDTH=5)
1965:49). However, except at a general level, paste composition is not always a useful indicator of vessel function (Bishop et al. 1982:313). Although vessel form tends to be closely related to decorative stylistic variation (e.g. Deboer 1982:19; Freidrich 1970; Plog 1980; Watson 1977:388), formal attributes are more likely to reflect precise vessel function (Lischka 1978). For example, the close relationship between morphological characteristics and the function of specific Tzeltal vessel-forms is emphasized in Table 2.

Clearly, more experimentation with archaeological assemblages is called for, in order to establish functionally-relevant types. Emphasis on formal attributes has met with some success (e.g. Braun 1980; Ericson and Atley 1976; Lischka 1978; Morris 1974:59; Smith n.d.; also see Renfrew 1977:4). Other methods which can provide functional inferences include: studies of use-wear (e.g. Bray 1982; Chernela 1969; Griffiths 1978; Matson 1973:217; Schiffer 1983b), and vessel contents (e.g. Candamin et al. 1976; Emery 1961:207-214, 243-246; Lucas 1934); material and design analysis (e.g. Arnold 1971; Bishop 1980; Bishop et al. 1982; Ericson et al. 1972; Braun 1982, 1983; Hammond 1971; Watson 1969; Rands 1967; Rands et al. 1975; Rands and Bishop 1980; Rice 1977; Rye 1976, 1981; Shepard 1964a, 1964b; Snow et al. 1983; Steponaitis 1981); as well as the traditional methods of archaeological context (e.g. Deal 1980; Grebinger 1971; Salmon 1980, 1982), and comparisons with ethnographic and ethnohistoric sources such as the Maya Codices.
### Table 2: Correlation between vessel morphology and primary function for major Tzeltal pottery types.

<table>
<thead>
<tr>
<th>Emic types, Tzeltal (Spanish):</th>
<th>Primary Function(s):</th>
<th>Functional Considerations related to vessel morphology: **</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Domestic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. poket (apastli)</td>
<td>serving/handwashing</td>
<td>1,2,3,6,17,50,51</td>
</tr>
<tr>
<td>2. sets' (vasija)</td>
<td>serving/dry storage</td>
<td>8,9 14,15,17,50,51</td>
</tr>
<tr>
<td>3. chalten (sarten)</td>
<td>frying vegetables</td>
<td>1,2,3,4,5,24,27,32,45,50,51</td>
</tr>
<tr>
<td>4. sets' (Cazuela)</td>
<td>frying vegetables</td>
<td>1,2,3,4,5,24,27,31,50,51</td>
</tr>
<tr>
<td>5. sasat (cosal)</td>
<td>roasting tortillas</td>
<td>1,2,3,23,27,28,32,33,34,35,53</td>
</tr>
<tr>
<td>6. makil st' (tapa)</td>
<td>potlid</td>
<td>40,45,46</td>
</tr>
<tr>
<td>7. oxom (olla)</td>
<td>cooking vegetables</td>
<td>1,2,3,4,16,18,23,27,29,30,31,37,50,51</td>
</tr>
<tr>
<td>8. chikbin (jarro)</td>
<td>making coffee/</td>
<td>1,2,3,16,23,27,29,30,36,43,45,47,50,51</td>
</tr>
<tr>
<td>9. chixnazab'il (pichacha)</td>
<td>straining corn and</td>
<td>1,2,3,4,24,30,42,47,51</td>
</tr>
<tr>
<td></td>
<td>limewater mixture</td>
<td></td>
</tr>
<tr>
<td>10. kib (cantaro)</td>
<td>carrying and</td>
<td>10,11,12,22,24,30,36,38,44,47,48,50</td>
</tr>
<tr>
<td></td>
<td>storing water</td>
<td></td>
</tr>
<tr>
<td>(Ritual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. poket (apastli grande)</td>
<td>mixing corn beer</td>
<td>1,3,4,5,23,30,37,39,50</td>
</tr>
<tr>
<td>12. torcelana (porcelana)</td>
<td>serving</td>
<td>4,2,3,6,17,50</td>
</tr>
<tr>
<td>13. neochab (none)</td>
<td>making beeswax candles</td>
<td>1,2,3,5,26,27,45,50,51</td>
</tr>
<tr>
<td>14. chik'rom (incensario)</td>
<td>offering incense</td>
<td>1,2,7,41,49,52</td>
</tr>
<tr>
<td>15. sostejal (candela)</td>
<td>offering candles</td>
<td>8,41,49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. oxom (olla grande)</td>
<td>cooking vegetables</td>
<td>1,2,3,4,16,18,23,25,27,29,30,31,37,38,50,51,53</td>
</tr>
<tr>
<td>17. tenosha (tinaja)</td>
<td>mixing/fermenting corn</td>
<td>1,2,4,18,20,21,22,23,30,37,39,50</td>
</tr>
<tr>
<td>18. chixnazab'il (pichacha chica)</td>
<td>straining chile gruel</td>
<td>1,2,24,42,50</td>
</tr>
<tr>
<td>19. yahuil nichim (flocero)</td>
<td>offering flowers</td>
<td>1,2,3,4,14,30,36,50</td>
</tr>
<tr>
<td>(Obsolete)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. balal oxom (tecomate)</td>
<td>transporting-and</td>
<td>10,11,12,13,30,39,50</td>
</tr>
<tr>
<td></td>
<td>storing coffee</td>
<td></td>
</tr>
<tr>
<td>31. chinpin (jarra)</td>
<td>support for serving</td>
<td>8,47,49</td>
</tr>
<tr>
<td></td>
<td>vessel</td>
<td></td>
</tr>
</tbody>
</table>
continued:

(functional considerations related to vessel morphology)
1. Orifice diameter unrestricted: directly related to frequency of access.
2. Orifice diameter unrestricted: directly related to ease of access.
3. Orifice diameter unrestricted: directly related to visibility of contents.
4. Orifice diameter unrestricted: implies that contents are removed by manipulation (including use of spoon or ladle).
5. Orifice diameter unrestricted: promotes stirring of contents.
6. Orifice diameter unrestricted: orifice as greatest width of vessel implies serving or consumption by manipulation rather than by pouring.
7. Orifice diameter unrestricted: promotes the oxygenation of contents and serves as vent for smoke emission.
8. Orifice diameter restricted: provides for closure of insertion (candle or serving vessel).
10. Orifice diameter narrow: promotes closure (such as cob stopper).
11. Orifice diameter narrow: prevents manipulation of contents and implies that contents must be poured.
12. Orifice diameter narrow: prevents spillage.
14. Orifice diameter: directly related to the range of "grain size" of intended contents.
15. Orifice diameter: inversely related to the duration of storage (reduction of orifice size decreases danger of content alteration or spoilage).
16. Orifice diameter/volume ratio: implies duration of heating (too wide an orifice increases heated surface and may boil dry, while too narrow on orifice may cause vessel to boil over).
17. Lip shape: comfortable lip shape promotes drinking (lip thickness for poket is interior, low, gradual and for segis and porcelana is indeterminate).
18. Flaring rim: implies that vessel is generally moved or carried by the rim.
19. Flaring rim: promotes closure by flat object.
20. Narrow neck: prevents spillage.
22. Narrow neck: reduces danger of evaporation by restricting access area of contents.
23. Wall thickness: thick walls increase vessel strength (and durability) in non-transport vessels.
24. Wall thickness: thin walls reduce weight (and increase transportability).
25. Wall thickness: thick walls increase weight (and reduce transportability).
26. Wall thickness relative to basal thickness: thinner walls inversely related to frequency and duration of heating.
continued:

27. Wall surface: roughened surface absorbs more heat than smooth surface.
29. Wall curvature: bulging vessel walls promote maximization of heat transfer within vessel heated directly in fire.
30. Vessel height: substantial height implies containment of liquids.
32. Vessel height/maximum diameter ratio: low ratio maximizes heated area of vessel.
33. Vessel diameter: broad diameter increases visibility of contents.
34. Vessel diameter: broad diameter increases ease of access to contents.
35. Vessel diameter: directly related to batch size.
36. Vessel diameter: low maximum diameter (below centre) promotes vessel stability.
37. Volume: directly related to size of group being served.
38. Volume: directly related to distance to water source and/or size of carrier. (Young girls are trained to carry water as soon as they are old enough to accompany their mother on water gathering trips. The size of their jar increases as they get older.)
39. Volume: directly related to transportability of vessel (volume of large vessels can be prohibitive to transport when full).
40. Solid form: implies use for closure.
41. Pedestal: tall, hollow pedestal implies handling when hot.
42. Perforations: imply that smaller grains (or liquid) are to be separated from larger grains of contents.
43. Spout: promotes pouring of liquids (reduces waste).
44. Handle(s): promote carrying by tumpline.
45. Handle(s): imply handling while hot.
46. Handle(s): location on larger diameter surface of solid implies that smaller diameter surface is the base.
47. Handle(s): size is directly related to leverage (stability) of vessel while handling.
48. Handle(s): number of handles is directly related to leverage (stability) of vessel while handling.
49. Basal width: wide foot of pedestal base is directly related to stability of vessel.
50. Basal curvature: flat (or slightly concave) base is directly related to vessel stability (for the kib, some additional facility such as a bench, parallel poles on the ground or a shallow pit, is generally used to aid stability).
51. Basal thickness: directly related to stability of vessel.
52. Basal thickness: thick bases decrease thermal conductivity between hot contents and pedestal support.
53. Basal thickness: thick bases increase strength (and durability) in non-transport vessels.

* excludes spindle whorl and nine tourist items (types 20-29).
(Deal 1982, Polan et al. 1979) or the Motul dictionary (Joesink-Mandeville 1973). Assuming that the use of information derived from all these methods can facilitate the establishment of reliable functional "boundary conditions" for specific formal types, these types should be useful for interpreting household pottery-related activities and socioeconomic and demographic conditions.

What is being suggested here is not that Mayanists dispense with highly refined, decorative stylistic typologies, but that such typologies are more suitable for inter-community studies, while formal typologies (developed according to functionally-related attributes) are more useful for intra-community (inter-household) comparisons. It is unlikely that a single typology could adequately reconcile functional and stylistic attributes (Brown 1982:180). Both approaches, or either one independently, can be used on a single assemblage.

b) The ware concept

As stated above, pottery formal and functional variation is dealt with here within the concept of the "type." Variation attributable to decorative style will be dealt with within the concept of "ware." In terms of the pottery used by the Tzeltal, this is manifested primarily in surface treatment variation (unslipped versus slipped versus glazed), although painted designs occur on some slipped and glazed vessel-forms.
The concept of ware, based on both stylistic attributes and paste composition, has often been misused in Maya pottery studies (Rice 1976; Sabloff and Smith 1972). The present study incorporates the interpretation of this concept introduced by Rice (1976; also see Ball 1977:662), in which the attribute classes of paste composition and surface treatment are treated independently. Paste ware (Rice 1976:539), primarily reflects the "...availability and diversity of ceramic resources within a particular area," whereas wares based on surface treatment are primarily determined by cultural factors (that is, they reflect stylistic variation). Gifford (1976:17) had also stressed that surface treatment can be considered almost purely cultural inspiration. Following Rice's interpretation, paste ware becomes an analytic unit which crosscuts the classificatory units of stylistic type and stylistic ware (based on surface treatment).

On the other hand, paste wares can often be used to relate paste composition to functional types, and especially for differentiating vessels which are to be used on the hearth from those which are not. Even stylistic wares can sometimes help in identifying vessel function, and especially for differentiating ritual from domestic vessels.

It is obvious from ethnographic studies that analysts must be careful when lumping vessels with similar surface treatments and basic form within the same ware category and ignoring paste composition. For example, Howry (1978:253-254) identifies the water carrying jars of Amatenango, Chamula, Tenango and Yocnajab...
as a single ware based primarily on slip (and secondarily on form). However, this classification tends to mask both the inherent stylistic traditions and resource differences between the four communities. In reality, the slips (and design elements) of these jars are easily distinguishable, and in the present classification they would represent four separate stylistic wares, as well as four separate paste wares.

In the present study, only gross stylistic variations were necessary in order to distinguish between local and imported wares. Potters born in Chanal and Aquacatenango did not decorate their vessels and the decorations on imported vessels had no meaning in themselves beyond the distinction between decorated and non-decorated. Decorated vessels were associated with imported, fine quality wares which were often purchased for ritual use. By contrast, someone studying pottery making within Amatenango would probably have further divided Amatenango slipped into red-slipped and white-slipped, or by decorative elements in order to characterize lineage microtraditions (see Chapter Two).

In terms of the above discussion, pottery produced by the Tzeltal Maya was distinguished here as slipped wares or unslipped wares and could be further differentiated by community of manufacture (such as Amatenango slipped or Amatenango unslipped). Glazed wares were imported from the Ladino centres of San Cristobal las Casas (barrio San Ramon) and Chiapa de Corzo. In an archaeological sense, the unslipped wares of Chanal and the small surrounding communities might be indistinguishible on
formal grounds (either stylistic, or functionally-relevant formal attributes), but should be distinguishible through material analysis and have thus been dealt with as separate wares.

c) The concepts of sphere, complex and subcomplex

The concepts of sphere, complex and subcomplex provide a useful framework for the discussion of the regional distribution of pottery, in terms of inter-community exchange and the development of craft specialization (see Chapter Two), as well as for comparisons between major pottery production centres. A ceramic complex is "the sum total of associated ceramics which has a convenient and easily distinguished geographical and temporal meaning" (Culbert 1967:92). Further, when two or more complexes share a majority of their common types they are considered a "ceramic sphere" (Culbert 1967:99). The contemporary Highlands of Chiapas is recognized as a ceramic sphere made up of five complexes, each representing a major pottery making centre and the geographical area in which they dominate production of certain vessel-forms (Howry 1978:253). These complexes include the Tzeltal communities of Amatenango (southern Tzeltal area) and Tenanango (northern Tzeltal area), the Tzotzil community of Chamula, the Zoque community of Ixtapa and the Tojolabal community of Yocnajab. Vessels produced by these five communities are distinguishible from those of adjoining
regions on both formal and decorative stylistic grounds. Both Chanal and Aguacatenango belong in the Amatenango Chiapas Highlands Complex (see Chapter Two). Except for the occasional Yocnajab vessel, no vessels made within the other complexes of the Chiapas Highlands Sphere were recorded in either community.

A complex can be further divided into "subcomplexes" which represent significant cultural categories (Culbert 1967:93) such as religious versus domestic, mortuary, or class distinctions. Four basic subcomplexes which crosscut Tzeltal communities, and which are useful for the study of pottery variability at the household level, focus on domestic, water carrying, ritual and trade (tourist market) behavior. For Tzeltal informants, differences in tempering material (kind and amount) and vessel form seem to be the major criteria for distinguishing between such subcomplexes. Except for minor variations between communities, all communities within the Chiapas Highlands Sphere share a similar range of vessel-forms for domestic and ritual functions. Virtually all tourist trade items found in Chanal and Aguacatenango originate in Amatenango or the ladino kilns of San Ramón. Also, Amatenango potters have a virtual monopoly on water carrying jars used in both Chanal and Aguacatenango. At the household level, these subcomplexes are manifested in household activity sets (see Chapter Two).

Table 3 provides a summary of the classification of Chanal and Aguacatenango pottery according to the type-variety scheme described above. The Chiapas Highlands sphere is seen as a
Table 3: Chanal and Aguacatenango pottery classification according to the type-variety approach.

Sphere: Chiapas Highlands
Complex: Amatenango

(Chanal Inventory)

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<thead>
<tr>
<th>Wares</th>
<th>Type diversity/Subcomplex:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic</td>
</tr>
<tr>
<td>Chanal unslipped</td>
<td>8</td>
</tr>
<tr>
<td>Siberia unslipped</td>
<td>1</td>
</tr>
<tr>
<td>Natilton unslipped</td>
<td>-</td>
</tr>
<tr>
<td>Onija unslipped</td>
<td>1</td>
</tr>
<tr>
<td>Frontera Tzajanish unslipped</td>
<td>1</td>
</tr>
<tr>
<td>San Fernando unslipped</td>
<td>4</td>
</tr>
<tr>
<td>San Pedro unslipped</td>
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<tr>
<td>Yola unslipped</td>
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<td>Amatenango unslipped</td>
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</tr>
<tr>
<td>Amatenango slipped</td>
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<tr>
<td>San Ramon glazed</td>
<td>4</td>
</tr>
<tr>
<td>Chiapa de Corzo glazed</td>
<td>-</td>
</tr>
<tr>
<td>Mexican glazed</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>29</td>
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(Aguacatenango Inventory)

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<tr>
<th>Wares</th>
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<td>Domestic</td>
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<tr>
<td>Mapite unslipped</td>
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</tr>
<tr>
<td>Aguacatenango unslipped</td>
<td>5</td>
</tr>
<tr>
<td>Amatenango unslipped</td>
<td>6</td>
</tr>
<tr>
<td>Marcos Becera unslipped</td>
<td>1</td>
</tr>
<tr>
<td>Pinola unslipped</td>
<td>2</td>
</tr>
<tr>
<td>Palizada unslipped</td>
<td>1</td>
</tr>
<tr>
<td>Tzajala unslipped</td>
<td>1</td>
</tr>
<tr>
<td>San Jose unslipped</td>
<td>1</td>
</tr>
<tr>
<td>Yocnajab unslipped</td>
<td>4</td>
</tr>
<tr>
<td>Amatenango slipped†</td>
<td>2</td>
</tr>
<tr>
<td>San Ramon glazed</td>
<td>5</td>
</tr>
<tr>
<td>Chiapa de Corzo glazed</td>
<td>-</td>
</tr>
<tr>
<td>Mexican glazed</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>30</td>
</tr>
</tbody>
</table>

† includes Amatenango potters living in Aguacatenango.
geographically distinct, pottery production and exchange network, which is dominated by five pottery making communities. The geographical area in which each of these communities dominate exchange is considered a pottery complex. Chanal and Aquacatenango are situated within the Amatenango Complex. The variation in Chanal and Aquacatenango functional requirements is manifested in formal-functional types within broad regional functional categories (subcomplexes). Decorative stylistic variation (in the form of surface treatment) is manifested in the wares produced by individual communities within the complex. The dynamic nature of pottery distribution within the Chiapas Highlands Sphere is discussed in Chapter Two.

Data comparisons

All pertinent data collected through interviews and material culture inventories were coded for statistical manipulation using the MIDAS statistical package (Fox and Guire 1976) on the MTS (Michigan Terminal System) facilities at Simon Fraser University. Coded data on over 7000 individual pottery vessels included locational information (within compound and barrio), emic type, community of origin, distance to potter's household, specific potter, current vessel use and condition, and morphological attributes (height, maximum width, rim diameter, basal diameter, number of handles, presence of spout). Besides various
descriptive statistics, the present study utilized certain non-parametric statistical tests (see Chapters Four and Five) which had previously been adapted by Aubrey Cannon and Brian Hayden (Hayden and Cannon 1983) for studying other traditional forms of Tzeltal material culture (including whetstones, manos and metates, and other artifacts).
Chapter Two

Household as production unit

"...among the Indians, pottery also has a soul. Metal or enamel containers do not have souls as do gourds and handmade pottery." (J. Nash 1970:53)

Introduction

The basic unit of pottery production among the Tzeltal, and throughout Mesoamerica in general, is the household. Thus, the first potential source of pottery variability and patterning at the household level is pottery production itself (a general model for Chanal is presented in Figure 6). Pottery variability and patterning within a potting household is strongly affected by the level of pottery production within the household. The level of production is geared to the economic needs (both consumption and exchange) of the household, but at the same time, is seen as being constrained by certain factors related to production, namely, (1) the level of specialized knowledge and skill of the potter, (2) the diversity and quantity of available pottery making resources, and (3) the efficiency of production. In the present chapter, three levels of household production are
Figure 6: Tzeltal pottery production model, indicating manufacturing activities, progressive material state of vessel, and decision-making related to breakage during production.
Clay preparation

Clay body

Forming

Clay shape

Drying

Breakage?

Yes

Reusable?

Yes

Reusability

No

Hard shape

Finishing

Final shape

Firing

Breakage?

Yes

Reusable?

Yes

Provisional

Discard

No

Hard shape

Disposal

No

Fired vessel

Curating

Protective storage for sale or use
recognized and each is characterized in terms of differential household economic needs. Potential pottery variability and patterning are addressed in terms of the above production-related constraints upon the potting household. Some archaeologists have suggested that pottery variability at this level can yield inferences concerning residence behavior, corporate group strength, and other aspects of community social structure (e.g. Deetz 1968, Longacre 1964, Michels 1979). In addition, the present chapter addresses the problem of the recognition of potting households in the archaeological record, as well as the level of Chanal and Aquacatenango pottery production in relation to the development of pottery making specialization in the Central Highlands of Chiapas.

**Household production**

(1) Economic needs and the level of production

The intensity of production in Tzeltal potting households was fundamentally determined by the economic needs of the residents. Balfet (1965) recognized three levels of pottery production among the Maghreb of North Africa, namely, (1) domestic, (2) elementary specialization, and (3) artisan specialization. These three categories were also applicable to
Tzeltal potters. Among the Tzeltal, domestic scale pottery production was characterized by: a low frequency of pottery making events; the production of small quantities of a limited number of vessel-forms; and household consumption of the finished products. At the this level of pottery production, the goal of the potter was to complete the household inventory, replacing vessels broken during the previous year and adding vessels if the household had grown in size. Producer and user were synonymous at the domestic level of production.

Elementary specialists were generally women who were forced to contribute to the household economy by producing beyond the requirements of the immediate family. They might sell or barter excess vessels to other members of the community, or possibly in the regional market in San Cristobal las Casas, or they might make specialized vessel-forms on commission for local religious festivals. Among elementary specialists pottery making events occurred more frequently (seasonally, or, in a few cases, on a year-round basis), and larger quantities of vessels were produced, although the number of forms was still generally limited.

The artisan specialists were even more dependent upon non-subsistence sources for their livelihood. They often had inadequate farmland and were forced to sell crafts or work as field laborers. These households generally produced pottery on a year-round basis. Production, including the collection of raw materials, vessel manufacture, and selling of the final products,
were carefully scheduled (as discussed below). Most transactions were on a cash basis. Also, at this level, middlemen played an important role, by purchasing from the potter and reselling the vessels in local or regional markets, and occasionally by peddling in more remote communities (also see Nicklin 1971:13). The specialist produced a large variety of vessel-forms, exhibiting standardized shapes, size ranges, and decorations.

While most previous ethnoarchaeological pottery studies focused on the artisan specialist (e.g. Arnold 1971; Foster 1960; Reina and Hill 1978; Thompson 1958), the vast majority of pottery in Tzeltal Maya communities, such as Chanal, was produced on a domestic or elementary specialist level of production (see Figure 7). The same might be said of Aquacatenango potters, except that in the last decade a few artisan specialists had moved to the community from nearby Amatenango. However, the Amatenango potters had not yet trained any local potters. In contrast, Amatenango was a community of artisan specialists.

Considering the low scale of specialization, it was not surprising that most Chanal and Aquacatenango potters belonged to the lower and mid-range of the economic scale (see Chapter Three). For the 28 potting households in Chanal, 11 (39%) had low economic ranking, 16 (57%) had mid ranking and only one (4%) of the households belonged to the upper economic ranking. For wealthier households there was no economic pressure on the women of the household to learn pottery making. In many of the poorer households, women simply did not make pottery because they did not
Figure 7: Frequency of pottery making events per year for 25 Chanal potting households.
know any potters who would teach them. In fact, even some of the
Chanal potters interviewed claimed that they learned to make
pottery by watching neighbours. For Aquacatenango, four of the
five potting households were of low economic ranking while the
fifth was of mid ranking.

(ii) Learning environment and the level of production

In addition to economic need, the environment in which a
potter learns the specialized skills and knowledge of pottery
production plays an important role in determining her productive
capacity as a potter (also see Spier 1976). As mentioned above,
women without easy access to a pottery learning environment are
unlikely to become potters, even though it would be economically
advantageous for the household. Most of the potter's repertoire
(the functional and stylistic diversity she can produce), as well
as the amount of pottery she can consistently produce, are
established during learning experiences early in her life. The
following discussion outlines three important aspects of the
learning environment, namely, (1) the formality of training, (2)
the relationship between teacher and pupil (teaching models) and
(3) the age at which the craft was learned. Pottery variability
which result from different learning environments are represented
by pottery traditions and microtraditions, as discussed below.
a) Training

Tzeltal and Chuj girls received little formal training in pottery making. A pupil learned mainly through watching and experimenting on her own rather than through structured lessons. This seemed to be a general rule even in the large pottery making centres like Amatenango and Chamula, and has often been recorded elsewhere (Longacre 1981:60; Stanislawski and Stanislawski 1978; Weigand 1969:31-32).

b) Age learned

A young girl's acquaintance with pottery making techniques often began with helping at minor tasks including gathering raw materials (clay, temper and firewood) and grinding temper. Tzeltal girls began by making miniature copies of the vessels made by their "teachers." In one Chanal potter's household even some young boys were making "toy" pottery in play. The crude miniature vessels found at many archaeological sites have often been identified (probably correctly) as the work of children or a potter's apprentice.

Tzeltal and Chuj potters interviewed began experimenting with pottery making over a wide range of ages. The range for Chanal, Aguaatenango, and San Mateo was six to 78 years, with a median age of 18 years (see Table 4). Hayden and Cannon (n.d) investigated the relationship between the intensity of production...
Table 4: Pottery making teachings patterns
(combined teachers and pupils of interviewed potters)

Community: Chanal Aguacatenango San Mateo Yolakitak Total

<table>
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<th>Status of teacher:</th>
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<th>Aguacatenango</th>
<th>San Mateo</th>
<th>Yolakitak</th>
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of the mother and age at which potting was learned in 18 households from Chanal, as well as Yolakitak, a Chuj community near San Mateo. The amount of pottery produced per year in each household was plotted against the ages at which girls in the households had learned how to make pottery. Since the relationship appeared to be curvilinear, values for the number of vessels produced by potters in the girls' households were converted to logarithmic values. The resulting graph (Figure 8) illustrated a strong and significant negative correlation \( r = -0.8586 \) between the two variables. This indicated that the intensity of production directly influenced the age at which a girl began learning the craft. The more intensely pottery was produced in the household of orientation, the earlier girls began to make pottery.

c) Learning models

In households where pottery was produced primarily for domestic use, and the frequency of production was low, girls tended to learn pottery making later in life (often after marriage), and they frequently learned their craft through non-kin relationships. In Chanal, three teaching models were most common, including, mother/daughter; spouse's mother/daughter-in-law; and non-kin teacher/pupil relationships (see Figure 9, Table 5). For Aquacatenango and the Chuj community of San Mateo, mother/daughter and non-kin (especially
Figure 8: Graphic relationship between the age at which individuals learned to make pottery as a function of the log of the frequency with which pottery was made in the household where the potters grew up.
Figure 9: Pottery Making teaching models in Chanal, Aquacatenango, San Mateo Ixtatan, and Yolakitak.
Chanal teaching models:
(46 potters representing 30 households)
(\(O\)=teacher(s); \(\otimes\)=interviewed potter; \(N\)=number of cases)

Aguacatenango teaching models:
(7 potters representing 5 households)

San Mateo teaching models:
(14 potters representing 12 households)

Yolakitak teaching models:
(25 potters representing 12 households)
Table 5: Approximate age at which pottery making is learned (with frequencies) for 4 Maya communities.

<table>
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<tr>
<th>Community:</th>
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<th>San Mateo</th>
<th>Yolakitak</th>
<th>Total</th>
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<td>10 (42%)</td>
<td>7 (58%)</td>
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<td>78</td>
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<tr>
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<td>14 (58%)</td>
<td>5 (42%)</td>
<td>2 (40%)</td>
<td>2 (7%)</td>
</tr>
<tr>
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Total: 24 | 12 | 5 | 41 | 27 | 68
Median: 18 | 13 | 12 | 18 | 10 | 13
Mean: 18.7 | 18.4 | 21.4 | 19.0 | 11.8 | 16.0
S.D.: 13.8 | 9.4 | 22.0 | 13.5 | 3.9 | 11.3
neighbour/neighbour) teaching relationships were the most common.

Similar learning patterns have been recorded among the Hopi and the Huichol. Among the Huichol, where each household made pottery for its own domestic use, girls generally learned how to make pottery only after they were married. They might follow recollected models from their mothers and grandmothers and older sisters, but usually took their final models from the family of their spouses (Weigand 1969:32). Hopi girls, who often grew up in households of elementary or artisan specialists, learned from watching relatives or friends (Stanslawski 1977:400). If the older relatives of a household made pottery a girl might begin experimenting between five and 15 years of age. If her mother had small children to tend, then she might learn from her aunts or grandmother. If a girl's relatives did not make pottery, they might learn after marriage from potters in their husband's family or from their neighbours.

Intra-community teaching networks in Maya communities where pottery was produced primarily for the domestic use of the potter's family could be relatively complex. This was the case in Chanal. For example, one potter, Guadalupe Hernandez Gomez, learned her craft after marriage from her husband's sisters and mother, then she in turn passed this knowledge on to her own daughter and her brother's wife's mother (another non-kin relationship).

In Maya communities where pottery making was an economic speciality (such as Amatenango, Chamula, and Yolaktak), since
almost all women made pottery on a frequent basis, girls were more likely to learn how to make pottery at a young age and therefore were likely to learn the craft within their family of orientation (especially from their mother or sisters). In Chamula, this was in fact the case (Howry 1976:150). Early in this century some Chamula men began to make large ritual cooking jars. This trade was originally learned from their mothers but later began to be passed on through father/son and brother/brother relationships.

Among the potters recorded by Ben Nelson in Yolakitak, 24 (80%) said that they learned (or were learning) from their mothers while only six (20%) had learned (or were learning) through their spouse's family. Similarly, in Amatenango, girls began making pottery at about age 11, under their mother's tutelage, and were experienced potters by the time they married, between the ages of 14 and 17 (J. Nash 1970:55). Two generations ago, however, girls were generally married at age 11 or 12 and a girl was more likely to learn pottery making from her mother-in-law (J. Nash 1970:55).

Hayden and Cannon (n.d.) viewed Maya craft learning frameworks as a kin-extensive mode of craft learning based on the relative economic independence of the nuclear household. Craft learning tended to be dispersed between nuclear families and other households from both parents's side of the kin network, as well as some unrelated individuals. Less than 30% of overall recorded craft learning for Chanal, Aguacatenango, San Mateo, and
Yolakitak took place outside the family of orientation (see Table 6). However, when compared to other craft activities, pottery making proved to be the most variable in terms of kinds of teaching relationships and rated relatively low in terms of the strength of the family of orientation as a teaching unit.

Statistical tests by Hayden and Cannon (n.d.) suggested that lineage strength among Tzeltal and Chuj Maya strongly influenced whether a craft was learned from the immediate family, extended family or non-kin. Nuclear family centred craft learning in the three Maya communities tended to occur in households with weak lineages. These included mostly households on either end of the economic scale: the poorer households with minimal or no cooperative relationships with other households and the richer households which had the greatest degree of economic independence.

d) Microtraditions

Variability in the potter's learning environment is manifested in the formal (functional and stylistic) and decorative stylistic diversity of her pottery. Such diversity is reflected in archaeological assemblages in the form of pottery traditions. Bray and Trump (1970:236) define a pottery tradition as a "...sequence of...pottery styles which develop out of each other and form a continuum in time." At the regional level, the...
Table 6: Teaching patterns for most common crafts (>10 cases) in Chanal, Aguacatenango, San Mateo and Yolakitak.

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<tr>
<th>Status of teacher:</th>
<th>Family of orientation</th>
<th>Father's</th>
<th>Mother's</th>
<th>Spouse's</th>
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<td>-</td>
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* includes proclaimed self-taught craftsmen and nonkin teachers.
+ includes previous spouses, now living separately, and co-wives.
** includes intended pupils of interviewed potters as well as those they are presently teaching.
internal variations of a tradition are patterned around technological (e.g. fine-paste), formal (e.g. modeled effigies) or stylistic (e.g. waxy surface or polychrome decoration) aspects (Rands 1964). At the community level, pottery "microtraditions" can exist in the work of the individual potters, the potting lineage, and the potting work group, as well as the overall community style (also see Deboer 1982). The ethnographic study of pottery making learning behavior provides insights into how microtraditions are established and perpetuated, how variations (innovations) occur, how socioeconomic, demographic and spatial constraints affect their development, how much variability exists within and between all of these units, and how distinctive they will be archaeologically. Of particular interest in this study, is how competing intra-community microtraditions can potentially create pottery variability at the household level.

Among Tzeltal potters, a microtradition might involve the transmission of information on both time-proven techniques and recent innovations. As at the level of regional pottery traditions, internal variations of a microtradition are patterned according to technological, formal, and stylistic aspects. Technological information concerns (1) the location and accessibility of various resources (clays, tempers, pigments and fuels) and their relative quality, (2) formulas for paste ingredients (which clays and tempers to use and in what amounts), (3) instructions on production techniques (including the degree of grinding of clays and tempers, use of various potting tools,
forming and finishing procedures and kiln construction), (4) scheduling (when to collect materials, prepare pastes, form, dry and fire vessels, as well as lengths of time for aging clays, drying and firing), and (5) measures to insure production efficiency (such as the use of wasters to prevent fire marks on vessels, and the reuse of leftover materials and fuels).

Formal information concerns (1) basic body shapes, (2) addition of appendages and remodeling (e.g. perforating, adding effigies), and (3) details of proportion (thickness of wall, base and rim, location of handles, relative size, neck height, rim diameter and curvatures, etc.).

Finally, stylistic information concerns (1) surface treatments (burnishing effect or slipping), (2) decoration (painting or embossing), and (3) design complexity and specific motifs.

Variations (often subtle) in all these aspects could occur at the level of individual potter, lineage, work group or community. However, technological quality seemed to be stressed over stylistic design. For example, potters who claimed to be able to identify the pottery of other potters put a strong emphasis on technological and formal indicators, that is, those closely related to function. Among the Tzeltal and Chuj, these included body shape, wall thickness, fineness of ground temper, shape of handle section, neck height, ratio of mouth diameter to maximum diameter, degree of polishing, size of punched holes, basal form, as well as a variety of rim characteristics and
variations in the forms of appendages. (See Hayden 1981:20). Similarly, Kalinga potters stressed formal criteria in recognizing the work of other potters (Longacre 1981:62). Furthermore, innovation among the Tzeltal, as among the Tzotzil potters of Chamula (Howry 1978:248), tended to involve functional (rather than aesthetic) changes to vessel form.

Certain factors related to the learning environment are seen to affect variability (randomization) in microtradition patterning in non-specialist communities. These factors include (1) innovation, (2) frequency of production, and (3) the adequacy of potting materials.

(1) Chanal potters began innovating early in their careers. Obviously, when a pupil was learning to make pottery she would try to duplicate the work of her teacher. However, in Chanal, potters seldom stayed strictly with the formal variants they were taught. Even within the bounds of material availability, the potter's personal skill, and her cultural traditions, a plethora of combinations of technique, form, and style were possible, and most potters were continually innovating and copying from other potters. In Chanal, where decoration was generally absent, this was restricted mainly to vessel shape and changes in rim and handle form. For example, in one Chanal household, two daughters had copied their mother's vessels in terms of body shape, but each of the three potters made radically different rim forms. Another Chanal potter invented a unique form of flat (everted) rim for her cooking pots, which, she claimed, allowed her to
carry the vessels without spilling the contents.

New sources of inspiration came mainly from pottery bought in the nearby hamlets of San Pedro and San Fernando, rather than from Amatenango. For example, most Chanal potters made wide-mouth jars and single-handle jars with an elliptical (vertical) body shapes. This form was also common in San Pedro, San Fernando, San Antonio, and Siberia. In contrast, the spherical and ovaloid (with widest diameter above the centre) body shapes made in Amatenango were much less common in Chanal (see Table 7). The wide-mouth jar was the one type which all Chanal potters made, and it was most commonly imported from within the peripheral distribution zones, as discussed below. Amatenango cooking vessels were only sold locally (e.g. in Aguacatenango), while most of the specialized vessel-forms which Chanal imported from Amatenango were not made by Chanal potters. The one major exception was the small and large hemispherical bowls (poket) which seemed to be direct copies of the imported Amatenango bowls.

In another example, one Chanal potter produced her own variant of the distinctive spiked Tojolabal censer (characterized by three or four straps meeting above the bowl and crowned by a bird effigy or cluster of spikes). The Chanal variant had three rows of spikes on each strap and a bird effigy, while the pedestal bowl was typical of Chanal censers. No other variants of the Tojolabal spiked censer were observed in any Tzeltal communities.
Table 7: Vessel body shapes made by Chanal potters.

<table>
<thead>
<tr>
<th>Body Shape</th>
<th>SPH</th>
<th>ELW</th>
<th>ELH</th>
<th>OVA</th>
<th>OVB</th>
<th>CYL</th>
<th>HYP</th>
<th>FRS</th>
</tr>
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<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Poket</td>
<td>26</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>15</td>
<td>6</td>
<td>1</td>
<td>1</td>
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<td>58</td>
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<td>4</td>
</tr>
<tr>
<td>2. Chalten</td>
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<td>2</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>percentage</td>
<td>14</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>3. Sets'</td>
<td>14</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>3</td>
</tr>
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<td>29</td>
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<td>14</td>
<td>-</td>
<td>14</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>4. Oxom</td>
<td>84</td>
<td>14</td>
<td>64</td>
<td>-</td>
<td>30</td>
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<td>36</td>
<td>35</td>
<td>-</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>5. Chikbin</td>
<td>37</td>
<td>4</td>
<td>28</td>
<td>1</td>
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<td>2</td>
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<td>3</td>
<td>13</td>
<td>5</td>
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<td>6. Neochab</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
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<td>33</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>22</td>
</tr>
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<td>7. Chikpos</td>
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<td>1</td>
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<td>17</td>
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<tr>
<td>8. Chixna'j</td>
<td>11</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>percentage</td>
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<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Body shapes are derived from photographs; SPH=spherical; ELW=elliptical (on vertical axis); ELH=elliptical (on horizontal axis); OVA=ovoid (widest diameter above centre); OVB=ovoid (widest diameter below centre); CYL=cylinder; HYP=segmented hyperboloid; FRS=frustrum.
(2) The infrequent production characteristic of non-specialist communities insures that the potter will not develop sufficient skills for making highly standardized vessel-forms. The less frequently a potter makes pottery, the more she must rely upon her memory to repeat the production sequence. Innovations in form and style at the domestic level may therefore tend to be unintentional and non-repeatable.

In Chanal, one example was witnessed, of pottery made over a period of several years by a single potter, in which there was very little similarity between vessels made a year or more apart. A similar "age effect" has been recognized as a source of design element variability in potting over time among both the Kalinga (Graves, cited in Longacre 1981:63) and the Hopi (Stanislawski 1978:220-221).

By contrast, among the more organized pottery-making households of Amatenango, where production was a year-round occupation, formal and decorative standardization caused an increase in microtradition patterning among household work groups. Furthermore, Amatenango potters were producing for a larger, regional market, in which the consumers had certain expectations about the quality and appearance of the product (form, weight, size, location of handles, etc.) which were beyond the capabilities of most Chanal potters. For non-specialist potters, producing for their own household or neighbours, such expectations were less rigid. For the neighbour, convenience and the ability to barter for pottery were of more importance.
Reina and Hill (1978:231-251) related regional market expectations among Guatemalan Indian consumers to the concept of *costumbre*, which stressed emulation and conformity of personal values at the community level. In other words, potters believed that they had to conform to *costumbre* in order to be competitive in the regional market.

Such conscious conservatism in pottery production might contribute to the longevity of certain vessel-forms recurring in the archaeological record but it is more likely that the reason lies in the fact that generalized vessel-forms have been successfully adaptive over time in relation to a stable agricultural subsistence strategy. For example, in and around Chanal, as well as San Mateo, the mountainous terrain has excluded all but the traditional pre-conquest agricultural techniques (e.g. Wagner and Hotchkiss 1959).

One of the conclusions of Arnold’s study of Pokom Maya pottery (1978a:58) was that pottery variability between communities can be related to differences in pottery making resources between the communities. An example of this situation occurred in the Chanal area. Nine Chanal potters were asked why they did not make the narrow-mouthed jars (*kip*) which everyone bought from Amatenango. Six of them said that they had tried but that the form was too difficult to make. One woman even claimed that there was a god in the Amatenango church which told the potters how to make these vessels. The other women (as well as one of the former), however, gave logical environmental reasons
for not making this vessel-form. They admitted that the local clay was not fine and smooth enough and that they don't have the fine sand temper used by Amatenango potters. Similarly, a Tojolabal potter, interviewed in San Miguel, claimed not to make this vessel-form because she didn't have the right kind of clay. Narrow-mouthed jars made with Chanal clay tended to collapse at the shoulders.

The archaeological importance of microtradition patterning was brought to a head during the 1960's. Studies of the spatial patterning of stylistic attributes in pottery assemblages from sites in the Plains (Deetz 1966, 1968), New York State (Whallon 1968), and the Southwest (Leone 1968; Longacre 1964, 1968) assumed that household or intra-community microtraditions were sensitive to rules of residence (matrilocality) and descent (matrilineality). More recent ethnoarchaeological studies among the Hopi and Tewa (Stanislawski and Stanislawski 1978; Stanislawski 1977, 1978) and the Kalinga (Graves n.d., cited in Longacre 1981) have indicated that the situation is more complex. The Stanislawskis pointed out that pottery teaching models tended to crosscut lineage, language, and residence barriers, while Graves found other factors beside learning frameworks contributing to design variability (such as seasonality of production and idiosyncratic tastes of the potter over time).

The relatively low level of production per household, and the relatively loose nature of pottery making instruction in a community like Chanal undoubtedly results in a residential mixing
of microtradition information. Under these conditions, and given complex learning networks, it would be meaningless to try to make reliable inferences concerning residence behavior on the basis of stylistic (formal and decorative) variation within the community. It may be more reliable in communities like Chanal, and especially in artisan specialist communities like Amatenango, to look for pottery patterning in terms of work group or neighbourhood microtraditions (also see Longacre 1981:63; Stanislawski 1978:221). However, as the Hayden and Cannon (n.d.) study indicated, the presence of pottery making itself may be related to household lineage strength, economic level, or other factors.

\textbf{iii) Environmental constraints on the level of production}

Another production-related factor which constrains the level of production within a potting household is the physical environment of the area in which the community is located. Maya pottery making is a resource-exploiting technology and therefore much of the behavior involved in the production of pottery is related to various environmental conditions. These conditions are particularly important in terms of (1) the procuring of resources, (2) the seasonality of pottery production, and (3) the scheduling of pottery making activities (Arnold 1976). A potter's understanding of the quality of materials available and
the strategies for coping with climatic variations can exert considerable influence upon the diversity and quality of her product, as well as the volume of vessels she can produce.

From an archaeological perspective, the environmental constraints on pottery production are reflected primarily in the paste composition of pottery vessels, in terms of the material content and quality of the clay, the availability (or choice) of temper, clays, and slips, and the degree of firing. On the other hand, environmental constraints such as climate, which contribute to the quality and form of the finished product, are not easily determined from the archaeological record.

Elsewhere, Arnold (1978a:41) has also stressed the importance of outlining pottery-environmental relationships, so as not to obscure any possible environmental variables when determining how social and ideological conditions of manufacture articulate with pottery (techno-economic) data. For example, how do strategies related to procurement of raw materials (amount collected and stored, etc.) affect the identification of potting households?

a) Procurement of raw materials

Resource procurement behavior in Chanal and Aquacatenango included (1) the gathering of clay (lum), (2) the collecting of temper, in the form of calcite cobbles (max) or fine-grained sand (hi'), (3) the collecting of firewood (si' or zi') for fuelling
the open kiln and, (4) the storage of these raw materials prior to production. Clay, temper (calcite and/or sand), and firewood represented the minimum material requirements of the Tzeltal potter.

As a rule, clay was gathered from the nearest known source when it was needed. Aquacatenango potters interviewed all used the same clay source, which was located near a well beside the Pan American highway (approximately 200 m. from the entrance to the community). In Chanal, potters exploited a number of different clay deposits, a few of which were located within the community, while all others were located in the nearby hills. However, only two Chanal potters used more than one source, both using a particular red clay for making perforated jars (chixnaajab'il, used as colanders). Chanal pottery making resources were all found within community boundaries and clay deposits were used communally and across barrio boundaries. One clay pit in an abandoned lot in barrio Nuevo was particularly popular. No potter interviewed travelled more than five km. from her home to collect clay, and the mean distance of their estimated distances was 1.04 km. (see Table 8). This figure is consistent with Arnold's statement that the primary resources for pottery production generally occurred within five km. of a pottery making community (1975, 1976:95).

In contrast, potters of Amatenango tended to use more than one clay source. During the 1979 season, the author and Douglas Bryant (of the New World Archaeological Foundation) accompanied a
Table 8: Distance to clay sources for Chanal and Aquacatenango.

<table>
<thead>
<tr>
<th>Household #</th>
<th>Barrio</th>
<th>Location of clay source</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Nuevo</td>
<td>(1) river</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) barrio Tamchay</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>Nuevo</td>
<td>barrio Nuevo</td>
<td>3.0</td>
</tr>
<tr>
<td>6</td>
<td>Palma Aquil</td>
<td>Not specified</td>
<td>2.0</td>
</tr>
<tr>
<td>7</td>
<td>Nuevo</td>
<td>barrio Nuevo</td>
<td>0.3</td>
</tr>
<tr>
<td>9</td>
<td>Nuevo</td>
<td>barrio Nuevo</td>
<td>0.6</td>
</tr>
<tr>
<td>10</td>
<td>Centro</td>
<td>not specified</td>
<td>3.0</td>
</tr>
<tr>
<td>13</td>
<td>Nuevo</td>
<td>barrio Nuevo</td>
<td>1.0</td>
</tr>
<tr>
<td>14</td>
<td>Palma Aquil</td>
<td>barrio Palma Aquil</td>
<td>1.0</td>
</tr>
<tr>
<td>15</td>
<td>Nuevo</td>
<td>barrio Nuevo</td>
<td>0.2</td>
</tr>
<tr>
<td>16</td>
<td>Nuevo</td>
<td>barrio Nuevo</td>
<td>0.2</td>
</tr>
<tr>
<td>17</td>
<td>Nuevo</td>
<td>barrio Nuevo (?)</td>
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</tr>
<tr>
<td>19</td>
<td>Centro</td>
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</tr>
<tr>
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</tr>
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<tr>
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<td>TAMCHAY</td>
<td>edge of community</td>
<td>0.7</td>
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<td>barrio Nuevo (?)</td>
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</tr>
<tr>
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<td></td>
<td>barrio Tamchay</td>
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</tr>
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<td>southeast edge of</td>
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<td></td>
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</tr>
<tr>
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<tr>
<td>41</td>
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<td>(1) Black clay from</td>
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<td>river</td>
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<td></td>
<td></td>
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<td>barrio Tamchay</td>
<td>1.0</td>
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<td>near Palma Aquil cross</td>
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<td>barrio Nuevo</td>
<td>0.6</td>
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N=29

MEAN=1.04
S.D.=1.11

*Since Chanal is sectioned into blocks of roughly 50 square meters, distances to clay sources were recorded in blocks for most households and converted to kilometers. Distances for 4 Chanal households (numbers 14, 24, 29, 41) and 3 Aquacatenango households (numbers 37, 38, 39) were estimated from community maps and informant information.

(?)=probable source
Table 8 continued:

<table>
<thead>
<tr>
<th>Household #</th>
<th>Barrio</th>
<th>Location of clay source</th>
<th>Distance (km.)</th>
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<td>first</td>
<td>near highway</td>
<td>0.2</td>
</tr>
<tr>
<td>37</td>
<td>first</td>
<td>near highway</td>
<td>2.0</td>
</tr>
<tr>
<td>38</td>
<td>first</td>
<td>near highway</td>
<td>2.0</td>
</tr>
<tr>
<td>39</td>
<td>first</td>
<td>near highway</td>
<td>0.2</td>
</tr>
<tr>
<td>N = 4</td>
<td></td>
<td></td>
<td>MEAN = 1.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S.D. = 1.04</td>
</tr>
</tbody>
</table>
family of Amatenango potters on an expedition to gather clay. The clay source was located upon the banks of a small stream on the outskirts of barrio Bochibal, which was about one km. north of the community centre. According to our informants, this was the only good source of the white (sakilum) and black (ekalum) clays, while the yellow clay (canalum) at the source was too granular for body paste. The white clay was used for most vessel-forms while the yellow clay was usually reserved for wide-mouth (cooking) jars. For better quality yellow clay they travelled to a source in barrio Madrajal.

In Chanal, raw clay was mined with an improvised digging stick and wrapped in corn husks or palm leaves and transported in a maguay fibre bag (red). The Amatenango potters used a spatula-like metal blade with a wooden handle for mining clay. Hard clumps of clay were loosened using this tool and these were beaten into subhemispherical shaped parcels (about 30-40 cm in diameter and weighing about 12 kg.) to facilitate transport by tumpline. A stream cobble was selected at random to serve as a beating tool. A parcel could be formed in about five minutes. One parcel was made for each person. The parcels were wrapped in cloth shirts and aprons and attached to a tumpline. The women then helped each other to lift and strap the bundles onto their backs. According to our informants, one clay parcel was needed to make one large narrow-mouthed jar (caya), or four large tripod vases (macetas).
Temper is an additive which affects the working properties of the clay paste (Arnold 1971:39). Chanal and Aguacatenango potters added a non-plastic crystalline calcite temper to their clay body. Calcite cobbles were collected in the hills around Chanal and in the warmer areas below the community. Informant estimates on the distance to calcite sources ranged between two and eight km. (with a mean of 4.9 km.). Aguacatenango potters also had a ready source of calcite in the hills around the community (see Table 4). One potter, however, claimed to use a source at a distance requiring a trip of one-half day for a round trip.

Amatenango potters, as well as the two Amatenango potters living in Aguacatenango, also used a fine-grained dolomite sand temper (Heyman n.d.) for vessels not intended for use on the hearth. This sand was gathered locally in both communities. The Aguacatenango potters collected sand from an outcrop about 400 m. from the main highway. The potters of Amatenango used three different sand tempers which they identified by color (black, white and yellow). The potters of the northern Tzeltal community of Tenango also used ground sandy limestone (hi) as a temper (Redfield and Rojas 1939:111) and the Tzotzil Maya of Chamula added sand and ground chert (pedernal) to their potting clay (Pozas 1977:287).

The other essential resource was fuel for the potting fires. Potters in Chanal gathered oak and pine bark and pine kindling locally for this purpose. One Aguacatenango potter
Table 9: Distance to calcite sources for Chanal and Aquacatenango.

for Chanal and Aquacatenango.

<table>
<thead>
<tr>
<th>Household #</th>
<th>Location of source</th>
<th>Distance* (km.)</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>river</td>
<td>5.0</td>
</tr>
<tr>
<td>6</td>
<td>river</td>
<td>5.0</td>
</tr>
<tr>
<td>10</td>
<td>not specified</td>
<td>8.0</td>
</tr>
<tr>
<td>14</td>
<td>river</td>
<td>5.0</td>
</tr>
<tr>
<td>20</td>
<td>not specified</td>
<td>4.0</td>
</tr>
<tr>
<td>28</td>
<td>mountain</td>
<td>?</td>
</tr>
<tr>
<td>30</td>
<td>lowlands</td>
<td>5.0</td>
</tr>
<tr>
<td>48</td>
<td>not specified</td>
<td>2.0</td>
</tr>
</tbody>
</table>

N= 8

(for N=7) MEAN=4.86
S.D. =1.77

Aquacatenango:

<table>
<thead>
<tr>
<th></th>
<th>Location of source</th>
<th>Distance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>mountain</td>
<td>1/2 legua</td>
</tr>
<tr>
<td>37</td>
<td>mountain</td>
<td>2.0</td>
</tr>
<tr>
<td>38</td>
<td>mountain</td>
<td>1/2 day return</td>
</tr>
<tr>
<td>39</td>
<td>mountain</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*Distances for 3 Chanal households (numbers 4, 6, 14) were estimated from community maps and informant information.
claimed to use local cypress wood as a fuel. Amatenango, on the other hand, was deforested within several kilometers radius due to its pottery making activities (Howry 1973), and Amatenango men travelled several kilometers south of the community with small carts to obtain firewood for their wives.

Energy was also expended in obtaining certain pottery making tools. Quartzite pebbles seemed to be used universally among Tzeltal, as well as, Tzotzil and Tojolabal potters for burnishing pottery. Most Chanal potters, as well as native Aquacatenango potters acquired these smoothing stones (alisadores) locally. Smoothing stones made from other materials were only found in three of the surveyed households. One Chanal woman used an avocado pit as a smoothing stone, while one other used a cue-ball which her husband had picked up at a pool hall in coastal Chiapas, and in Aquacatenango, one potter used two dried clay balls to produce a burnished effect. Most active potters tended to save particularly good stones while occasional potters tended to throw them away (or misplace them) after one use. The curation of smoothing stones was very prominent among Amatenango potters, in general, as well as among the Amatenango potters living in Aquacatenango. Amatenango potters seemed to go great distances to acquire good smoothing stones, including places such as El Puerto (eight km.) and Venustiana Carranza (60 km.).

Smoothing stones were chosen with great care and different parts of a stone served different functions (and were given different names). For example, according to one informant, only
the ends of the stones were used for smoothing while the sides of flat stones might be used to form the inside of a vessel rim. John Clark (of the New World Archaeological Foundation) attempted to purchase a smoothing stone from a family of Amatenango potters, and after failing on one attempt, persuaded the grandmother to sell him a stone from a collection which had belonged to her mother (1979:personal communication). She produced a small bowl full of stones and sold him a damaged one for 10 pesos ($0.50). These stones were all highly polished from use and the one purchased had visible striations and a highly lustrous shine on one end (also see Hodges 1964:31). Clark suggests that the great value and high degree of curation of these stones may be attributed to the highly "commercial atmosphere" of the community.

Some potters also visited archaeological sites to find manos and metates for grinding up calcite. These were often passed on from mother to daughter (both Amatenango potters living in Aquacatanango have received manos and metates in this way). Also, one Aguacatenango potter used a small travertine boulder metate for grinding pigments. This was found to the south of Aquacatenango, near El Puerto.
b) Seasonality

The seasonal changes of weather and climate have a pronounced affect on the frequency of pottery making activities, and especially in terms of drying newly formed vessels and firing (also see Papodsek 1974). Drying is an extremely important and very delicate step in pottery production. Water occurs in the capillary spaces between clay particles and is also chemically bound to the crystal structure of the clay (Arnold 1976:96; Shepard 1956:72,81). If vessels dry too rapidly, a dangerous situation develops where the unevenness of drying or excessive shrinkage may cause cracking, and if the vessel is not sufficiently dry, water trapped in the vessel can cause damage during firing due to excessive shrinkage or the formation of steam (Arnold 1976:97; Shepard 1956:72,81). Similarly, O'Neal (1976:56) suggests that the length of the drying period seems to be inversely related to the proportion of vessels broken during firing.

In Tzeltal communities, clay was often allowed to sit in reused pottery vessels, which caused it to absorb more water and thus increase its plasticity before modeling. Subsequent removal of water from the clay body caused the loss of plasticity and resulted in a durable vessel form. By air drying the vessels before firing most of this water was removed, while any remaining water could be removed in a pre-firing process. Instead of pre-firing, Chanal potters would allow a longer drying period.
Baer and Baer (1950:39) reported a similar situation among the Maya of Petha in the Lacandon area.

Climatic dampness has a number of adverse affects on pottery production. According to Arnold (1976:97), it (1) increases the drying time necessary between manufacture and firing and thus increases the susceptibility of the pottery to breakage, (2) weakens the vessel walls after partial drying, causing malformation, cracking or breaking, and (3) reduces the firing temperature by dampening fuel and may cause breakage, blackening and irregular heating.

The rainy season in Chanal, Aquacatenango and Amatenango was from June to September. Even potters who worked year-round produced less pottery during this period of relative high humidity. Chanal potters claimed that rainy weather (especially in July and August) often caused the pottery to fall apart.

Potters who worked year-round moved potting activities indoors on rainy days and sometimes even fired their pottery in the kitchen hearth. During the rainy season, drying pottery was generally stored in the kitchen rafters over the hearth.

The reduction in potting activity in Chanal during the rainy season period is reflected in Figure 10, which indicates the number of potters who worked during each month of the year. Only three Chanal pottery making households worked year-round, while most others worked only during the winter months (December-March). Even in the potting community of Yolakitak, all potters produced pottery intensively only during the dry
Figure 10: Seasonal flux of pottery making in Chanal.

Months of production:

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sept
- Oct
- Nov
- Dec

Frequency of potting households:

- 15
- 10
- 5
- 4
- 3
- 2
- 1
- 0

JAN FEB MAR APR MAY JUN JUL AUG SEPT OCT NOV DEC
months (March-April) and only occasionally during the rest of the year. June Nash suggested that the main deterrent to pottery production in Atametanango during the rainy season was the lack of a closed kiln (1970:57). In one way, however, the rainy season benefited pottery making in Atametanango: clay could be more easily gathered when it was damp (J. Nash 1970:48). This explains why huge stockpiles of clay parcels could be observed in the porches of Atametanango households during the summer of 1977. Even during the dry, sunny months of January and February, high winds caused a reduction in output for Atametanango because they complicated drying (N. Nash 1961:118).

c) Scheduling

Prolonged bad weather might throw off the scheduling of potters who work year-round. However, this could be overcome by over-producing on sunny days during the rainy season or by working inside on rainy days and firing several times on the first sunny day. Seasonal variations in climate also caused scheduling conflicts with various social and subsistence activities. The latter include: (1) the size and local importance of certain festivals (2) relative success of other economic activities and (3) the number of other commitments of the potter.

Non-potting Tzeltal households tended to restock their pottery inventories during the week of an important festival. Major pottery making communities such as Atametanango reached peak
production capacity just prior to and during the larger festivals of local importance (see M. Nash 1961:187-188). This did not affect the production of most Chanal potters unless they were commissioned to make vessels for a cargo official for a particular festival.

Other economic activities also affected the scheduling of pottery production. In a year when milpa production was down pottery making could provide an important income supplement of a household or for an occasional potter could limit the number of vessels which had to be replaced by an outlay of cash. Pottery making was always an important income supplement in Amatenango, and especially in years of crop failure (Hunt 1962:81). In Aquacatenango, where there were few potters, crop failure was more likely to result in a higher migration rate for work on coastal plantations (Hunt 1962:81). Most Aquacatenango women made blouses for sale to tourists in San Cristobal. One woman said that she only made pottery when she was not busy making blouses.

The number of small children a potter had, also limited her production volume. This would be especially significant in communities such as Chanal and Aquacatenango where potters tended to work separately and child-care would take precedence over potting. However, even the well organized production of Amatenango potters was considerably restricted by the presence of small children (M. Nash 1961).
d) Summary of environmental constraints

A number of environmental factors affected the time and location of pottery production, as well as the paste composition, forms and quality of the vessels produced. The ability of the individual potter to deal with these constraints upon pottery production had a tremendous influence upon the variability (diversity and volume) of her product. Varying outlays of time were necessary for the procurement of clay, tempers and fuels. In Chanal and Aguacatenango, resources were gathered from the nearest available source as they were needed (seldom outside of a five km. radius of the community). Such procurement strategies (following Bishop et al 1981:317) might be characterized as either nondiscriminating (with little preference for variants of available resources) or discriminating (with concentration on resources with specific qualities). Communities which specialized in pottery making, such as Amatenango, tended to exploit a larger variety of potting materials and were willing to travel further to procure them (that is, a specializing procurement strategy: Bishop et al 1981:317). Similarly, Deboer (1982) found that among the Shipibo-Conibo potters, Zipf's principle of least effort did not account for all procurement behavior when distance to resources was considered. However, as with the Shipibo-Conibo, the procurement behavior of Amatenango potters might also, to some extent, be a function of social factors such as trade connections and kin distributions. This
was particularly true of the more exotic materials, such as pigments and smoothing stones.

Certain activities such as drying and firing of pottery were very susceptible to seasonal fluctuations of weather and climate. These fluctuations also affected scheduling of pottery making activities in that they might conflict with cultural activities, such as festival celebrations, subsistence agricultural tasks and child care. Although no major factors were identified which significantly affected the interpretation of pottery variability within communities, on an inter-community level, these factors were obviously important in accounting for technological variability (especially in terms of paste composition) associated with different levels of household production.

(iv) Production activities

An additional constraint on the level of production attained by an individual potter, although admittedly of less importance than those already discussed, was her expertise (efficiency) at production. Actual production activities of temper preparation, modeling (or forming), drying, finishing and firing of vessels were relatively consistent for all potting households in Chanal and Aquacatenango, and were not drastically different from activities of the larger pottery making centres. Differences
occurred mostly at the qualitative and quantitative levels. For example, potters who sold their vessels had to produce a better quality of vessel, quickly and efficiently, and a wide variety of functional types in order to be competitive. They also required a larger, and often more specialized, tool-kit (see Tables 10 and 11). This seems to be generally true of any specialist versus domestic producer. The median number of tools used by Chanal potters was four. Only two of 15 (13%) potters, who produced exclusively for domestic use, used more than four tool-forms, while eight of 13 (62%) potters, who produced for sale, used more than four tool-forms. Variation in pottery making activities in Chanal and Aquacatenango are discussed below, with special emphasis on pottery making tool diversity, degree of cooperation among potters and their efficiency at producing a durable product.

The first two procedures involved in pottery production, digging of clay and gathering of calcite cobbles, were discussed in the section on procurement of resources. Behavior involved with the preparation of the plastic clay body consisted of converting the calcite cobbles into fine grains or powder, and mixing the ground calcite with raw, aged clay (that is, clay that had been allowed to sit and absorb moisture). The two Amatenango potters living in Aquacatenango followed the Amatenango practice of adding sand temper to the clay of vessels not destined for use in hearths.
Table 10: Pottery making tool classification.
(format adapted from Scheufler 1968)

<table>
<thead>
<tr>
<th>Working Process:</th>
<th>Requirements</th>
<th>Tools and Equipment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) clay mining;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. digging</td>
<td>Something with which to dig clay</td>
<td>digging stick (metal bladed or improvised)</td>
</tr>
<tr>
<td></td>
<td>something to prevent the clay from drying out too quickly</td>
<td>corn husk; palm leaf; maq; plastic wrapping</td>
</tr>
<tr>
<td>2. maintenance of clay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. transport to storage location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. storage of clay and temper</td>
<td>temporary storage facility</td>
<td>reuse pottery vessel;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wooden box; tin can; qourd</td>
</tr>
<tr>
<td>(b) treatment of clay;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. reduction of calcite</td>
<td>something with which to break up cobbles</td>
<td>hammerstone</td>
</tr>
<tr>
<td>2. grinding</td>
<td>something with which to grind calcite or pigments into powder</td>
<td>reused mano and metate; flat limestone boulder</td>
</tr>
<tr>
<td>3. mixing of clay and temper</td>
<td>a surface on which to knead materials</td>
<td>three-legged stool (matisul mape); wooden square (cha'ay)</td>
</tr>
<tr>
<td>(c) construction of vessel;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. forming (modeling)</td>
<td>something on which to model vessel</td>
<td>three-legged stool; wooden square; percursary wheel</td>
</tr>
<tr>
<td>2. temporary clay storage</td>
<td>something on which to store clay for retrieval while modeling</td>
<td>wooden square; stone cobble; three-legged stool</td>
</tr>
<tr>
<td>3. moistening of fingers and clay</td>
<td>something in which to store water</td>
<td>reused pottery vessel; bucket</td>
</tr>
</tbody>
</table>
Table 10 continued:

(d) drying and finishing:
1. drying to somewhere to store newly made vessels kitchen rafters
2. perforating something with which to make holes pointed stick; nail;
   something with which to remove excess knife (cuchillo);
   clay reused machete; roof tile fragment
3. fettling something with which to rub dried vessel river cobble (alisador);
   consolidating avocado seed; hard clay ball

(e) decorating:
1. mechanical something with which to carve details knife
2. painting something in which to mix paint or slip metal bowl
   etching something with which to apply paint cane brush (with frayed end or feather tip
   a design to follow decorated vessel or drawn design

(f) firing:
1. pre-firing something to support vessels planks
2. preparing kiln somewhere to build open space (horno)
   kiln oak bark; cypress;
   something for fuel resincus pine pyramid of kindling;
   kiln stone props
3. firing something to support vessels and fuel stone cobbles
   something to protect vessels from fuel potsherd wasters
   something with which to adjust fuel long pole
4. dismantling kiln something with which to remove vessels long pole
Table 11: Distribution various pottery making tool-forms in Chanal and Aguacatenango.

<table>
<thead>
<tr>
<th>Working process and tool:</th>
<th>Chanal Households (out of 31)</th>
<th>Aguacatenango Households (out of 5)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temper preparation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hammerstone</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>mano</td>
<td>18</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>metate</td>
<td>21</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Modeling:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>three-legged stool*</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>wooden square</td>
<td>31</td>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>stone clay support</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>water container*</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Finishing:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>knife (for fettling)</td>
<td>12</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>raq</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>smoothing stone</td>
<td>29</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>perforator</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>scraper (for fettling)</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>slip mixing container</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>paint brush</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Frequency is low due to inadequate recording of this item.
a) Preparation of clay body

The grinding of calcite temper was generally done with a damaged or broken mano and metate, or a sandstone boulder metate like the one recorded at the Coroh site of Coneta (Hayden 1976). In Chanal these were often shared by one or more related households. Calcite grinding generally took place on the potter's household patio or on the patio of another household where the potter worked (see Table 12). Most of the debris from this activity would eventually be swept to the edge of the patio (see Chapter 4). However, archaeologists might expect small portions of the calcite powder and scattered crystals to be incorporated into the hard patio floor, especially if sweeping was not done immediately and the same location was used each time. This activity was generally done a day or two prior to each pottery making event, while some potters preferred to prepare a large batch to last for several events. Some potters also kept a cobble hammerstone (or reused mano or metate fragment) on hand for use as a pestle for reducing the calcite cobbles before grinding. Other potters would probably do this while gathering calcite or used their calcite grinding mano as a hammerstone.

The mixing of raw clay and temper to form a clay body was done by hand kneading just prior to forming. This operation was often done on a small three-legged stool (matsul mate) or a small square wooden plank (cha'tay), where it was left in storage
Table 12: Location of pottery making activities for Chanal, Aquacatenango, San Mateo and Yolakitak.

<table>
<thead>
<tr>
<th>Tzeltal Communities:</th>
<th>Aquacatenango:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (N):</td>
<td>Calcite</td>
</tr>
<tr>
<td>Main House (9)</td>
<td>2</td>
</tr>
<tr>
<td>Kitchen (11)</td>
<td>1</td>
</tr>
<tr>
<td>Patio (52)</td>
<td>20</td>
</tr>
<tr>
<td>Patio of another</td>
<td>-</td>
</tr>
<tr>
<td>household (3)</td>
<td>2</td>
</tr>
<tr>
<td>Circum-patio (16)</td>
<td>3</td>
</tr>
<tr>
<td>Garden (2)</td>
<td>-</td>
</tr>
<tr>
<td>Pathway (1)</td>
<td>1</td>
</tr>
<tr>
<td>Abandoned</td>
<td>-</td>
</tr>
<tr>
<td>building (1)</td>
<td>-</td>
</tr>
<tr>
<td>Outside sitio (4)</td>
<td>-</td>
</tr>
</tbody>
</table>

| Chuj Communities:   | Yolakitak: |
| San Mateo Ixtatan:  | Calcite | Modeling | Firing | Calcite | Modeling | Firing | Grinding |
| Structure* (40)     | 2       | 2        | 7      | 11      | 12       | 6      |          |
| Patio (16)          | 3       | 7        | 1      | 1       | -        | -      | 4        |
| Circum-patio (2)    | -       | -        | -      | -       | -        | -      | 2        |

*main house and kitchen are generally combined in both communities.
during the forming process. One potter kept a flat cobble on her patio where she made pottery which served as a clay storage stand while she was modeling. An Aquacatenango potter used her calcite grinding metate for this purpose.

Clay mixing, like calcite grinding, generally took place on the household patio (or patio of another household). Besides the stand for clay, a container of water was kept nearby for dampening the clay and moistening the potter's fingers.

b) Forming of clay shape

In 1977 project members were fortunate to be able to observe and photograph two Chanal potters at work. One woman, Catarina Gomez Moreno, was an occasional domestic potter, while the other woman, Juana Lopez Gomez, would be considered an elementary specialist. Juana produced the best quality pottery of all the Chanal potters interviewed and was the only Chanal potter to experiment with painting her pottery.

The time required to model a small wide-mouth jar (olla), from clay preparation (excluding the grinding of calcite temper) to clay shape was between 20 and 30 minutes for both potters. A three-legged stool served as a stand on which raw clay and temper were kneaded together. When the right consistency was attained, the clay was set aside and just enough tempered clay was removed to form a flat disc-shaped base. This disc was then worked into a shallow, roughly smoothed bowl, using the palm of the hand.
thumb and forefinger. Following this, successive coils (approximately two cm. in diameter, with a length approximately the circumference of the vessel at the level where it was to be added) were rolled between the palms and added to the base. The first coil was attached to the rim of the shallow base and the walls were smoothed. The second coil, which was much thinner, was added to the interior around the base and was smoothed into the base and lower body of the vessel. Additional coils of the larger size were added until the desired height was reached. These coils were only roughly smoothed (mostly on the interior of the vessel). The last coil added was smoothed and extended into a flaring rim. The body coils were then smoothed together and the belly was extruded by smoothing with the fingers. Lastly, the rim was worked into its final form and the vessel was ready for drying.

In her demonstration, Juana continued to model her small jar into a pitcher. This was accomplished by adding a handle and making the mouth of the vessel more elliptical. To add the handle, a section of the rim was squeezed to raise it above the rest of the rim. Another coil was rolled and attached to this raised section and smoothed into it. A slight crook was made in the coil raising it above the rim. The bottom foot of the handle was attached to the shoulder and smoothed into place. Final touches consisted of smoothing of the rim and body with frequent wetting of the fingers. It is important to note that a potter will sometimes use the leftover kneaded clay from a forming event
to quickly model a small all-purpose bowl (gots) rather than curating the clay for another occasion or mixing it with some untempered clay. It is significant that almost all of the examples of this bowl-form found in Chanal were recorded in the households of potters. Other households also needed all-purpose bowls but generally obtained industrially made bowls.

c) Drying to produce hard shape

Newly formed vessels were dried prior to firing to reduce plasticity (through dehydration) and thereby created a "hard shape." The critical affects of drying on production success have been discussed. Special care was taken to insure that vessels would dry properly. For example, Chamula potters wedged sticks into the mouths of drying vessels to prevent twisted lips (Russ 1969:3). In Chanal and Aquacatenango vessels were dried outside in the shade on sunny, windless days. Otherwise they were dried indoors in the shade, in the rafters or by the fire at night. The length of time that vessels were allowed to dry varied from a few days to as long as two months in one Chanal household. Breakage due to cracking or accidental disturbances was very likely to occur during this process. If a vessel was damaged before it lost most of its plasticity it might be ground up and its clay mixed with more prepared clay to form new vessels, otherwise, it was merely discarded.
Vessels which had been partially dried to "leather hardness" received functional and decorative finishing before they were fired. In Chanal this included polishing, perforating and fettling. Fettling techniques, employed to tidy up newly made vessels (see Hodges 1964:31), included the removal of excess clay from the inside of a colander after the perforations had been made. Small metal nails, pointed sticks, bone awls or knitting needles were used for making perforations. Basal trimming was another fettling technique by which excess clay around the base of the vessel was removed after forming. A reused machete or knife usually served this function. Polishing (or smoothing) was both a functional and decorative technique. Rubbing the surface of a hard vessel body with a quartzite pebble compacted the surface of the clay, reducing porosity, while at the same time, each stroke of the tool imparted a small, smooth, decorative facet on the vessel. Amatenango potters did their compacting before the vessel was slipped and painted.

Only one Chanal potter had experimented with painting. She used oil paints and followed designs in her son's art book from school to decorate small wide-mouth jars. The two Aquacatenango potters from Amatenango followed the Amatenango practice of painting certain vessel-forms. Painting was done with a brush, fashioned from a piece of cane (carrizo), frayed at one end, or fitted with a feather tip. One potter had a special metate (made from a travertine boulder) for grinding her pigments. Black, red, yellow and white pigments were purchased by Aquacatenango
potters from other communities. In 1979, a palm-sized portion cost about five pesos ($0.25).

d) Firing

The final production process is the firing of finished vessels. According to Colton (1939:63), the fundamental principles involved in this process are (1) that fuel must be supplied that will attain temperatures between 500 and 1000 degrees centigrade, (2) heat radiation must be minimized, and (3) the burning fuel must be kept from touching the objects being fired.

Unfortunately, we did not acquire measurements for firing temperatures for Chanal and Aquacatenango. However, they must have been less than the larger pottery fires of Amatenango, which have been measured at 900 degrees centigrade (Heyman n.d.). Heat radiation was minimized by building a pyramid of fuel around the vessels to be fired and using stones to hold the fuel and vessels in place. Colton called this arrangement a "temporary kiln" (1939:64), in which the ashes held their form during the firing process and prevented heat radiation. A similar arrangement was used by the Maghreb potters of North Africa (Balfet 1965:167). Pottery sherd "wasters" were placed between the fuel and the pottery to prevent the burning fuel from touching the vessels being fired. Despite this precaution each vessel received some exterior fire-clouding (or "fire-marks"). Douglas Bryant
observed an Amatenango potter actually break up an unused comal to get a suitably sized molder (1979: personal communication).

Chanal potters generally fired in small batches of around five or six vessels, or two to four medium or large vessels. Very large wide-mouth jars (oxon) or unrestricted plates (samets) were likely to be fired separately. A special open kiln for samets was observed in the Huistan paraque of San Pedro. A single vessel was supported on three stones or broken vessels (firedogs) and a pyramid of kindling was built around the vessel. The fire was set using kindling and bark, under the vessel between the supports. Similarly, Howy (1978:247) reported considerable variation in the openness of the kiln and fuel size between single female (and especially samet makers) and male potters in Chamula.

In Amatenango, potters generally fired much larger batches of vessels (several dozen) and often had two or more fires going at once or had vessels in different stages of firing. The probable reason for these large bonfires was for the conservation of fuel, which had to be carted in from several kilometers to the south of the community (also see Hodges 1964:36; Wicklin 1979:448). All Amatenango pottery was given a preliminary pre-firing to complete the dehydration which began with the drying process. During pre-firing, vessels were placed on a rectangle of boards or in a circle on the ground and a small fire was set in the middle. Each vessel was turned several times to ensure that all areas were heated. One final firing (of
approximately six dozen vessels) in the streets of Amatenango was timed at just under one half hour. The fires were tended constantly, with long poles being used to adjust the position of the burning firewood.

The location of pottery fires was generally more varied than the locations of other potting activities. Among Chanal and Aquacatengo potting households, 11 households fired pottery at the edge of their patios, nine on the kitchen or main house hearths, six on the patio itself, four in the streets outside the compound, two in the compound garden and one other in an abandoned building. In Amatenango, most potters seemed to fire their vessels in the streets, which were thoroughly littered with ash, charcoal and small potsherds. On one visit we observed a dismantled kiln, that is, charred logs, wasters, and stone props stacked against the outside wall of a compound fence, ready for the next firing.

Once the fire had burned out and been allowed to cool for a few minutes, a long pole was used to dismantle it and to remove the pottery. Firing success, as mentioned above, is largely dependent on adequate drying, as well as the relative skill of the potter. Breakage rates tended to be much higher among the potters of Chanal and Aquacatengo than among the artisan specialists of Amatenango. The ultimate fate of a damaged vessel depended upon its state of disrepair. If only slightly damaged it would probably be stored with other damaged vessels for future reuse. If greatly damaged, the vessel might be broken up to
salvage large pieces for use as wasters or to be stored for reuse, while smaller pieces were discarded (often around the firing hearth). Successfully fired vessels were removed to protective storage areas for future use or sale.

Consideration of pottery manufacturing procedures yields several kinds of information important for the interpretation of the archaeological record, especially in terms of the locations of activity areas and tool storage, and the diversity, value and relative condition of potting tools. The following section considers how this information can be useful for the recognition of archaeological potting households.

Archaeological visibility of the potting household

A general model of pottery production for Chanal and Aquacatenango is presented in Figure 11, and the tools and byproducts with potential archaeological visibility are indicated for each step. Archaeological visibility refers to the "...actual amount of physical remains, however clearly or ambiguously they might be perceived" (Deetz 1977:94). Estimates of the relative probability of the visibility of each of these artifacts and features are based on the relative durability of the materials and the frequencies of their occurrence.
Figure 11: Channel pottery production model and archaeological residues.
Ethnological (systemic) context

Procurement of raw materials → raw materials (clay, calcite, sand, fuels)

Storage of raw materials → reused vessel storage
container/contents
raw materials

Teaper preparation → calcite powder
reused mano/metate hammerstone

Preparation of clay body → prepared clay
calcite powder debris
sand debris

Forming process → surplus clay debris

Drying process → sherds of damaged vessels

Discard → sherds/rejected vessels

Finishing process → fettling debris (from base, perforations, etc.)
slip or paint spillage
discarded/lost smoothing stone

Firing process → charcoal/ash deposit
stone vessel props
wasters

Storage (use or sale)

Storage (reuse) → large body sherds and incomplete vessels

Archaeological context

Strength of visibility

Mid-High
Mid-High
Low
Mid-High
Mid
Low
Low
Low
Mid-High
Low
Mid-High
Mid
Mid
The procurement of raw materials for pottery making entails the removal of clays, tempering materials (calcite and sand), and wood fuel from their natural (geological) context and placing them into an ethnological (or, after Schiffer 1976, "systemic") context. These materials are gathered in varying quantities depending upon several factors, including (1) the season of year (2) the distance to and topography of the resource area, (3) the number of people collecting, and (4) the relative amount of pottery a potter (or potters) makes, or intends to make during the season. Of these materials, raw (untempered) clay, tempered clay, ground and unground calcite temper, sand temper, and mineral pigments have a high potential for archaeological visibility (see Table 13), and especially if microdebitage analysis is used (Fladmark 1982).

Of the 32 active potting households surveyed in Chanal and Aquacatengango, 25 (78%) of them had supplies of tempered and/or untempered clay on hand, while 22 (69%) of them had supplies of ground and/or unground calcite temper. By contrast, no non-potting household in Chanal had either temper or clay on hand. In Aquacatenango, three potters interviewed used a variety of sand tempers and two potters used mineral pigments. In each case these were stored in the compound. Thus, even households which had ceased production and households which were just beginning to learn potting had clay or calcite on hand. In addition, while only three of the 25 active potting households in Chanal were producing pottery when our survey was conducted (June
Table 13: Frequencies of archaeologically visible pottery making materials in Chanal and Aquacatenango.
(x=present but frequency or state not specified)

<table>
<thead>
<tr>
<th>Pottery making tools:</th>
<th>Potting tools:</th>
<th>Household stone</th>
<th>calcite mano</th>
<th>calcite metate</th>
<th>calcite hammerstone</th>
</tr>
</thead>
<tbody>
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<td>Chanal:</td>
<td></td>
<td></td>
<td></td>
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<td>5*</td>
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<td>6**</td>
<td>x</td>
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<td>34</td>
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*uses mano and metate stored at mother's compound.
**not actively potting when survey was conducted.
Table 13 continued:

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<tr>
<th>PH*</th>
<th>Raw materials:</th>
<th>Storage containers:</th>
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<td>clay calcite sand pigments (t=ground temper; c=cobble)</td>
<td>pottery vessel other</td>
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<tr>
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<td>x t</td>
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<td>x c</td>
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<tr>
<td>6</td>
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<td>x c/t</td>
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<tr>
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<td>x t</td>
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<td>45</td>
<td>c</td>
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<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>x c/t</td>
<td></td>
</tr>
</tbody>
</table>

Totals (minimum number of occurrences):

|               | 28 | 24 | 3 | 2 | 53 | 33 | 4 | 17 |

* potting households.
and July), 17 (77%) of the other households had clay supplies on hand and 15 (68%) of them had calcite temper on hand. Only five active Chanal potting households (16%) did not have raw materials on hand.

The fact that such a high proportion of households stored raw materials for potting was very significant, since these raw materials are of little value and would likely be left in situ if the housesite were abandoned. Moreover, small amounts of all these materials would be likely to occur in household refuse areas, patios, and unused spaces within structures. Calcite cobbles were often stored loose inside structures, while ground calcite (and sometimes cobbles), sand, and clay were generally stored in reused damaged pottery vessels, and often spilled in pottery manufacturing. In the 32 active potting households, 77 partially broken, but reused pottery vessels were recorded being used to store raw materials for pottery making (47 storing clay, 28 storing calcite temper, and two storing sand). Among the four inactive households, nine pottery vessels were being used to store clay (six vessels) and calcite (three vessels).

Some industrially manufactured storage containers, locally made wooden containers, and gourd bowls were also reused in this fashion. For the active potting households these included seven tin cans (two storing clay, five storing calcite), four buckets (one storing clay, three storing calcite), two wooden boxes (one storing clay, one storing calcite), two gourd bowls (storing calcite) and three plastic bags (storing calcite), and one small
plastic tub storing pigments. In one inactive household a bucket was being used for calcite storage and in another, 10 calcite cobbles were being stored in a wooden washing basin (batea). In all probability, many of the industrially made containers would represent pottery containers in Precolumbian times. In total, 107 containers (80% pottery) were being used for the storage of raw materials for pottery making in 36 Chanal and Aguacatenango households. Storage areas for these containers varied considerably with the areas in and around the main living structure and the sweatbath being the most common (see Table 14).

The use of pottery vessels for raw material storage has great potential for the recognition of potting households in archaeological situations (see below). This is true because the pottery container as well as its contents are potentially visible in archaeological situations, and because the containers are generally partially incomplete or in poor repair and therefore likely to be left upon site abandonment. Even if the container is discarded, some clay or other material is likely to adhere to the vessel walls. Furthermore, distinctive pottery making tools which have high potential archaeological visibility include smoothing stones, hammerstones, specialized manos and metates. Smoothing stones are exclusively a modeling and burnishing tool, while manos, metates, and hammerstones are used for the crushing and grinding of calcite cobbles into a fine calcite temper.

One Chanal potter used a river cobble as a mano, while two others used river cobbles as hammerstones. In addition, metates
Table 14: Storage locations of pottery making tools and materials in Chanal and Aquacatenango.

| Inside Inside Inside Inside On or On or |
| House kitchen storehouse around sweatbath bordering |
| patio |

**Tool storage:**

<table>
<thead>
<tr>
<th></th>
<th>Inside House</th>
<th>Inside kitchen</th>
<th>Inside storehouse</th>
<th>Around sweatbath</th>
<th>On or bordering patio</th>
</tr>
</thead>
<tbody>
<tr>
<td>stones</td>
<td>8</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>mano</td>
<td>6</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>metate</td>
<td>6</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>9</td>
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<td>20</td>
<td>9</td>
<td>0</td>
<td>3</td>
<td>2 18</td>
</tr>
</tbody>
</table>

**Raw material storage:**

<table>
<thead>
<tr>
<th></th>
<th>Inside House</th>
<th>Inside kitchen</th>
<th>Inside storehouse</th>
<th>Around corn bin</th>
<th>Compound (away from structures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>clay/sherds</td>
<td>5</td>
<td>1</td>
<td>-</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>calcite</td>
<td>8</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>sand</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>pigments</td>
<td>1 16</td>
<td>-</td>
<td>4</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

**Number of Households:**

|        | 36 | 13 | 2 | 13 | 25 |

**Outside Tool storage:**

<table>
<thead>
<tr>
<th></th>
<th>Outside house walls</th>
<th>Outside kitchen walls</th>
<th>Outside storehouse walls</th>
<th>Around corn bin</th>
<th>Compound (away from structures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>stones</td>
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<td>-</td>
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<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
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<td>7</td>
<td>0</td>
<td>0</td>
<td>5 73</td>
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</tbody>
</table>

**Raw material storage:**

<table>
<thead>
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<th></th>
<th>Outside house walls</th>
<th>Outside kitchen walls</th>
<th>Outside storehouse walls</th>
<th>Around corn bin</th>
<th>Compound (away from structures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>clay/sherds</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2</td>
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</tr>
<tr>
<td>sand</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>pigments</td>
<td>- 10</td>
<td>-</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

**Total:**

|        | 21 | 11 | 6 | 5 | 7 | 139 |


often served as supports for the surplus clay while modeling or as a modeling stand. The fact that the manos and metates used by potters for grinding temper were generally well worn, recycled, incomplete or badly damaged suggests that they would very likely be left at the upon site abandonment. Grains of ground calcite would likely be incorporated into the grinding surface of these tools. In addition, in Chanal, there was a definite tendency for potting households to have two or more manos (Figure 12). This tendency, of course, reflected the addition of reused manos for pottery making to the household inventory. Similarly, of 22 Chanal non-potting households with metates and 28 potting households with metates, the non-potting households averaged 1.4 (s.d. 0.7) metates per household while the potting households averaged 2.1 (s.d. 0.8) metates per household.

Only potting households (or households of former potters) in Chanal possessed smoothing stones. However, only 14 (42%) of the potting households which claimed to use smoothing stones, actually had them on hand or could find them. Most people had lost or misplaced them. This loose curational behavior suggested that a given potter might contribute several smoothing stones to the archaeological record while she was actively making pottery. On the other hand, they were so small and infrequent that they could easily be missed in most archaeological excavations. However, if recovered they would be good positive indicators of potting activities in a household.
If abandoned at a site, these potentially visible tool-forms would probably be discarded or left at their location of storage rather than at their location of use, although these locations were sometimes very close to each other. Activities involving the use of these items generally took place on the household patio, which was cleaned up after each event. Smoothing stones were almost always stored inside the main house or kitchen while the larger temper-preparation tools were found in a number of different locations inside or around the outside walls of the main house or kitchen or more often along the edge of the patio. The metates were the largest tools and those most likely to be used and stored in a single location (that is, use and storage locations were generally synonymous).

Pottery firing equipment (hearth, stone props, and wasters) are also potentially visible remnants of pottery-making activity. Potters interviewed generally had one or more specific locations for firing pottery which they used repeatedly. Of course, the more often a location was used the more likely it is that it would be visible in the archaeological record. Traces of firing activity would include some fire-reddening of the soil, possibly charcoal and ash deposits, thermally fractured rock used for propping vessels, and potsherd wasters. The discovery of a firing hearth would depend largely upon the area of the site excavated. Excavations limited to house mounds would probably miss potting hearths since they were often located away from structures and the patio.
Additional materials with generally low potential archaeological visibility include the byproducts of pottery making activities. Examples of this would include the debris from calcite grinding; ground calcite and sand from the preparation of the clay body; surplus clay from modelling and finishing activities; spillage of slip or pigment during decorating; and sherds and partially complete vessels discarded or set aside after breakage during drying or firing. Other than the breakage of vessels, these materials might occur in relatively small amounts, yet in situations where an activity is repeated many times a year in one location (such as calcite grinding) a gradual deposit of debris may leave a permanent record of the activity. In this context, a model of the pottery making behaviors of living potters presents a useful interpretative tool.

Having discussed the potential archaeological visibility of various pottery making tools and raw materials it is essential to emphasize the importance of recognizing pottery making behavior on the community level if social interpretations based on stylistic variation are to be attempted. For example, Hayden and Cannon (n.d.) have stressed that analysts must establish that a specific craft activity was actually carried out at a household (or among households on the community level) being studied before one can reliably use stylistic variation among artifacts (in this case pottery) as a basis for making inferences concerning post-marital residence behavior.
Figure 12: Two-way cross-tabulation of variable 381 (presence /absence of potter/household) and variable 890 (greater than one/less than two manos/household).

**Two-way Cross-Tabulation:**

<table>
<thead>
<tr>
<th>Manos:</th>
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<tbody>
<tr>
<td>N</td>
<td>53</td>
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<tr>
<td>TOTAL</td>
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<td>&lt;TWO OBSERVATIONAL</td>
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<td>22</td>
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<td>EXPECT</td>
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**Tests of Independence**

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<td>Fisher Exact Prob</td>
<td>.0003</td>
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The recognition of archaeological potting households is not an easy task and is seldom dealt with adequately in the literature. Only a few recent studies have dealt with the problem of recognizing pottery making behavior in archaeological sites (e.g. Kent 1981; Haury 1976).

At Snaketown (Haury 1976:194-197), one good example of a pottery making activity area was found, dating to the last horizon of the community's history, which occurred on a courtyard surrounded by five structures. One of these structures had its entrance on the courtyard, which contained five elongated clay mixing basins and at least six firing pits. The latter had a matrix made up largely of ashy material and showed some reddening of the soil. These were believed to be contemporary and probably representative of some kind of craft organization. Other visible remnants of potting activity included a lump of prepared clay beside one basin; a mortar and pestle (for clay or pigments?), beside another basin; a roughed-out plainware basal sherd modelling stand; and a mixture of potsherd wasters (some large and all heavily burned) and thermally fractured stone "props" in the firing pits.

Assuming similar production methods, our Tzeltal Maya data concerning pottery production indicates that it should be possible to identify potting households in Pre-Columbian Maya sites. Certain pottery making equipment (smoothing stones, hammerstones, manos and metates), raw materials (clay, temper, and pigments), and firing equipment (stone props and wasters)
seem to have relatively high potential for deposition, recovery and recognition in the archaeological record. If microdebitage analysis is used, byproducts of temper grinding should also be visible.

A cautionary note might be added concerning the use of calcite in Aguacatenango; although most households did not make pottery, some collected calcite in the nearby hills and exchanged it in Amatenango for finished vessels. Therefore several non-potting households had supplies of calcite temper on hand. However, it seems reasonable to assume that the occurrence of two or more of the above artifacts and/or features in association would be sound indicators of pottery making behavior at a given household.

The presence of pottery making tools has been used in the Maya area, on at least two occasions, for recognizing potting households. In a single domestic structure excavation at the Classic site of Yerba Buena (Chiapas), Douglas Bryant has postulated the presence of a potter from the occurrence of two items: a ball of calcite-tempered clay and distinctively worn pottery smoothing stones (1979: personal communication). The other occurs in the Chorti Maya area of El Salvador, where Sheets (1979) has excavated a Protoclassic site at Ceren. The site, consisting of a single household, was constructed on the top of the partially weathered ash of the Ilopango eruption of c. 300 A.D., and was later buried by the Laguna Caldera eruption of c. 600 A.D. Area two of the site has been interpreted as a pottery
manufacturing location because of the presence of a lump of hematite (red iron oxide pigment), a hand-formed ball of fine clay, and an andesite smoothing and polishing stone (Sheets 1979:40-41).

In addition, at Tikal, Becker (1973:399) has postulated the presence of potting households on the basis of high vessel frequencies and type diversity relative to other households and house groups. These inferences are consistent with the findings of the present study (see chapter five). In Chanal, of 49 potting and non-potting households in which locally made pottery could be adequately identified, potting households averaged 36.8 local vessels (s.d. 25.2) while non-potting households averaged 26.2 local vessels (s.d. 19.2). Furthermore, potting households averaged 7.1 locally made formal-functional types (s.d. 3.0) while non-potting households averaged 5.2 such types (s.d. 2.9).

**Domestic production versus village specialization**

The preceding discussion has emphasized the differential variability and patterning associated with levels of household production. In this final section, this information is reconsidered at the village level, in terms of why Chanal and Aquacatenango are not (or cannot be) self-sufficient or exploitative (in terms of trade) in pottery production. To deal
with this problem, we must take into account both ethnographic and ethnohistoric factors which may contribute to the change from domestic production to village specialization. The following discussion reviews the present position of these two communities within the regional exchange network, and considers available ethnohistoric information in order to speculate on how the present situation has developed.

The communities which supplied both Chanal and Aquacatenango with pottery could be viewed as four distinct geographical distribution zones, termed here, (1) intra-community, (2) peripheral, (3) intra-sphere, and (4) inter-sphere. In Chanal, the "intra-community" distribution zone, satisfied at least 50% of the total pottery consumption needs of the community (see Tables 15 and 16). In contrast, Aquacatenango potters produced less than 5% of the pottery consumed by the community, while more than 80% came from Amatentanco.

The second geographical zone, termed here the "peripheral distribution zone" included a number of small production centres in parajes, ranchos, and colonias within about a 10-15 km radius of the two communities. Middlemen or the potters themselves, or members of the potter's immediate family made regular trips into Chanal and Aquacatenango to peddle pottery wares from door to door.

The third geographical zone included communities which supplied the regional market at San Cristobal las Casas, all of which were located within 15-100 km. radius of the two
Table 15: Frequency and percentage of pottery contributed to Chanal and Aquacatenango by each supply zone.

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Table 16: Pottery distribution zones for Chanal and Aquacatenango, indicating type diversity provided by each source.

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</table>

| (Inter-community) Aquacatenango* | - | - | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| (Peripheral) Marcos Becerra | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pinola | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Amatenango | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| Palizada | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Napite | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Tzajala | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| San Jose | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (Intra-sphere) San Ramon | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Yocnajab | x | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Chiapa De Corzo | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (Inter-sphere) Central Mexico | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

* type number corresponds to type number in classification (Appendix B)
** in order of relative distance from Chanal or Aquacatenango.
+ not including forms made by resident Amatenango potters.
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<td>Frontera Tzajish</td>
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<td>(Intra-sphere)</td>
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<td>San Ramon</td>
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<tr>
<td>Yocnajab</td>
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<td>Amatenango</td>
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<tr>
<td>Chiapa De Corzo</td>
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<td>(Inter-sphere)</td>
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<tr>
<td>Central Mexico</td>
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<td></td>
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<td>x</td>
</tr>
</tbody>
</table>

* type number corresponds to type number in classification (Appendix B).
** in order of relative distance from Chanal or Aquacatenango.
+ not including forms made by resident Amatenango potters.
communities. Howry (1976:259) considered San Cristobal las Casas a major "bulk ing" point for the pottery making centres of the region, especially Amatenango and Chamula. Also prominent were the lead-glazed wares produced by the ladino potters of San Ramon (a barrio of San Cristobal las Casas) and Chiapa de Corzo. The small glazed, wheel-made bowls of Chiapa de Corzo were purchased and resold by Chanal merchants.

The only wares not produced within a 100 km. radius of either Chanal or Aquacatenango were a handful of small factory produced cups from Central Mexico. These were included in the "inter-sphere" distribution zone. They were also made available to the Tzeltal through the pottery shops of San Cristobal las Casas.

Amatenango would be included in the "intra-sphere" distribution zone for Chanal, while it must be considered part of the "peripheral" zone for Aquacatenango due to the proximity of the two communities. Occasionally, Amatenango pottery found its way directly to Chanal via: middlemen who made semi-regular visits by truck; by Chanal merchants who stocked a few narrow-mouth jars (A T); and via Chanal pilgrims who visited there during the two major Amatenango festivals. In contrast, many Amatenango potters peddled their wares door-to-door in Aquacatenango.

It seemed surprising that Chanal, although it had at least 150 active potters and abundant resources (clay, temper and fire wood) for pottery making, exported almost no pottery and imported
more than 40% of the vessels (based on inventory counts) consumed by the community (see Table 17). The 19% of vessels of unknown origin were certainly produced within the peripheral distribution zone and at least some of these were probably from Chanal itself. Still, 26% of the vessels recorded in Chanal came from the intra-sphere distribution zone. Equally perplexing was the Aquacatenango situation, where less than 5% of the vessels consumed by the community were made locally despite the fact that Aquacatenango shared many of the same resources with Amatenango.

In fact, some of the clay deposits exploited by Amatenango potters were located on Aguacatenango lands, but were not exploited by Aguacatecos (Hunt 1962:82). In addition, M. Nash (1966:73) pointed out that any village within the entire region around Amatenango (approximately 3100 square km.) had access to virtually the same resources but none of them have developed pottery making as a specialization.

Most of the basic differences between Chanal and Amatenango pottery production were discussed above. Primarily, these involved the organization and intensity of production (see Table 17). Almost every Amatenango household produced pottery. Pottery making was a community speciality and the potter's productive skills and knowledge were not exported (M. Nash 1966:73). In sociological terms, Amatenango possessed the strong "closed corporateness" that Reina and Hill (1978:199) saw as characteristic of Guatemala Highland pottery production centres, and as one factor in the maintenance of the traditional practices.
Table 17: Comparison of pottery making in Chanal and Amatenango.

<table>
<thead>
<tr>
<th>State:</th>
<th>Chanal</th>
<th>Amatenango</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy:</td>
<td>Household production</td>
<td>Village industry</td>
</tr>
<tr>
<td>time involved</td>
<td>occasional/part-time</td>
<td>part-time/full-time</td>
</tr>
<tr>
<td>number of potters</td>
<td>1-3 friends/relatives</td>
<td>extended family/guild</td>
</tr>
<tr>
<td>organization</td>
<td>none (work separately)</td>
<td>assembly-line</td>
</tr>
<tr>
<td>locality</td>
<td>sedentary</td>
<td>sedentary</td>
</tr>
<tr>
<td>market</td>
<td>home-use/intracommunity</td>
<td>local/regional</td>
</tr>
<tr>
<td>raw materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clay</td>
<td>local (&lt;1km)</td>
<td>local (&lt;1km)</td>
</tr>
<tr>
<td>temper (calcite)</td>
<td>distant (2-8 km)</td>
<td>local</td>
</tr>
<tr>
<td>(sand)</td>
<td>not used</td>
<td>local</td>
</tr>
<tr>
<td>water</td>
<td>local</td>
<td>not used</td>
</tr>
<tr>
<td>fuel</td>
<td>local</td>
<td>local</td>
</tr>
<tr>
<td>pigments</td>
<td>local</td>
<td>distant (&gt;5km)</td>
</tr>
<tr>
<td>smoothing-stones</td>
<td>local</td>
<td>distant (5-60 km)</td>
</tr>
<tr>
<td>investments</td>
<td>time only</td>
<td>cash for pigments and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transportation</td>
</tr>
<tr>
<td>seasonality</td>
<td>dry season (Dec.-Mar.)</td>
<td>year-round</td>
</tr>
<tr>
<td>labour division</td>
<td>generally none</td>
<td>considerable</td>
</tr>
<tr>
<td>time involved to make each vessel</td>
<td>&lt;20 min.</td>
<td>&gt;30 min.</td>
</tr>
<tr>
<td>technology:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>manufacturing technology</td>
<td>hand/small tools</td>
<td>hand/small tools</td>
</tr>
<tr>
<td>special tools</td>
<td>not used</td>
<td>used by guild (but has no moving parts)</td>
</tr>
<tr>
<td>wheel</td>
<td></td>
<td>open fire**</td>
</tr>
<tr>
<td>kiln</td>
<td>open fire</td>
<td></td>
</tr>
<tr>
<td>raw materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clay</td>
<td>black and red</td>
<td>black, white, yellow</td>
</tr>
<tr>
<td>temper</td>
<td>calcite</td>
<td>calcite and 3 types of sand</td>
</tr>
<tr>
<td>fuel</td>
<td>pine kindling,</td>
<td>pine kindling,</td>
</tr>
<tr>
<td></td>
<td>oak bark</td>
<td>oak bark, cypress</td>
</tr>
<tr>
<td>range of functional types produced</td>
<td>narrow</td>
<td>wide</td>
</tr>
<tr>
<td>range of wares</td>
<td>unslipted only</td>
<td>slipped (red &amp; white)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and unslipted</td>
</tr>
</tbody>
</table>

*Two Aguacatenango potters had grown up and learned to make pottery in Amatenango and continued to carry on the manufacturing practices of that community, while other potters of Aguacatenango are closer to the Chanal pattern.

**The one potter's guild in Amatenango has a closed kiln build for them by I.W.A.H. but it was not being used during the present survey.
(such as potting) and accouterments of Indian culture.

All Amatenango girls were taught to make pottery and lived within an atmosphere of constant pottery production. The women of the household gathered raw materials, constructed, decorated, and fired the pottery in an assembly-line fashion. The men gathered firewood, helped with the final stages of firing, and often marketed the final product. Pottery making in Chanal was a much more loosely organized affair. Potters generally worked alone and the men did not participate. Chanal potters produced only the "less elaborate" plainwares, while Amatenango potters produce plainwares, as well as a variety of slipped and decorated wares. Amatenango had a virtual monopoly in the southern Tzeltal area on one essential vessel-form, the narrow-mouth jar, used for water carrying (see Figure 13).

The community of Amatenango was established early in the Colonial period (J. Nash 1970:2). It has been a major pottery production centre since at least the last century. Even before the building of the Pan American Highway in 1955, Amatemango pottery was peddled by horseback to small communities within a 80 km. radius (J. Nash 1970:91). Ethnohistoric documentation of Tzeltal and Tzotzil pottery making is conspicuously lacking (Calnek 1962:39), however, Culbert (1965:46) believes that Amatenango pottery production may represent a pottery tradition (Huistan Hard) which began in the Postclassic and probably was still in production at the time of conquest (Culbert 1965:72). Furthermore, Culbert states that specialization probably existed
Figure 13: Map of the Chiapas Highlands, indicating major potting communities which provide pottery to Chanal and Aquacatenango, and the overlapping distribution zones of narrow-mouth jars made in Amatenango, Chamula, Tenango, and Yocnajab (adapted from Howry 1976).
in the Central Highland's during each period from the Classic to the present (1965:46-47).

Amatenango and Aquacatenango had a very close producer-consumer relationship. Aquacatenango households used more than 75% Amatenango vessels, while serving as suppliers of tempering material for some Amatenango potters. The latter group took cobbles of calcite in exchange for pottery. In Amatenango, pottery production served as an important safeguard against crop failure, while in Aquacatenango a crop failure meant a higher migration rate of men to the lowland fincas for wage labor (Hunt 1962:81).

By contrast, the present location of Chanal was probably not occupied until the early 1800s by families migrating from the community of Oxchuc due to shortages of agricultural land (Calnek 1959:57). Chanal was not listed as a community until 1854 (Trens 1957:516), and until the 1930s the community was very small. At that time, families from surrounding parajes were persuaded to move into the community, and the present grid plan was laid out. Not surprisingly, close connections still existed between Chanal and the surrounding smaller communities at the time of our visit. This situation probably accounted, at least in part, for the close formal similarities between Chanal pottery and those of the surrounding communities, as well as the dependence upon these communities (through kin connections) for at least 15% of the pottery consumed in Chanal.
Arnold (1975:192) believes that pottery making specialization sometimes began as an adaptation to poor agricultural land in areas where ceramic resources also occurred. A case can easily be made for this situation in the Central Highlands of Chiapas. For example, Collier has linked the dependence on household industry and wage labor in Amatenango and Chamula, to the lack of adequate farmland (1975:76). Deteriorating agricultural land combined with the availability of good clay and temper have also been linked to the recent emergence of male potters and the subsequent increase in pottery specialization in Chamula (Rowy 1973:10; Russ 1969:68). Similar relationships between problems in agriculture and the emergence of pottery production in Amatenango suggests that agricultural-based events in the past may have led to and perpetuated pottery specialization. As Arnold has noted (1980:147), "people would probably not choose to become craft specialists if the subsistence base was adequate."

In the case of Chanal, another limiting factor to the development of pottery specialization was population density. There was a much smaller market in the Chanal area which could be exploited by Chanal potters. Even in the more densely populated area around Amatenango there was probably not a large enough market to support more than one community specializing in pottery production. If regional pottery exchange were as competitive in the past as it is today, then it is not surprising that one community eventually came to dominate an area despite the wide
availability of resources.

Culbert (1965:47,67) suggested that the manufacture of San Gregorio coarse vessels, during the Early Postclassic (Yash phase), might parallel the situation recorded in the Chanal area, in which a number of communities had potters who made a few plainware vessels for local use while finer vessels were imported from larger centres. As is the case with Chanal and the surrounding communities, certain basic vessel-forms (during the Yash it was two wide-mouth jar forms) were similar, but paste, color and finish had different ranges at each site, indicating local production in communities sharing the same "basic" pottery tradition. Similarly, studies at Palenque (Rands 1967) and Tikal (Fry and Cox 1974; Fry 1979), indicated that domestic vessel-forms (especially wide-mouth jars) were characterized by highly localized distribution. Even potting centres like Amatenango could only find a local market for most domestic pottery, while specialized forms were distributed more widely.

The above discussion provides one possible scenario for the rise of specialization in Amatenango and the present role of Chanal and Aquacatenango as pottery consumers. According to this scenario, during the Colonial period the community of Amatenango was established on the flat bottomland of a major highland valley (today called the Amatenango Valley). Among the settlers were at least a few potters who shared potting information linked to a tradition which began in the Late Classic or early Postclassic in the Huistan Valley. Due to a combination of widely available
resources for pottery production and an undependable, overused, or inadequate agricultural base, pottery making flourished and a community style developed. Amatenango pottery eventually came to dominate the limited valley market, and today it continues to expand its market due to improved roads and methods of transport. Aquacateco concentrated on agriculture and took advantage of their proximity to Amatenango by exchanging food surpluses and raw materials (calcite temper) for pottery.

Chanal was established more recently due to land shortages in Ozchuc. The community remained small and dispersed until the 1930s. While potting resources were plentiful, they were of relatively poor quality for making complex vessel-forms and the specialized knowledge for production of trade wares was lacking. Furthermore, specialized vessel-forms could be acquired through well-established trade routes over which Amatenango and Tenango pottery were peddled. With the expansion and consolidation of the community in the 1930s, more potters probably settled in the community and potting knowledge spread through kin and nonkin relationships, and the available resources were utilized for vessels requiring little skill or high quality clays. While, this scenario is purely speculative, it is consistent with currently available ethnographic, ethnohistoric and archaeological sources.
The present chapter has dealt with the pottery variability and patterning peculiar to Tzeltal pottery making households. Pottery variability within potting households concerns not only vessel frequency and type diversity, but also microtradition variation in terms of the technical, formal, and stylistic differences in the product of a household's potter (or potters).

The spatial distribution of pottery in potting households versus non-potting households primarily concerns the storage of vessels between stages of manufacture and between manufacture and sale, as well as the storage of raw materials in reused vessels. All of this variability and patterning seems to intensify as the level of production increases.

Three levels of pottery production were recognized in the Tzeltal area, including (according to Balfet's terminology) domestic production, elementary specialization, and artisan specialization. In Chanal and Aguacatenango, the level of production had never risen beyond that of elementary specialization. The rise of the artisan specialist, as in Amatenango, seemed to be related to the economic needs of the community (that is, as a supplement to agriculture), along with the availability of pottery making resources and the development and maintenance of the specialized knowledge for exploiting those resources.
If archaeologists wish to base inferences of post-marital residence behavior on pottery stylistic variation, or if they wish to study intra-community craft specialization, then they must be able to recognize archaeological potting households. Information on Channel pottery making indicates that potting households can be recognized most reliably through the identification of discarded pottery making tools and the residues of pottery production. The former includes smoothing stones, hammerstones, manos, and metates used in pottery paste preparation and forming activities, stone props, and wasters used in firing activities. The latter includes deposits of clay, temper, and pigments, often in reused vessels, as well as the remains of the firing hearth. In addition, relatively high vessel frequency or type diversity counts may be useful as supporting evidence in households were clear identification of potting activity cannot be made on pottery making tools or production byproducts alone.
Chapter Three

Household as consumption unit

"As with all artifacts, ceramics are part of a living totality, and they must be understood in their functional and symbolic role." (Deetz 1977:50)

Introduction

In the previous chapter, a model of Tzeltal household pottery production was presented and some predictions were made concerning the archaeological visibility of Tzeltal potting activities. The present chapter concentrates on a model describing variability in pottery use and reuse in contemporary Tzeltal households (figure 14) and a discussion of the archaeological implications of variations in household pottery requirements.

According to the model presented here, pottery use and reuse are viewed as two distinctive cycles of activity. In the study communities, during the use cycle, a given pottery vessel was used for its specific primary function, then, if necessary
Figure 14: Relationship between use cycle, reuse cycle, and provisional discard.
cleaned and dried, and finally curated in a protected storage location. While in storage, it might itself become a temporary storage container (see below).

The cycle of use and curation events was completed when the pottery vessel was broken. If the vessel was not immediately repaired, thus renewing the cycle, or immediately disposed of outside of the compound, it was placed in a provisional discard location (see Chapter 4). Many vessels, or vessel fragments in provisional discard were eventually selected for reuse. During the reuse cycle, the vessel or item was used for a secondary (or, if broken again, tertiary) function generally unrelated to its original function. At any time, during either cycle, a vessel might be deemed useless and discarded (see Figure 15).

The following discussion deals with the use and reuse cycles in more detail. The use cycle is discussed in terms of variation in vessel function and activity sets, and individual household needs. The latter includes variations due to (1) current household socioeconomic conditions, (2) borrowing and loaning of vessels, (3) vessel uselife and replacement rates, and (4) storage requirements. A review of the Precolumbian pottery sequence for the Central Highlands indicates the potential for making comparisons at the activity set level (at least, ritual versus domestic) between modern and Precolumbian pottery assemblages.

The reuse cycle is discussed in terms of repair methods and reuse requirements. Finally, discussion shifts to the archaeological implications of variations in household pottery use and reuse activity.
Figure 15: The decision-making related to the life span of a pottery vessel in Chimal and Aquacatenango.
Maintenance and temporary storage.

** Secondary or tertiary use.
Use cycle

(i) Functional variation and activity sets

Pottery items satisfied a wide variety of domestic and ceremonial requirements of the Tzeltal household. Each vessel-form was associated with a specific range of functions. Certain groups of vessels were seen to embody distinct "activity sets." An activity set consisted of a group of vessels which serve a specific activity, were associated with a specific activity area, and were stored together near their area of use.

Three major activity sets could be found in any Tzeltal household, including (1) food preparation and serving vessels, (2) water procurement and storage vessels, and (3) ritual vessels.

The Tzeltal food preparation and serving set consisted of nine vessel-forms in Chanal and Aquacatenango, including five general purpose bowl and jar forms and four vessel-forms with restricted functions:

(1) Bowl, small hemispherical (Poket): used for serving cooked vegetables or corn gruel.
(2) Bowl, small restricted (*sets*): used for serving cooked vegetables or corn gruel, or ladle.

(3) Bowl, small elliptical (*chaltep*): used for frying vegetables, and occasionally meat or fish.

(4) Bowl, small frustrum (*sets*): used for serving cooked vegetables, frying vegetables.

(5) Plate, large unrestricted (*sang*): used for roasting tortillas.

(6) Solid, frustrum (*makil sti*): used for pot lid.

(7) Jar, small, wide-mouthed (*oxom*): used for boiling vegetables.

(8) Jar, single-handle (*chikbin*): used for making coffee, boiling vegetables, making home remedies.

(9) Jar, perforated (*chixnejab'il grandi*): used for washing lime-soaked corn.

Of these nine vessel-forms, the basic activity set consisted of at least one serving bowl, a wide-mouth jar and an unrestricted plate. All forms were generally used and stored within the kitchen structure (Table 18), while new vessels were stored in the rafters. For entertaining, meals might be eaten in the living house, in which case serving bowls would be used to transfer prepared foods between the two structures.

The second activity set consisted of only one vessel-form (type 10), the narrow-mouth jar (*kib*). This vessel served primarily for the transportation of water from water source to
Table 18: Storage location of formal/functional types, by activity sets, for Chanal and Aguacatenango.

(Chanal)

<table>
<thead>
<tr>
<th>Location:</th>
<th>Activity set:</th>
<th>Domestic</th>
<th>Ritual Offering</th>
<th>Borcelana*</th>
<th>Cooking/Brewing</th>
<th>Kib</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>House altar</td>
<td></td>
<td>21</td>
<td>90</td>
<td>37</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>House (general)</td>
<td></td>
<td>287</td>
<td>24</td>
<td>60</td>
<td>123</td>
<td>49</td>
<td>53</td>
</tr>
<tr>
<td>House/kitchen</td>
<td></td>
<td>96</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Kitchen</td>
<td></td>
<td>1036</td>
<td>3</td>
<td>127</td>
<td>64</td>
<td>79</td>
<td>21</td>
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<tr>
<td>Storage bdg.</td>
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<td>41</td>
<td>2</td>
<td>27</td>
<td>26</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Sweatbath</td>
<td></td>
<td>44</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>9</td>
<td>1</td>
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<td>Corn bin</td>
<td></td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>2</td>
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</tr>
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<td>Workshop</td>
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<tr>
<td>Tienda (for sale)</td>
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<tr>
<td>Abandoned bdg.</td>
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<td>3</td>
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<td>-</td>
<td>-</td>
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<td></td>
</tr>
<tr>
<td>On/around patio</td>
<td></td>
<td>45</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>56</td>
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</table>

(Aguacatenango)

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<td>House (general)</td>
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<td>House/kitchen</td>
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<td>Kitchen</td>
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<td>622</td>
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<td>Storage bdg.</td>
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<tr>
<td>Sweatbath</td>
<td></td>
<td>54</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Animal pen</td>
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<td>55</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>6</td>
<td>2</td>
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<tr>
<td>On/around patio</td>
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<td>759</td>
<td>4</td>
<td>4</td>
<td>67</td>
<td>201</td>
<td>6</td>
</tr>
</tbody>
</table>

* The unrestricted bowl (Borcelana) is generally part of the ritual activity set, but is occasionally reused for domestic functions or serves both ritual and domestic serving functions. In either of these cases, it is stored in the kitchen with domestic vessels.
kitchen, where it also served as a water storage container. Some households sat up drainage troughs beside structures with a kib at the lower end to collect rain water. Smaller narrow-mouth jars were used to hold water in the sweatbaths, as well as for training young girls to carry water. Generally each household would have at least one of these vessels, and many households stored extra vessels of this type in case of breakage.

The ritual activity set consisted of nine vessels-forms, most of which were restricted in function, including:

- (11) Bowl, large hemispherical (*pocket grande*): used for beer mixing, handwashing.
- (12) Bowl, small unrestricted (*boicelapa*): used for serving vegetables or corn gruel; offering fruit, vegetables, or coffee on altar; serving guests on ritual occasions.
- (13) Bowl, single-handle (*beochab*): used for making wax candles.
- (14) Bowl, pedestal-based (*chikpo*): used for offering incense.
- (15) Cylinder, pedestal-based (*sonjobal cantele*): used for offering candles.
- (16) Jar, large wide-mouth (*oxom grande*): used for cooking vegetables or preparing corn gruel for large gatherings.
- (17) Jar, large composite (*tenogha grande*): used for beer mixing and fermenting, dry storage.
(18) Jar, perforated (chixnañab'il chicha): used for straining corn gruel.

(19) Jar, pedestal-based (florepo): used for offering flowers.

Of these vessel-forms, the basic ritual activity set included a pedestal-based bowl for offering incense, a large wide-mouth jar and one or more serving bowls. Some people purchased beer (chicha) from bootleggers and therefore did not require the large chicha-making vessels. Also, the single-handle bowl (meochab) was only used in Chanal. It was a very specialized item, which was commissioned by a person holding the First Alférez cargo position (see Chapter Five). It was only used on one occasion, to make beeswax candles for a special ritual offering. This vessel was generally saved by the family as an heirloom.

The preparation of large quantities of food in the Oron grande was sometimes done on special festival hearths, constructed on or around the family patio. These and other large ritual vessel-forms were stored in any available space (in corners, rafters, along outside walls, and in storage buildings when they occur), while other ritual vessels were primarily used on the family altar and are generally stored on or around the altar (Deal 1980).

Two types (30 and 31 of this classification) were traditional vessel-forms which were no longer produced. One was
the Chanal cylindrical jar (halal oxom) which, according to one informant, was once popular for carrying hot liquids to the milpa. The three specimens recorded were being used for cooking beans, storing beans, and storing peaches. The other type, the Aguacatenango pedestal-based bowl (chinpin) served as a support for a serving bowl. One other traditional pottery item, the spindle-whorl (pe'tet), was generally found in households with weavers. Some of these were made locally, while others were bought in San Cristobal las Casas or Comitan, and probably originated in Ochuc.

(ii) "Gourd containers"

Throughout modern Mesoamerica, gourd containers can sometimes substitute for certain pottery types and therefore can affect the diversity of a household's pottery inventory. The use of gourd containers is a tradition dating back at least 9000 years in various parts of Mesoamerica (Lathrap 1977:725; Lowe 1971; Whitaker and Cutler 1967). Moreover, "a variety of gourd containers (including certain thick-rinded pumpkins and squashes) probably served as prototypes for the form, surface finish, and decoration in the Mesoamerican "basal" pottery tradition (Josink-Mandeville 1974). The production and functional variation of gourd containers among modern Maya groups has been well documented (e.g. Baer and Baer 1950:13-14; Berlin et al. 1974:128-131; McBryde 1947:57,138;
In modern Ch'anal and Aguacatenango households, while the open mouth gourd bowl (see below) was substituted for any pottery utility bowl, other gourd vessels had restricted functions which generally did not overlap with pottery vessels (see Table 19). Gourd vessels were often associated with ritual activities, especially the restricted mouth bowl (pompo) and the gourd cup (jicara). In particular, the use of gourd vessels in funerary rites has often been reported (Menget 1968:54; Wisdom 1941:304), and they have been found in early burials (McBryde 1947:138).

The six types of gourd containers recorded in Ch'anal and Aguacatenango included:

1. Bowl, restricted mouth: used for storing tortillas (on ritual occasions a special pedestal (pechec) made from maguey cordage, with strings for suspension, was used to support the tortilla server).
2. Bowl, open mouth: used for general dry storage.
3. Ladle: used to ladle dry foods (especially beans or kernelled corn) or water.
4. Bottle: used for storage and transport of liquids and is usually closed with a cork made from a corn cob or husks.
5. Cup: used for serving liquids (trago or atole) on ritual occasions.
6. Bowl, perforated for suspension: used for carrying corn kernals for planting. (Armadillo carapace bags also served this function).
Table 19: distribution of gourd vessels per household in Chanal and Aquacatenango.

<table>
<thead>
<tr>
<th>Vessel type</th>
<th>(Chanal)</th>
<th></th>
<th>(Aquacatenango)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Mean</td>
<td>S.d.</td>
<td>Maximum</td>
</tr>
<tr>
<td>Restricted-mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>bowl:</td>
<td>42</td>
<td>7.79</td>
<td>8.4</td>
<td>22</td>
</tr>
<tr>
<td>Unrestricted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bowl:</td>
<td>13</td>
<td>1.32</td>
<td>2.5</td>
<td>12</td>
</tr>
<tr>
<td>Cup:</td>
<td>30</td>
<td>1.30</td>
<td>4.3</td>
<td>18</td>
</tr>
<tr>
<td>ladle:</td>
<td>9</td>
<td>1.55</td>
<td>2.3</td>
<td>-</td>
</tr>
<tr>
<td>Bottle:</td>
<td>14</td>
<td>2.96</td>
<td>3.4</td>
<td>21</td>
</tr>
<tr>
<td>Suspended bowl:</td>
<td>1</td>
<td>0.02</td>
<td>0.4</td>
<td>12</td>
</tr>
</tbody>
</table>
(iii) Recent changes

The remaining vessel-forms (and vessel equivalents) must be considered in light of two recent trends, recognized by Ricklin (1971:21), in pottery production in both Mesoamerica and the Southwest. One is the increase in non-utilitarian pottery vessels for the tourist trade, and the other is the decline in traditional pottery with the advent of modern industrial equivalents. Nine vessel-forms recorded in Chanal and Aquacatenango must be considered tourist types, including:

(21) Bowl, tripod (molcajete and majode): used for grinding chile pepper.
(22) Effigy vessel (alcan
gis): used for child's money bank.
(23) Figurine (figurilla): used for child's toy.
(24) Jar, small composite (tenosha chica): used for child's toy.
(25) Dish, flaring-mouth (cenicer
cero): used for ashtray.
(26) Cup, single-handle (vaseo): used for serving liquids.
(27) Vase, wide-mouth (maggia): used for flower pot.
(28) Bowl, loop-handle (mochelum): used for general dry storage, decoration.
(29) Bowl, incurving rim (batea): used for general utility, clothes washing.
These types were very rare in both communities. In Chalal they represented only .7% of the total community pottery inventory (23 vessels), while in Aquacatenango they represented 1.6% of the total inventory (66 vessels). When they occurred, they were most often stored inside the main living structure.

The second trend, the industrial replacement phenomenon, sometimes greatly altered the size and diversity of a household's pottery inventory. Metal, glass and plastic containers were moderately priced alternatives to many pottery types, especially for food serving and water transport. On the other hand, industrial equivalents of ritual vessels were uncommon, except for serving functions (see below).

The most commonly replaced vessels were food serving bowls (see Table 20). When asked why industrially made bowls were often preferred over pottery ones, the consistent reply from informants was that the metal ones lasted longer. The same reason has been suggested for the preference of metal containers over pottery in the Kathmandu valley (Birminham 1975:385).

As among the Huichol (Weigand 1969:20), some Tzeltal families used metal and plastic buckets for transporting water from wells and in obtaining water from deep wells. Among the Tzeltal it was socially acceptable for a man to carry water if he used a bucket, but not acceptable if he used a pottery vessel.

As with metal bowls, metal cooking vessels were used because they lasted longer, and also because they heated up faster.

These included metal pots, cooking pans, frying pans, metal
Table 20: Distribution of industrial replacement vessels in Chanal and Aquacatenango.

<table>
<thead>
<tr>
<th>Vessel type:</th>
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<th></th>
<th></th>
<th>(Aquacatenango)</th>
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<tr>
<td></td>
<td>Maximum</td>
<td>Mean</td>
<td>s.d.</td>
<td>Maximum</td>
<td>Mean</td>
<td>s.d.</td>
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<tr>
<td>(Food preparation/ serving)</td>
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<td></td>
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<tr>
<td>Bowls:</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>metal</td>
<td>18</td>
<td>6.19</td>
<td>4.2</td>
<td>26</td>
<td>9.52</td>
<td>5.4</td>
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<tr>
<td>plastic</td>
<td>11</td>
<td>2.15</td>
<td>2.8</td>
<td>18</td>
<td>4.06</td>
<td>3.6</td>
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<tr>
<td>glass</td>
<td>23</td>
<td>0.62</td>
<td>3.2</td>
<td>10</td>
<td>1.46</td>
<td>2.2</td>
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<td>Plates:</td>
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<td></td>
<td></td>
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<tr>
<td>metal</td>
<td>20</td>
<td>1.62</td>
<td>3.7</td>
<td>3</td>
<td>0.30</td>
<td>0.7</td>
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<td>5</td>
<td>0.28</td>
<td>0.8</td>
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<td>0.13</td>
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<td>23</td>
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</table>

* There is a minimum number per household of one for metal cups, and beverage bottles in Aquacatenango.
Table 20 continued:

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<th>(Chanal)</th>
<th>(Aquacatenango)</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>Maximum</td>
</tr>
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<td><strong>Cookware:</strong></td>
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</tr>
<tr>
<td>metal pot</td>
<td>9</td>
</tr>
<tr>
<td>tin can/wire handle</td>
<td>12</td>
</tr>
<tr>
<td>tin can pitcher</td>
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<tr>
<td>metal comal</td>
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</tr>
<tr>
<td>frying pan</td>
<td>5</td>
</tr>
<tr>
<td>cooking pan</td>
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</tr>
<tr>
<td>metal sarten</td>
<td>-</td>
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<td>metal potlid</td>
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<td>homemade potlid</td>
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<td><strong>(Handwashing)</strong></td>
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<tr>
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<td>5</td>
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<td><strong>(Water-carrying)</strong></td>
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<td><strong>(Storage/utility)</strong></td>
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<td>Containers:</td>
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<td>-</td>
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<td><strong>Jar:</strong></td>
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<td>glass</td>
<td>8</td>
</tr>
<tr>
<td><strong>Bottle:</strong></td>
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<tr>
<td>&quot;tragó&quot; bottle</td>
<td>2</td>
</tr>
<tr>
<td>beverage</td>
<td>18</td>
</tr>
<tr>
<td><strong>(Offering vessels)</strong></td>
<td></td>
</tr>
<tr>
<td>Candle holder:</td>
<td>6</td>
</tr>
<tr>
<td><strong>Flower holder:</strong></td>
<td></td>
</tr>
<tr>
<td>glass</td>
<td>2</td>
</tr>
<tr>
<td>metal</td>
<td>-</td>
</tr>
</tbody>
</table>
comales, recycled tin can pitchers, reused tin cans with wire handles and metal buckets. Metal buckets were suspended over the hearth. Pottery, however, was universally believed to leave a better taste in cooked food. Often a metal vessel was only used if a pottery one was broken, or if the cook was in a hurry. Furthermore, metal tortilla griddles, although they required less fuel, were accused of heating too fast, and thus burning the tortilla around the edges while leaving a soggy, bad tasting middle. Most households had at least one of these, however, for reheating tortillas. This type, in particular, represented an addition rather than a replacement for its pottery equivalent.

Except for caches of metal bowls and cups (generally around the family altar) few industrially made items were used for ritual purposes. A few households had metal or homemade wooden candle holders, while a few others had metal or glass flower vases. Tin cans were quite often used for offering flowers on family altars, as well as containers for planting young seedlings. A large glass bottle (garapag) was often used for fermenting corn alcohol (frago), while beverage bottles were used for distributing smaller portions.

As long as cash continues to be scarce and pottery vessels remain cheaper and more accessible than industrial equivalents, there will be little danger of pottery disappearing from Tzeltal households. Furthermore, pottery can be made in the household, received as gifts, or bartered for produce.
(i) Socioeconomic factors

Matson (1973:216) suggested that the diversity of available types of pottery in the possession of a given household at any one time was largely dependent upon current socioeconomic and demographic conditions of the household, such as (1) family size, (2) group needs, and (3) social factors, as well as (4) the replacement factor (vessel uselives and replacement rates).

The Chanal and Aguacatenango data provided a useful opportunity to study the relationships between such factors and pottery variability in real households. Unless these relationships were strong, the use of archaeological pottery assemblages to infer any of these conditions about archaeological housesites in the Tzeltal area might be seriously questioned. In the present study, a series of graphs were generated, which compared various aspects of household socioeconomic and demographic conditions with vessel frequency and type diversity (see Appendix C). The socioeconomic variables represented family size, economic rank, social rank, religious cargo rank, and civil cargo rank.

When viewed at the level of the individual household, inferences concerning pottery frequency or diversity appeared to be highly unreliable when socioeconomic factors were used as the
predictive basis. However, when the average values of pottery variables by rank were examined, underlying relationships among households become clearer (also see Hayden and Cannon 1982a). The average values for each rank were linked by a line to give an indication of the trend of the relationship (see summary in Table 21).

In Channel, besides vessel frequency and type diversity, four additional pottery variables were used to characterize household pottery assemblages, including (1) ritual set diversity, (2) food preparation and serving set diversity, (3) imported type diversity, and (4) pottery type diversity with industrial equivalents added. Tourist types which were occasionally being used for domestic or ritual functions in a household were also added to that household’s food preparation and serving or ritual activity set. Imported type diversity included all pottery items (including tourist types) known to be made outside the peripheral distribution zone.

The following discussion outlines the criteria for the variables used and reviews the graphed relationships in more detail.

Family size:

This variable represented the total number of individuals in each household. Studies of prehistoric demographics have sometimes assumed a close relationship between pottery vessel size or frequency and family size (e.g. Cook 1972; Turner and
Table 21: pottery frequency and diversity trends in relation to certain ranked socioeconomic and demographic variables for Chanal and Aguacatenango (graphs are presented in Appendix C).

(P=positive trend; I=indeterminate trend)

(Chanal)

<table>
<thead>
<tr>
<th>Economic Rank</th>
<th>Social Rank</th>
<th>Civil Cargo Rank</th>
<th>Ritual Cargo Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pottery Frequency</td>
<td>Pottery Diversity</td>
<td>Pottery and Industrial Diversity</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>I</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>P</td>
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<table>
<thead>
<tr>
<th>Ritual Set Diversity</th>
<th>Food Set Diversity</th>
<th>Imported type Diversity</th>
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<td>P</td>
<td>I</td>
<td>P</td>
</tr>
</tbody>
</table>

(Aguacatenango)

<table>
<thead>
<tr>
<th>Economic Rank</th>
<th>Social Rank</th>
<th>Civil Cargo Rank</th>
<th>Ritual Cargo Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pottery Frequency</td>
<td>Pottery Diversity</td>
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<td>I</td>
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</table>
Lofgren 1966). However, recent ethnoarchaeological studies among
the Chuj Maya (Nelson 1981), as well as the Shipibo-Ccniibo
(Deboer and Lathrap 1979) and the Hopi (Stanislawski 1980) have
not found good correlations between vessel size and number and
household size or composition. The Tzeltal data tended to
support these latter studies. In Chanal and Aguacatenango, both
pottery frequency and type diversity showed a random association
with family size (see Figures 24-27).

Of particular interest here was the fact that many small
families had large pottery inventories. For example, many of the
smaller sized families consisted of older couples, whose children
had moved away. In such cases, it seemed that the pottery
inventory was more characteristic of the stage of family
development when children were present, and that the pottery used
in that stage was simply maintained. However, when two variables
reflecting the stage of family development (namely, the maximum
size attained by the household, and the age of the household
head) were graphed against vessel frequency and type diversity,
again, random relationships were indicated. While family size at
any given time obviously affects the size and diversity of a
household's pottery inventory, these relationships must be masked
by other factors (as discussed below) which exert considerable
influence upon household pottery variability over time.
Economic rank:

The economic rank used here was based primarily on potential income. It was decided that the sum of a household's income from various economic activities was a reliable indicator of a family's present economic state, and further, the estimates given to us by informants could be roughly evaluated from recorded observations. Potential income included (1) the value of all livestock, (2) any earnings from finca and other wage labour, as well as, specialized and part-time money earning activities (such as stores, cantinas, etc.), and (3) sales from milpa surplus (including fruit, vegetables, and firewood). The latter value was considered a fair estimate of the value of a family's land holdings, since not all land was used at a given time for produce and since the relative quality of land holdings varied considerably.

To begin with, it was assumed that wealthier households would have more pottery and a greater diversity of pottery types than would poorer households. To a certain extent the graphs confirmed this assumption (see figures 28-31). As economic rank increased, in Chanal, there was an increase in average ritual set diversity, food set diversity, and pottery (including industrial type) diversity. The wealthiest Chanal households (rank 4) tended to have a greater diversity of imported types, while all other ranks had about the same number of imported types.

For both communities, average pottery frequency and type diversity (excluding industrial equivalents) showed an
indeterminate relationship with economic rank. Actually, for economic ranks, values for type diversity in any one rank only varied between 11 and 13 for Chanal and between 12 and 14 for Aguacatenango. Average pottery frequency in Chanal increased between rank 1 and 3 and then decreased slightly in rank 4. This situation probably reflected a greater dependency on industrial equivalents among higher ranking households in Chanal, since there was a strong positive trend between economic rank and pottery and industrial type diversity together. The most commonly occurring industrial equivalents (bowl forms) definitely showed an increase in the higher economic rank (see Figure 32).

Social rank:

In each household, the household head was given a social rank based on the criteria of age, position in civil or religious cargo system, deference, public drunkenness, and position in lineage. The following six ranks were established (for graphing this data, ranks 1 and 2, and 5 and 6 were collapsed to make four ranks of comparable size):

Rank 1= widower household heads, drunkards.
Rank 2= young household heads, persons not high in lineage authority, low cargo positions.
Rank 3= elder household heads, near top of lineage authority, although low cargo positions.
Rank 4 = medium level cargo positions to which many people pay deference (such as treasurer or lower Alférez position).

Rank 5 = older individuals with much deference and moderately high to high cargo position (such as judge, high Alférez).

Rank 6 = oldest and highest members of cargo ladder (church President, civil President, or retired Presidents).

As in the case of household wealth, households of higher social status were expected to have larger, and especially, more diverse pottery inventories, the latter due to religious or civil obligations involving gatherings at their homes. Unlike the relatively weak and often indeterminate relationships with economic rank, most graphs using the social rank variable showed a positive trend (see Figures 33-36). Only average pottery and industrial type diversity and food preparation and serving set diversity showed somewhat of an indeterminate association with social rank in Chanal. Both of these graphs showed a decrease in the highest rank. In general, there seemed to be a closer relationship between social rank and the diversity of ritual and imported types, as opposed to domestic types (the majority of pottery as well as industrial types are domestic). The positive trend of type diversity and social rank could largely be attributed primarily to ritual, rather than domestic type diversity. The same may also be true of the positive trend of
type diversity and social rank in Aquacatenango. The decrease in average pottery frequency in Aquacatenango, where the cargo system has a much weaker presence, may reflect a greater dependency on industrial types and the reduced pottery requirements of the cargo system in that community.

Cargo rank:

The ranking for social status used above took into account the civil or religious cargo status of the household head. However, in order to determine the relative affects of civil versus religious cargo status on the relationship between social status and pottery variability, civil and religious cargo status were also treated separately. As with social status, each household head was given a rank from one to four.

In Chanal, all but one of the pottery variables showed a positive trend as religious cargo rank increased, while average ritual set diversity, average imported type diversity and average pottery and industrial type diversity showed positive trends as civil cargo position increased (see Figures 37-44). Average pottery frequency and food set diversity all showed a decrease in rank 3 followed by an increase in rank 4.

In Aquacatenango, average pottery frequency showed a strong positive trend while average pottery diversity showed a decrease between civil cargo ranks 1 and 2, then increased through rank 4. Similarly, average pottery diversity and average pottery frequency showed a decrease between civil cargo ranks and 1 and 2.
and increased in the higher ranks. As mentioned above, the traditional form of cargo system has deteriorated considerably in Aquacatenango in recent years, so that fewer people assume cargo positions. This includes many of the wealthier families, who might have the lowest cargo rank but have relatively large and diverse pottery inventories (thereby increasing the average pottery frequency for that rank).

In general, both civil and religious cargo ranks indicated similar relationships with pottery frequency and type diversity, and both closely corresponded to the results recorded for social status. However, civil cargo rank did differ from social status and religious cargo rank when compared to pottery type diversity (excluding industrial types), and social status differed from both cargo rankings when compared to pottery plus industrial type diversity.

It is clear that socioeconomic factors play an important role in pottery variability. In Chanal and Aquacatenango, household pottery diversity and vessel frequency seem to be most closely associated with the social status of the household head (especially where this reflects religious cargo rank). In Chanal, ritual set diversity is seen to be sensitive to all of the socioeconomic variables considered. The Chanal sample also indicates that the diversity of pottery and industrial replacements together tends to have different relationships with socioeconomic variables than does pottery diversity alone. In fact, only average food set diversity and pottery plus industrial
type diversity show positive associations with economic rank. Current family size in both communities does not appear to be closely related to pottery variability.

The results of this graphic exercise indicate that pottery vessel frequency or type diversity alone is not a good indicator of any of the socioeconomic or demographic factors considered. However, ritual set diversity may be a reliable indicator of the ritual status of the household head. While household social and economic levels obviously account for some of the pottery variability, other factors, which are more difficult to quantify, must also be important. These probably include the idiosyncratic tastes of household occupants, changing household composition, replacement factors, borrowing and loaning practices, milpa inventories, as well as various production considerations (see Chapter Two). The problems associated with the use of pottery data to infer socioeconomic condition in archaeological housesites is treated in more detail in Chapter 5.

(ii) Replacement factors

a) Uselife variation

While pottery type diversity and vessel frequency are probably geared to complex variations in household socioeconomic
and demographic conditions, the differential uselives of functional types of pottery vessels is also an important factor in determining the frequencies of each type observed in the archaeological record of a given household compound (see David 1972; Deboer 1974:335). Specifically, functional types with short uselives should have a more rapid turnover rate and thus contribute an increasingly larger proportion of vessels to a household's pottery refuse over time.

The major factors related to a vessel's longevity have been discussed by Foster (1960:606), David (1972:141) and Pastron (1971:109). These include (1) basic strength, (2) function, (3) storage and drying practices, and (4) causes of breakage. Moreover, the repair of vessels for both use and reuse functions must also be considered as a factor in extending vessel uselife.

(1) Basic strength refers to the relative "hardness" of vessel walls (in terms of serviceability) and wall thickness in proportion to vessel size (also see Foster 1960:606). The relative hardness of a vessel depends in part on paste composition, surface treatment (especially glazing), and firing conditions. The relative skill of the individual potter must also be considered an important factor. As a rule, the potters of Chalan tended to be much less proficient than potters of the larger centres such as Amatenango and Yocnajab. The paste composition (in terms of amount and kinds of temper used) of Tzeltal vessels were related to intended function for the vessel. For example, in Amatenango, large amounts of coarse calcite
temper were used in vessels to be used on the hearth which required a more porous paste. Such pastes are relatively soft after being fired. In contrast, serving vessels, not intended for the hearth, had a sand temper which created a finer paste and which was relatively hard after being fired.

Glazed, kiln-fired vessels made in San Ramon and Chiapa de Corzo were considered the most durable pottery vessels in a Chanal inventory followed by the slipped, open-air fired Amatenango vessels. The relatively low uselives estimated for the imported glazed vessels was probably indicative of their function and frequency of use (see below) rather than of their durability. The locally produced plainwares, being crudely formed, heavily tempered with calcite, and fired at relatively low temperatures, were considered the least durable.

Closely related to basic strength is differential vessel wall thickness. For example, the relative wall thickness of large ritual cooking jars and beer mixing bowls (often more than one cm.) partly compensated for their high calcite content and thus contributed to their longevity (also see Rye 1981:59).

Furthermore, such large, thick-walled vessels were heavier and less portable than other vessels in the household inventories and therefore were less likely to be broken in transport.

(2) Differences in vessel function and frequency of use resulted in variation in the breakage frequency of a given type. Food preparation and serving vessels were used much more often than ritual vessels and this was reflected in relative uselife.
Estimates of uselife given by Chanal and Aguacatenango informants confirm this (Table 22). In both communities, the three vessels used daily on the hearth (oxom, samet, and chikbi) were considered to be among the shortest-lived functional types, while most ritual vessels were given long uselives. Uselife estimates for certain types probably showed some variation due to differential sizes of household pottery inventories, that is, a household using only one oxom would be likely to give a shorter uselife estimate for that type than a household which uses nine oxom interchangeably. Elsewhere, both David (1972:41) for the Fulaní and Pastron (1974:109) for the Tarahumara, include cooking vessels at the low end of the scale followed by serving bowls and storage vessels. Foster also included cooking vessels at the low end of the scale for Tzinzuntzan, followed by water storage vessels and fiesta pottery (1960:608).

In Chanal and Aguacatenango, one type of ritual serving vessel (the borcelana) was given a relatively short uselife. This probably reflected the effects of Tzeltal drinking habits, in that in many households they were used only on occasions which featured ritual drinking. Similarly, DeBoer and Lathrap (1979:128) gave the shortest uselife among Shipibo-Conibo vessel types to the beer drinking mug. In Chanal and Aguacatenango, vessels used in the preparation of beer (mixing bowls and brewing jars) were used before, but not during, fiesta gatherings and tended to have long uselives. Similarly, Shipibo-Conibo serving and brewing jars were estimated to have long uselives (Deboer and
Table 22: Uselife estimates for Chanal and Aquacatenango pottery types

<table>
<thead>
<tr>
<th></th>
<th>(Chanal)</th>
<th></th>
<th>(Aquacatenango)</th>
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<tbody>
<tr>
<td></td>
<td>Use-life</td>
<td>Use-life</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(in years)</td>
<td>(in years)</td>
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</tr>
<tr>
<td>Mean (s.d.)</td>
<td></td>
<td>Mean (s.d.)</td>
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<tr>
<td>Food preparation and Serving:</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Small cooking jar (Oxom)</td>
<td>.58 (.64)</td>
<td>.61 (.93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tortilla griddle (Samet)</td>
<td>.49 (.31)</td>
<td>.67 (.71)</td>
<td></td>
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<tr>
<td>Boiling pitcher (Chikbin)</td>
<td>1.68 (1.25)</td>
<td>1.55 (.72)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serving bowl (Seis')</td>
<td>2.17 (1.04)</td>
<td>.50+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water carrying jar (Kib)</td>
<td>2.29 (1.62)</td>
<td>1.15 (1.23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serving bowl (Poket)</td>
<td>2.57 (2.16)</td>
<td>.86 (.65)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frying bowl (Chalten)</td>
<td>2.83 (3.07)</td>
<td>1.56 (1.44)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize colander (Chiknalab'il)</td>
<td>-</td>
<td>1.25 (.50)</td>
<td></td>
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<tr>
<td>Ritual:</td>
<td></td>
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</tr>
<tr>
<td>Serving bowl (Porcelana)</td>
<td>1.26 (1.13)</td>
<td>.96 (1.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large cooking jar (Oxom grande)</td>
<td>3.72 (1.45)</td>
<td>1.99 (2.13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atole colander (Chiknalab'il)</td>
<td>3.20 (2.79)</td>
<td>1.19 (1.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incense burner (Chik'oom)</td>
<td>5.80 (4.78)</td>
<td>1.67 (1.67)</td>
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<td></td>
</tr>
<tr>
<td>Candle holder (Sombras Cantelal)</td>
<td>10.00+</td>
<td>2.46 (2.35)</td>
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<td></td>
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<tr>
<td>Beer mixing jar (Temosha)</td>
<td>12.50 (3.54)</td>
<td>2.92 (4.47)</td>
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<tr>
<td>Beer mixing bowl (Poket grande)</td>
<td>20.00 (14.14)</td>
<td>8.50 (9.19)</td>
<td></td>
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</tr>
<tr>
<td>Flower holder (Yahuil nichim)</td>
<td>-</td>
<td>3.00 (2.63)</td>
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</table>

* Does not include types for which estimates were not recorded.
+ Based on only one estimate.
Differential drying and storage practices also affected relative uselife. Vessels not frequently in use were often given more protective storage. On one hand, ritual beer mixing bowls, atole colanders, and serving bowls were often stored in wooden boxes or in the rafters of the main house structure, while other ritual vessels (incense burners, candle holders, flower holders, etc.) and occasionally serving bowls were stored on or under the family altar. On the other hand, food preparation and serving vessels were often stored along the interior walls (or exterior walls when drying) of the kitchen where there was considerably more risk of damage. Furthermore, water-carrying jars, since they are constantly in transit, were very susceptible to breakage and therefore, tended to have a shorter uselife.

Causes of breakage were closely connected with locations of use and storage and drying practices. Food preparation and serving vessels drying or stored along walls were susceptible to accidental breakage by animals and small children. Dogs and poultry were commonly quoted as a frequent cause of breakage in Tzeltal kitchens. Many vessels were damaged while being transported from use locations to storage locations. In the case of water-carrying jars, breakage generally occurred at the water source or along the trail. Handles often snapped off when a woman hoisted her jar onto her back or when she slipped on a wet trail. Vessels used on the hearth were most frequently broken while in use on or around the hearth. Vessels often
cracked on the fire because they were filled too full or because the fire was too high. Sometimes a vessel was knocked into the fire or off their firedogs by a person or animal, or occasionally someone simply dropped a vessel because it was too hot to handle.

Breakage also occurred on and around the household patio. Ritual serving bowls were often broken during fiestas by clumsy drunks. Vessels laid out to dry were often broken by animals and children. Others were knocked off of storage benches or occasionally damaged when firewood was dropped on them. Colanders were often broken by too vigorous corn washing.

b) Vessel repair

The decision of whether to repair a pottery vessel depended upon the nature and extent of the damage and the relative reuse value of the vessel. If a vessel was only slightly damaged (such as a chip or crack), it would usually continue to serve its original function. If the damage was more extensive, a decision had to be made as to whether it could be temporarily mended. If the repair was unsuccessful or not attempted the vessel would be put in a provisional discard location (see Chapter 4). The vessel might eventually be repaired, if needed, or reused for a different function.

If repair was attempted, there were a number of commonly used techniques, depending upon the nature and extent of the damage to the vessel. The types of damage most often observed to
be repaired were cracks or holes in the upper body, neck or rim of a vessel. The most popular method of repairing cracks was to apply a sticky pitch made from pine resin. Sometimes a small piece of cloth, impregnated with this resin was used as a patch. An alternate method involved the application of a coat of powdered lime in a water solution. This lime coat would be hardened over the fire and serve as a temporary patch. A popular method of temporarily repairing cracked vessels which were not used on the fire, was to melt wax (and in one case plastic) over the crack. Also, some potters would repair a cracked vessel with new clay and refire it over the kitchen hearth.

If a crack occurred in the rim or neck of a vessel, a rope or wire strapping might be used to prevent the crack from extending lower on the vessel. Occasionally, if a rim were badly chipped, the rim might be sanded smooth or sawed-off and then sanded.

Holes were also occasionally repaired with pine pitch, lime or clay, but more often a stopper was used. The most commonly used material for stoppers was a dried, dekernelled corn cob. Other kinds of stoppers observed included wooden corks, sections of corn stalk, rolled plastic and in one case the distal end of a feather.
c) Replacement rates

Unfortunately, the number of vessels broken per year does not necessarily exactly equal the number of vessels acquired per year. While the use-life of a vessel type remains more or less constant over time, replacement rates are more sensitive to seasonal and larger cycle changes in family social and economic position, as well as family makeup and seasonal variation in the availability of pottery (also see Deboer 1974:341). Increases in family size due to births, additional wives, or members from other families, and decreases due to death, children moving away and family disagreements, all appeared to have some effect on vessel replacement rates. Changes in diet or household subsistence economy will undoubtedly affect replacement rates (especially in poorer households) in terms of supplementing or deleting vessel types to accommodate the change in lifestyle.

Chanal and Aquacatenango informants were asked to estimate the approximate number of each type they would replace each year. The mean values of replacement rates for the two communities (see Table 23) demonstrated the similarity in their vessel requirements. The bulk of vessels replaced were those used for food preparation and serving (80.78% for Chanal and 78.26% for Aquacatenango). The fact that Aquacatenango households tended to replace fewer vessels per year (an average of 23.70 compared to 33.29 for Chanal) probably reflected the greater dependence on industrial vessels (especially for ritual serving vessels).
Table 23: Mean vessel replacement rates for Chanal and Aguacatenango.

<table>
<thead>
<tr>
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<th>(Chanal)*</th>
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<th>(Aguacatenango)</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Percentage</td>
<td>Mean</td>
<td>Percentage</td>
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<tr>
<td></td>
<td>Replacement Inventory</td>
<td>Frequency/year</td>
<td>Replacement Inventory</td>
<td>Frequency/year</td>
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<tr>
<td>Food Preparation</td>
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<tr>
<td>and Serving:</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Bowl (Poket)</td>
<td>1.36</td>
<td>3.66</td>
<td>2.80</td>
<td>10.92</td>
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<tr>
<td>Bowl (Chalten)</td>
<td>6.31</td>
<td>1.86</td>
<td>1.10</td>
<td>2.08</td>
</tr>
<tr>
<td>Bowl (Poket, Sets')</td>
<td>3.35</td>
<td>5.04</td>
<td>0.10</td>
<td>0.19</td>
</tr>
<tr>
<td>Jar (Oxom, Chiktin)</td>
<td>16.63</td>
<td>45.98</td>
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<td>52.84</td>
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<td>Jar (Chixnajal'it)</td>
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<td>0.20</td>
<td>2.23</td>
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<tr>
<td>Jar (Kib)</td>
<td>3.62</td>
<td>10.38</td>
<td>2.90</td>
<td>9.24</td>
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<tr>
<td>Plate (Samet)</td>
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<td>6.58</td>
<td>2.40</td>
<td>2.70</td>
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<tr>
<td>Subtotal:</td>
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<td>18.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ritual:</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cylinder (Somiebal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cantela)</td>
<td>-</td>
<td>.59</td>
<td>.30</td>
<td>.07</td>
</tr>
<tr>
<td>Jar (Oxom grande)</td>
<td>2.50</td>
<td>5.12</td>
<td>1.40</td>
<td>1.91</td>
</tr>
<tr>
<td>Jar (Tenosha)</td>
<td>-</td>
<td>.73</td>
<td>.50</td>
<td>1.74</td>
</tr>
<tr>
<td>Jar (Chixnajal'it)</td>
<td>.04</td>
<td>1.26</td>
<td>.40</td>
<td>.89</td>
</tr>
<tr>
<td>Bowl (Borcelana)</td>
<td>3.17</td>
<td>9.65</td>
<td>1.20</td>
<td>1.37</td>
</tr>
<tr>
<td>Bowl (Chik'rom)</td>
<td>.69</td>
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</tr>
<tr>
<td>Subtotal:</td>
<td>6.40</td>
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<td>5.20</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td>-</td>
<td>5.54</td>
<td></td>
<td>4.49</td>
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<tr>
<td>Total:</td>
<td>33.29</td>
<td>100.00</td>
<td>23.20</td>
<td>100.00</td>
</tr>
</tbody>
</table>

* Chanal data includes only 30 households in which the author worked.
that community, as well as the higher proportion of better quality Amatenango pottery to local wares in household inventories.

(iii) Additional considerations

a) Borrowing/loaning

The size and contents of a given household's pottery inventory was also affected by the borrowing and loaning of pottery between households. Most borrowing and loaning of pottery took place just prior to major religious festivals, but also in preparation for weddings, baptisms, birthdays, deaths, house building, harvests, cargo duties, and even for general use when supply was short. In Aquacatenango, thirty-five household heads claimed to borrow pottery one to four times per year and thirty-three households claimed to loan pottery one to six times per year. Several informants said that they would loan to anyone in the community, however, most loaning and borrowing seemed to take place between immediate neighbours and close relatives. In Chanal, household heads claimed to borrow and/or loan pottery one to six times per year. Informants indicated that these transactions occurred more often through family ties or with compadres (godfathers) than among neighbours.

All types of vessels were loaned and borrowed for short periods, especially ritual unrestricted bowls (borchelana), large
wide-mouth jars (oxom grande), unrestricted plates (samel), unrestricted bowls (poker) and narrow-mouth jars (kip). The only commonly loaned or borrowed industrial replacement type was the metal cup.

In Aquacatenango, the procedure for borrowing pottery was relatively standardized. The borrower took a cup of coffee and a piece of bread to the home of the anticipated loaner and asked to borrow a certain number of pottery vessels. If the loaned vessels were used for cooking, when the food was prepared in the vessel, a portion was taken back to the loaner as a gift. If the vessel should break, the borrower repaid one-half of its value to the loaner.

b) Milpa inventories

Households which farm milpas at some distance from the community also kept a small pottery inventory at their milpa houses. Based on information from fourteen Chalan households, these inventories consisted of one to three unrestricted plates, one to four wide-mouth jars, one to three narrow-mouth jars, one to four single-handle jars and a variety (up to six) of bowls. Possible industrial replacements included a tin can with a wire handle, a metal bucket and a drinking glass.
Storage requirements

Chanal and Aguacatenango households did not acquire any specific vessel-forms primarily for use as storage containers, yet any jar, bowl or cup was a potential temporary storage container. Facilities used for long term storage included a variety of hide and cordage bags, baskets, wooden boxes and in recent times, plastic bags, metal chests, cardboard boxes, barrels, and large tin cans (see Table 24). Similarly, in the Yucatan, R. Thompson (1958:146) reported the preference of large baskets over pottery for food storage.

As containers, pottery vessels serve "to keep matter in an idle state...between procurement and consumption, enabling the regulation of rates of inputs such that they accommodate rates of consumption" (Hunter-Anderson 1977:301). The walls of the containers prevent stored materials from dispersing into the environment, and allow for their intact transportation (Hunter-Anderson 1977:295-296). Furthermore, pottery vessels are ideal storage containers because of their curvilinear (especially spherical) body forms which have high rates of volume to surface area (Hunter-Anderson 1977:298). Aberrations from the basic curvilinear forms can be due to physical constraints, such as flat bottoms (for stability) and spouts (for pouring), as well as quality and workmanship.

In Tzeltal households, at any time between primary use events, while a vessel was itself in storage, it might serve as a
Table 24: distribution of storage containers per household in Chanal and Aquacatenango.

<table>
<thead>
<tr>
<th>Vessel type</th>
<th>Chanal</th>
<th></th>
<th></th>
<th>Aquacatenango</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Mean</td>
<td>s.d.</td>
<td>Maximum</td>
<td>Mean</td>
<td>s.d.</td>
</tr>
<tr>
<td>Burlap bag</td>
<td>24</td>
<td>5.23</td>
<td>5.6</td>
<td>17</td>
<td>4.10</td>
<td>5.3</td>
</tr>
<tr>
<td>Cordage bag</td>
<td>28</td>
<td>8.87</td>
<td>5.9</td>
<td>26</td>
<td>7.74</td>
<td>5.8</td>
</tr>
<tr>
<td>Plastic shoulder/hand bag</td>
<td>60</td>
<td>4.56</td>
<td>8.4</td>
<td>20</td>
<td>5.30</td>
<td>4.2</td>
</tr>
<tr>
<td>Armadillo bag</td>
<td>8</td>
<td>0.49</td>
<td>1.5</td>
<td>4</td>
<td>0.44</td>
<td>0.9</td>
</tr>
<tr>
<td>Hide bag</td>
<td>9</td>
<td>0.72</td>
<td>1.5</td>
<td>1</td>
<td>0.04</td>
<td>0.2</td>
</tr>
<tr>
<td>Bull testicle bag</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>0.14</td>
<td>0.4</td>
</tr>
<tr>
<td>Basket</td>
<td>44</td>
<td>13.17</td>
<td>9.4</td>
<td>22</td>
<td>10.16</td>
<td>5.3</td>
</tr>
<tr>
<td>Wooden box</td>
<td>28</td>
<td>5.87</td>
<td>5.0</td>
<td>17</td>
<td>2.90</td>
<td>3.3</td>
</tr>
<tr>
<td>Cardboard box</td>
<td>55</td>
<td>3.38</td>
<td>8.1</td>
<td>30</td>
<td>5.30</td>
<td>6.2</td>
</tr>
<tr>
<td>Barrel</td>
<td>1</td>
<td>0.02</td>
<td>0.1</td>
<td>1</td>
<td>0.10</td>
<td>0.3</td>
</tr>
<tr>
<td>Metal chest</td>
<td>3</td>
<td>0.51</td>
<td>0.7</td>
<td>2</td>
<td>0.26</td>
<td>0.6</td>
</tr>
<tr>
<td>Large tin cans</td>
<td>2</td>
<td>0.26</td>
<td>0.6</td>
<td>13</td>
<td>1.50</td>
<td>2.6</td>
</tr>
<tr>
<td>Total</td>
<td>43.08</td>
<td></td>
<td></td>
<td>37.96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
container for any of a great variety of materials, including:

1. construction materials (sand, mud, cement, string).
2. potting materials (clay, temper, water).
3. consumable liquids (water, honey, vinegar, oil, beer, atole, pozole, apple sauce).
4. consumable foodstuffs (peppers, eggs, beans, corn, apples, avocados, salt, seeds, dates, flour, tortillas, spices, tomatoes, greens, corn meal/mash, plums, potatoes, mushrooms, rice, peaches, oats/oatmeal, squash, meat, fish, coffee, sugar, garlic, noodles, peanuts).
5. dry goods (matches, kindling, lime balls/powder, soap/soaproots, money, tin cans, clothing, rope/rope fibre/rope bags, dishes, silverware, batteries, sewing equipment).
6. ritual items (incense, serving bowls, shot glasses, wax, bloodletters, offerings of fruit, coffee, flowers, candles).

Surprisingly, of all pottery vessels being used as storage containers in Chanal, Aquacatenango and San Mateo Ixtatan, at the time of our surveys, over 60% were under 25 cm. in height (63% in Chanal, 60% in Aquacatenango, and 63% in San Mateo). In other words, the majority of storage containers in all three villages tended to be small, rather than large, vessels. This is of particular interest concerning archaeological interpretations because size is often the major criterion for the identification of storage vessels in archaeological assemblages. The above
observation may be deceiving, since, while most storage vessels were relatively small, most large vessels were in fact being used for temporary storage of dry goods and consumable foodstuffs. Moreover, a larger proportion of large vessels than of smaller vessels was being used for storage, and this is consistent with the archaeological assumption concerning relative vessel size and storage practices.

Precolumbian household requirements

Ultimately, our ability to use ethnoarchaeological pottery models for the interpretation of Precolumbian pottery assemblages rests on the degree of similarity which exists between our present models and our archaeological data for a given period. To better understand the potential for such comparisons, the following discussion reviews the Precolumbian pottery sequence for the Central Highlands, with special attention to similarities and differences in functional diversity (that is, subcomplex change) over time.

Considerable diversity in vessel-forms has been recorded in the Central Highlands for Early Classic (Kan) times to the present. However, Culbert (1965:45) suggests that the most common pottery form classes show a great stability throughout this sequence. He attributes this stability to an adherence to
certain "rules of basic shape and dimensions" which he believes are based on vessel function. Culbert's study includes an attempt to establish functional classes for Precolumbian pottery in the Central Highlands based on vessel morphology and comparative ethnographic data. Using Culbert's preliminary classification, the following discussion addresses the problems of broad subcomplex (domestic versus ritual) change through time in the Central Highlands, and the possible affects of these changes on household inventories and activity set composition.

Prior to the Kan phase (the Early Classic), little is known of Central Highlands pottery (Culbert 1965:79). The Kan phase is marked by a population increase in the area which probably represents a large-scale migration into the area of peoples speaking the parent stock from which Tzeltal and Tzotzil differentiated (see Campbell 1978; Culbert 1965:82; Voqt 1969:13). Kan pottery includes several examples of fine quality, small, restricted or unrestricted bowl-forms, one large unrestricted bowl-form, wide-mouth jars, narrow-mouth jars, effigy dish and jar forms, and everted rim censers (Culbert 1965:56-60). The diversity of Kan bowl-forms is consistent with the situation today, and they probably served a similar range of domestic and ritual functions. There is a relatively great abundance of fine quality bowl-forms in Precolumbian times. It is possible that some highly developed form of ritual system (like the modern cargo system) required households to keep on hand quantities of finer serving bowls.
Besides bowl-forms, the Kan domestic subcomplex probably included wide-mouth jars and smaller large diameter bowls as cooking vessels (Culbert 1965:44). Two food preparation vessel-forms which are conspicuously absent in the Kan phase assemblage are the unrestricted plate (tortilla griddle) and the perforated jar (colander). Both forms appear first in the Late Classic (Tsah phase). Culbert (1965:44) suggests that the relative scarcity of the former, from the archaeological record of the Central Highlands, may indicate that something else, such as a large stone, served its function. Similarly, such griddles are not commonly found in archaeological sites in the Yucatan (Thompson 1958:63), but they were in use when the Spanish arrived, as evidenced by the Motul dictionary of the late sixteenth century (Joesink-Mandeville 1976:46). However, this form did occur much earlier, in Middle Classic deposits at Kaminaljuyu (Lischka 1978:230, Borhegyi 1959) and Middle Preclassic deposits at Quelepa (Sheets 1982:102). One additional domestic vessel, the narrow-mouth jar is similar to present-day water-carrying jars and probably served the same function.

Culbert sees no clear distinctions between domestic pottery inventories and the inventories of ceremonial centres throughout the entire sequence, and this may also be true among the Classic Lowland Maya (1965:45; Smith and Gifford 1965). In general, the Kan ritual subcomplex shows less diversity than that of the present-day Tzeltal. This may be due, in part, to a greater reliance on bowl-forms in Kan period rituals, and to the addition
of certain distinctive ritual vessel-forms during the contact period (such as candle-holders and flower-holders). The only certain Kan ritual vessel is a bowl censer. The effigy dish and jar forms may have ritual functions. Also, a large unrestricted bowl-form is present which may have served the beer-mixing and hand-washing functions of its modern counterpart. Culbert (1965:44) sees this form more as a water storage vessel, similar to those described by R. Thompson (1958:113,117-118) for the Yucatan. The author has not observed any large bowl-forms being used for water storage in the Chiapas Highlands. In fact, only the narrow-mouth, water carrying jar (kib) was being used for water storage in Chanal and Aquacatenango.

The Tsah phase (Late Classic) is characterized by a denser occupation of the Central Highlands. Tsah pottery, especially large storage bowls and jars, indicate closer ties between Central Chiapas and the Maya Lowlands. Imported vessels are rare, as in earlier phases, but are traceable to the Maya Lowlands (Culbert 1965:83).

Tsah pottery represents a similar range of vessel forms to the Kan phase. These include small, fine quality, restricted and unrestricted bowl-forms, wide-mouth jars, narrow-mouth jars, and unrestricted plates (Culbert 1965:62-67). One incomplete vessel exhibits exterior applique spikes ("bosses"). Applique spikes are used almost exclusively on ritual vessels, although a wide range of ritual functions is possible (Deal 1982). Tsah pottery differs from Kan pottery primarily by having less diversity of
fine bowl-forms, greater diversity of large bowl-forms, and the use of the unrestricted plate form. The decline in fine quality bowl-forms in particular may be related to changing trade relationships.

The Yash (Early Postclassic) phase of the Central Highlands is characterized by the continued occupation of Tsah phase sites (Adams 1961:352) and a similar pottery inventory. In fact, Culbert (1965:84) views the Yash phase pottery inventory as transitional between the Tsah and later Lüm phase inventories. Yash vessel-forms include large and small fine quality, unrestricted bowl, cylinder, and jar forms, wide-mouth jars and the frying pan type censer (Culbert 1965:69-71). The Yash inventory differs from the previous phases by: having a lower diversity of large bowl-forms and fine quality bowl-forms, although there are more fine quality vessels of other forms (e.g. cylinders and jars); by a lack of an unrestricted plate forms; by an uncertainty over the vessel form which served for water-carrying; and by the presence of two distinctive ritual forms (the frying pan censer and fine quality cylinder). Several fine quality bowl-forms, including one with applique spikes, an effigy whistle and an unslipped stamp seal were found in a Yash phase tomb at Cerro Ecatepec (Culbert 1965:figure 15). In general, changes in Yash phase pottery inventories suggest an elaboration in ritual pottery.

The Lüm (Late Classic) phase of the Central Highlands is marked by the emergence of larger, more complex and fragmented
political units (Adams 1961:352-359; Culbert 1965:86-87), accompanied by an increase divergence of pottery inventories between eastern and western sectors of the region. In general, the Lus phase pottery inventory included small, fine-quality, unrestricted bowl-forms, large restricted and unrestricted bowl-forms, wide-mouth jars, narrow-mouth jars, perforated jars and a dish-censer.

Perforated jars (presumably colanders) and narrow-mouth (vague-neck) jars are more common in the Eastern sector, while large bowl-forms, wide-mouth jars and the dish-censer are associated with the western sector. The dish censer may have had detachable bases in the form of large hollow cylinders (Culbert 1965:77). Rare, possibly imported, vessel-forms in the western sector also included a miniature jar and a bottle-form.

Little is known of the Colonial pottery record for the Central Highlands. However, the pottery assemblages from the Coxoh excavations are probably representative of the pottery diversity available in both areas during Colonial times. When the Spanish arrived, the Chaipas Highlands was being used for major trade and conquest routes between Central Mexico and Guatemala Highlands (Culbert 1961; Wauchope 1970).

Coxoh pottery include a number of vessel forms which can be directly linked with the Late Preclassic, including, the unrestricted plate, narrow-mouth jar, wide-mouth jar, perforated jar, unrestricted bowl forms, spiked, pedestal-based bowls and ladles, and spindle whorls, as well as exotic (glazed) Spanish
vessels, such as soup dishes, pitchers, cups and candle holders (Lee 1979:102-103; 1980:23). The imported, glazed Spanish pottery is always rare but some appeared in "even the most humble indigenous house" (Lee 1979:102). These imported bowls probably replace earlier fine quality bowl-forms, and may have served both domestic and ritual functions, as in modern indigenous households. Coch pottery assemblages differ from the Lum phase pottery of the Central Highlands mainly by the addition of Spanish vessel-forms.

Based on Culbert's study of Central Highland pottery, at least 16 basic formal variants of pottery vessels were available during the Kan phase, 12 during the Tsah, eight during the Yash and 11 during the Lum (Table 25). In addition, at least 14 formal variants were available to the Colonial Coch. These estimates are far less than the 31 vessel-forms in Chanal and Aguacatenango, however, the adoption of certain European ritual forms and the tourist trade items have greatly altered the vessel diversity of present-day Tzeltal inventories. Most of the essential vessel-forms have persisted and probably had served the same range of functions as their modern variants. The relative lack of ritual types may merely reflect a greater reliance on bowl-forms in Precolumbian times and the fact that relatively few housesites have been completely excavated. Thus, if these changes are considered, the potential for comparing models based on modern Tzeltal pottery with Precolumbian pottery assemblages should be significant.
Table 25: functional diversity of Pre-Columbian vessel-forms of the Central Highlands of Chiapas (after Culbert 1965) and the Coxoh-Maya area (after Lee 1979).

<table>
<thead>
<tr>
<th>Phases:</th>
<th>Kan</th>
<th>Tsah</th>
<th>Yash</th>
<th>Lum</th>
<th>Colonial</th>
<th>Modern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small bowl</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>functions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large bowl</td>
<td>1</td>
<td>4</td>
<td>1(?)</td>
<td>2</td>
<td>?</td>
<td>1</td>
</tr>
<tr>
<td>functions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perforated jar</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>functions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide-mouth jar</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1(?)</td>
<td>6</td>
</tr>
<tr>
<td>functions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narrow-mouth jar</td>
<td>3</td>
<td>1</td>
<td>?</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>functions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestricted</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>plate functions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Censer function</td>
<td>1</td>
<td>1(?)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Rare/other</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Total Reported</td>
<td>16</td>
<td>12</td>
<td>8</td>
<td>11</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>diversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The reuse cycle

The reuse cycle differed from the use-curation cycle in at least three important characteristics. First, when a vessel was reused it went through an activity set transformation. Generally, it could no longer be used for its original function and was therefore reused as part of an activity set which included only broken vessels. Secondly, use location and storage location were generally the same. Thirdly, once a vessel entered the reuse cycle its value decreased. If a vessel was broken while in reuse it would not likely be repaired. Furthermore, whether it was damaged while being reused or not, when the compound (or feature with which it was associated) was abandoned, it would almost always be abandoned (see Chapter 4).

Whether or not a given vessel was reused for a given activity was determined by the nature of the surviving portion (that is, whether it was a rim only, a large sherd, a bottomless vessel, etc.), rather than by its original value, quality, or morphology. At least six reuse activity sets were recognized in Chanal and Aguacatenango pottery inventories, including:

1. Food preparation/kitchen maintenance: functions included pot lid, propping tortillas up at the hearth, cutting board, collecting corn grinder or colander waste, lime-mixing container,
and removal of ash or garbage from kitchen.

2. Animal husbandry: functions included nests for poultry (chickens and turkeys), feeding dishes, and containers for preparing medicine for animals.

3. Gardening: functions included enclosures for protecting seedlings, (usually a rim or bottomless vessel), containers for watering plants and trays for seed drying.

4. Construction and general maintenance: functions included paving material for patios or pathways, chinking in hearths of sweatbaths or wattle-and-daub walls, roof slating or props for poultry coops, retaining walls for ash dumps, storage containers for construction materials (mud, sand, cement, string) and containers for mixing pine pitch sealant.

5. Pottery making: functions included storage containers for raw materials (clays, tempers, paints, slips), mixing containers for paints and slips, and containers for water for handwetting and clay smoothing while potting.

6. Ritual: functions included holders for candles, stands for candles in glass containers, containers for afterbirth burial, and items of religious significance (such as broken incense burner parts or Precolumbian sherds).

The use of pottery vessels as containers in which to bury afterbirths is of particular interest to archaeologists because of the potential archaeological visibility of these vessels. This practice was more common in Aquacatenango than in Chanal.
Informants in 13 households claimed to have buried placentas in pottery containers from as many as eight births. In each case a small wide-mouth jar was used. A pit between 20-60 cm. deep and 20-40 cm. in diameter was dug within the compound (sometimes near the house) and the same pit was used for successive births.

The practice of burying the afterbirth in pottery vessels has been recorded in various parts of Mesoamerica. For example, Parsons (1936:76) reported variations of this custom in several Zapotecan communities. Among the Zapotec, the afterbirth might be wrapped in a cloth (or banana leaf), placed in a new jar and buried at the corner of the house, in the patio, or in a "shaded place" in the house (Parsons 1936:76). More recently Vivian Gotthilf (1983:personal communication) recorded this practice in three Oaxacan villages (San Matio Cajoñes, San Pablo Yaqanitza and Santo Tomas), as well as Menton, in the Chiapas Depression and three Guatemala Highland communities (Barillas, Santa Eulalia and San Mateo Ixtatan). Some households in Santa Eulalia and San Mateo used lidded jars. One of our San Mateo informants claimed that an inverted new bowl (joc lum) was ritually killed when burying the afterbirth. In the Mixteca community of Cuilapam, the "washed" jar containing the afterbirth was placed inside a second jar and buried at the corner of the house (Parsons 1936:76-77, note 31). In the Chorti Maya area, a gourd vessel served this function, and this was buried in a secret "and shaded" place on family land (Wisdom 1941:288).
Other miscellaneous reuse functions included the use of broken vessels to mark the location of lime storage pits, as children's toys and as containers for holding bathwater in sweatbaths. Some vessels might also be reused a second or third time. The most obvious occurrence of this situation were the small wide-mouth jars or single-handle jars which had been reused for lime-mixing containers, broken, and then reused as firedogs or as enclosures for seedlings.

The average proportion of vessels being reused in Chanal and Aquacatenango households, at the time of our surveys, was 21% of the household inventory for both communities. This translated to 13 vessels per household in Chanal and 18 vessels per household in Aquacatenango. In Chanal, potters tended to reuse twice as many vessels than non-potters (a mean of 16 vessels per household for potters and eight vessels per household for non-potters).

These reused vessels represented a diversity of four types per household in Chanal (with five types for potters and three types for non-potters) and six types per household in Aquacatenango.

**Some archaeological implications**

The preceding discussion presented a model of Tzeltal pottery use and reuse. The remainder of this chapter will address some of the archaeological implications of the use and reuse cycles in terms of how successfully archaeologists can interpret Pre Columbian household pottery requirements.
Knowledge of modern Tzeltal pottery activity sets and storage strategies may help to clarify many present problems of deriving functional categories for Pre Columbian vessel-forms. However, it is clear that archaeologists are more likely to find pottery storage areas than pottery-related activity areas. Even pottery storage areas, except for the temporary storage of broken vessels, may not survive site abandonment (see Chapter 4).

While the reuse of broken pottery is well documented in the ethnographic literature (for example, David and Hennig 1972; Deboer and Lathap 1976, Stanislawski 1969; Tschopik 1941, 1953; Weigand 1969), the implications of reuse practices for archaeological interpretation is seldom discussed (some exceptions include Brew 1946:250; Lister and Lister 1981; Stanislawski 1969; Weigand 1970). For example, if we assume that extensive reuse of pottery vessels was also practiced in Pre Columbian times, it is not surprising that few restorable vessels are found in archaeological refuse heaps. Also, since most households are abandoned slowly, with no anticipation of returning, generally, only discarded or reused vessels are left in situ (see Chapter 4). Given this situation, archaeologists should not expect to define activity areas without a thorough knowledge of the variation of vessel reuse practices.

Reused vessels are more likely to be abandoned than primary-use vessels, so that the condition of an archaeological specimen may reflect its secondary rather than primary function. However, reuse vessels represent a relatively small proportion of
an ongoing household's inventory (although a high proportion of
the cumulative discarded inventory), and except when used in the
construction of structures (e.g. in adobe structures or sweatbath
hearth), tend to occur away from structures.

The recognition of functional types and activity sets in
archaeological contexts must be based on a firm understanding of
the range of variation of present-day vessel-forms and the
spatial relationships between different vessel-forms and features
such as structures and patios on which they are used and stored.

Storage locations of basic domestic and ritual activity sets do
not usually overlap spatially. In our sample of modern Pueblo
communities, the former was almost exclusively associated with
the separate kitchen structure while the latter was associated
with the living structure. Even when the two structures were
combined there was some effort to separate ritual and domestic
vessels (e.g. altar versus cooking area). Unique or rare items
were generally stored singly or occasionally with ritual vessels.
Small glazed bowls (porcelain) might serve either domestic or
ritual functions. Those saved for ritual functions tended to be
stored in caches with other ritual vessels, while those used for
domestic functions were generally interspersed with other
domestic vessels. Water-carrying vessels were usually stored
outside, often on specially constructed storage tables or benches
but were occasionally stored in kitchen structures.

Several possible factors in combination may be used to
distinguish domestic and ritual activity sets when vessels are
found in situ or in stored positions. The basic requirements for identification might include the following:

(food preparation and serving set)

1. a greater frequency and diversity of distinctive non-ritual vessel-forms (tortilla griddle, small cooking jars, etc.) than of ritual forms (censers, large cooking jars, etc.).

2. fire-cooking of vessels.

3. proximity to recognized hearth features (and/or domestic versus sleeping or ritual structures).

4. absence of known ritual vessel-forms and other ritual paraphernalia.

(ritual set)

1. proximity to altar feature, or assumed ritual offering area.

2. presence of distinctive ritual vessel-forms (such as incense burners, large bowl or jar forms, elaborate vessel-forms, rare items).

3. proximity to other ritual paraphernalia (such as eccentric worked stone, stone bloodletters, figurines).

4. absence of domestic vessels (especially those used in cooking) and water-carrying jars.

5. lack of evidence of a cooking hearth in the structure.
An archaeological example of possible activity sets found in situ in Maya housesites was reported by Fauvet (1973: 155-157, 163-166) at the Protohistoric site of Mixo Viejo (in the Guatemala Highlands). On house platform A31 (inside the structure), was a concentration of seven vessels (six unslipped and one white slipped) which had probably been broken and left in situ when the walls of the structure collapsed. The sherds of these vessels were in a good state of preservation, and not widely dispersed, so that the original vessels could be reconstructed. All seven vessels (four formal variants) were easily identified as either cooking or water-carrying vessels, based on formal similarities to modern vessels. One of the vessels was believed to have been broken independently of, and prior to, the others, since its sherds were badly worn and more widely dispersed (probably due to trampling activity). By contrast, a second house platform (A32), contained only six fine paste vessels (on the platform itself), three of which were tripod bowls (one containing charcoal). Based on differential wall types (A32 was wattle-and-daub, while A31 was wattle only), platform A32 may have been a living house, and platform A31 a kitchen. If this was true, it is possible that the six vessels of A32 represented part of a ritual activity set, while the vessel concentration in A31 represented part of a former domestic activity set. Thus, it seems reasonable to assume that archaeologists will occasionally be able to identify basic activity sets, under favorable depositional conditions.
The present chapter has dealt with household use and reuse of pottery vessels and some of the archaeological implications associated with the use and reuse cycles. The following chapter continues with the next stage in the life of pottery vessels, that of disposal and ultimate abandonment prior to entering the archaeological record.
Chapter Four

Household depositional context

"To a large extent, ethnoarchaeology is the ethnographic study of processes of human discard."
(Gould 1978b:259)

Introduction

The models of pottery production and use-reuse presented above, operated within the predepositional context. Pottery (from raw material to reuse) was in direct association with its producers and users, and areas of production and use, and it participated in an ongoing cultural system (see Sullivan 1978:195). Household pottery variability and patterning within the predepositional context was geared to the functional requirements of the household. Initial household requirements and replacement rates are believed to be influenced by changing socioeconomic and demographic conditions (especially social and ritual status) of the household. When socioeconomic and demographic conditions remain constant, the rate of vessel
breakage (uselife) associated with different functional types becomes an important factor in determining pottery refuse volume and diversity.

When a pottery vessel is no longer in direct association with producers or users, but remains in the cultural system, it is considered to be in the depositional context. For example, a broken vessel propped against an outside wall of the kitchen is considered to be in the depositional context unless its location is eventually altered by human activity. The ethnoarchaeologist, therefore, has the opportunity to study depositional processes as they occur. In archaeological contexts, the archaeologist can attempt to discern the spatial patterning of his artifacts (items) and features (surfaces, item clusters, etc.) believed to have resulted from depositional processes (e.g. Binford 1978; Carrillo 1977; Halstead et al. 1978; Hayden 1982; Kobayashi 1974; Meggers and Evans 1957:247-248; Schiffer 1972, 1979; South 1977, 1979). However, the task of elucidating the depositional processes themselves falls within the realm of the ethnoarchaeologist (Binford 1981; Deboer and Lathrap 1979; Gould 1978b; Schiffer 1978; Stiles 1977:91,93; Thomas 1979:chapter 12).

Pottery is a particularly useful artifact category around which to develop a discussion of depositional behavior because it is relatively indestructible and therefore highly visible in the archaeological record. Furthermore, the disposal behavior associated with pottery seems to be representative of disposal behavior for many other durable items.
The present chapter is divided into three sections dealing with (1) the recognition, definition and classification of phenomena (processes, stages, etc.) of the depositional context at the household level of analysis, (2) a discussion of the Tzeltal Maya data upon which the classification is based, and (3) the usefulness of the ethnographic model of Tzeltal depositional behavior for the interpretation of the archaeological patterning of pottery refuse.

Depositional context and the Tzeltal household

The depositional context of a household compound is briefly outlined here in terms of three stages (preabandonment, abandonment, and postabandonment); a more detailed discussion of these stages constitutes the bulk of this chapter. Each of these stages results in distinct (recognizable) changes in the frequency, type diversity, spatial patterning of discarded pottery within the household assemblage (see Figure 16).

The initial, preabandonment stage is characterized by various types of disposal behavior, termed "disposal modes" (after Binford 1978:344). In terms of pottery, variation in depositional behavior is intimately connected with the internal arrangement of structures, gardens and specific activity areas within a household compound. The spatial distribution of discarded items within an ongoing household is also seen to be
Figure 16: Pottery deposition model, with emphasis on assemblage change within the depositional context.
affected to some degree by the cycle of structure reuse and
renovation and the concomitant movements of pottery-related
activities.

The abandonment stage involves not only abandonment but the
physical conditions of abandonment which may vary over the
use-life of a given compound. House-site abandonment includes four
basic modes which reflect the speed of abandonment and the
probability of reoccupation of the compound site. Each
abandonment mode has different effects on the content (nature,
size, and distribution) of the items and features remaining at
the abandoned house-site. When the structure reuse and renovation
cycle ceases, a compound enters an open or closed "vacant lot"
abandonment state.

The postabandonment stage is characterized by a number of
postabandonment cultural processes which alter the content of
discarded and abandoned items and features on sites deserted
within an ongoing community. The extent of the alterations are
believed to be greatly influenced by the conditions of the
abandonment (reflected in the content of abandoned items and
features) and the state of abandonment (open or closed lot), and
the proximity of the abandoned compound to the centre of the
community.

The following section is a detailed discussion of the
Tzeltal Maya depositional context upon which the above
classificatory scheme is based.
The preabandonment stage

In order to understand the variability and patterning of archaeological pottery assemblages, it is first necessary to examine the behavior associated with pottery disposal and abandonment and the resulting spatial patterning of pottery remains within a typical, ongoing Tzeltal compound (see Figure 17). In the preabandonment stage, Tzeltal pottery disposal can be characterized by five distinctive modes including (1) provisional discard, (2) disposal resulting from housesite maintenance (hereafter termed, maintenance disposal), (3) dumping disposal, (4) loss, and (5) breakage.

Table 26 outlines the predicted variation in the nature of pottery refuse, vessel condition, and feature association related to each of these disposal modes. The first three modes are intentional strategies for the disposal of refuse, while the latter two modes are examples of unintentional refuse disposal. In addition, the spatial patterning of discarded pottery can be altered due to trampling activity and gardening.

Based primarily upon Tzeltal and Chuj informant responses, Hayden and Cannon (1982b) have identified three general principles related to intentional refuse disposal (in terms of how refuse is sorted and where it is dumped). These include (1) economy of effort, (2) the temporary retention of potentially reusable materials, and (3) hinderance minimization. Each of these principles seem to operate differently in relation to
Figure 17: Tzeltal refuse pattern.
TZELTAL REFUSE PATTERN
Table 26: Tzeltal pottery disposal modes in relation to refuse type, artifact condition, spatial patterning and associations (adapted from South 1979:221).

<table>
<thead>
<tr>
<th>Refuse type</th>
<th>Condition</th>
<th>Spatial patterning (associated feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disposal mode:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provisional Discard:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single vessels</td>
<td>secondary</td>
<td>f,d</td>
</tr>
<tr>
<td>Vessel clusters</td>
<td>secondary</td>
<td>f,d</td>
</tr>
<tr>
<td>Maintenance:* secondary</td>
<td>f</td>
<td>c (circum-patio; drainage ditch)</td>
</tr>
<tr>
<td>Loss: defacto</td>
<td>f,d,w</td>
<td>c,i (away from structures)</td>
</tr>
<tr>
<td>Pathway: primary</td>
<td>f</td>
<td>i (pathway)</td>
</tr>
<tr>
<td>Dumping: Discrete secondary</td>
<td>f,d</td>
<td>c (circum-patio toft)</td>
</tr>
<tr>
<td>Broadcast secondary</td>
<td>f,d</td>
<td>c,i (circum-patio toft)</td>
</tr>
<tr>
<td>Tossing secondary</td>
<td>f,d</td>
<td>i (Toss zone)</td>
</tr>
</tbody>
</table>

* Whole vessel; f=fragment of vessel; d=damaged vessel.
** c=cluster; i=individual items.
† characterized by small fragments of pottery (and other items), while all other modes result in both large and small artifact deposition.
different disposal modes and under different household contexts (such as reuse requirements, compound location, etc.). The following discussion treats each disposal mode, as well as dispersal activity, in more detail.

(i) Intentional disposal modes

a) Provisional discard

The provisional discard of damaged vessels and other inorganic items may prove to be the most important disposal mode for understanding the spatial patterning of archaeological pottery assemblages. Provisional discard among the Tzeltal was represented by two distinctive strategies. The first strategy involved the isolated storage of material item fragments. Among the Maya it took the form of provisional discard, (often in difficult-to-get-at places) of damaged material items in anticipation of potential future repair and/or reuse. The second strategy involved the discrete storage (in clusters) of damaged or partly damaged pottery vessels. The resulting caches of broken pottery were features of most Tzeltal Maya compounds. The basic difference between the two strategies was that the former was a less structured activity which featured the storage of items singly (or in disordered association) rather than in tightly bounded clusters. The locations of these singly stored
items could soon be forgotten, while a cluster of broken pottery represented a continually used household facility.

In terms of the first strategy, various damaged items or their fragments, including machete blades, axes, bottles, odd shoes, toys, corn grinder parts, metal and plastic sheeting, metal bars and pipes, and pottery vessels could be observed lying along the base of interior or exterior walls, in corners, and under tables, beds and corn bins, hanging from beams or tossed into the rafters. Because these items had little immediate value and were likely to be left behind upon abandonment, one could readily see how this type of disposal behavior could lead to misleading interpretations of activity areas within structures. For example, two or more items with potential functional association (that is, which could have been used for the same craft or specific activity) might be loosely placed in provisional discard locations for reuse in general proximity to each other, such as under the same bench, or along the same wall, yet they might wrongly be interpreted as evidence of a certain past activity in that locality. In fact, in Maya households (and probably most other dwellings) this kind of short term refuse storage was much more likely to account for artifacts being associated with living floors than was primary disposal.

In terms of the second strategy, clusters of damaged or partly damaged vessels were often found along the outside walls of structures, along the edges of the patio, occasionally on the roofs of sweatbaths or other buildings, in structures which were
used for storage, or in abandoned structures (see Table 27).
Elsewhere, Weigand (1969:23) reported that among the Huichol, that "Nearly every sherd which is a potential container is stored, most often in a corner of the kitchen, even if it cannot be put to immediate use." Similarly, Reina and Hill (1978:247) described five broken vessels being stored along the outside wall of a new kitchen in a Quiche household in Zunil. As with the loose provisional storage of single items, clustering of broken vessels along house walls in this manner might wrongly be construed as evidence for pottery-related activity in archaeological housesites.

The second provisional disposal strategy can be equated with Binford's category of "placing" (or "positioning"), which is characterized by artifact clustering in locations where they can be easily retrieved, but at same time, are not in the way of ongoing activities (1978:346). Similarly, Hayden and Cannon (1982b) have suggested that this kind of storage is related to the principle of least effort, since collecting refuse together for periodic trips to dumping locations is much more efficient than making trips to dumps every time a vessel is broken. They add that the length of storage for a given item will depend primarily on its original value, its reuse potential, the degree of further breakage while in storage, and its hindrance value to other activities.
Table 27: Locational distribution of whole and fragmentary pottery vessels not in use.

<table>
<thead>
<tr>
<th>Location</th>
<th>Provisional Discard (single vessels)</th>
<th>Provisional Discard (vessel clusters)</th>
<th>Misplaced /Lost Whole vessels**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main structure</td>
<td>-</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Kitchen</td>
<td>3</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Sweatbath</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Storage structure</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Abandoned structure</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>On and around patio</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Corn bin</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Street</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>General Compound</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Not specified</td>
<td>-</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Totals</td>
<td>12</td>
<td>20</td>
<td>21</td>
</tr>
</tbody>
</table>

(Aguacatenango)

| Location:           |                                      |                                      |                                 |
|---------------------|--------------------------------------|---------------------------------------|                                 |
| Main structure      | 10                                   | 21                                   | -                               |
| Kitchen             | 10                                   | 17                                   | -                               |
| Sweatbath           | 2                                    | 4                                     | -                               |
| Storage structure   | 3                                    | 8                                     | -                               |
| Abandoned structure | -                                    | 1                                     | -                               |
| On and around patio | 16                                   | 15                                    | 3                               |
| Corn bin            | -                                    | -                                     | -                               |
| Street              | -                                    | -                                     | -                               |
| General Compound    | 12                                   | 23                                    | 9                               |
| Not specified       | 3                                    | 3                                     | 3                               |
| Totals              | 56                                   | 92                                    | 15                              |

* Each value represents the number of households in which a given disposal mode resulted in the placement of pottery in a given location.

** recorded only for the 33 households in which the author worked.

++ includes vessels displaced by children.
b) Maintenance disposal

Maintenance disposal refers to the efforts made to keep a clean living and working space. This was achieved by regular sweeping of living house, kitchen and patio areas. Most household activities occurred in the kitchen, therefore the kitchen floor was usually swept clean each morning. The house floor and patio, however, were only swept about once every two or three days. Frequently, difficult to reach places such as under tables and benches, around hearths, along walls and in corners were left unswept. Such places were likely to become artifact traps for small items, including potsherds (Green 1961b:91; Weigand 1969:26). Due to the frequent sweeping, the primary refuse from household activities tended to be removed. Sweepings, including mostly organic materials and dust with some small pottery sherds, were either dumped in an area reserved for refuse (often at the edge of the patio) or hoed into the garden as a form of compost. Patio refuse was often merely swept off the edge of the patio, and it was sometimes burned before disposal.

The drainage ditches along the outside of house and kitchen walls also served as artifact traps. The movement of animals, people, and rainwater along the edge of the patio carried the smaller items (often from sweepings) into the ditches where they accumulated. Damaged pottery vessels which were temporarily stored along the walls of structures would also contribute small pottery fragments to these traps as the vessels deteriorated.
c) Dumping disposal

Probably the bulk of material items contributed to the archaeological record of sedentary communities are the direct result of the intentional dumping of refuse. In Tzeltal Maya communities this could take place in discrete dumping locations, as well as in areas of dispersed (broadcast) refuse. Locations of dumping included (1) within the household compound, (2) neighbourhood dumping locations, and (3) community streets.

According to some informants in Chamal, potsherds tended to dull their hoes if left in the compound garden area, and therefore they were removed from the compound. Howry believed this to be the rule in most Maya households (1973:28). However, Aguacatenango and the Tzotzil community of Chamula seemed to be exceptions to this rule. In Aguacatenango, while larger items and glass were often taken to neighbourhood dumping areas, and cobbles and smaller refuse often ended up in the streets, potsherds were generally scattered about the compounds. This differential disposal of pottery seems to be associated with the lack of intensive gardening in Aguacatenango compounds, while, in Chamula, this practice may have been related to the long distance to wooded disposal areas (Howry 1973:28).

Frequently, within compounds, some inorganic refuse was either dumped, tossed, or dispersed by children within a household "toft" area. Following Lewis (1976:101), a toft is (1) the immediate site of a dwelling and is outbuildings, (2) it is the location of most activities associated with the dwelling, and
(3) its size and form is not fixed (it may vary according to the nature of the dwelling and its associated features). By definition, the toft is also the principle area of domestic refuse disposal (Hurst 1971:116; Lewis 1976:105).

In Chanal and Aquacatenango, the nature of toft refuse was viewed as varying according to major features, such as patios, kitchens, and other structures. These toft areas bordered upon compound garden and orchards. The patio toft area was characterized by: (1) dispersed (broadcast) refuse, (2) patio sweepings accumulated along the patio edge, (3) one or more small discrete dumping locations (often under a tree or bush) and (4) a "toss zone" (see Binford 1978:345) toward its outer limits. In general, within a patio toft, the highest density of refuse occurred along the edge of the patio and between structures and decreased as one moved away from the patio edge. The toss zone was merely a broad area at the outer limit of the patio toft which collected larger unwanted inorganic items such as tin cans, old shoes, and large potsherds, as well as items left by children. These were usually tossed from the patio after use or were thrown from their provisional discard locations by children playing. Households with sweatbaths generally had a small discrete dumping location nearby where fire-cracked rock, ash, and charcoal, as well as sherds from vessels used to hold bathwater were discarded.

Where kitchens constituted separate structures, the toft area directly around the kitchen generally had a somewhat
different appearance from the patio toft area since it consisted mainly of organic wastes from food preparation and consumption. These were dumped once or twice a day, or occasionally kitchen refuse was thrown through convenient holes in the kitchen walls. Potsherds found in kitchen tofts were likely to be almost exclusively from domestic food preparation and serving vessels.

Pits were seldom used for refuse disposal, yet in a few cases pits had been dug for other purposes (such as wells or fruit ripening) and were eventually refilled with dirt and refuse from the toft areas (also see Gotthilf 1983; Hayden and Cannon 1982b), sweepings from structures and the patio areas, or even refuse related to the excavation and use of the pit (see Green 1961a). If a structure was slowly being dismantled within an ongoing household it might become a dumping location for large inorganic items, and especially pottery (also see Butzer 1982:90-92).

(ii) Unintentional disposal modes

a) Loss

Loss cannot be considered a major disposal mode in terms of pottery. Large objects such as whole vessels have a low loss potential (see Fehon and Scholtz 1978:271; Hildebrand 1978:277) and conversely, a high rate of recovery from loss. In Chanal compounds, when whole or damaged vessels were lost (e.g.,
resulting from the play of small children), they would undoubtedly be found again by adults, if they had not subsequently been damaged by animals while lost. Even vessels not recovered before the compound was abandoned would likely be found by people scavenging the site for reusable items.

b) Pathway breakage

A common disposal behavior primarily associated with the water-carrying jar (kib) was accidental breakage along pathways between kitchen and water source. Vessels were often dropped while being handled at the well or at the storage location around the kitchen. On other occasions the carrier might slip or lose her balance and drop the vessel along the pathway. When this happened the larger sherds were either saved for reuse or swept to the sides of the pathway.

c) Potsherd dispersal

The vertical-dispersal (and to some extent, horizontal dispersal) of refuse in occupation areas is often attributed to trampling activity (e.g. Bradley and Fulford 1980; Fauvet 1973:157; Green 1961a:52; Hughs and Lampert 1977; Kirkby and Kirkby 1976; Matthews 1965:295; McPherron 1967:254; Orton 1982; Stockton 1973). Stockton (1973) has conducted experiments to determine the effects of trampling on artifact movement. His
study emphasizes the importance of surface composition to artifact movement. In general, small artifacts are more likely to move downward in less compact deposits (such as sandy or loamy surfaces) while large objects tend to move upward.

In terms of Tzeltal pottery, trampling, during the preabandonment stage, should be most intense on house floors, patios, and pathways. Small sherds missed during the maintenance of these areas after vessel breakage were likely to be kicked about and trampled into these compacted surfaces. Vertical movement in these surfaces would vary seasonally, with little movement during the dry season, when the surfaces are hard, and maximum movement during the wet season, when these surfaces varied from soft to soupy mud. Little trampling was likely to be associated with discrete dumping locations, while broadcast refuse in compound toft areas would receive some random trampling.

Some vertical and horizontal movement (especially the latter) of sherds during the preabandonment stage would also result from gardening activities. Since compound gardening was more intense in Chanal than in Aguacatenango, it might be expected that gardening activity would be more likely to affect pottery patterning in Chanal. However, this was somewhat compensated by the informal "taboo" in Chanal against dumping large sherds in gardening areas.

Children could also act as dispersing agents for broken vessels and sherds (also see Weigand 1969:24). In Tzeltal
households, sherds were popular as place markers for games and as missiles. Also, more complete vessels were used in house-keeping play.

(iii) The reuse and renovation cycle of structures

During the occupation of a given household there is a continuing cycle of reuse and renovation of individual structures within the household compound (also see David 1971; Lind 1979; Rock 1974). This cycle ends for each structure when it is completely abandoned or when it is only used for refuse disposal or for dismemberment in order to recycle the materials in the construction of another building or for destruction in order to reuse of the land as pasture or garden. The cycle ends for the compound when the entire household cluster of buildings are abandoned. During the cycle, separate structures may change function as new structures are added to the compound (Figure 18). For example, an old kitchen may become a storage building when a new kitchen is built, or houses which served both as kitchens and living quarters may become strictly sleeping and storage structures upon the addition of a structure for cooking. Alternatively, structures can retain their original function throughout the entire history of the compound and merely be renovated or rebuilt (usually about every 20 years).

Since a given compound may enter the abandonment stage at any moment during this cycle, 'an element of confusion' may be
Figure 18: Idealized model of Tzeltal main structure renovation and reuse.
* Utilizes original platform
** Utilizes new platform

** Old kitchen may be converted to storage and the house become house and kitchen, until a new kitchen is built.
added to the interpretation of the archaeological situation if there has been a change in position, number, or function of structures within the compound (David 1971:123; also see Meggers and Evans 1957:248; Stanislawski 1973:380). In Chanal, this situation might be further complicated by the practice of relocating structures in different areas of the compound in order to use the previous locations of structures for gardening because of an undesirable original slope or watertable levels. Similarly, in Chamula, when a housesite was abandoned the house structure was dismantled or burned and the leveled platform was left fallow and eventually cultivated (Howry 1973:29).

An additional problem occurs in households with wattle-and-daub or mud brick structures since wall clay which accumulates over former living floors generally retain both the colour and texture of the surrounding soil (see Fitch and Branch 1960; Gullini 1969; McIntosh 1974, 1977). Also the pits from which the clay is obtained become artifact traps and are occasionally used for refuse disposal. In terms of pottery, sherds from previous occupations are excavated and used in wall construction while more recent sherds are trapped or dumped into the pits from which the clay was taken. Furthermore, the size and number of structures within some compounds may be in a constant state of flux due to changes in family size and economic position. Most importantly, as the cycle of structure changes progresses there may be concomitant changes or reorientation in the areas of pottery-use activities, storage, and disposal of
pottery and other durables within the compound.

The difficulties of conceptualizing an ideal cycle of structure change are reflected in the record of domestic structure reuse and abandonment for Aquacatenango (see Table 28). Occupants of 33 households had reused or abandoned one or more structures while they had occupied their compounds (all within the last 60 years). Of the 51 structures recorded, in 26 cases (51%) new structures had been built on the platform mounds of dismantled structures or portions of the old structures had been incorporated into new ones. In all other cases new structures (with new platforms) were built in different locations from the old structures although they were generally built near to the old structures. Similarly, Wauchope (1938:152) reported that Maya in the Yucatan generally built a new house to one side of the old one. In 14 (28%) of the Aquacatenango cases, all traces of a previous structure and platform were destroyed by gardening, patio construction, or some unremembered activity. In the remaining 11 cases (22%), some structural remains, the platform mound, or a hearth feature from a previous structure were clearly visible.

Among the households surveyed in Aquacatenango, only two structures, a kitchen and a sweatbath, remained relatively intact after abandonment. Both of these had been abandoned within the last six years. Only five erect, recently abandoned structures were recorded among the households surveyed in Chanal. Abandoned structures were observed in some households visited—but not
Table 28: Domestic structure reuse and abandonment recorded for 33 Aquacatenango households.*

<table>
<thead>
<tr>
<th>Number of cases/structural type:</th>
<th>House</th>
<th>House/ Kitchen</th>
<th>Sweatbath</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replaced or incorporated</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>(new house)+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replaced or incorporated</td>
<td>3</td>
<td></td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>(new kitchen)+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replaced by house/kitchen+</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Replaced by storage unit+</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>No surface remains:</td>
<td>3</td>
<td>4</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Converted to garden*+</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Converted to patio:</td>
<td>3</td>
<td></td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Platform mound remains only:</td>
<td>4</td>
<td>2</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Covered by woodpile:</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Abandoned and still erect:</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>8</td>
<td>15</td>
<td>51</td>
</tr>
</tbody>
</table>

* At 17 households the families were using only the original structures.
+ No change in position of structure
++ 3 of these cases represent the movement of a single household cluster (2 houses and 1 kitchen).
surveyed in both communities. In general, it seemed that abandoned structures were relatively rare in growing communities, and if they were left erect for any length of time they often served as refuse dumps, animal shelters, play areas for children, or as a convenient covered activity area, such as a sheltered area for woodworking.

While such changes in structure location will mix artifact patterning in toft areas, they will destroy artifact patterning from previous structure configurations resulting from provisional discard and loss although there may be little or no effect on pathway, maintenance, or dumping behavior. Because loss accounts for such a small percentage of items, the effects of this mode on overall refuse patterning will probably be negligible in Maya sites. Thus, except for possible remnants of the previous toft areas, refuse patterning should reflect the last use configuration of structures. As long as structure reorientation and reuse occur in the same patio context, the overall refuse patterning should not be too badly distorted. However, clearly, the best context for examining refuse patterning is in semi-sedentary communities which occupy land for only a few years or up to one generation.
Abandonment stage

Whatever the reason for the desertion of a compound (household cluster), the primary behavioral factors determining the nature of the material items (size, condition, value, location, etc.) left at the site will include (1) the rapidness of the departure and (2) the anticipation of returning or not returning to the site at some future date (Baker 1975; Lange and Rydberg 1972; Stevenson 1979, 1982; see Table 29). At least four compound abandonment modes can thus be recognized, including (1) gradual abandonment with return anticipated, (2) gradual abandonment with return not anticipated, (3) rapid abandonment with return anticipated, and (4) rapid abandonment with return not anticipated.

(1) Gradual abandonment modes

Most archaeological sites are believed to have been abandoned gradually, with or without anticipation by the occupants of returning at a future date. Decisions to abandon a site in this way may be the outcome of any of a number of reasons, including village factionalism, religious disputes, conflicts over rights to resources, health problems, or poor agricultural conditions (e.g. Heizer 1962; Stanislawski 1973).

For example, many of the "pueblos de Indios" established by the Spanish after the conquest eventually had to be abandoned because
### Table 29: Pottery abandonment at Tzeltal Maya housesites (format adapted from Stevenson 1979:226)

<table>
<thead>
<tr>
<th>Condition of Abandonment:</th>
<th>Rapid</th>
<th>Rapid</th>
<th>Gradual</th>
<th>Gradual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipation of return:</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Probability of Material State Occurance:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Vessels in Association with Activity Loci:</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Vessels in Defacto State*: Moderate/ High</td>
<td>Moderate/ High</td>
<td>Low</td>
<td>Low/ Moderate</td>
<td></td>
</tr>
<tr>
<td>Vessels in Manufacture: Moderate/ High</td>
<td>Moderate/ High</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Vessels in Storage: Low</td>
<td>Low/ Moderate</td>
<td>Low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>(caches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vessels of Socioeconomic Value: Moderate/ High</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*abandonment due to death may create this situation.*
the locations were unhealthy, had inadequate farmland, or lost viability due to trade restrictions (Markman 1972:199).

Under gradual abandonment conditions, pottery of significant social or economic value, together with vessels in a state of manufacture and vessels in association with activity areas are not likely to be deserted (see Lange and Rydberg 1972:430; Robbins 1973:212). In cases where return is not anticipated, refuse which would normally be removed from living and working areas might be allowed to accumulate while the site is being abandoned (Stevenson 1982:246). In cases where return is anticipated there is more likelihood that usable items will be left at an abandoned site. It has been suggested that an orderly versus random arrangement of useful materials may reflect anticipated return to a site (Baker 1975). Caching of whole and functional items also implies anticipated return (e.g. Gould 1981:10; Stevenson 1982:253).

An abandonment practice relatively common among the Tzeltal Maya which results in a situation resembling anticipated return, but which is actually quite different, is the orderly abandonment of a living house after a death in the family. This practice can be traced through Landa (Tozzer 1966:130) to at least the early Colonial period (16th century). According to Wauchope, houses are generally deserted after there have been one to three deaths, depending upon the size of the family occupying the house (1938:152).

A modern example of a compound abandoned due to a death in
the family was reported in the paraje of San Pedro in 1977. Unfortunately, it was not clear whether items used primarily by the deceased individual constituted the principal material left in the house. In the San Pedro compound, the kitchen structure of the compound had been largely dismantled and usable items scavenged, while the living house was relatively intact and some of the household ritual paraphernalia was still stored in the rafters. These included two large fiesta cooking jars, a large fiesta tortilla griddle, and a gourd tortilla-storage bowl.

(ii) Rapid abandonment modes

Instances in which a site is abandoned rapidly (and especially when the occupants have no anticipation of returning) are probably less common than those of gradual abandonment except in the cases of the immediate threat of attack, an epidemic, or an impending natural disaster (such as an earthquake, fire, or volcanic activity). However, Friede and Steel (1980) suggest that most occupation floors excavated in prehistoric African settlements represent huts which have been burned down. Their experiments with burning down abandoned huts shows that one effect of fire is a measurable change in the magnetic properties of supporting soils. Because of these changes it may be possible to infer the rapid abandonment of households in cases of fire.
The Classic site of Ceren, El Salvador which was buried by volcanic activity (Sheets 1979), creates an ideal kind of situation for archaeological interpretations, since pottery and other artifacts are likely to be left in association with activity and storage areas under such conditions. Furthermore, as a result of rapid abandonment, more complete and valuable vessels, which are normally removed, may be left in the structure (Green 1961b:91). The effects of rapid abandonment are similar whether or not return is anticipated, with the possible exception that the latter situation would result in the removal of some vessels with social (such as heirlooms) or economic (resale) value.

Other factors which may contribute to determining the nature of items left at a site include (1) their portability, (2) the means of transportation, (3) the distance to the new site, (4) the season of movement, and (5) the relative functional utility of the items (Stevenson 1979). Pottery vessels are not highly portable and the normal mode of transportation is by foot (with baggage supported by a tumpline). Thus, under conditions of gradual abandonment, most vessels (and especially larger ones) might be given to relatives or sold if the new site is at any distance away or if the move takes place during the rainy season. Under rapid abandonment conditions, it is highly unlikely that any but the most valuable vessels (polychromes, heirlooms, etc.) would be removed. Pottery being stored for potential repair or reuse would almost certainly be deserted, under both gradual and rapid abandonment conditions.
(iii) Abandonment states and options

The various stages of abandonment have been discussed, but it should also be stressed that there are a number of optional movements between these stages and the final archaeological record (see Figure 19). Once the compound is abandoned it might remain: a closed (or fenced) compound with limited access (option 1, Figure 19); an open site (vacant lot) with unlimited access (option 2, Figure 19); or it might enter the archaeological record directly due to catastrophic events, or the relocation of entire communities, as among the semi-nomadic Lacandon. In the latter case, compounds would not be exposed to significant cultural postabandonment activities (option 3, Figure 19). A closed (fenced) site may be reoccupied, or converted to a garden or pasture (option 4, Figure 19), it may be opened by removal of fence boundaries (option 5, Figure 19) or it may enter the archaeological record without becoming open (option 6, Figure 19). Once a compound becomes an open (vacant) lot it may be reoccupied, or converted to a garden or pasture (option 7, figure 19) or enter directly into the archaeological record (option 8, figure 19). Finally an archaeological site may be reoccupied after being left isolated from human activities for many years (option 9, figure 19). Thus there are many possible pathways or sequences between occupation and the archaeological context, each with slightly different archaeological consequences for the
Figure 19: Preabandonment, abandonment, and postabandonment states of Tzeltal compounds and optional movements between them. (Numbers indicate options referred to in text).
patterning and content of items and features. Obviously, sites directly entering the archaeological record, or sites which remain closed until the community is abandoned, hold the most promise for archaeological interpretation.

Postabandonment stage

Much of the "smearing and blending" of cultural remains that occurs after a site is abandoned can be attributed to natural processes (such as soil erosion and the deterioration of the perishible ecofacts (e.g. Butzer 1982; Foley 1981; Schiffer 1983b; Wood and Johnson 1978). However, as Ascher (1977:237) points out "there are also contributing human factors in the first stages of smearing and at every stage in its progression." These factors include a number of activities associated with the "open" or "vacant" lot stage experienced by many housesites in Tzeltal communities. This stage is characteristic of housesites which are left "open" to general public traffic and are thus accessible for various activities comparable to those conducted in open housing lots in our own towns and cities (see Wilk and Schiffer 1979). By comparison, abandoned lots which are not readily accessible to everyone (such as those in fenced compounds) are here termed "closed." Both "opened" and "closed" compounds are, of course, exposed to the same kinds of postabandonment activities, however, one would expect those
activities to be conducted with considerable less intensity in "closed" abandoned lots. Major postabandonment processes include (1) scavenging, (2) shortcutting, (3) children's play, and (4) postabandonment dumping disposal.

(i) Scavenging

Scavenging activities are generally associated with the early abandonment stage. Many sites may already be devoid of reusable items before they become vacant lots. The intensity of scavenging at a given abandoned housesite is directly dependent upon the kinds and quantities of materials left during the abandonment process. Logically, there will be "better pickings" at rapidly abandoned housesites. Usable pottery, as well as ground stone items (such as metates) would be "choice" items for scavenging. Larger pottery fragments might also be taken depending partially upon the relative availability of pottery within the community as a whole.

Scavenging is also affected by the population flux of the community. The shorter the period of time in which the entire community is being abandoned, the lower the intensity of scavenging. For example, one would not expect a great deal of scavenging to occur at the abandoned Arab village reported by Nisson (1968), where virtually the entire population departed en masse when their water supply was closed-off. Furthermore, the semi-nomadic Lacandon and other swidden horticulturalists are
known to regularly change village locations. Scavenging activity is more intense in communities which are growing, which maintain a constant population level, or which are gradually abandoned.

The scavenging of artifacts from known Precolumbian sites (the reclamation process) was also relatively common in the Tzeltal Maya area. In Aquacatenango, a fine quality, 3-legged bowl which dates to the Classic period was being reused as a dog’s drinking dish in one household. Also, manos and metates were commonly reclaimed for grinding temper (this also occurred in the Southwest; see Harvey 1964:58). Similar examples occurred in Chanal. In one Chanal household, a fine, long-necked vase being used as a flower-holder and a shallow bowl being used as a spindle-dish were probably both of Precolumbian origin. In another household, prehistoric sherds and adze blades (taken from a nearby cave) were stored in a place of reverence on the family altar. A further example, involving the reclamation of pottery burial vessels from an archaeological site, was reported by Blom (1954:125), in which “...a cave that contained more than two dozen pottery vessels all in such excellent state of preservation that the finder took them to his house where the women used the pots for carrying water and cooking food until at last all the pieces were broken.”
(ii) Shortcutting

Once an abandoned compound was freely accessible to the entire community the probability of the preservation of the original pathways decreases. The use and preservation of such pathways was also dependent upon the nearness of the site to the community centre where the bulk of human traffic converged. New pathways were formed if they provided a speedier transect of the lot. After a short time it was difficult to distinguish these new "shortcuts" from the original pathways within the compound. Moreover, pathway breakage and dumping often occurred along the edge of these communally used pathways, which could cause considerable distortion of the refuse patterning associated with the original compound occupation.

(iii) Children's play

Abandoned housesites were also popular play areas for children, and especially if there were partially standing structures and material fragments about to serve as play equipment. Pottery vessels or fragments were essential housemaking equipment for children in their own households and were probably equally important when playing at abandoned housesites. In fact, children might bring pottery from their own household to their "playhouse" at an abandoned lot. Recent articles by Wilk and Schiffer (1979) and Hammond and Hammond (1981) have treated the subject of the effects of children's play on abandoned lots in more detail.
(iv) Postabandonment dumping

Disposal behavior patterns associated with vacant lots tended to vary considerably from those of in-use compounds and was characterized by a dumping disposal mode often accompanied by small fires (such as when organics were discarded). An ongoing compounds, decisions concerning where to throw refuse within a compound were made in relation to the location of structures, patio and other features, and activity areas, while disposal behavior in abandoned lots seemed to be most closely associated with pathways, boundary fences, and other structures that provided depressions or concealment of trash. Similarly, Wilk and Schiffer (1979) reported that refuse disposal in modern vacant lots in Tuscon, Arizona often took place along and at the ends of terminating paths.

The present sketch of the Tzeltal depositional context is predominantly etic in structure and admittedly incomplete. Its usefulness for the development of meaningful hypotheses concerning the prehistoric depositional context will rest upon future investigations of both ethnographic and archaeological households. The following section deals with some of the more immediate archaeological implications suggested by the present understanding of the Tzeltal depositional context.
Some archaeological considerations

The discussion, thus far, has dealt with the recognition, definition and classification of some of the phenomena of the depositional context. The remainder of this chapter addresses some of the more obvious implications of Tzeltal disposal behavior for Maya archaeology, followed by a discussion of expectations concerning the composition (type diversity, vessel frequency, etc.) of the pottery assemblages of archaeological housesites, and speculation on the interpretation of past depositional behavior using ethnoarchaeological pottery data.

(1) Ethnographic and archaeological refuse patterning

While abandonment and postabandonment behavior are not rigidly bounded there is a distinguishable set of disposal patterns within the Tzeltal Maya area. Although some degree of variation seems to occur between communities, it appears that these patterns represent economical, sensible solutions to common problems of spatial organization (also see Hayden and Cannon 1982b). A better understanding of these patterns should enable archaeologists to identify relatively undisturbed compound areas, as well as the conditions of abandonment (e.g. at Coneta, where archaeological remains and the early historical record indicate rapid abandonment; see Lee 1979).
The following discussion reviews some of the more interesting archaeological assumptions relating to the present study, and outlines some examples of likely archaeological refuse patterns and inferences concerning abandonment and postabandonment activities associated with them.

(1) Several authors have suggested that artifact clustering in archaeological sites may be produced by disposal behavior rather than representing activity areas (e.g. Binford 1978:356; Murray 1980:398; Schiffer 1983b). The Tzeltal data is in agreement with this suggestion. Both dumping and provisional discard can result in such clustering and might wrongly be associated with activity areas inside of structures. If clustering seems to be activity-related it is more likely the result of provisional discard or postabandonment behavior, rather than predepositional activities.

(2) Maintenance disposal practices add to the visibility of work areas such as the household patio, by concentrating refuse around these areas.

(3) A characteristic of the patio toft is a general size sorting of discarded items, with larger items being tossed to the outer limits of the toft. This characteristic may be useful for delimiting compound refuse areas based on the distribution of larger items of refuse relative to structural features. Children
are also important dispersing agents.

(4) The intensity of compound gardening is an important factor in decisions concerning where to dump refuse (especially inside versus outside compound), as well as in the dispersion of sherds which do become incorporated in garden plots. The removal of large fragments of pottery from the compound for hindrance minimization will have a considerable effect on the nature of the household pottery assemblage in terms of the proportion of the pottery refuse produced by the household which remains in association with the compound after abandonment.

(5) Several abandoned structures in Canal and Aquacatenango were closed to general access. In the past, in instances where structures had remained closed until the entire community was abandoned, their pottery assemblages would be less likely to have experienced postabandonment alterations. Obviously, the less a housesite was affected by postabandonment processes, the higher would be the probability of making accurate interpretations concerning the original occupation.

(6) Postabandonment refuse disposal (and especially pottery disposal) differs from preabandonment refuse disposal primarily in terms of location of dumping areas within the compound. Postabandonment dumping results in concentrations of refuse along fences and pathways or in household depressions rather than near
the household cluster.

(7) Reusable items, such as manos, metates, and nearly whole vessels are usually scavenged after housesite abandonment. The frequency and condition of such artifacts left on a site may therefore be useful for interpreting the conditions of site (or community) abandonment in terms of the speed of abandonment and the intensity of postabandonment activity.

In order to explore the archaeological implications of the Tzeltal observations in more detail, the ways in which abandonment and postabandonment activities might combine to produce distinctive archaeological patterning must be considered. Figures 20a-f illustrate some of the most likely combinations of depositional events which might affect a common refuse pattern in the preabandonment stage as well as the resulting archaeological patterns. Special attention is given to certain patterns with high potential for archaeological visibility, that is, patio and pathway and toft refuse, provisional discard, and deserted usable whole vessels. Six archaeological patterns are examined as follows:

| Pattern 1: |
| Characteristics | :discernable patio and pathway tofts. |
| | :provisional discard present. |
| | :usable whole vessels present. |
Figure 20a: Archaeological refuse pattern 1.
**Assumptions**

- no or minimal postabandonment activity.
- return was probably anticipated after abandonment but not achieved; or rapid abandonment occurred and return was not anticipated.
- single occupation.

**Pattern 2:**

**Characteristics**

- discernable patio and pathway tofts.

- provisional discard present.
- no whole vessels present.

**Assumptions**

- minimal postabandonment activity;
  - possible scavenging of whole vessels.
  - return was anticipated and whole vessels were left and eventually scavenged; or
  - return was not anticipated, whole vessels were taken upon abandonment, and postabandonment activity was minimal.
- single occupation.

**Pattern 3:**

**Characteristics**

- discernable patio and pathway tofts.

- provisional discard present
- no whole vessels present.

- intrusive pathway present.
- small dumps along boundaries and intrusive pathway.
Figure 20b: Archaeological refuse pattern 2.
Figure 20c: Archaeological refuse pattern 3.
Assumptions: considerable postabandonment activity, especially shortcutting, minor dumping, and scavenging. Return was not anticipated; or return was anticipated and not achieved, and whole vessels were scavenged.

Single occupation.

Pattern 4:

Characteristics: blurred but discernable patio and pathway tofts.

Assumptions: extensive postabandonment activity, especially dumping, shortcutting, and scavenging. Abandonment situation unclear.

Single occupation.

Pattern 5:

Characteristics: very blurred patio and pathway tofts.

Assumptions: moderate sherd density over entire site.

Figure 20d: Archaeological refuse pattern 4.
Structure Outline
Patio
Potsherds
Broken Vessel
Whole Vessel
Pathway

ORIGINAL REFUSE PATTERN

SINGLE OCCUPATION

SUCCESSIVE OCCUPATION

GRADUAL WITH RETURN ANTICIPATED

RAPID WITH RETURN ANTICIPATED

GRADUAL WITH RETURN NOT ANTICIPATED

RAPID WITH RETURN NOT ANTICIPATED

GARDENING
SCAVENGING / PLAY
SHORT CUTTING
MINOR DUMPING
MAJOR DUMPING

NO MODIFICATION

ARCHAEOLOGICAL PATTERN 4
Figure 20e: Archaeological refuse pattern 5.
Structure Outline
P. Patio
*= Potsherds
Broken Vessel
Whole Vessel
Pathway

ORIGINAL REFUSE PATTERN

SINGLE OCCUPATION

GRADUAL WITH RETURN ANTICIPATED

RAPID WITH RETURN ANTICIPATED

GRADUAL WITH RETURN NOT ANTICIPATED

RAPID WITH RETURN NOT ANTICIPATED

GARDENING

SCAVENGING / PLAY

SHORT CUTTING

MINOR DUMPING

MAJOR DUMPING

NO MODIFICATION

ARCHAEOLOGICAL PATTERN 5
Assumptions: postabandonment gardening discernable.
abandonment situation unclear.
single occupation.

Pattern 6:
Characteristics: very curtailed patio and pathway tofts.
no provisional discard present.
no whole vessels.
high sherd density over entire site.

Assumptions: postabandonment gardening extensive.
abandonment situation unclear.
successive occupations of site.

During the 1979 field season, one of the Coxoh Project crew members conducted a surface collection of artifacts from two abandoned Aguacateno housesites (Brulotte n.d.). Brulotte's data can be used here to demonstrate how the Tzeltal depositional model might aid the interpretation of archaeological refuse patterning. One of the most striking characteristics of the two abandoned housesites is the relatively low potsherd densities associated with the house platforms, which are both presumably house and kitchen combined (see Figures 21 and 22). In order to understand why such a situation would occur, a number of relevant factors are considered. These factors include various aspects of the depositional context related to (1) depositional behavior as
Figure 20f: Archaeological refuse pattern 6.
Figure 21: Sherd density contour map for abandoned housesite #1, Aguacatenango.
Figure 22: Sherd density contour map for abandoned housesite #2, Aguacatenango.
ABANDONED HOUSEHOLD #2
AGUACATENANGO
SHERD DENSITY
CONTOUR MAP

LEGEND
SHERD DENSITY / m²
SOLID = < 1.25
1 = 1.25 - 5
2 = 5.25 - 10
3 = 10.25 - 15
4 = 15.25 - 20
5 = 20.25 - 25
6 = 25.25 - 30
7 = 30.25 - 35

PATHWAY (+P)
HOUSEMOUND

N
2m

FENCED BOUNDARY
UNFENCED BOUNDARY
it affects the density of pottery refuse and its spatial distribution within a compound, and (2) the general physical characteristics of abandoned compounds (location, open or closed state, etc.) reflecting the intensity of postabandonment activity.

(1) Depositional factors:

To begin with, how did each of the recognized disposal modes and processes contribute to the accumulation of pottery refuse on and around (within one or two meters from the outside walls) the house platform itself? Maintenance and provisional discard disposal are probably the most important relevant factors in this regard. Frequent sweeping of house and kitchen floors (as well as associated patio areas) removes almost all accumulations of sherds in structures and in patio areas, although such sweeping results in concentrations of small sherds (and other small items) in the drainage ditches and along the edges of the patio near dwellings. Thus during the predepositional stage, virtually all large pottery refuse associated with a house or kitchen platform results from provisional discard (and to a lesser extent, trampling activity after maintenance).

In Aquacatenango, cases of provisional discard of single damaged vessels were associated with the houses of 21 households (42% of sample) and with the kitchens of 17 households (34% of sample). This could be compared with the provisional discard of clusters of broken pottery, which occurred along the outside
walls of houses in 10 households (20% of sample) and likewise along the walls of kitchens in 10 households. Singly stored broken vessels and vessel fragments generally occurred inside while clusters of broken pottery rarely occurred inside structures. Thus, many households would not have had large sherds even in provisional discard around structures, and even if such objects were left upon abandonment they might quickly be removed due to various postabandonment processes.

All other disposal modes (and to some extent provisional discard) resulted in the accumulation of discarded potsherds (especially broadcast patterning) throughout the compounds. Since the toft, garden, and orchard areas within Aquacatenango compounds were not regularly cleaned, as were the floors of structures and patio areas, a greater buildup of refuse in these areas relative to structures and patio areas over time might be expected. However, at least two preabandonment practices unrelated to household economic activities could have contributed considerable sherdage to abandoned house platforms. The first was the practice of constructing wattle-and-daub structures and the second was the use of abandoned structures for the dumping of refuse. The latter practice was only rarely observed in Aquacatenango, but the use of wattle-and-daub was very common. Furthermore, the relative amount of sherdage incorporated in the wallfill was observed to increase with proximity to the community centre.
In terms of the abandonment modes discussed above, one might expect low potsherd densities on and around house platforms to reflect a gradual rather than rapid rate of abandonment, and especially if return was not anticipated. In general, as the speed of abandonment decreases, the frequency of deserted whole or damaged pottery vessels (and potential sherdage) is likely to decrease, and similarly, as the probability of return decreases, the likelihood of deserted vessels decreases. After abandonment in an ongoing community, certain postabandonment processes, if they come into effect, may greatly alter relative sherd densities within an abandoned compound. Specifically, scavenging and children's play may remove any deserted vessels (including large fragments) associated with the structure (such as those in provisional discard), and postabandonment dumping activity may create new high density concentrations of sherds along pathways and fences away from structures. The location of new pathways may be crucial in this regard.

(2) Characteristics of the abandoned sites:

The two abandoned Aquacatenango compounds were extensively surface collected, over a six week period. Both compounds represented the open (vacant) lot state of abandonment. Each lot was partially fenced, but open to through traffic. Brulotte observed intensive postabandonment activity on both sites during his survey. This took the form of continual traffic along old and new pathways and dumping of refuse (especially small organic
refuse fires) along pathways and fences. The general effect of such activities was to increase the sherd densities in these areas relative to the house platform area. The system of pathways on both lots was extensive. One new pathway (P2 on Figure 20) cut across the house platform of housesite #1 and the two highest density areas within the mound seemed to be associated with it. In fact, the relative high density of one survey unit (three sherds/square m.) seemed to be the direct result of a single event of pathway breakage, in which a water-carrying jar (ki:t) was dropped on the platform mound (and survived as a cluster of nine sherds).

Secondly, the materials from which the houses were constructed were of importance. In both cases only the platform mound remained from the original structure. Presumably both structures were dismantled during or after abandonment of the compounds. The structure in housesite #1 was of "corazon de piedras" (heart of stone) construction, evidenced by the scattering of small stones on the housefloor and by small diameter postholes, while the structure in housesite #2 was of wattle-and-daub construction, evidenced by 26 daub fragments (Brulotte n.d.). As mentioned above, postsherds formerly mixed into the daub walls might account for the slightly higher density associated with the house platform of housesite #2. Prehistoric plainware sherds in walls might be indistinguishable from modern plainware sherds. Surface sherds derived from wallfill were absent at housesite #1.
Thirdly, the proximity of each compound to the centre of the community was taken into consideration. Since housesite #2 was more centrally located than housesite #1 (the latter being located near the outskirts of Aquacatenango), it was open to much more foot traffic and had become a more popular disposal area. This latter fact was reflected in the tremendous differences in surface sherd densities between the two sites.

In sum, at least 10 factors can be identified which could have affected the differential potsherd densities of house platform versus compound areas for the two abandoned Aguacatenango compounds, including:

1. A combination of the frequency of occurrence of house, kitchen and patio maintenance disposal (especially the sweeping of structure interiors), and the increase in refuse concentration in loft areas over time.

2. The likelihood that most pottery left on and around the house or kitchen structure upon abandonment would consist of singly stored fragmentary vessels along the interior walls and/or a cluster of fragmentary vessels around the exterior of the structure.

3. Disposal behavior, other than provisional discard disposal, resulting in refuse dumping (broadcast or discrete patternings) away from structures, and probably outside of the compound.

4. The use of abandoned structures for refuse disposal as a relatively rare occurrence in ongoing communities.
(5) The use of wattle-and-daub wall construction affecting relative potsherd densities on housemounds (e.g. the relatively higher density of potsherds associated with household #2).

(6) The likelihood that the amount of pottery refuse left upon abandonment, on and around the house platform, would decrease or increase under different abandonment conditions. Decreases would occur especially under gradual abandonment conditions with no anticipation of return. Under such conditions, no items of value would likely be left, including usable (or reusable) pottery vessels.

(7) Open abandoned lots in ongoing communities being more susceptible to postabandonment cultural processes than closed abandoned lots.

(8) Intensity of postabandonment activity (especially the processes of shortcutting and dumping) increasing with proximity to the community centre.

(9) Scavenging and children's play in open lots removing any items of value for adults or children (including items such as fragmentary pottery, manos, metates, etc.) left upon abandonment.

(10) Relative potsherd densities on open lots being greatly distorted by postabandonment dumping along pathways and borders. Under varying sets of conditions, most of these factors could play important roles in creating low or high potsherd density, although preabandonment maintenance behavior, as well as the intensity of postabandonment dumping must be given priority
in initial examination of the topic. When such conditions are
taken into consideration, the accurate interpretation of relative
potsherds density on abandoned Aquacatenango (and possibly any
Tzeltal) house platforms appears to be highly probable. Of the
six refuse patterns discussed above, both abandoned Aquacatenango
sites seem to be most comparable to pattern 4.

(ii) Quantifying discard

Considering the complexity of Tzeltal pottery deposition,
what kind of expectations can we have for predicting the size and
diversity of household pottery assemblages over time? One way of
addressing this question is to mathematically simulate household
pottery inventory change. This can be easily done using
Schiffer's (1976:60) total discard model (other models are
presented by David 1972, and Deboer 1974). This formula can be
used with ethnographic pottery inventories to make predictions of
changes in the relative proportions of pottery types within
inventories over time, as well as changes in size of inventories
over time.

In order to include as many recognized pottery types as
possible in the simulation, an average household inventory for
each community was established, using the mean frequencies for
each pottery type for which use-life estimates were collected. No
individual household inventory included all of the types used in
the simulation. The following discussion outlines the information required by the equation and Tables 30 and 31 give summaries of all values observed and generated for each pottery type in the average household.

The equation for calculating total discard (Schiffer 1976:60), is expressed as:

\[ TD = \frac{St}{L} \]

where: \( T_d \) = total discard per unit;

- \( s \) = the average number of a given item (vessel) type normally in use at a given time;
- \( t \) = the time span over which a given item (vessel) type is in use;
- \( L \) = lifespan (or uselife), expressed in units of time (t).

To facilitate the simulation, the frequency of each type (S) and the uselife of each type (L) are assumed to remain constant over time. That is, each time a vessel is broken it is immediately replaced. In reality, replacement rates tend to vary considerably from household to household over time according to changes in household socioeconomic and demographic conditions (see Chapter 3). With vessel number and uselife held constant, the estimates of type proportion (percentage of inventory) over time will become constant immediately upon replacement of the original inventory. However, the difference between the original
### Table 30: Total discard model for Chanal.

<table>
<thead>
<tr>
<th>Emic type</th>
<th>Uselife</th>
<th>Original Frequency</th>
<th>Total Discard</th>
<th>%Original</th>
<th>%20 Years</th>
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<tr>
<td>Samot</td>
<td>.49</td>
<td>2.64</td>
<td>107.76</td>
<td>5.40</td>
<td>10.26</td>
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<td>Oxom</td>
<td>.58</td>
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<td>706.55</td>
<td>41.94</td>
<td>67.28</td>
</tr>
<tr>
<td>Chikbin</td>
<td>1.68</td>
<td>3.19</td>
<td>37.98</td>
<td>6.53</td>
<td>3.62</td>
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<td>Sets' (local)</td>
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<td>.66</td>
<td>6.08</td>
<td>1.35</td>
<td>.58</td>
</tr>
<tr>
<td>Kib</td>
<td>2.29</td>
<td>4.71</td>
<td>41.14</td>
<td>9.64</td>
<td>3.92</td>
</tr>
<tr>
<td>Poket</td>
<td>2.57</td>
<td>3.45</td>
<td>26.85</td>
<td>7.06</td>
<td>2.56</td>
</tr>
<tr>
<td>Chalten</td>
<td>2.83</td>
<td>.66</td>
<td>4.66</td>
<td>1.35</td>
<td>.44</td>
</tr>
<tr>
<td>Total domestic</td>
<td></td>
<td></td>
<td>35.80</td>
<td>73.27</td>
<td>88.66</td>
</tr>
<tr>
<td>Porcelana</td>
<td>1.26</td>
<td>5.43</td>
<td>86.19</td>
<td>11.11</td>
<td>8.21</td>
</tr>
<tr>
<td>Chinnajab'il</td>
<td>3.20</td>
<td>.75</td>
<td>4.69</td>
<td>1.53</td>
<td>.45</td>
</tr>
<tr>
<td>Oxom grande</td>
<td>3.72</td>
<td>3.77</td>
<td>20.27</td>
<td>7.72</td>
<td>1.93</td>
</tr>
<tr>
<td>Chik'pom</td>
<td>5.80</td>
<td>1.78</td>
<td>6.14</td>
<td>3.64</td>
<td>.58</td>
</tr>
<tr>
<td>Somlebal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cantela</td>
<td>10.00</td>
<td>.36</td>
<td>.72</td>
<td>.74</td>
<td>.07</td>
</tr>
<tr>
<td>Tenosha</td>
<td>12.50</td>
<td>.24</td>
<td>.38</td>
<td>.49</td>
<td>.04</td>
</tr>
<tr>
<td>Poket grande</td>
<td>20.00</td>
<td>.73</td>
<td>.73</td>
<td>1.49</td>
<td>.07</td>
</tr>
<tr>
<td>Total ritual</td>
<td>13.06</td>
<td>1.19.12</td>
<td>26.72</td>
<td>11.34</td>
<td></td>
</tr>
<tr>
<td>Total inventory</td>
<td>48.86</td>
<td>1050.13</td>
<td></td>
<td></td>
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</table>
Table 31: Total discard model for Aquacatenango.

<table>
<thead>
<tr>
<th>Emic type</th>
<th>Use life</th>
<th>Original Frequency</th>
<th>Total 20 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>xOriginal</td>
<td>Discard (20 yrs)</td>
<td>20 Years</td>
</tr>
<tr>
<td>Samet</td>
<td>0.67</td>
<td>1.48</td>
<td>44.18</td>
</tr>
<tr>
<td>Oxom</td>
<td>0.61</td>
<td>6.67</td>
<td>218.69</td>
</tr>
<tr>
<td>Chikpin</td>
<td>0.56</td>
<td>26.69</td>
<td>951.43</td>
</tr>
<tr>
<td>&quot;Sets&quot; (imported)</td>
<td>0.50</td>
<td>1.04</td>
<td>41.60</td>
</tr>
<tr>
<td>Kib</td>
<td>1.15</td>
<td>5.76</td>
<td>100.17</td>
</tr>
<tr>
<td>Poket</td>
<td>0.80</td>
<td>7.76</td>
<td>180.47</td>
</tr>
<tr>
<td>Chalten</td>
<td>1.56</td>
<td>1.70</td>
<td>21.79</td>
</tr>
<tr>
<td>Chichina</td>
<td>1.25</td>
<td>1.48</td>
<td>23.68</td>
</tr>
<tr>
<td>Total domestic</td>
<td>52.53</td>
<td>1582.01</td>
<td>79.19</td>
</tr>
<tr>
<td>Porcelana</td>
<td>0.96</td>
<td>8.08</td>
<td>168.33</td>
</tr>
<tr>
<td>Chichina chica</td>
<td>1.19</td>
<td>7.2</td>
<td>12.10</td>
</tr>
<tr>
<td>Oxom grande</td>
<td>1.99</td>
<td>1.04</td>
<td>10.45</td>
</tr>
<tr>
<td>Chikpon</td>
<td>1.67</td>
<td>1.14</td>
<td>13.65</td>
</tr>
<tr>
<td>Somiebal</td>
<td>2.46</td>
<td>0.02</td>
<td>0.16</td>
</tr>
<tr>
<td>Cantela</td>
<td>2.92</td>
<td>0.72</td>
<td>4.93</td>
</tr>
<tr>
<td>Tenosha</td>
<td>8.50</td>
<td>1.84</td>
<td>4.33</td>
</tr>
<tr>
<td>Poket grande</td>
<td>3.00</td>
<td>0.24</td>
<td>1.60</td>
</tr>
<tr>
<td>Total ritual</td>
<td>13.80</td>
<td>215.55</td>
<td>20.81</td>
</tr>
<tr>
<td>Total inventory</td>
<td>66.33</td>
<td>1797.56</td>
<td></td>
</tr>
</tbody>
</table>
and subsequent inventory proportion is of considerable interest (see below).

According to Tzeltal informants, the average life expectancy for a traditional plank-wall, thatched-roof structure is about 20 years (also see Howry 1978:256). Using our Chanal data as an example, the predicted discard rate for the most common vessel type in Chanal, namely, the unslipped, wide-mouthed jar (oxom), for a single occupation of 20 years, can be expressed as:

$$T_{jar} = \frac{20.49 \text{ jars} \times 20 \text{ years}}{.58 \text{ years}} = 707 \text{ jars}$$

A comparison of total discard rates for the entire inventory indicates the effect of different uselives on the proportion of the original inventory. For example, in our average household inventory for Chanal, unslipped, wide-mouth jars represent 41.94% of the total inventory, while over a 20 year period these jars will constitute 67.28% of vessels contributed to the pottery refuse of the household. This increase is directly attributable to a relatively low uselife (.58 years) of this type. In fact, in Chanal, only two of the major domestic types, the unslipped, wide-mouth jar (oxom) and the unrestricted plate (samej), actually increased in percentage proportion of the projected pottery assemblage, while the percentage of all other types decreased. In Aquacatenango, an increase is also seen for the single-handled jar (chikpin) and restricted mouth bowl.
In terms of activity sets, an increase in short-lived domestic types (and plainwares in general) over time is apparent, along with a concomitant decrease in the longer-lived ritual types. This is consistent with the relatively high proportion of plainware sherds usually associated with domestic house excavations (see Wauchope 1938:120). The percentage proportion of domestic vessels is seen to increase from 73% to 89% of the household inventory over a 20 year period in Chanal, while the proportion of ritual vessels drops from 27% to 11% over the same period. In Aquacatenango similar (although less dramatic) results are indicated, with the percentage proportion of domestic vessels rising from 79% to 88%, while the proportion of ritual vessels drops from 21% to 12% of the household inventory over a 20 year period. Most importantly, the predicted proportions for each community are virtually the same for domestic and ritual vessels (89% versus 11% for Chanal, and 88% versus 12% for Aquacatenango).

Summing the values of the total discard variable over a 20 year period (or one occupation) produces an estimate of 1050 vessels for the average Chanal household (22 times the original inventory) and 1798 for the average Aquacatenango household (27 times the original inventory). Assuming that these values are a reasonable approximation of reality, then the average Chanal household can be expected to discard about 53 vessels per year (for the 20 year period), while the average Aquacatenango
household would discard about 90 vessels per year in the same
period. In each community, the average family size is
approximately seven persons. Therefore, according to the
simulation model, the per-capita discard rate for Chanal would be
about eight vessels per year while the per capita discard rate
for Aquacatenango would be about 13 vessels per year.

Simulations of this kind are useful for illustrating the
variation in pottery assemblages caused by differential lengths
of household occupation. But before such a model can be used for
archaeological interpretation, a better understanding is needed
of (1) use-life estimates for more exotic types, (2) the
relationship between replacement rates and changes in household
socioeconomic and demographic conditions, and (3) factors
affecting inside versus outside compound disposal (concerning the
latter see Hayden and Cannon 1982b).

Summary of depositional context

In terms of pottery and other durable elements, the
locations of storage and disposal behavior seem to be the most
important factors in the ethnographic context which contribute to
their eventual spatial distributions in the archaeological
record. Of recognized disposal modes, provisional discard
locations are probably the most sensitive to the transformation
stages of structures within a compound, while maintenance
disposal, dumping, and pathway breakage may escape alteration due
to such transformations.

In terms of abandonment and postabandonment behavior, within
a large residential archaeological site, one might find
housesites reflecting varying conditions of abandonment, from
households abandoned rapidly (e.g. due to fire) with relatively
little postabandonment activity to gradually abandoned households
with a high degree of postabandonment activity. In order to make
comparisons between household assemblages meaningful, only
households exhibiting the same kind of abandonment and
postabandonment conditions should be compared. Generally the
last structures in use prior to abandonment of a given compound
will be the ones most intact in the archaeological record.

Households which have been converted to garden may be so
obliterated as to escape detection during surface surveys except
as refuse scatters, while others may have suffered little from
postabandonment activities.

Unless abandonment of the compound is rapid, all except the
least valuable vessels are likely to be taken from the site and
either curated to the new site or sold or given to neighbours and
relatives. Whatever survives to the abandonment stage may become
exposed to further cultural and natural processes. The frequent
scavenging of reusable vessels and vessel fragments and the use
of the site for refuse disposal from other compounds probably
have the most devastating effects on the final pottery record of
a housesite. Although the overlapping of such disposal patterns
makes the analysis of depositional behavior more difficult, it does not preclude it, and is an essential consideration when interpreting the use context of items found on living floors of structures.

These few general observations concerning the formation of pottery assemblages in Tzeltal Maya housesites may ultimately not be applicable outside the Maya Highlands, however, some understanding of the regularities of pottery-related depositional behavior, regardless of geographical location, must form the base-line of any statement concerning the social nature of a given pottery assemblage.
The prediction of household socioeconomic conditions

"Classification is long and life is fleeting."
(Willey 1961:230)

Introduction

In the previous chapters, ethnographic pottery information was used for theoretical model building, however, such information is also useful for testing and evaluating standard archaeological methods of analyzing pottery assemblages from excavated sites. The most common archaeological method involves the measurement of the frequencies (or proportional frequencies) of vessels, vessel types and vessel wares comprising an assemblage. One of the ultimate goals of such analyses is, or should be, the interpretation of socioeconomic information from the pottery assemblages. However, obtaining reliable measurements of vessel frequency is a major problem for archaeologists (see Orton 1980:156).
Before considering the interpretation of the socioeconomic conditions of a given housesite one must first be confident that there is no (or negligible) postabandonment disturbance of the assemblage, or that any physical remnants of postabandonment activities can be identified (see Chapter 4). With the above goal (and restriction) in mind, the aim of the present chapter is to outline the methodological problems surrounding the use of frequency measures for characterizing pottery assemblages, to suggest an alternative quantification measure, that of type diversity, and to explore the types of socioeconomic inferences that can be made at the household and community levels based on Tzeltal pottery data.

**A methodological morass**

As stated previously, if ethnologists (or ethnoarchaeologists) and archaeologists wish to compare data sets based on observations of the same variables, then similar methods of measuring and analyzing these variables should also be used whenever possible. One area in which problems arise when comparisons are made between ethnographic and archaeological data sets concerns the methods used to measure the relative frequency of pottery vessels, types, or wares. The difficulties arising with pottery type frequency measures result from the fact that such measures are based primarily on whole vessel counts in the functioning ethnographic context while they are made primarily on
incomplete vessel fragments in the archaeological context. If we are concerned with quantifying ethnographic data for the development of predictive models of the relationships between material culture frequency and socioeconomic conditions, or if we merely wish to compare descriptive statistics (graphs, histograms, etc.) of such relationships between the two excavational units, then it would be useful (even necessary) to use similar methods of measurement. Logically it would be better in practice for the archaeologist to try to convert his potsherds into whole vessels rather than for the ethnoarchaeologist to destroy the pottery of his unsuspecting informants for the purpose of making sherd counts. However, the conversion of archaeological sherdage into whole vessels is a thorny problem since the methods presently are not adequate to the task.

While debate over methods used to measure taxonomic frequency within faunal assemblages seems to abound in the archaeological literature (see Grayson 1980), there seems to be little concern over the methods used to measure pottery type frequency (notable exceptions include Millet 1979 and Orton 1975; 1982). However, some of the methods used to measure the frequency of pottery types are comparable to those used by faunal analysts and they share many of the same methodological weaknesses. The lack of attention being paid to the methods used in pottery analysis can undoubtedly be attributed to the kinds of problems for which pottery data have traditionally been used to solve.
Archaeologists have long recognized the utility of faunal remains for understanding human subsistence behavior and historical biogeography, and that the quantification of taxonomic diversity and relative frequencies is basic to these ends (Grayson 1980:199). Pottery data, on the other hand, have traditionally been used for the development of regional chronologies, the relative dating of features within sites, and the description of pottery types and their proportions. In all of these situations the accuracy of type frequency values is not necessarily important beyond the determination of whether type A is more common than type B in components being compared. Even so, the use of type frequencies based on sherd counts alone for measuring chronology (that is, seriation) has been brought into question (for discussion see Sullivan 1978:209). Recently, a number of researchers have attempted to use pottery assemblages for investigating the relative socioeconomic conditions of sites or between sites (e.g. Bawden 1982:172; Deboer 1974; Deetz 1965; Dickens and Chapman 1978; Fry 1970; Lischka 1978; Michaels 1979; Redman 1979:78; Upham et al. 1981). In this study, it is argued that traditional methods of treating pottery assemblages, while probably adequate for the original culture historical problems they were meant to deal with, have not been appropriate for investigations of socioeconomic conditions at the level of the individual households.
It seems obvious from the archaeological literature that the methods of pottery analysis, including methods of measuring type frequency, chosen by a given archaeologist depend largely upon the kinds of methods used previously by other archaeologists working in the same area. Methods are often used without being given any critical thought as to whether or not they are the most efficient ones available or are more relevant to the kinds of problems being investigated. Some of the more commonly used methods for measuring type frequency are outlined below and their limitations and relative usefulness are discussed.

(ii) Number of inferred vessels (NIV)

The majority of methods presently being used by pottery analysts to determine type frequency result in a measure which represents the number of inferred vessels (hereafter abbreviated to NIV) for each type. Whether the analyst is using the total sherdage from his or her site, or using only the rim sherds, some attempt is generally made to combine any sherds that can be assigned (with relative certainty) to individual vessels (this is sometimes called the "batch" method). The NIV measure should not be confused with the "number of individual specimens" (WISP) measure used by faunal analysts which can be viewed as equivalent to raw sherd counts. Rather, the NIV measure is the analog of the Minimum Number of Individuals (MNI) measure used by faunal analysts. Further, it should not be confused with Orton's
"maximum number of vessels" (1975:31), which does not infer two given sherds to be from the same vessel unless they can be joined (that is, unless it can be demonstrated). In other words, Orton's measure represents a step between raw sherd counts (or NISP) and the number of inferred vessels (NIV).

The reduction of entire collections of sherds to whole vessel counts (Newell and Krieger 1949; McPherron 1967), or merely the reduction of decorated rim and body sherds to whole vessel counts (Brose 1970), can be a very tedious and time consuming task (many years in some cases) and requires a large continuous excavation unit (preferably an entire site) in order to be effective (Barker 1977:179; Baumhoff and Heizer 1959:309; Ford 1951:93). Additional difficulties arise when the sorting of sherds into vessel "batches" involves assemblages in which designs are relatively simple, formalized, or repetitive (Ford 1971:93).

To get around the problems of reducing huge sherd collections to whole vessel counts in many areas, it has become a common practice to use only rim sherd counts for deriving NIV measures which are then used directly to determine type frequency (examples include Deetz 1965; Fry 1970; Lischka 1978; Pearce 1978). An alternative method proposed by Wright (1974) predicts whole vessel type frequency by dividing the number of rim sherds per type by the average number of rim sherds represented in vessels which could be reconstructed from the assemblage.
The pottery assemblage from a Gamma-gamma village site (the Gamma-gamma is a hypothetical culture invented by Ford 1954) was found to consist of three distinctive types. The minimum number of vessels per type per strata was determined using three different methods (see Table 32). Method one merely used the NIV values based on rim sherds (combining as many rim sherds as possible) to represent the actual type frequency per strata. In method two the NIV values for rim sherds were compared to the NIV values for basal sherds for each level. The highest of the two values was taken to represent the final number of inferred vessels per type. Method three converted the raw counts of rim sherds to an approximation of whole vessel frequency by dividing the raw counts by the average number of rim sherds found in vessels that could be reconstructed.

Although this is a hypothetical case, it is easy to see how these three different methods can give vastly different estimates of vessel frequency per type. In fact, there are a number of problems and limitations concerning the use of NIV or MISP measures of type frequency, including:

(a) At given housesites, and over an entire site, practices of differential vessel use and reuse, pottery disposal, as-well as site abandonment activities greatly affect the relative frequencies of vessel fragment types (rims versus bases, etc.). In Chanal, for example, the section from rim to neck of a broken vessel was often saved for reuse as an enclosure for seedlings
Table 32: Example of three methods used for measuring minimum number of pottery vessels per type for a hypothetical Gamma-gamma village site.*

<table>
<thead>
<tr>
<th>Method</th>
<th>One</th>
<th>Method Two (rims/bases)</th>
<th>Method Three**</th>
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<tbody>
<tr>
<td>Total</td>
<td>Rims</td>
<td>Bases</td>
<td>NIV rims</td>
</tr>
<tr>
<td>Rims</td>
<td>NIV</td>
<td>&amp; bases</td>
<td></td>
</tr>
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<td>NISP</td>
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</tr>
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(Type A)

<table>
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<th>Total</th>
</tr>
</thead>
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<tr>
<td></td>
<td>100</td>
<td>97</td>
<td>32</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>52</td>
<td>1</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>46</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>195</td>
<td>222</td>
<td>48</td>
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</tr>
</tbody>
</table>

(Type C)

<table>
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<th>(Type B)</th>
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<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>84</td>
<td>22</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>319</td>
<td>64</td>
<td>50</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>323</td>
<td>209</td>
<td>25</td>
<td>209</td>
</tr>
<tr>
<td>Total</td>
<td>295</td>
<td>341</td>
<td>146</td>
<td></td>
</tr>
</tbody>
</table>

* Raw rim-sherd counts, NIV values for rim and basal sherds, and total NIV were taken from a table of random numbers (Blalock 1972:554).

**This value equals the raw rim-sherd counts divided by the average number of rim-sherds for reconstructable vessels (arbitrarily set at 5 sherds per vessel).
while the body and base of the vessel were discarded (often outside the compound).

(b) Another problem concerning the use of NIV or NISP measures of type frequency is that they assume that all specimens (and all types) are equally affected by chance or deliberate breakage. This assumption does not account for the relative quality of vessel types, largely determined by characteristics of vessel fabric, morphology (such as structural strength) and function, which may prevent one sherd from breaking in a situation in which a less "robust" sherd might. In addition, breakage rates of vessels in Chanal and Aquacatenango were believed to be affected by a number of demographic factors, such as family size and the number of small children and dogs. Furthermore, fragmentation of pottery can result from random hazards at each depositional locality (Jelinek 1967:84), such as areas of shortcutting.

Orton (1980:163) estimates the number of vessels represented by two types from the sherdage of a hypothetical archaeological assemblage by dividing the number of sherds of each type by a constant (being the number of sherds into which a vessel of each type is always assumed to break). Orton's method, which is basically similar to that used by Wright (1974) on rim sherds from a "real" assemblage, illustrates that, if a number of types exhibit differential breakage characteristics, the estimates of relative proportions of the types is seriously affected by the
proportion of the entire site which is excavated. There is a tendency for vessels which break into more pieces to represent a larger proportion of an assemblage (and higher type frequencies) as the percentage of the total site excavated decreases.

Using Schiffer's discard model (see chapter 4), Tzeltal vessel types with shorter uselives such as the small wide-mouth jar, were predicted to constitute greater proportions of a given household's pottery assemblage after the original assemblage had been completely replaced (also see David 1972, and David and Hennig 1972:20; Deboer 1974). Such frequently used and easily broken vessels will probably increase in proportion to other vessel-forms over time.

(c) Another problem with using NIV or NISP measures of type frequency involves variable sherd size. Doran and Hodson (1975:114) have stressed the necessity of fixing a lower limit to the size of items (sherds or flakes) counted which is consistent with the techniques of excavation in use. Collection techniques emphasizing different limits of sherd size may also greatly affect relative proportions of vessel types and especially NISP measures. Screening (sieving) techniques developed to collect "microsherds" and lithic "microdebitage" is one example of this situation (Fladmark 1982; Keighley 1973; McPherron 1967). Although sieving has the benefit of being an unbiased approach, it is not an easy task to count sherds which are often too small to be diagnostic, and painted motifs are often unrecognizable
(Keighley 1973:135; Sullivan 1978:209). Therefore the use of microsherds for estimation of type frequency may not be warranted.

(d) The greatest problem with using raw counts of sherds (NISP) as estimates of relative type frequency is the inherent interdependence of sherd specimens which even the most careful analyst may not be able to accurately assess. If two rim sherds from a given vessel are not recognized as being from the same vessel they will not likely be counted as representing two separate vessels. In other words, the method precludes their being classified as a single observation. As Grayson points out (1980:202), statistical methods (counts, percentages, chi-square, regression, etc.) used to analyze samples based on NISP measures (raw counts) assume that the specimens (bone fragments or sherds) used are representative of the sample population and that each is independent of every other one, and therefore the application of such methods to NIV measures becomes inappropriate if it cannot be ascertained that sherds are derived from the same vessels. The same reasoning also applies to NIV measures of type frequency.

(e) The second NIV method is more comparable to the MNI method used by faunal analysts. However, anyone who might be considering the use of this method should refer to Grayson's detailed criticisms of the use of the MNI method in faunal studies (1980). According to Grayson, because the relationship
between MNI values and actual frequencies is never known and because different aggregation techniques can give MNI results for a single collection which are not necessarily comparable, MNI cannot provide a valid measure of type frequency that is greater than ordinal in scale (and even an ordinal scale must be empirically determined in each case). Thus there are several factors which bias estimates of MIV or NISP based on potsherds. These include (1) differential use, reuse, discard, and abandonment practices, (2) vessel quality (robustness), (3) random hazards of different discard locations, (4) percentage of site excavated, (5) sherd size collected, (6) aggregation techniques, and (7) the length of site occupation.

An alternative measure of MIV, devised specifically for pottery analysis, is based on rim arc measurements (see Deboer 1974; Egloff 1973; Fulford 1973:23-24; Orton 1980:165-167). Using rim sherds representing each recognized vessel type, the length of arc of each sherd is divided by the total rim circumference for the sherd (estimated using a graded series of concentric arcs). The values derived by this method for each sherd of a given type are summed and the resulting sum is used as an estimate of the minimum number of vessels for that type. By adding radii at 5% intervals along the circumference of the concentric arcs, Egloff (1973) was able to derive a "percentage factor" equaling the fraction of the vessel orifice represented by each sherd. When the most closely corresponding arc is
determined, a sherd is placed on the arc at the 0% radius point and the radius closest to the opposite end of the sherd is recorded as the percentage of the total rim which the sherd represents.

Orton (1980:164-167; 1982) presents an interesting variation on this method using rim and/or basal sherds which he calls "vessel-equivalent." The vessel-equivalent of a given sherd equals the percentage of the whole vessel which it represents (in terms of weight or surface area). The advantage of this method is that proportions estimated from vessel-equivalents are not hampered by the problems of differential breakage characteristics of types or by the proportion of site excavated. When both rim and basal sherds are used the vessel-equivalents for a given type equal the sum of rim and basal percentages divided by two.

Although the rim (or basal) arc method may represent an improvement on the use of WIV measures of type frequency based on sherd frequencies, it also suffers from the differential discard and abandonment of vessel fragments (as mentioned above). Fry (1970:202) for example, noted that any (socioeconomic) inferences made from sherd collections from individual structures and mound groups (peripheral to Tikal) were hampered by the "rather small number of rim sherds obtained from most groups." Millett (1979:77) also points out that this method would presumably be of little use on extremely fragmentary material and some hand-made wares with irregular rims. In fact, from our Maya observations, pottery made by most non-specialists tends to have irregular rim
openings and therefore sherds from different points along the same rim may correspond to different rim arcs. Basal arcs might overcome this problem, as long as bases are more regular than rims, and the vessels studied do not have round bases.

(ii) Weights versus counts

Because of the many problems with the use of sherd or vessel counts, many pottery analysts have begun using sherd weights as an alternative or comparative method to making sherd counts. In terms of solving traditional problems these weight-oriented studies seem encouraging (examples include Baumhoff and Heizer 1959; Evans 1973; Gifford 1976; Gifford and Shutler 1976; Hinton 1977; Hulthen 1974; Jelinek 1967; McPherron 1967; Solheim 1960; Willey 1961). The relative sherd size per type accounts for the major difference in percentages derived from the two methods. The advantage of the sherd weight method is that varying sherd size between excavation units does not affect total weight per unit (Baumhoff and Heizer 1959:309). This situation is illustrated in Table 33 in which percentages of sherdage per type based on weight are compared to percentages of sherdage per type based on individual sherd counts for Gifford's site 17 in Fiji. A comparison of these percentages with the number of sherds per ounce indicate that the sherd counts for plain versus incised and relief modeled sherds show a disproportionately high percentage per 6" level when compared to percentages of sherd weight per level for the same types.
Table 33: Percentage of sherds by weight and number, and the number of sherds/ounce by level from a 3x6 foot pit at Site 17, Fiji (after Gifford 1976: tables 17 and 18).

<table>
<thead>
<tr>
<th>Depth (in.):</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>30</th>
<th>36</th>
<th>42</th>
<th>48</th>
<th>74</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%weight</td>
<td>79.0</td>
<td>80.0</td>
<td>81.0</td>
<td>82.5</td>
<td>76.5</td>
<td>74.5</td>
<td>47.5</td>
<td>49.5</td>
<td>45.0</td>
</tr>
<tr>
<td>%number</td>
<td>89.0</td>
<td>90.0</td>
<td>91.0</td>
<td>90.0</td>
<td>89.0</td>
<td>82.0</td>
<td>60.0</td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>sherds/ounce</td>
<td>7.5</td>
<td>8.0</td>
<td>7.0</td>
<td>8.0</td>
<td>8.0</td>
<td>9.0</td>
<td>8.0</td>
<td>7.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Mean=7.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>s.d.=.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incised:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%weight</td>
<td>17.0</td>
<td>16.0</td>
<td>14.0</td>
<td>10.5</td>
<td>10.0</td>
<td>3.5</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>%number</td>
<td>9.0</td>
<td>7.5</td>
<td>4.5</td>
<td>5.0</td>
<td>4.0</td>
<td>1.0</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sherds/ounce</td>
<td>4.0</td>
<td>3.0</td>
<td>2.0</td>
<td>3.0</td>
<td>3.0</td>
<td>4.0</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean=2.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>s.d.=1.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relief:

| %weight     | 4.0  | 4.0  | 5.0  | 7.0  | 13.5 | 22.0 | 52.0 | 50.5 | 55.0 |
| %number     | 2.0  | 2.5  | 5.0  | 5.0  | 7.0  | 16.0 | 39.5 | 40.0 | 34.0 |
| Sherds/ounce | 5.0  | 4.0  | 6.5  | 5.0  | 4.0  | 7.0  | 4.0  | 4.0  | 3.0  |
| Mean=4.72   |    |    |    |    |    |    |    |    |    |
| s.d.=1.3    |    |    |    |    |    |    |    |    |    |

*the interval 48-74 in. was not excavated in 6 in. levels.*
McPherron (1967:251) notes that the relationship between sherd frequency and sherd weights remains relatively constant through time. Microsherds (those smaller than a "dime") which were too small for attribute analysis could still be used in weight measures (McPherron 1967:46). A regression analysis of microsherd frequency and weight for 100 provenience units (containing at least 10 microsherds) revealed that microsherd weight was a good predictor of relative frequency of microsherds.

Any attempt to use the relationship between sherd weights and sherd counts as an adjustment factor when estimating actual type frequency is likely to create more problems than it would solve. The major problem created by comparing sherd weight with sherd counts is the likelihood of distortions caused by the weight of sherds from large vessels. Baumhoff and Heizer (1959:312) present an equation for adjusting the weights of sherds from larger vessels which can be used to estimate the number of whole vessels, but only if one has control over the size range of the vessels in a given assemblage.

Two recent articles considering the relative theoretical (Orton 1975,) and practical (Millett 1979) merits of different measures of pottery type frequency agreed that the two most important methods are sherd weights, and some measure of NIV (Orton's derived from rims or bases and Millett's from all sherds). Orton favoured sherd weights slightly over raw sherd counts and concluded that the maximum number of vessels (those demonstrated rather than inferred) was not recommendable.
Millett ranked sherd counts and adjusted sherd weights (Hulthen's method) as third and fourth in his study (1979:76). He went on to conclude that sherd weight will be the most useful for intersite comparison since it is much more easily calculated than the number of inferred vessels. In a more recent article, Orton (1982) used two new models for sherd breakage (Kirkby processes and recursive sampling) to assess the performance of sherd count, weight, NIV, and vessel equivalents. Of these measures, the vessel equivalent method was predicted to be more often unbiased, while NIV ("vessels represented") should generally give the lowest sampling error.

The present discussion suggests that sherd weight measures are at least as useful as sherd count measures, and Solheim has argued that comparing the two results can yield more information than either method by itself (1960:329). However, in terms of aiding in the estimation of whole vessel type frequency, weight measures seem to be little more appropriate than the use of raw sherd counts.

An alternate method

(i) Introduction

As the above discussion indicates, archaeologists are still a long way from finding a reliable method of estimating vessel type frequencies. Of the methods discussed, the use of rim or
basal arc lengths (and percentage factors) seems to be the most reliable way of determining vessel type frequency (Eqlof 1973; Orton 1980, 1982).

More recently, Ericson and Atley (1976) presented a detailed method of reconstructing vessel morphology and capacity from a pottery assemblage composed of sherds. Segments of vessels were reconstructed using geometrical formulae and these segments (manifested as geometrical solids) were combined to form vessels. Using a 20% sample of an experimental assemblage their prediction of vessel morphology was an impressive 76% accurate. The identification of shapes and the use of geometrical formulae were somewhat hampered by formal irregularities in some vessels. Similarly, Smith (n.d.) proposed a detailed procedure using geometrical formulae aided by statistical methods to reconstruct vessel size and shape from potsherd assemblages, and predict vessel function from the reconstructed vessels. Interpretations of vessel use, in turn, could be used for making interpretations of socioeconomic conditions associated with the assemblage. The general approach of these methods is promising for estimating formal-functional type frequencies from samples of potsherd assemblages. However, when dealing with large and non-experimental assemblages they are adversely affected by the time and boredom factors characteristic of the "batch" method.

Clearly, a better understanding of the nature of the interdependence among potsherd specimens in archaeological assemblages is needed if archaeologists are to adequately make
use of ethnoarchaeological models and descriptive statistics for investigating the relationships between archaeological pottery assemblages and past socioeconomic or other conditions. The present situation calls for more experimentation with (and comparison among) the analytical methods presently being used on our archaeological assemblages. This may include model and computer simulation experiments, as exemplified by Orton (1982), or the controlled monitoring of breakage and deposition in the ethnographic context. The latter (where operationally possible) would be admittedly more time consuming, but is a potentially more objective approach. The remainder of the present discussion concerns an alternate method of treating pottery data in order to obtain socioeconomic information, namely, measuring diversity within pottery assemblages. Under certain conditions, this method appears to be superior to vessel frequency (however measured) for deriving socioeconomic information.

(iii) Diversity measures

Measuring type diversity is an alternate method of treating pottery assemblages, and one which appears to have the potential for more accurately yielding socioeconomic information on households than measurements based on whole vessels. According to this method each type represented at a given housesite or feature would be given a value of "1" without consideration to its relative frequency compared to other types. When pottery
assemblages are characterized in this way, it appears that the relative diversity of vessel types within a given unit is more representative of the social or economic characteristics associated with that unit than are NIV or NISP estimates per type made for the same unit, especially when sherd counts are low (e.g. the rim sherd counts from Fry's mound groups on the periphery of Tikal). For example, a hundred vessels from one unit may represent 20 types while the same number of vessels from another unit may represent only two types.

As a method of quantifying pottery (or any artifact) assemblages, diversity has several advantages. First, it is simple to calculate once the assemblage has been broken down into its component types (whether functional or stylistic) and wares (based on slips or glazes, as well as paste characteristics). Secondly, it is not affected by the relative frequency or size of sherds from each vessel type or ware. Thirdly, it is less likely to be affected by disposal behavior (that is, it is more likely that all types will be represented than all vessels). Lastly, it is less affected by variation in collection techniques than are frequency measures.

The greatest disadvantage of diversity measures is that in some areas (such as the prehistoric Great Lakes region) there is relatively little recognizable formal or stylistic diversity in pottery assemblages. This situation probably reflects a relatively low level of socioeconomic differentiation in such areas. This problem is not so acute in the Maya area. In the
modern community of Chanal the number of formal-functional types per household ranged from three to 17 (and comprises as many as 23 wares when stylistic variants are taken into consideration). High diversity scores for formal-functional types seems to be mostly a function of the variability of ritual types owned by a household. The diversity of food preparation and serving types ranged from three to seven (mean of 4.8) per household while the diversity of ritual types ranges from zero to eight (mean of 4.4) per household. Of the seven other types every household had between two and four types and two of these can usually be accounted for by the fact that 93% of all households had water-carrying jars and 57% had one or more spindle whorls.

In order to evaluate diversity measures versus frequency measures as a basis for making predictions of socioeconomic conditions at the household level, correlation coefficients were calculated between two pottery measures thought to be strongly reflected in pottery household assemblages and two dichotomous socioeconomic variables. The two pottery variables were pottery vessel frequency and type diversity and the two socioeconomic variables were presence/absence of a potter and presence/absence of a First Plater. It must be explicitly stated that the object of the exercise was to assess which of the two quantification methods is a stronger indicator of certain socioeconomic conditions believed to be reflected in pottery inventories and not an attempt to demonstrate the feasibility of making inferences concerning these conditions at the household level of analysis.
A description of and assumptions involved with the two socioeconomic variables chosen are as follows:

1. Presence/absence of a First Alferez

In Chanal, two persons, entitled First and Second Alferez, were selected to sponsor certain religious festivals. The main responsibility for the fiesta belonged to the First Alferez. This involved organizing and providing ritual paraphernalia; keeping festival wooden idols and presenting them to the public; and providing all food and drink for officials and a general feast at his home. One of the commitments of the First Alferez was to provide the large ritual pottery types required for the particular festival he was sponsoring, as well as the special candle-making bowl (nechab) which was to be used for one occasion only (it was saved as an heirloom of the family). Some of these vessels might be borrowed from relatives and neighbours, while others (especially the candle-making bowl) might be commissioned from a local potter. Heads of 16 of the households interviewed had held this position.

The assumption involved with this variable was that households whose members had participated in this specialized ritual office, for which specialized ritual pottery types must be procured, would have a relatively large and more varied pottery inventory. Seven of the 11 households for which information could be obtained on pottery purchased by Alfereces had purchased at least two vessel types: the candle-making bowl and large
wide-mouth jars (oxom). Two of these households as well as two others had loaned two or three large wide-mouth jars (one household on three different occasions) to other people holding the Alferez office, and one former Alferez interviewed had borrowed large wide-mouth jars and a large composite jar (tenosha) when he held the office. Numerous small unrestricted glazed serving bowls (bocelapa) and large hemispherical bowls (pokets) are also commonly bought for such occasions. The fact that four households either borrowed or loaned pottery for this position may seriously affect the strength of the relationships involved, although typically each Alferez purchased at least some portion of the pottery required for the festivals.

(2) Presence/absence potter

Twenty-eight Chanal households interviewed had potters. The assumption involved with this variable was that a household in which a specialized activity such as pottery making occurred would contain a relatively high frequency of products of that activity (although not by necessity). One might also assume that in a modern Maya community a household with a potter would rely more heavily on pottery as opposed to industrial equivalents than would a non-potting household. Also, a potter might have on hand a greater variety (diversity) of their specialized products.
Method of comparison

The method used here to compare household pottery frequency and type diversity with the dichotomous variables presence/absence Alferez and presence/absence potter was Kendall's tau used as a non-parametric point-biserial correlation (described by Marascuilo and McSweeney 1977:453-454). As in Cannon's study (1983) the parametric point-biserial correlation (for description see McNemar 1962:192-193) was not used here because the continuous variables were not normally distributed in each class of either dichotomous variable. Kendall's tau was calculated for each pair in the following manner:

1. The continuous variable (Y1) was rank ordered (beginning with the household with the lowest value) and the presence/absence of the dichotomous variable (Y2) was assumed to represent a ranking (absence receiving the lowest rank).

2. Each ordered pair of values (152, 163...) in each variable were compared, and those in proper order (low/high) were assigned a score of (+1), while those in reverse order (high/low) were assigned a score of (-1) (see Marascuilo and McSweeney 1977:439-445). Each score of Y1 was then multiplied by the corresponding score of Y2 and the resulting pairs with a score of (+1) were considered to be concordant, while those with a score of (-1) were considered to be discordant. Kendall's tau (τ) represents a measure of the difference of proportion of the
concordant and discordant pairs, and was calculated by the following formula:

\[ T = \frac{N_c - N_d}{\sqrt{\binom{n}{2}} \cdot \binom{U_1}{2} \cdot \binom{n}{2} \cdot U_2} \]

where \( U_1 = \frac{1}{2} \sum_j T_j (T_j - 1) \)

\[ U_2 = \frac{1}{2} \sum_j U_j (U_j - 1) \]

where \( T_j \) = the number of tied values on the \( Y_1 \) variable

\( U_j \) = the number of tied values on the \( Y_2 \) variable

\( N_c \) = the number of concordant pairs

\( N_d \) = the number of discordant pairs

(iv) Results and discussion

The use of type, ware, or attribute diversity in pottery assemblages does not seem to be widely used by pottery analysts at present (some exceptions include Feinman et al. 1981; Rice 1981; Upham et al. 1981; Whittlesey 1974). Cannon (1983), working
with data from the Coroh Project, has tested and evaluated the
effects of three different quantification methods (frequency,
proportion, and diversity) upon making inferences concerning the
presence of specialized activities (including potting) and their
associated artifacts. As in Cannon's study, both frequency and
diversity measures showed only a weak to moderate correlation
with each dichotomous variable, yet what is important for the
purpose of this study (as it was in Cannon's) is that the
diversity measure showed the strongest degree of association with
each dichotomous variable.

The Kendall's tau value for the association between
presence/absence of an Alferez position and pottery diversity was
.48 (p < .001), compared to .42 (p < .007) using a pottery
frequency measure. Weaker associations occurred between
presence/absence pottery and pottery diversity (t = .23, p < .054)
and pottery frequency (t = .08, p < .484), yet diversity again
showed a much stronger association. Cannon's comparison of
presence/absence of pottery making with measures of frequency and
diversity (using only locally-made pottery) yielded similar
relative associations between presence/absence pottery and type
diversity (t = .29, p < .019) and between presence/absence pottery
and vessel frequency (t = .15, p < .184). Although none of the
associations were strong, they did demonstrate that the holding
of a First Alferez position and making of pottery do affect the
composition of a household's pottery assemblage.
Of the two quantification techniques used here, diversity of pottery types was a more powerful indicator of the presence/absence of an Alferez and of pottery making at the household level. The methodological problems involved with using frequency measures on archaeological data were discussed above. Furthermore, artifact frequency was often affected by other factors, besides functional need, such as accessibility, family development, length of housesite occupation, and idiosyncratic taste (Deboer and Lathrap 1979:124; Hayden and Cannon 1983). The use of diversity measures to quantify pottery or other artifact assemblages might not be regarded as the panacea to methodological problems in archaeology, however, they might prove to be more useful alternatives (depending upon the problem being addressed) to quantitative characterizations of household artifact assemblages based on frequency. For our Chanal sample, given a choice between diversity and frequency, the diversity measure was easier to formulate and yielded better results for predicting presence/absence of both Alfereces and potters, and presumably, other socioeconomic conditions. By breaking diversity down into subgroupings such as: functional versus stylistic types; locally-made versus imported types; or food preparation and serving versus ritual types; it might be possible to derive even more accurate inferences concerning socioeconomic characteristics at the household level.
The variability of pottery diversity

(i) Introduction

Before prescribing the extensive use of diversity measures on archaeological pottery assemblages it would be useful to explore the nature of household pottery diversity, that is, to determine as far as possible which socioeconomic factor or factors contribute most to pottery diversity at the household level. According to Rathje (1979:20), many recent studies of modern material culture have led to the conclusion that there are no direct correlations between material culture and behavior, or in other words, that our stereotyped views of material culture-behavior relationships are oversimplified in the real world.

More recently, a study of modern Tucson households (Schiffer et al. 1981), yielded weak to moderate statistical correlations between the frequency of certain material items (furniture and appliances) and household stability (=the number of moves in the last 5 years), number of people in the household, and household income (Spearman's R values of .37, .34 and .53 respectively). Similarly, Hayden and Cannon (1983), using the Coxoh data, have found weak relationships between individual socioeconomic variables (household wealth, status, etc.) and frequencies of various items of material culture (luxury items, durable items, and various kinds of tools). Can archaeologists expect
comparatively weak relationships between household socioeconomic conditions and diversity in household pottery inventories? The following section addresses this question using modern Maya pottery data, in an effort to identify and account for as much of the variability in household pottery type diversity as possible.

Following the procedures used by Hayden and Cannon (1983) for analyzing household material item variability for the communities surveyed by the Cozoh Project, multiple regression analysis was chosen as the potentially most useful method for assessing the mutual relationship between a number of independent (socioeconomic) variables and each dependent (pottery) variable. Despite the significant difficulties involved in using this method, a multivariate technique was chosen because of the degree of interdependence between the socioeconomic (independent) variables. During the regression, certain independent variables showing some significance when compared individually to a given dependent variable (in the form of product moment correlation coefficients) were eliminated as redundant or as having little effect on the dependent variable when used with the other socioeconomic variables. Thus, the intent was to impose a greater analytical control over the relationships between the variables used. An attempt was made to monitor sources of variability as differentiated according to (1) household pottery requirements (need) and (2) household access to pottery (that is, the relative ability to have greater pottery diversity). Sixteen socioeconomic variables believed to influence either household
need or accessibility were chosen for the analysis. Assumptions concerning the "role" of each category (need and accessibility) and a description of the contents of individual variables is outlined below, followed by a description of the regression technique and the results generated.

Pottery, dependent, variables capable of describing archaeological assemblages, as well as ethnographic inventories were chosen for the analysis. Six variables were used, including (1) formal-functional pottery type diversity, (2) stylistic ware (based on surface treatment) diversity, (3) imported type diversity (4) pottery plus industrial equivalent type diversity, (5) food preparation and serving type diversity, and (6) ritual type diversity. The fourth variable was included in an attempt to account for the possible effects on the household inventory of adding to or replacing pottery types with their industrial equivalents (see Chapter 3). A summary of the range and mean values of these variables, along with the seven continuous socioeconomic variables appear in Table 34.

Socioeconomic, independent, variables were chosen largely on the basis of reasonably expected relationships with household pottery inventories. Some variables were only deemed meaningful if used in a dichotomous fashion, such as presence/absence potter. One other dichotomous variable, high/low social status, was included along with some of the continuous variables from which it was abstracted (see below) on the assumption that it might show greater influence on diversity measures at a more
Table 34: Summary of contents of continuous variables used for regression.

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>s.d.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent (pottery) variables:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal-functional type diversity</td>
<td>3</td>
<td>18</td>
<td>11.1</td>
<td>3.1</td>
<td>53</td>
</tr>
<tr>
<td>Pottery ware diversity</td>
<td>4</td>
<td>23</td>
<td>13.0</td>
<td>4.2</td>
<td>38</td>
</tr>
<tr>
<td>Imported pottery type diversity</td>
<td>0</td>
<td>11</td>
<td>4.3</td>
<td>2.1</td>
<td>53</td>
</tr>
<tr>
<td>Pottery plus industrial type diversity</td>
<td>15</td>
<td>45</td>
<td>24.4</td>
<td>6.0</td>
<td>53</td>
</tr>
<tr>
<td>Food preparation/serving type diversity</td>
<td>3</td>
<td>7</td>
<td>4.8</td>
<td>1.2</td>
<td>53</td>
</tr>
<tr>
<td>Ritual type diversity</td>
<td>0</td>
<td>8</td>
<td>4.4</td>
<td>1.9</td>
<td>53</td>
</tr>
<tr>
<td><strong>Independent (socio-economic) variables:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of children/household</td>
<td>0</td>
<td>8</td>
<td>2.8</td>
<td>1.7</td>
<td>53</td>
</tr>
<tr>
<td>Number of economic males/household</td>
<td>0</td>
<td>6</td>
<td>2.0</td>
<td>1.3</td>
<td>53</td>
</tr>
<tr>
<td>Number of economic females/household</td>
<td>0</td>
<td>5</td>
<td>2.0</td>
<td>1.1</td>
<td>53</td>
</tr>
<tr>
<td>Annual household income</td>
<td>39</td>
<td>1986</td>
<td>539.5</td>
<td>445.9</td>
<td>50</td>
</tr>
<tr>
<td>Number of trips to other communities per year</td>
<td>1</td>
<td>58</td>
<td>11.6</td>
<td>13.3</td>
<td>52</td>
</tr>
<tr>
<td>Age of household head</td>
<td>20</td>
<td>99</td>
<td>44.9</td>
<td>18.4</td>
<td>51</td>
</tr>
</tbody>
</table>
general level, whereas the "finer" (more continuous) component variables might pick up "noise" from other variables used in the regression. Schiffer et al. (1981:83) have suggested that much of the gross variability in household material culture (both kinds and quantities) could be accounted for by four factors, including (1) stage of household development (size, composition, etc.), (2) residential stability, (3) time since last move, and (4) relative wealth or income. Channel equivalents of the first and last of these were included in the present study (variables #7 and #12 below). The other two variables did not tend to vary greatly in Channel.

(ii) Variables emphasizing household requirements (need)

(1) Number of children per household. The number of children in a household is often believed to affect the kinds and frequencies of pottery vessels required by the household. For example, more or larger cooking vessels would be required to prepare a meal for a larger family.

(2) Presence/absence of a lineage head. The presence of a lineage head in a household suggests that the household was often responsible for holding lineage-based gatherings and would require more pottery (and more of the larger types) for this reason. However, lineage heads tended to loan out more pottery to other households of his or her lineage and this might cause
considerable fluctuations in the size and contents of the household inventory, as well as that of the borrower.

(3) Presence/absence of a former First Alferez. As mentioned previously, the presence of a former First Alferez in the household was expected to be particularly significant in terms of the diversity of vessel types (and especially ritual types) owned by a household, as well as general vessel frequency, since one requirement of this cargo position was that the holder provide the pottery vessels used during the festival, including certain specialized types. This involved considerable expense for the office holder, and once the festival was completed his household kept the purchased vessels. After holding an Alferez position, large vessels might be converted to storage containers or stored away and used again only singly when family or lineage rituals required, or when requested as a loan by relatives.

(4) Presence/absence yearly festivals. If a family held yearly gatherings to celebrate a birthday in the family or to celebrate the corn harvest one would expect such families to have a relatively large pottery inventory and possibly a more diversified one. This depended partly upon the civil or religious nature of the celebration. In addition, household heads might borrow vessels for such occasions from their lineage heads, compadres, or neighbours. Conversely, families not holding yearly celebrations might be expected to have smaller and
possibly less diversified inventories, especially in food preparation and serving vessels.

(5) Presence/absence of high civil cargo positions. People with civil cargo positions equivalent to or above the Alferez level would be involved in more social interactions and were more likely to hold gatherings at their homes for which the larger vessel types would be required, thus adding more diversity to their inventories.

(6) Presence/absence of high religious cargo positions. This variable would be greatly affected by the inclusion of an Alferez (variable #3 above) but would also include households with holders of other religious cargo positions. These households would be more likely to have both a larger and more diversified pottery inventory, especially in ritual types.

(7) Age of household head. The age of the household head was used here as an indirect measure of the stage of household development. The assumption was that the older the household head the longer the household had been together. The longer the household was in existence the more pottery types the household was likely to have accumulated. For example, the Chansl household with the most pottery (147 vessels) and the second highest diversity (17 types) was occupied by only an elderly couple who had had seven children, five of whom had moved away
while the two still living at home were of marrying age. This information was not obtained for two households.

(8) Family type. The family type variable, dichotomized to nuclear versus extended, indicated relative family size which was assumed to affect the quantity and possibly the diversity of pottery types in a household.

(9) Proportion of income from household produce. Households with a higher proportion of their income coming from agricultural produce were assumed to be more linked to the traditional economy and indirectly were more likely to hold traditional values. In terms of pottery diversity, these households were more likely to hold agricultural festivals for which larger ritual pottery vessels would be required. They might also be more likely to prefer pottery types over industrial equivalents, which were assumed to be associated with the more progressive households (that is, those linked to the modern cash economy).

(10) Social Status. Each household in Chanal was given a social status rank based on a number of sociopolitical conditions as they were perceived during the survey period (see Chapter 3). Ranks increased with higher civil or religious cargo position, the age of the household head, and presence of a lineage head, and they were decreased according to negative social attitudes.
such as chronic drunkenness, involvement in illegal affairs, and lack of respect for authority. The difficulties of forming an objective and meaningful status ranking have been well documented (Kelsall and Kelsall 1974:52-61; Price and Price 1972:311-317), especially using archaeological artifact assemblages (a notable exception is Michaels 1979:Chapter 5).

Conceptual problems arose because status was an attribute conferred by others, so that the person in question had limited control over his status or how different people might perceive his status. For example, Chanal cargeros would often confer a higher prestige on their own cargo position than would other cargeros. Such small discrepancies were hopefully minimized in our status ranking by the use of a diverse number of attributes. Furthermore, for the present study the margin of error was minimized by dichotomizing the variable into low (ranks 1 to 3) and high (ranks 4 to 6) status. The relationship between social status and pottery frequencies and diversity must be a complex one due to the diversity of attributes making up the ranks. In general, one might expect higher social rank to involve more social interaction (at both lineage and community levels) which should require both a larger and a more diverse pottery inventory. Although perceived as basically a need related variable, one might also expect accessibility to pottery to be related to social status, that is, more social interactions might create exposure to more pottery diversity.
(iii) variables emphasizing accessibility

(11) Number of economic males. The number of males contributing to the household income was assumed to be directly connected to the household's ability to afford more pottery and a greater variety of pottery. However, it might also reflect family size (extended versus nuclear family) and therefore also reflect household pottery needs.

(12) Number of economic females. As in variable #11 above, the number of females contributing to the household income was assumed to have an influence on the household's ability to afford more pottery types. Also, family size and presence of more kitchen workers might be involved and thus reflect household pottery needs.

(13) Annual income. Households with high incomes were assumed to be able to afford more pottery and more kinds of pottery. In three cases, where income was believed to be greatly exaggerated by the informant, the cases were dropped from the analysis.

(14) Presence/absence potter (and therefore potting) during the household's existence. As mentioned above, potters were more likely to have a greater diversity of vessels on hand, because they produced and stored them for sale and because they generally
relied less on industrial equivalents than did non-potting households.

(15) Store (tienda) owner. Store owners were generally among the wealthier householders and were able to afford a greater variety of pottery types which they sometimes sold from their stores. They were also more likely to have a greater diversity of industrial equivalents since they sold many of these items in their stores.

(16) Number of trips to other communities per year. Household heads who made more trips to other communities were more likely to come into contact with a greater variety of pottery types, especially at festivals in pottery making centres such as Amatenco. One case was dropped for this variable because we could not obtain this information.

(iv) Regression method

Before running the regression analysis the SELECT command option of the MIDAS statistical package (Fox and Guire 1976:152-153) was used to eliminate all but the strongest "predictors" from among the independent variables. Using the STEPWISE option of this command a variable selection procedure was performed which selects independent variables for the regression model.
Variables were entered into the equation one at a time until a point in the selection was reached when the addition of any further variables would have a negligible effect on the ability of the previously entered variables to predict response variable values. The use of this command allowed for the elimination of any independent variables from the final regression which might be highly intercorrelated with other independent variables and therefore redundant. Whenever this occurred, random measurement errors in some variables would tend to increase the apparent effects on the dependent variable of those variables with which they were highly correlated (Blalock 1972:450). When the STEPWISE option was specified the following procedure was generated:

1. A partial t-statistic was generated to determine if the regression coefficient was significantly different from zero. The independent variable with the highest t-statistic was the first to be entered into the equation.

2. The first variable was held constant and a partial t-statistic was calculated for the remaining variables and those variables with the highest t-statistic were entered into the equation until all variables whose t-statistic exceed the specified probability level (.1 was used here) had been entered.

3. Any subsequent variable whose entry into the equation would cause a significant decrease in the value of the t-statistic of a previously entered variable was automatically deleted from the equation. These variables were considered
redundant or as having little effect on the frequency of the dependent variable.

In order to judge the appropriateness of the final regression model, the residuals (the differences between observed and predicted values for the dependent variable) were computed and standardized by dividing each by the standard error of the regression equation. These standardized values of the dependent variable were graphed against the predicted values. By examining the resulting graph, any outliers (cases with large residuals relative to the residuals for the remainder of the observations) could be observed. Outliers, when they occur could distort the relationship between dependent and independent variables (for discussion see Chatterjee and Price 1977; Hartwig and Dearing 1979:46-48). In other words, these cases would not fit the model describing the bulk of the sample and could therefore be dropped from the final regression equation. No outliers were observed in the following equations.

The final multiple linear regression analysis was performed using the REGRES command of the MIDAS statistical package (Fox and Guire 1976:211-212). Only the independent variables selected by the SELECT command were used in the equation. The final
equation of the regression model is expressed by:

\[ Y = a + B_1 (X_1) + \ldots + B_k (X_k) \]

where, \( Y \) = the dependent (predicted) variable
\( X_1 \) = the initial independent variable
\( a \) = the additive constant
\( B \) = the regression coefficient (slope)

The present study was less concerned with accurate prediction of the dependent variable than in determining the relationship between the the dependent and other variables. The coefficient of variation was computed to provide a measure of the size of the prediction error relative to the size of the dependent variable being measured (see Younger 1979:327). The coefficient of variation was expressed by:

\[ CV = \frac{SE}{Y} \]

where \( CV \) = the coefficient of variation
\( SE \) = the standard error of the regression model
\( Y \) = the mean value of the dependent variable

The value of \( CV \) represented the average error of predictions made by the regression equation. It provided a non-parametric measure of the predictive ability of the regression equation.
In order to assess the relative strength of each independent variable in the equation, the standardized regression coefficients (slopes) were computed and compared. These values (also called beta weights) indicated the amount of change produced in the dependent variable by a standardized change in one of the independent variables when the other independent variables were controlled (Blalock 1972:452-453).

Four of the 6 SELECT runs chose only one or two dichotomous variables for inclusion in the predictive formula. In these four trials, instead of completing the regression analysis, less complicated statistical methods were opted for, namely, the Kruskal-Wallis oneway test of variance by ranks and the Mann-Whitney U test (see below). These two nonparametric tests provided an indication of the tendency for each independent sample (that is, the group of households in each strata of the dichotomous variables) to have a greater or lesser diversity of the pottery category (ritual types, etc.) being tested. In order to gain some understanding of the degree of association between the dependent variables and the independent dichotomous variables, Kendall's tau was used again as a nonparametric point-biserial correlation. As before, these methods were employed in terms of data exploration.
(v) Analysis results:

Trial #1: pottery type diversity

As a result of the SELECT procedure only two independent variables were chosen for inclusion in the predictive formula. Interestingly, these were the two variables used above to compare type diversity and vessel frequency measures, namely, the presence/absence of a potter and the presence/absence of a former first Alferez. In the present study these variables were believed to be representative of household accessibility and need, respectively. Rather than completing the regression analysis, another method was opted for, namely, the Kruskal-Wallis oneway test of variance by ranks provided by the KSAMPLE command of the MIDAS statistical package (see Fox and Guire 1976:245-251). KSAMPLE, being a nonparametric command, did not require the assumptions of normality and equal variances, while the Kruskal-Wallis test seemed to be the most efficient of the nonparametric tests for k-independent samples (Siegel 1956:194). The Kruskal-Wallis test assumed that the dependent variable (in this case type diversity) had an underlying continuous distribution and required at least an ordinal measurement of that variable (Siegel 1956). The present study was particularly concerned with the assumption that type diversity was not the same for the four independent samples:

(1) absence potter; absence Alferez

(2) presence potter; absence Alferez
(3) absence potter; presence Alferez

(4) presence potter; presence Alferez

The null hypothesis being tested was:

H₀: pottery type diversity was equal for each of the four samples specified (1-4 above).

H₁: pottery type diversity was not equal for at least one of the four samples.

Procedure (after Siegel 1956, and Fox and Guire 1976)

(1) All observations for the four samples were ranked (1-N) in a single series.

(2) The sum of the ranks (R) for each sample was determined.

(3) Since ties occurred between two or more scores, the following formula was used to compute the value of KW (the Kruskal-Wallis statistic):

\[
KW = \left( \frac{1}{12} \right) \sum_{j=1}^{k} \frac{2}{N(N+1)} \left( R_{j} - 3(N+1) \right) - \frac{\sum_{j=1}^{k} T_{j}^{2}}{N(N-1)}
\]
where,

\[ K = \text{number of samples} \]
\[ R_j = \text{sum of ranks in } j\text{th sample} \]
\[ n_j = \text{number of cases in } j\text{th sample} \]
\[ N = n_j, \text{ the number of cases in all samples combined} \]
\[ \sum_{j=1}^{k} j \]

directs one to sum over all groups of ties

\[ T = t - t \quad \text{(when } t \text{ is the number of tied observations in a tied group of scores)} \]

\[ \sum T \]

directs one to sum over all groups of ties

If \( H_0 \) was true, then \( KW \) was distributed approximately as chi-square with df\( = k-1 \) as the sample size \( (N) \) increased in size.  

(4) The method of assuming the significance of the observed value of \( KW \) was not very good if \( k \leq 2 \) or when \( k = 3 \) and the number of cases in each of the three samples is five or less. In the present test, \( k = 4 \) and the number of cases for the four samples were 17, 20, eight and eight, respectively.  

(5) If the probability associated with the observed value of \( KW \) was equal to or less than the previously set significance level \( (\alpha = .01 \text{ in this trial}) \), \( H_0 \) was rejected in favor of \( H_1 \).  

(6) In trial #1, the region of rejection consisted of all values of \( KW \) which were so large that the probability associated with their occurrence under \( H_0 \) was equal to or less than \( \alpha = .01 \).
The computed value of $KW>20.2$, with $df=3$, had a probability of occurrence under the null hypothesis of $p<.0002$. Since this probability was smaller than $\alpha=.01$, $H_0$ could be rejected in favor of $H_1$.

The conclusion according to test results, was that, the four samples differed in diversity of pottery types. Households with either a potter or former Alferez tended to have a more diverse pottery inventory, and those with both potter and former Alferez tended to have the greatest diversity. The correlation coefficients (Kendall's tau) calculated above suggested that only a moderate degree of association existed between type diversity and presence/absence of Alferez ($t=.48$, $p<.001$) and a weaker degree of association existed between type diversity and presence/absence potter ($t=.23$, $p<.054$). Given these degrees of association, type diversity alone was obviously not a sufficient basis for inferring either the presence of a potter or former Alferez for a given household.

Trial #2: pottery ware diversity

Informants were not always able to differentiate wares representing the peripheral distribution sources, since they exhibited a high degree of formal and fabric similarity. Any households in which ware diversity information was lacking for more than 20% of the pottery inventory were dropped from the regression analysis. This amounted to 15 households or 28% of the sample. Despite this fact, it was important to include ware
diversity among the dependent variables, since, unlike formal-functional type diversity it should be sensitive to the variability of more rare or imported vessels which archaeologists generally associate with relative social status.

Only three of the 15 independent variables were chosen by the SELECT runs for the predictive model: number of economic males, presence/absence former Alferez, and presence/absence of high religious cargo position. The former was believed to be representative of household accessibility to pottery while the latter two were more representative of household need. The regression equation took the form:

\[ Y = 9.3 + 0.92 (X_1) + 5.20 (X_2) + 1.90 (X_3) \]

with SE = 3.00, Mean = 12.95, and where,

- \( Y \) = household ware diversity
- \( X_1 \) = number of economic males
- \( X_2 \) = presence/absence of First Alferez
- \( X_3 \) = presence/absence high religious cargo position

The coefficient of variation (CV) for this equation indicated an average error of 23%. In other words, predictions of the relative ware diversity of a given household would be off on an average of 23% (approximately three types) based on the above equation. The predictive ability of the equation was therefore relatively high. The relative strength of the
predictor variables was indicated by the following beta weight values:

(1) presence/absence Alferez = .51
(2) economic males = .27
(3) presence/absence religious cargo position = .22

Trial #3: imported type diversity

Imported type diversity included all pottery items known to be made outside the peripheral distribution zone. As in case #1, the SELECT command did not choose any continuous variables, and in fact, only a single dichotomous variable (low/high social status) was chosen. As discussed above, this variable was assumed to be representative of household need. Rather than completing the regression analysis, a less complicated technique was chosen to compare the two variables, namely, the TWOSAMPLE command of the MIDAS statistical package (see Fox and Guire 1976:177-178, 222-224). TWOSAMPLE was a univariate, twosample nonparametric command which provided certain statistics which tested the hypothesis that the two samples were from the same underlying population (Fox and Guire 1976:222). The statistic used here was the Mann-Whitney U test, which according to Siegel (1956:116) was the most powerful of the nonparametric tests and a useful alternative to the parametric t-test. The present study was concerned with the assumption that the values for imported type diversity were on average larger for households with high
social level than for households with low social level.

The null hypothesis being tested was:

\[ H_0: \text{imported type diversity was equal for households with low and high social status.} \]

\[ H_1: \text{imported type diversity was not equal for households with low and high social status.} \]

Procedure

(1) The values of the independent samples were determined.

Sample one \((n_1)\) equaled the number of cases of low household social status \((n_1=30)\), while sample two \((n_2)\) equaled the number of cases of high household social status \((n_2=23)\).

(2) Scores (values) for both samples were ranked together (lowest rank=lowest score) with tied observations receiving the average of the tied scores. The sum of the ranks for each sample was computed. The rationale behind this procedure, according to Fox and Guire (1976:223), was that, if the distributions of the two populations differed in location, then the low ranks tended to fall in one sample, and the high ranks tended to fall in the other sample. If a rank sum for either sample was too high (or too low) the null hypothesis could be rejected.

(3) Since \(n_1>n_2\), the value of \(U\) was determined by the formula:

\[
U = W_n - (n_2(n_2+1))/2
\]
where, 

\[ W_n = \text{the sum of the ranks assigned to the sample with the smaller number of observations} \] (in this case \( n_2 \))

When \( n_1 \) and \( n_2 \) were large (>10) the distributions of the Mann-Whitney U statistic could be approximated by a normal distribution. The attained significance level was twice the area under a standard normal distribution to the right of the value (Fox and Guire 1976):

\[ U - \text{mean} (U) | / \sqrt{\text{var} (U)} \]

where the mean of the sample distribution,

\[ \text{Mean} (U) = \frac{n_1 (n_2)}{2(2)} = 37 \times 16 = 296 \]

and the variance of the sample distribution,

\[ \text{Var} (U) = \frac{n_1 (n_2)}{3(3)} \left[ \frac{(n_1+n_2)}{4(n_1+n_2)} - \frac{(n_1+n_2)}{4(n_1+n_2-1)} \right] \text{ and } \sum_{i=1}^{k} T_j \]

where, \( k \) = the number of different sets of ties,

and \( \sum_{i=1}^{k} \) directs one to sum over the number of different sets of ties.
and $T_j = (T_i - T_{ii})/12$, where,

$T_i = $ the number of tied observations in the $i$th tied set.

4) If the observed value of $U$ had an associated probability equal to or less than the previously set significance level ($\alpha = 0.01$), $H_0$ could be rejected.

5) In the present trial, the computed value $U = 238$ had a probability of occurrence under the null hypothesis of $p < 0.0506$, with an average rank for $n_1$ of 23.4 and for $n_2$ of 31.7. Since the associated probability level for the computed value of $U$ was larger than the previously set significance level ($\alpha = 0.01$), the null hypothesis could be accepted. Imported type diversity was not significantly different for households with low versus high social status. Further, the Kendall's tau point biserial correlation indicated a weak degree of association between the two variables ($t = 0.25$, $p < 0.038$). The relationship between these two variables might be somewhat obscured by the fact that household social status was not a true dichotomy. The combined effects of the constituent variables might be hiding what seems intuitively a stronger relationship.

**Trial #4: Pottery and Industrial equivalent type diversity**

As in trial #3, only the single variable household social status was chosen by the SELECT command. Again the Mann-Whitney test was used. The assumption which was of interest in this trial was that the value for pottery and industrial type
diversity were on average larger for households with high social level than for households with low social level.

The null hypothesis being tested was:

H0: pottery and industrial type diversity was equal for households with low and high social status.

H1: pottery and industrial type diversity was not equal for households with low and high social status.

In the present test (where n1=30 and n2=23), the computed value $U=160$ had a probability of occurrence under the null hypothesis of $p<0.0009$, with an average rank for $n_1$ of 20.8 and for $n_2$ of 35.0. Since the associated probability level for the computed value of $U$ was considerably less than the previously set significance level ($\alpha=0.01$), the null hypothesis could be rejected. The evidence supported the alternate hypothesis, implying that the bulk of the values in sample two was higher than the bulk of values in sample one, or that higher status households tended to have more pottery and industrial type diversity than households with lower status. However, the Kendall's tau point-biserial correlation indicated only a moderate degree of association between the two variables ($r=0.38$, $p<0.001$). This result was interesting, in that many industrial equivalents (especially serving vessels) seemed to be used today as imported pottery vessels were being used prehistorically. If this was true, than this result might be a relatively accurate reflection of the prehistoric situation.
Trial #5: food preparation and serving type diversity

This variable included all of Canal domestic vessel types directly used in food preparation and consumption. Four independent variables were chosen by the SELECT runs for the predictive model: number of economic males, annual income, presence/absence of yearly festival, and presence/absence religious cargo position. The former two were believed to be representative of household accessibility, while the latter two (and to some extent the number of economic males) were representative of household need. The regression equation took the form of:

\[ Y = 4.04 + 0.38 (X_1) - 0.0009 (X_2) + 0.83 (X_3) + 0.53 (X_4) \]

where, \( Y \) = food preparation and serving vessel diversity

\( X_1 \) = number of economic males

\( X_2 \) = annual income

\( X_3 \) = presence/absence yearly festivals

\( X_4 \) = presence/absence religious cargo position

The coefficient of variation (CV) indicated an average error of 19%. In other words, the prediction of diversity of food preparation and serving vessels of a given household would be off on the average 19% (or approximately one type) when predicted using the above equation. The predictive ability of the equation must be considered relatively high despite the fact that the
average diversity for this variable was only 4.8 types per household. The negative association with household annual income might be, in part, reflective of the fact that diversity of domestic types tended to decrease in wealthier households which were more closely linked to the cash economy and more likely to replace domestic pottery types with industrial forms (ritual types had fewer industrial equivalents). Also, the number of economic males in this case might be reflective of family size and therefore family pottery requirements. The relative strength of the predictor variables, according to beta weight values were:

1. economic males = .36
2. presence/absence yearly festival = .35
3. presence/absence religious cargo position = .23
4. annual income = -.33

Trial #6: ritual type diversity

As in cases #3 and #4 only a single dichotomous variable (presence/absence Alferez) was chosen for inclusion in the predictive formula. Similarly, a Mann-Whitney U statistic was calculated, using absence of a former Alferez as n1 and presence of Alferez as n2. The null hypothesis being tested was:

H0: ritual type diversity was equal for households with a former Alferez (n2) and households without a former Alferez (n1)

H1: ritual type diversity was not equal for households with a former Alferez and households without a former Alferez
Since both $n_1$ and $n_2$ were greater than 10 ($n_1=37; n_2=16$), the $U$ statistic was derived by the same formula used in case #3. The computed value of $U=68.5$ had a probability of $p<.0000$, with average ranks for $n_1$ of 20.9 and for $n_2$ of 41.2. Since the associated probability level for the computed value of $U$ was again considerably less than the previously set significance level ($=.01$), the null hypothesis could be rejected. The evidence supported the alternate hypothesis, implying that the bulk of values in sample two (presence of Alferez) was higher than the bulk of values in sample one (absence of Alferez), or that household's with a former Alferez tended to have more diversity of ritual types than those without an Alferez. Further testing using Kendall's tau, indicated a moderate degree of association between the variables: ritual type diversity and presence/absence of a former Alferez ($t=.54, p<.001$).

Discussion

As with pottery type frequency, it seems that we can expect to find only weak to moderate relationships between socioeconomic conditions and pottery type diversity. Other factors besides those included in the tests must also influence type diversity. There are obviously no single factors which can account for all the variability in any of the pottery diversity variables tested above. However, there are some general conclusions that can be drawn concerning the variability of pottery diversity at the
household level (see Table 35):

(1) Four of the pottery diversity measures showed some (often strong) association with one or more religious, need related variables (namely, presence/absence Alférez in three cases, presence/absence religious cargo position in two cases, and presence/absence yearly festivals in one case). This is consistent with the statement made above that higher type diversity scores for households seemed to be accounted for mostly by the presence of more ritual vessel types. The presence/absence of a former Alférez in particular seems to be related to pottery type diversity. In terms of archaeological interpretations, our Chanal sample suggests that a knowledge of type diversity (especially of ritual types) could be usefully included among other factors (although not sufficient by itself) for inferring relative household religious involvement at some time during its existence (that is, high ritual type diversity or high overall type diversity seem to suggest high relative religious status).

(2) Variables representing the accessibility of pottery seem to have an equally important role in determining overall household pottery diversity as variables related to household requirements.

(3) Variables related to household size and development (number of children, family type, and age of household head) seem to have surprisingly little affect on household pottery diversity in Chanal, except possibly to the extent that social status and
Table 35: Socioeconomic variables chosen by SELECT RUNS for 6 dependent variables.
(+= positive relationship; /= negative relationship)

<table>
<thead>
<tr>
<th>SELECT run for each trial*:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
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<td>Need related:</td>
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<td>1. number of children/household</td>
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<td>2. presence/absence lineage head</td>
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<td>3. presence/absence Alférez</td>
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<td>4. presence/absence yearly festival</td>
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<td>5. presence/absence civil cargo</td>
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<td>6. presence/absence religious cargo</td>
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<td>7. age of household head</td>
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<td>8. family type</td>
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<td>9. proportion produce of income</td>
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<td>10. social status</td>
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<td>Accessibility related:</td>
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<td>11. number of economic males</td>
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<td>12. number of economic females</td>
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<tr>
<td>13. annual income</td>
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<td>14. presence/absence potter</td>
<td>+</td>
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<td>15. store owner</td>
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<tr>
<td>16. number of trips</td>
<td>-</td>
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</tbody>
</table>

* Trial #1= functional-morphological type diversity; Trial #2= pottery ware diversity; Trial #3= exotic type diversity; Trial #4= pottery plus industrial equivalent type diversity; Trial #5= food preparation and serving type diversity; Trial #6= ritual type diversity.
cargo position also imply certain degrees of family development.

(4) It would also appear that high diversity in domestic pottery vessels tends to be associated with low income, more traditional households. This appears to be due to the greater use of industrial equivalents in higher income households (see Chapter Three).

In general, household pottery diversity may be of some use (although not sufficient by itself) for inferring those socioeconomic conditions selected by the predictive models.

There is no reason at present for recommending it's use for inferring any of the independent variables not chosen by the models. A surprisingly large amount of pottery diversity seems to be associated with religious or social status.

The measurement of type diversity has been discussed and presented as a useful alternative or supplementary method to measurement of type frequency in dealing with household assemblages. Present methods used to measure type frequency seem to be inadequate for making statistical inferences concerning relative household (or housesite) socioeconomic characteristics. In fact, recent studies of modern material culture suggest that material culture frequencies and socioeconomic and demographic conditions may not be as strongly correlated as is generally believed (e.g. Hayden and Cannon 1983; Rathje 1979; Schiffer et al. 1981).

While the relationships between type diversity and household socioeconomic conditions appear to be nearly as complex in nature
as type frequency and socioeconomic conditions, diversity measures have enough advantages over type frequency measures to recommend a wider archaeological application and cautious use in inferring household characteristics. Possibly more refined partitioning of pottery assemblages into subassemblages reflecting specific activities (activity set diversity) and relative availability of types (local versus imported diversity) will produce more accurate interpretations in a wider range of archaeological realms of inference.

There is also the possibility that even if socioeconomic inferences at the household level may prove to be too unreliable to use in archaeological interpretations, ceramic diversity measures of households from entire communities may be useful for characterizing socioeconomic inequality in those communities. Hayden and Cannon (1983) have used household data in this fashion to describe the economic inequality in Chanal, Aquacatenango, and San Mateo. Such approaches might equally be applied to ritual-specific assemblages to monitor ritual specialization in communities. Thus diversity measures have considerable potential for inferring socioeconomic characteristics of communities.
Chapter Six

Summary and Conclusions

"Unless ceramic studies lead to a better understanding of the cultural context in which the objects were made and used, they form a sterile record of limited worth." (Hatton 1973:213)

Introduction

This study has dealt with pottery variability in terms of vessel frequency, and the diversity of types, and in terms of spatial patterning at several levels ranging from production to disposal in Tzeltal Maya households. The archaeological implications of this variability have been discussed in some detail. Some suggestions concerning the development of pottery specialization in the Amatenango Complex have also been made. This concluding chapter provides a summary of some of the major archaeologically relevant conclusions and a discussion of some of the implications of this study for future ethnoarchaeological and archaeological research in the Maya Highlands.
Household as production unit

Pottery production itself is seen as the initial source of pottery variability and patterning in Tzeltal households, not only between potting and non-potting households, but between households representing different intensities of pottery production. Three levels of production are recognized, with each successive level representing an increase in (1) the number of production events per year, (2) the number of vessels produced per event, (3) the number of vessel-forms produced by the potter, and (4) the size of the distribution sphere associated with the pottery products. The level of production of a given household is constrained by environmental factors (climate and resource availability) and the household learning environment, while the necessity of production is probably related largely to the agricultural self-sufficiency of the household. Production of pottery for sale or trade is viewed as a means of supplementing households' economies where agricultural production is inadequate.

Environmental conditions of a given area influence the level of production in terms of material availability and scheduling. The quality of local clays and tempering materials limit the quality and formal diversity of the pottery produced in the area. For instance, the production of narrow-mouth jars requires special materials. Knowledge of the resources available in a given area are useful to the archaeologist attempting to
differentiate locally-made from imported vessels and to understand the development of craft specialization. For example, pottery specialization is not likely to develop in an area with poor pottery making resources (clays, tempers, and fuels). Specialist communities may acquire some exotic materials (e.g., pigments, smoothing stones) through trade or kin connections, but non-specialist communities tend to use only local resources. Seasonal variations in climate (wet versus dry seasons) tend to regulate the scheduling of non-specialist production, and especially drying and firing, while specialists use alternative methods to allow year-round production.

Microtraditions (individual, household, work group, lineage or community levels) are largely the archaeological manifestations of pottery learning frameworks. Intra-community microtraditions have a complex structure, in which technological, formal and stylistic information is exchanged. In non-specialist communities, pottery making seems to occur so infrequently that most individuals do not develop enough skill or expertise to produce highly standardized stylistic forms. As a result, technological qualities of products are stressed over stylistic variation. Another result of infrequent production is that potters often learn to make pottery late in life, and therefore teaching models are as likely to occur through non-kin as through kin relationships. In specialist communities, learning pottery making is more likely to take place early in life and to be concentrated within the family of orientation (especially
mother-daughter relationships). Because of the greater control in the potting medium and the tendency to learn the craft within the family of orientation, significant stylistic variability between households or residential corporate groups is more likely to occur.

In non-specialist communities like Chanal, where there was little standardization beyond a basic community form for commonly produced vessel-forms (such as the wide-mouth jar), pupils often began experimenting and innovating while still learning the craft. This generally took the form of variations in rim form and location of handles. Many functionally-related and formal criteria, such as body shape and neck height, were found to be most useful for differentiating between individual potters and to a large extent reflected different individual potting activity. Sources of inspiration for variations in pottery characteristics came primarily from imported vessels (especially those from peripheral communities) rather than through teaching connections. Furthermore, when production was only seasonal, rather than a year-round occupation, vessel-forms produced by a given potter were more likely to reflect changing idiosyncratic tastes of the potter.

In general, the relatively loose framework of pottery making instruction and lack of cultural controls on innovation, such as that recorded in Chanal (in contrast with Reina 1963), results in an intra-community mixing of pottery stylistic patterning which would seriously affect the inference of residence behavior in
non-specialist archaeological communities. It might be more reasonable to restrict such inferences to inter-household work groups, since Chanal teachers and pupils tended to live together or in close proximity and their pottery tended to serve a relatively restricted area within the community. This situation occasionally resulted in groups of households whose pottery inventories showed basic formal similarities in locally-made plainwares because they purchased their pottery from a group of potters who generally worked together and whose pottery shared some basic formal attributes (such as body shape, rim forms, handle placement, basal trimming, etc.). These households might have no lineage or other connections beyond buying from the same potter or potters.

In order to study intra-community craft specialization, or in order to make inferences concerning residence behavior based on pottery data related to pottery production, it is necessary to be able to recognize archaeological potting households. The Tzeltal production model indicates that this should generally be possible for a number of reasons, including:

1. Pottery making supplies (especially clays and tempers) were usually kept on hand year-round and most often were stored in reused vessels. These vessels (as well as loose materials) were of relatively little value and would probably be left upon the abandonment of the site. Unless there was a local shortage of potting materials, these supplies would probably not be scavenged either.
(2) Pottery making supplies and some tools (especially metates) were generally stored near the area of their use. In Chanal, this was usually the household patio, so that supplies were often stored near the edge of the patio (e.g. along the external walls of structures, or on the roofs of sweatbaths). Residues of calcite powder might also provide evidence of pottery making.

(3) Many pottery making tools were very distinctive in terms of condition, wear-patterns and embedded residues (especially smoothing stones, reused manos and metates, and crude hammerstones). Manos and metates used for potting were generally reused, so that their poor condition made them less likely to be scavenged. In addition, potters tended to keep extra manos on hand, so that there was more likelihood that this tool-form would be present in archaeological potting households than in non-potting households. Furthermore, smoothing stones were small and often misplaced and lost, especially by non-specialists, who did not use them on a regular basis, and were therefore likely to occur in archaeological deposits.

(4) Firing areas might be visible due to regular reuse of the same hearth(s) and the buildup of sherdage from numerous breakage events during firing. They were usually found away from structures and patio areas. Furthermore, firing equipment might be visible in the form of fire-cracked rocks used for propping up vessels and firewood, and pottery wasters used to separate pottery from firewood.
(5) Besides having more manos, potting households in Chanal generally had more reused pottery (a mean of 16 vessels per household versus eight vessels per household for non-potters). Some of these were obviously used for storage of potting materials. Reused vessels might be recognized by location within compounds (e.g. provisional discard), use-wear patterns (e.g. evidence of repair or reworking for reuse), and residues related to use (primary versus secondary).

(6) Potting households might also be expected to contain a greater diversity of formal-functional types (see Chapter Five). One type in particular, the small unrestricted bowl (sets'), was generally found only in potting households, because they were made with clay left over from the production of other types.

Certainly, if all of these factors were taken into consideration, all of the pottery making households in Chanal should be distinguishable from non-potting households.
Household as consumption unit

The model of household pottery use and reuse indicates the ways that pottery variability and patterning are affected by the specific requirements of the individual household, especially in terms of changing household socioeconomic and demographic conditions. Household inventories are characterized by groups of vessels which are seen to be used and (generally) stored together, that is, activity sets. Activity sets are seen as the manifestation of broad, regional, functional subcomplexes at the household level.

Basic Chanal and Aquacatenango activity sets were related to food preparation and serving (four bowl-forms, three jar-forms, one plate and one solid), water-carrying and storage (one jar-form), and ritual (four bowl-forms, four jar-forms and one cylinder) functions. These were supplemented by gourd containers (three bowl-forms, one ladle, one bottle and one cup) and a variety of industrial equivalents. Some vessel-forms were often replaced, at least in wealthier households, by industrial equivalents, and especially serving bowls by metal bowls and cups. In addition, some vessel-forms made for the tourist market were found in Tzeltal inventories, and especially miniature vessels and figurines used as children's toys. Use and storage locations of activity sets generally did not overlap.
The relative stability of basic vessel-forms over time in the Chiapas Highlands should make the activity set concept useful for archaeological interpretation. At the household level, the activity set concept may be useful for differentiating the function of various structures (domestic, sleeping, ritual or storage) and also for recognizing activity areas within structures (also see Plannery and Winter 1976:34).

Household vessel frequency and type diversity were seen to be sensitive to complex socioeconomic and demographic conditions of the household. In archaeological investigations, type diversity, where it can be applied, might be more useful as an indicator of household socioeconomic conditions than vessel frequency. In general, pottery diversity variables seemed to be most strongly related to social status, and especially the ritual position of the household head, while they did not seem to be closely linked to economic (wealth) status. However, when industrial equivalents were included with pottery types, pottery diversity became more sensitive to economic (wealth) ranking. Of the pottery variables, ritual pottery diversity and imported type diversity were the most sensitive to the range of socioeconomic variables considered.

The affects of industrial vessels on modern household pottery inventories not only appears to vary between households of different wealth status, but also between communities with different degrees of involvement in the regional (Ladino) economy. In Chanal, industrial equivalents seem to be most often
additions to the household inventory, while in Aquacatenango they seem more likely to be replacements for pottery. If this is in fact the case, then the pottery inventories of Chanal households would be comparable to Precolombian household inventories, while in Aquacatenango, pottery plus industrial replacements would be more comparable to Precolombian pottery inventories. Furthermore, the most common industrial replacement vessels in modern households (serving bowls) might be equated with the use of imported fine quality bowl-forms in the past.

As long as the type diversity and vessel frequency of a given household are relatively stable (that is, as long as breakage and replacement rates coincide), vessel use-life variation will have a strong influence on the amount of each type to be disposed of over time. The longevity of a vessel is conditioned by a number of factors, including (1) basic strength (wall hardness and thickness) and vessel size, (2) use and reuse frequency and variation, (3) drying and storage practices, (4) opportunity for breakage (especially due to children and animals), (5) the potential for vessel repair, (6) the number of vessels in the household inventory, and (7) the amount of industrial replacements in the household inventory.

There seems to be a belief among archaeologists that once a pottery vessel is broken it is generally not reusable (Renfrew 1977:6). In the Tzeltal area, at least, this was not the case. Both Chanal and Aquacatenango households averaged at least 21% reused vessels in their pottery inventories. In fact, any part
of any broken vessel had potential for immediate reuse (for paving muddy areas, in wall or poultry nest construction, for planting seedlings, etc.) and many vessels were stored in provisional discard locations for possible future reuse. In addition, certain reuse functions, such as the planting of seedlings, might cause seasonal increases in the proportions of vessels in reuse. Furthermore, narrow-mouth, water-carrying jars were likely to represent a larger proportion of vessels being broken during the rainy season when pathways are slippery.

The reuse of vessels in Tzeltal households provides a number of other interesting insights related to the interpretation of archaeological pottery assemblages. For example, use-wear and residues associated with reused vessels are likely to reflect secondary rather than primary use. However, the distinctiveness of many reused vessels (e.g. storing of potting materials) and their frequent location away from structures may help to differentiate them from primary-use vessels. Furthermore, reused vessels are generally of little value, so that they would be the most likely vessels to be left at the site upon abandonment and would have little potential value for scavengers.
Household as depositional unit

During the preabandonment stage, depositional activity is characterized by several intentional and unintentional modes of disposal. Intentional modes include one clustered and one more dispersed strategy of provisional discard, maintenance disposal, and dumping (including broadcast dumping, discrete dumping, and tossing). Unintentional modes include loss and pathway breakage.

All of these depositional modes, except for vessel loss, result in the deposition of relatively large, damaged or fragmented vessels. Under normal abandonment conditions, single vessels or fragmented vessels may be associated with the floors of structures (due to provisional discard), the patio toft area (due to broadcasting and tossing behavior), or pathways (due to pathway breakage). Clusters of vessels may be associated with the structure walls (due to provisional discard), patio toft areas (due to maintenance disposal, and discrete or broadcast dumping), drainage ditches or pit features (due to maintenance disposal).

In archaeological compounds, vessel clustering due to such depositional behavior should represent the last configuration of structures on the site. There is some danger that such patterning may wrongly be interpreted as activity areas. Structural renovation and rebuilding, when it occurs, may result in the mixing of refuse patterns within the toft area (including provisional discard), while not affecting refuse patterning which
results from pathway breakage, maintenance disposal or discrete dumping. The optimal archaeological context for examining pottery disposal is the short-term, single occupation, such as those found in semi-sedentary communities.

In contrast to the above patterns, the artifact patterning which results from maintenance disposal is almost exclusively composed of small fragments of pottery. The spatial distribution of these fragments, such as concentrations in drainage ditches and along patio edges, as well as trampling within structures or on patios or pathways, may indicate the limits of household patio and structure-related work areas. Relative sherd densities may be useful for identifying loft areas associated with structures and general activity areas, such as patios, which are usually devoid of refuse.

Modes of housesite abandonment are more likely to affect vessel frequency and type diversity rather than the spatial patterning of pottery. For example, differential modes of abandonment are not likely to affect discarded vessels or vessel fragments. They will be left behind more or less in the same location under all conditions of abandonment. The number and diversity of whole or damaged vessels left upon abandonment are directly related to the speed of abandonment and whether or not return is anticipated. Whole vessels, especially those in storage or use locations, are only likely to be left under rapid abandonment conditions (e.g. Sheets 1979), or under gradual abandonment conditions were return is planned but not achieved.
The fact that the frequency and diversity of whole or slightly damaged vessels is likely to increase with the rapidity of abandonment may be useful for identifying the conditions of abandonment, or for comparing abandonment conditions which can be monitored in other ways, such as the magnetic alterations of soil due to house burning.

Further variations in vessel frequency and diversity are likely to occur due to postabandonment activity. For example, scavenging causes decreases in both frequency and diversity by the removal of any vessels of potential reuse value, while the dumping of new refuse increases frequency and diversity. Fortunately, refuse dumping on abandoned housesites tends to leave predictable patterns.

The short-term intensity of postabandonment alterations differs according to the open or closed nature of the housesite during the occupation of the community. The length of time a housesite remained closed prior to community abandonment should be inversely related to the intensity of postabandonment alterations.
The prediction of household socioeconomic conditions

One of the most difficult problems of archaeological pottery studies is the establishment of reliable estimates of type frequency. However, this problem must be addressed if we are to use type frequency estimates for making inferences concerning the socioeconomic and demographic conditions represented by archaeological assemblages. Of the methods currently available, NIV (number of inferred vessels) measures are always preferable to WISP (raw sherd counts) measures for this purpose, especially when rim and basal arc or vessel equivalent methods are used (Egloff 1973; Orton 1980, 1982) for the NIV measures. If analysis time and cost are not factors, and sherds are not too fragmentary, reconstructions using geometrical formulae (Ericson and Atley 1976; Smith n.d.) may be a better alternative.

Simulation experiments (e.g. Orton 1982), aided by data from controlled monitoring of breakage and deposition in the ethnographic context (see below) may improve the archaeologist's understanding of the interdependence among potsherds in archaeological assemblages.

Statistical analyses presented here have indicated that type diversity is generally a more useful alternative or at least a good supplementary method for making socioeconomic inferences about households than is type frequency. Because it may reflect different socioeconomic or demographic conditions than vessel frequency, type diversity cannot be expected to replace
measurements of type frequency for making socioeconomic and demographic inferences at the household level. However, type diversity has a number of advantages which justify a more extensive use of it with archaeological assemblages. Type diversity is easy to calculate, therefore time-efficient, and it is not affected (as are NIV and NISP) by differential breakage rates, reuse and disposal behavior, excavation techniques, or assumptions of sherd interdependence. In our Chanal sample, both graphic representations (Chapter 3) and regression analysis (Chapter 6) suggest that type diversity is closely associated with the social and religious status of the household head, and is a better predictor of these conditions than vessel frequency.

Some suggestions for future research

One of the underlying goals of the Coxoh Ethnoarchaeological Project was to provide more extensive, better quality, and especially more archaeologically-relevant ethnographic data than currently available to Mesoamericanists working in the Maya Highlands. In terms of pottery, information was particularly lacking on variation in household requirements and pottery variability and patterning related to discard behavior. The present study rectifies this discrepancy to a certain extent, at least in terms of identifying areas of concern to future
archaeological interpretation of pottery assemblages. The following discussion deals with a number of methodological problems associated with ethnoarchaeological fieldwork, some suggestions for improving the quality of data intended for use in making archaeological inferences, and an outline of the ideal conditions for evaluating the models presented here with archaeological data.

(i) Ethnoarchaeological considerations

To begin with, the Chanal and Aquacátenango statistical analyses would be more reliable if a random sample of households could have been obtained. Unfortunately, this is very difficult (and perhaps impossible) to attain, especially in more traditional communities such as Chanal and Cancuc. This situation could be improved by experimental sampling studies (e.g. Honigman and Honigman 1955) in communities which have had extensive and friendly contact with anthropologists (such as Zinacantan), in which comparisons could be made between samples of random and judgementally selected households. In this way, many of the biases involved with the use of judgemental samples of households might be predicted and possibly adjusted for in future studies.

Another advantage of selecting a community which has been previously studied, is that much of the initial groundwork involved with ethnographic fieldwork (e.g. mapping of community
and becoming familiar with internal sociopolitical organization will have been completed. A restudy of Chanal or Aquacatenango, for example, would provide much useful data concerning the relationships between pottery production and household inventory change over time (some of the practical and theoretical difficulties of the restudy method are addressed by Garbett 1967).

Our method of household interviews, in which information was collected on a wide range of topics in a single visit, severely limited the kinds and amount of pottery data we could collect. While information on inter-household variability in vessel use, reuse and disposal behavior could be observed in this manner, it is not conducive to collecting information on temporal variability and patterning. For example, if archaeologists are going to use simulation models to make predictions concerning vessel discard rates over time using ethnographic data, then they must monitor temporal changes in the lifespan of various pottery types (including duration of reuse of vessels) and replacement rates (in relation to changes in household wealth, social status, family size, etc.).

Monitoring vessel use, breakage, storage, and disposal behavior has the disadvantage of requiring the investigator to remain in manageable proximity to the households participating in the experiment. However, such a study need not be time-consuming if records were updated periodically (e.g. once a week or biweekly) while the investigator is working on a separate project.
Records could be kept of relevant data such as date of vessel purchase, frequency of use, use and storage locations, date of breakage, condition after breakage, proportion of vessel or type of sherd (rim, body etc.) saved for repair, reuse or discarded, location of discard, and any features associated with the discard location.

Black and white photos of storage locations would be useful for monitoring changes in storage arrangements of vessels and relationships between pottery vessels and features. This can also be done by recording changes in vessel storage and use locations on transparent mylar plastic used as overlays on scale maps of compounds. This latter method was found to be extremely effective for recording compound activity areas and refuse patterning in Chanal and Aguacatenango.

Another alternative is the use of portable videotape units. Beale and Healy (1975:985) consider ethnoarchaeological study and research films as an area of great untapped potential for archaeological filmmaking. For example, films of actual pottery-related behavior in an ongoing community could be invaluable tools for ethnoarchaeological research. Such activities might include (1) the collection and storage of raw materials, (2) pottery production and the dispersal of production byproducts, (3) the use and storage of different vessel types, (4) the movement of vessels between production stages and between production and sale, and (5) the actual abandonment of compounds.
If vessels are too similar to be distinguished easily, then they can be tagged for individual recognition. Although the results have not yet been published (at least to the author's knowledge), attempts have been made to monitor breakage elsewhere (Longacre 1981:63). However, such studies can only be archaeologically applicable in the region in which they were collected since different pottery pastes, functional types, and pottery-related behavior are involved. Nevertheless, such results would only be of comparative interest to Mesoamericanists.

In order to form a better understanding of the relationships between pottery frequency and type diversity and differential socioeconomic and demographic conditions, it would also be useful to experiment with different systems for ranking such conditions. For example, a combined ranking of social and economic factors (such as that used by Price and Price 1972; also see Lewis 1960:37) might be more sensitive to pottery variability in some communities.

If archaeologists are to use emic formal-functional typologies in their predictive models, then they must have a clear understanding of the range of variation in vessel size and formal attributes within their formal-functional types. The cognitive prototype method presented by Kempton (1981) would provide one way of addressing this problem. Kempton uses drawing sheets exhibiting line drawings of pottery vessels in which gradual changes in body form, attachments and spouts were
emphasized. Different sheets could be used to emphasize more abrupt changes. Using this method, informants could indicate which drawings they consider to represent a wide-mouth jar. A comparison of these sheets could then be used to establish clearer definitions of individual types. Also, variations between how producers and vessel users perceived different types could be monitored in this way. Categories established by the cognitive prototype method could also serve as convenient checklist for recording frequencies of basic formal variants per household, since photographing all the pottery in each Tzeltał household would have been an expensive and time-consuming task.

(ii) Archaeological considerations

Ideal conditions under which to evaluate the models presented in this study for making archaeological interpretations would include:

(1) Sites located within the Tzeltał Highlands.

(2) Ethnographic model comparison with pottery assemblages, beginning with recent sites and then working backwards (e.g. abandoned modern housesites, recent historic sites, Colonial sites, Late Postclassic sites, etc.). Beginning with recently abandoned sites is particularly useful in cases where previous
occupants are available to facilitate an assessment of interpretations based on archaeological methods (e.g. Bonnisen 1973; Lange and Rydberg 1972; Longacre and Ayers 1968; Stevenson 1982).

(3) Household compounds or house clusters with clear boundaries.

(4) Samples taken from as large an area as possible within each compound (preferably the whole compound or a large random sample) and including areas away from structures, such as gardens. In this way refuse patterning is more likely to be recognized and postabandonment alterations assessed, and thus these biases on estimates of type frequency based on NIV or WISP measures would be eliminated.

(5) Horizontally provenienced pottery refuse since clustering is likely to represent preabandonment structural zones, patios, work areas, and other kinds of refuse areas. It would also be useful to begin by excavating isolated housesites, which would be less likely to be affected by postabandonment cultural alterations and overlapping of occupations (also see Bogucki and Grygiel 1981; Dillehay 1973; Mosely and Mackey 1972). This situation would provide ideal conditions for differentiating refuse from activity patterning before excavation of larger sites where more complex patterning would be expected.

(6) Criteria established for ruling out provisional discard before considering activity areas or activity sets. This can be addressed by paying special attention to the condition of all
vessels and vessel fragments, especially those found in clusters in the vicinity or within structures.

Clarifying the relationships between vessel form and function has great potential as a field of study in its own right (also see Renfrew 1977:3). Indeed, it has received much needed attention in the archaeological literature in recent years (see Chapter 1). However, more experimentation is needed both with ethnographic and archaeological pottery assemblages, in order to delimit functional boundaries within formal classes. Besides formal attributes, work is also needed to relate functional variation with variation in chemical (elemental) and petrographic content of pastes, and use-wear and use-residue characteristics. Furthermore, extensive use of ethnohistoric sources (e.g. the Maya Codices, the Motul dictionary, archival records) may provide additional insights into the functions of vessel-forms no longer in use.

The results of this study exemplify the kinds of pottery-related information which can be obtained through a synchronic approach to ethnographic fieldwork. The study was exploratory in nature and clearly further work is needed to investigate relationships between the full range of pottery-related behavior, from production to discard, and resulting pottery variability and patterning at the household level. Such work could be most efficiently achieved in association with a long term archaeological research project.
Any such project would benefit by conducting coincident ethnographic fieldwork directed toward specific problems related to the site or sites being excavated. The opportunity for doing ethnographic research in many parts of the Maya area has already been lost. Traditional Maya culture survives, but largely in areas in political turmoil. While the potential for ethnoarchaeological research in the Chiapas Highlands is enormous, the question is for how long?
Appendix A

1979 Pottery Questionnaire

Note: Photo all pottery made by potters of village being interviewed and use profile views only with origin/potter identification.

Note: Codes appear in [ ] following each question.

1. **No**, Does anyone make pottery in this household? Who? [frequency of occurrence]

   (1)
   (2)
   (3)

2. ( ) Which types of pottery do you buy? Where are they from? About how much do they cost? [quantity produced/year]

   Type | Potter or community of origin(s) | Cost [pesos] | # bought/yr for household

   ( )
   ( )
   ( )
   ( )
   ( )

3. ( ) Who makes the best pottery in the community? [potter number if known]

4. **No**, Do you barter for pots, or get any as gifts?

   Type | Origin (persons, groups or places)

   ( )
   ( )

5. ( ) How much do you think is spent by the household on pottery during the year? [in pesos]
6. No. Does anyone in the household ever borrow or loan pottery? Whom? What types? What purpose? Frequency? [e.g. large cooking pots, large storage pots, glazed bowls, plates, painted/carved ritual gourd cups, colanders]

<table>
<thead>
<tr>
<th>Relation</th>
<th>Residence</th>
<th>Purpose</th>
<th>Frequency</th>
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</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
<td>year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(blocks)</td>
</tr>
</tbody>
</table>

Borrowed from [frequency]:
- ( ) glazed bowls
- ( ) large cooking vessels
- ( ) large storage vessels
- ( ) other
- ( ) other

Loaned to:
- ( ) glazed bowls
- ( ) large cooking vessels
- ( ) large storage vessels
- ( ) other
- ( ) other

7. How long do pots last? Where are they broken most frequently (especially mention water-carrying jars, incense burners, large cooking vessels, beer mixing bowls)?

<table>
<thead>
<tr>
<th>Type</th>
<th>Length of time [fraction of year]</th>
<th>Where broken most frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>( )</td>
<td>( )</td>
<td>( )</td>
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</tr>
</tbody>
</table>

8. ( ) Where do you throw your broken pots? Always? Do you ever save any pieces for other purposes?

Types
- ( )
- ( )

Parts saved
- ( )
- ( )

Reuse function

9. No. Do you ever mend broken pots? Why?

Types
- ( )
- ( )

How repaired
- ( )
- ( )

New function

( )

( )
10. **Yes**. Are the pottery we see all the pottery you have? Do you have any stored away? [at a friend's or relative's; loaned out; in milpa]

11. **No**. Do you have any pottery that have not been used in the past year?

12. **No**. Have you ever received any pottery from your parents or grandparents? Are they special in any way? [Have you ever picked up any pots from abandoned houses?]

[The remainder of the questions are for potters]

13. ( ) How often do you make pottery? [times/year]

14. ( ) How much pottery do you make each time? and which types? Are they made for sale, or trade, or for the household?

<table>
<thead>
<tr>
<th>Types</th>
<th>Sale, trade</th>
<th>Price, produce</th>
<th># made</th>
<th># broken</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>or household</td>
<td>/pot</td>
<td>/year</td>
<td>/year</td>
</tr>
<tr>
<td>[S,T, or H]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. No__ Do you sell pottery?  
   ( ) About how much money do you make from selling pottery per year? [in pesos]

16. ( ) Interviewer's estimate of quality of work of this potter according to community standards:  
   Comments: 
   ( ) Technical  ( ) Decorative

17. No__ Does anyone sell your pottery for you? Who? How are they transported?

18. ( ) Who buys your pottery? Are most of them from your barrio? or your lineage? or your clan? or other communities?

19. No__ Do you or anyone else in the household make any special pottery [figurines, small pots, incense burners, large cooking pots for fiestas, marriage pots, or special orders?] Who buys these pots?

<table>
<thead>
<tr>
<th>Type</th>
<th>Maker and Relation (if not ego)</th>
<th>Function</th>
<th>Buyer/user &amp; Storage</th>
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20. ( ) What tools do you use to make pottery? [e.g. smoothing stone, knife, tablita, rag, paint brush]

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<tr>
<th>Type</th>
<th>Function</th>
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21. Where do you get materials for making pottery?

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<th>Location</th>
<th>Direction</th>
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</table>
22. No__ Does anyone make pottery with you or help you make them?

Task: [ ] Helpers or Age | Relation: [ ] Residence | Frequency of co-work
specialization (if applicable) and since when?

23. ( ) Who taught you/they how to make pottery? Relation? [potter number if known]

24. No__ Did you/they learn from more than one person? What was their relationship? (Rank according to who learned most from) [t=technical, d=decorative]

<table>
<thead>
<tr>
<th>Rank</th>
<th>Teacher(s)</th>
<th>Age</th>
<th>Relation or Affiliation</th>
<th>Residence while learning</th>
<th>Frequency while learning</th>
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25. No__ Have you taught anyone else to make pottery? Who and what is their relation?

Who | Relation | Frequency of visits while learning | Age taught
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26. No__ Whose pottery do your's look most like? In what way? [potter number if known]
27. Pick three rims or decorative motifs and ask who they were learned from (please illustrate). [Include potter number if known]

28. No__ Can you recognize pottery made by the people you learned from and how? Or pottery made by other groups?

29. No__ Can you recognize pottery from other villages? How? [List places]

30. ( ) Who makes pottery most similar to your own? Did they learn from the same people as you did? (If not, why did you think it looks like yours?) What is their relation to you? Do you ever work with them in making pots or other types of work? How often? [Potter number if known]

Person Work group Frequency Relation Teacher

31. No__ If you liked a decoration that someone else used, would you copy it? Why not?

32. ( ) Why do you not make water-carrying jars (or any other type not made in the community)?
[The remainder are observations only]

33. ( ) Observations on possible individual or group decorative or technical idiosyncracies not mentioned (especially re: surface finishing and slipping).

Measure: Line width: ( )
[ in mm. ]
Line spacing: ( )
Indentation spacing: ( )

34. ( ) Where do you grind temper?
( ) Make pots?
( ) Fire pots?

[fill in from activity area overlays]

35. ( ) Do you store pottery for sale anyplace? Where?
[fill in from maps]

Location:

( )
( )

36. Note evidence of pottery reuse observed in compound (i.e. any broken pottery reused for another function).

Type Part saved Reuse function
( )
( )
( )
( )
( )

37. Note any industrial replacements (metal, glass, plastic, etc.) of pottery, or natural material replacements (such as gourd containers or stalagmite candle holders).

<table>
<thead>
<tr>
<th>Industrial type</th>
<th>Pottery Equivalent</th>
<th>Function</th>
<th>Why preferred</th>
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Appendix B

Classification of Chanal and Aguacatenango Pottery

Introduction

A pottery vessel is here defined as a container which serves for the temporary or long-term storage of liquids or dry goods. In a liberal interpretation of this definition, cooking and beer mixing activities are said to require containers on a temporary storage basis. Tzeltal vessels are first divided into easily recognizable classes of general vessel form, including plate, dish, bowl, jar, vase and cup. These terms are widely used in Maya archaeological and ethnographic reports. Following Raymond Thompson's classification model (1958:27), vessel types are given a name which consists of a noun which refers to a defined general vessel form (such as bowl, jar, vase, etc.) and one or more adjectives referring to the most distinctive formal attributes of the class (such as small bowl or small restricted bowl).

Descriptions of body shapes are modeled on simple geometrical forms similar to those proposed by Anna O. Shepard (1954) and more recently by Ericson and Stickel (1973). The use of geometrical descriptions for body shape are more explicit than commonly used terms such as "globular", "egg-shaped" and "pear-shaped", which may have different meaning to different researchers. Also, Ericson and Stickel have found that by translating real body forms into abstract geometrical ones, they could estimate vessel capacity using formulae for deriving the
volumes of the geometrical solids which approximate a vessel's shape. Their system is designed for functional considerations, in that the volume of various behavioral activities which utilize pottery vessels (assuming that vessel form can be used to derive vessel function) could be estimated for a given culture, past or present (1973:366). In our own research, since we had only one day to spend at each household surveyed, only three measurements (maximum height, width and rim diameter) could be made on each vessel (this was augmented by photographs). The Ericson and Stickel method did prove useful, however, in establishing the size ranges of small and large unrestricted bowls.

Definitions for general vessel forms, as well as a number of formal and decorative attributes used in this study are presented below in a glossary. Following the glossary is a detailed description of each pottery type recorded for Chanal and Aguacatenango.
Glossary

General vessel (and non-vessel) forms:

Bowl: vessel with height no more than equal to but no less than one-third of its maximum diameter (R.E. Smith 1955:4).

Cup: Small hemispherical vessel with a single vertical handle.

Jar: a vessel with restricted orifice, whose height and width are approximately equal, and whose greatest diameter lies at approximately half its height.

Pestle: hand-held bar (non-vessel pottery object).

Pitcher: jar or vase with a single vertical handle and occasionally a lip-spout.

Plate: vessel with height less than one-fifth its maximum diameter (R.E. Smith 1955:4).

Vase: vessel whose height is obviously greater than its width (Lothrop 1927:109).

Whorl: perforated flywheel (non-vessel pottery object).

Formal and decorative attributes:

Basal ridge: unpolished portion around the base of a vessel, where access clay has been removed after the vessel has been burnished.

Base: bottom of a vessel to a point where change of angle or curve indicates the start of the vessel side (Sabloff 1975:24).

Body: vessel wall segment between the base and shoulder (or rim if there is no shoulder).

Burnishing: decorative surface polishing done with a smooth pebble (usually quartzite).

Cylindrical body: vessel body approximates the shape of a cylinder.

Direct rim: rim is direct continuation of body or neck wall (R. Thompson 1958:33).
Elliptical body: vessel body approximates the shape of an elliptical or, in the case of a bowl, a segmented ellipsoid positioned on its vertical or horizontal axis.

Everted rim: rim turns sharply outward forming an angle with neck and vessel wall (R. Thompson 1958:33).

Flaring mouth: diameter of vessel opening is greater than the maximum diameter of the vessel body (characteristic rim form of bowl, dish and plate forms which approximate the shape of a frustrum or segmented hyperboloid).

Flat bottom: nearly plane undersurface of a vessel which varies from very slightly convex to slightly concave (R. Thompson 1958:33).

Frustrum body: vessel body shape approximates the shape of a truncated cone.

Glaze: watery, colored or transparent lead coating with a grainy texture to the touch.

Hemispherical body: vessel body approximates one half of a sphere.

Horizontal handle: loop with opening on the vertical plane (thickest at juncture with vessel wall: see R. Thompson 1958:33).

Incurving (or restricted) orifice: vessel opening formed by the converging of the vessel walls which is characteristic of hemispherical bowl-forms and spherical, elliptical and ovaloid jar-forms.

Lip: edge or tip of rim.


Loop-handle: vertical handle crossing above the centre of a vessel orifice and attached to the lip of the rim.

Neck: body segment of restricted vessel-form between the shoulder and rim of a vessel.

Node: subconical projection on the exterior of a vessel.

Opposed lug: subtriangular lumps or ridges on opposite sides of a vessel.
Oval body: vessel body approximates the shape of an ovaloid or segmented ovaloid standing on its long axis with the widest diameter above or below the centre of the vessel.

Pedestal base: flaring, trumpet-like, hollow or solid foot with the line of cleavage between the pedestal and the vessel bottom being visible (R. Thompson 1958:31).

Piecrust rim: finger impressed fillet, encircling the rim of a vessel (resembles the ridge of a piecrust).

Plainware: unslipped or otherwise undecorated vessels.

Pock marks: circular depressions on vessel exterior produced by use-wear.

Red slip: watery, red or red-orange clay employed as background color on Amatenango vessels.

Rim: area between the change of direction of side or neck and lip, or the margin of vessel orifice...only when the thickened or displays change in wall direction or both is the rim set as a distinct part of the vessel (Sabloff 1975:24).

Rim thickness: characterized by (1) location of maximum thickness of rim (at lip, low on rim, or medial on rim), (2) location of thickest portion of rim in relation to vessel wall (interior, exterior, or indeterminate), and (3) relative degree of thickening of rim in relation to vessel wall (rim junction), which is either gradual or abrupt (Shepard 1954:246).

Shoulder: point of maximum diameter of a restricted vessel (Shepard 1954:241).


Subhyperboloid body: vessel body approximates the shape of a bisected hyperboloid.

Unrestricted orifice: vessel opening (or mouth) from the neck, or upper body if the vessel has not neck (characteristic of spheroid, ellipsoid, and ovaloid bowl forms).


White slip: watery, white clay paint employed as background color on Amatenango vessels.
Classification

(Domestic—food preparation and serving—types 1-9; Figure 23a)

(1) Small hemispherical bowl:

Ware classes: Amatenango slipped, Yocnajab slipped, Chanal unslipped, San Fernando unslipped, San Pedro unslipped.
Emic terminology: poket or apaxta (Spanish: apastli).
Sample size: Chanal 85 slipped, 124 unslipped; Aguacatenango 440 slipped.
Size: slipped forms, height 4-22 cm., rim diameter 10-31 cm., volume 103-7800 cubic cm.; unslipped forms, height 3-30.5 cm., rim diameter 8.5-32 cm., and volume 297-7800 cubic cm.
Shape: body shape varies from spherical to ovaloid (with maximum width above centre; orifice varies from slightly restricted to unrestricted; slightly concave or flat base; rim thickness interior, low, gradual for slipped forms (occasionally unslipped forms have exterior, medial, gradual rim thickness); unslipped forms have thick base relative to vessel wall and basal ridges are common.
Primary function: general utility (handwashing and serving). Occasionally larger ones are reserved for ritual handwashing.
Comments: calcite temper; slipped vessels have red to red-orange or white slip; decorations on upper body and rim and interior body and rim; floral design common; unslipped forms seem to be locally-made copies of the imported slipped forms.

(2) Small restricted bowl:

Ware classes: Amatenango slipped, Aguacatenango slipped.
Emic terminology: sarten (Spanish: vasija)
Sample size: Chanal 16; Aguacatenango 57.
Shape: restricted mouth, hemispherical body shape; rim indeterminate; flat base.
Size: height range 3-18 cm., rim diameter 14-19 cm.
Primary function: utility bowl (serving, dry storage, etc.).
Comments: calcite temper; red to red-orange or white slip; exterior burnishing; one vessel had a white slip with geometrical designs on the interior body and rim and exterior rim.

(3) Small elliptical bowl:

Ware classes: San-Ramon glazed, Chanal unslipped, San Pedro unslipped; Amatenango unslipped, Aguacatenango unslipped.
Emic terminology: chalten (Spanish: sarten).
Figure 23a: Line drawings of Chanal and Aquacatenango vessel-forms (Domestic vessels). Letters refer to variants in body shape for certain types.
Sample size: Chanal 38 unslipped; Aguacatenango 45 glazed, 43
unslipped.
Shape: ellipsoid (horizontal axis) body shape; rim indeterminate;
slightly concave or flat base; thick base relative to walls;
basal ridge common; 5 vessels have 1 or 2 horizontal handles;
unrestricted orifice.
Size: height range 3-35 cm., rim diameter 5.5-45 cm.
Primary function: frying vegetables, and occasionally meat or fish.
Comments: San Ramon glazed vessels are modelled in Chamula and
sold to San Ramon potters, who glaze the interiors and resell
them (Rus 1969:42); all are calcite tempered; often crudely
formed.

(4) Small frustrum bowl:

Ware classes: Chanal unslipped, Amatenango unslipped.
Emic terminology: sets2 (Spanish: cazuela).
Sample size: Chanal 44; Aguacatenango 8.
Shape: frustrum or occasionally elliptical (vertical axis) body
shape; rim is indeterminate; slightly concave or flat
base; thick base relative to walls, basal ridge common.
Size range: height range 3-15 cm., rim diameter 6-26 cm.
Primary function: frying vegetables or general utility.
Comments: calcite temper; generally crudely formed; size is often
determined by amount of leftover clay from manufacture of
other vessels.

(5) Unrestricted plate:

Ware classes: Amatenango unslipped, Aguacatenango unslipped,
Chanal unslipped, San Pedro unslipped, San Fernando
unslipped, Yocnajab unslipped.
Emic terminology: samet or tzamet (Spanish: comal).
Sample size: Chanal 223; Aguacatenango 115.
Shape: frustrum body shape; rim thickness exterior, medial,
abrupt; flat base; basal ridge common; one Amatenango
vessel had a cylindrical body shape, a curving
(lifter-like) horizontal handle and indeterminate rim
thickness.
Size: height range 1-5.5 cm., rim diameter range 9-65 cm.
Primary function: griddle for roasting tortillas and
occasionally for roasting or drying seeds.
Comments: calcite temper (large grained inclusions); often
crudely made.

(6) Frustrum solid:
Ware classes: San Ramon glazed; Chanal unslipped.

Emic terminology: _nakil sti' (Spanish: tapa).

Sample size: Chanal 5 unslipped; Aguacaténango 1 glazed.

Shape: frustrum-shaped solid; flat base and truncation; 2 examples have a single loop handle.

Size: height approximately 1 cm., and rim diameter range 11.5-16 cm.

Primary function: cover (potlid) for small wide-mouth jar.

Comments: unslipped forms have calcite temper; crude form; the 5 unslipped forms were made by 3 different potters.

(7) Small wide-mouth jar:

Ware classes: San Ramon glazed, Amatenango unslipped, Aguacaténango unslipped, Floresta unslipped, San Fernando unslipped, San Pedro unslipped, Siberia unslipped, Yola unslipped, Yocnajab unslipped, Onija unslipped, Pinola (Villa Las Rosas) unslipped, Frontera, Tzajála unslipped, Natilón unslipped, Tzajála unslipped, Pailzada unslipped.

Emic terminology: _oxen in Chanal and _pin in Aguacaténango (Spanish: _clía; glazed form is sometimes called _boca).

Sample size: Chanal 3 glazed and 1435 unslipped; Aguacaténango 5 glazed and 521 unslipped.

Shape: unslipped and glazed vessels generally have an elliptical (vertical axis) body, while ovaloid shapes (with maximum width either above or below mid-height) are also very common; spherical and horizontal elliptical body shapes occur rarely; divergent neck; rim thickness is most often indeterminate, but sometimes exterior, medial, abrupt; flat base; occasionally has 2 handles.

Size: unslipped and glazed wares have a height range of 2-42 cm., width range of 6-22 cm., and a rim diameter range of 3-17 cm.

Primary function: unslipped and glazed vessels are used for cooking vegetables and preparing corn gruels (_pozol and _atole); miniature forms are children's toys.

Comments: unslipped vessels have only calcite temper; thick base; rough uniform wall thickness; often crudely made with saging or poorly shaped walls; vessels walls are usually at least partially burnished; occasionally coiling rings are visible on exterior.
(8) Single-handled jar:

**Ware classes:** San Ramon glazed, Mexican glazed, Amatenango slipped, Amatenango unslipped, Marcos Becerra unslipped, Aguacatenango unslipped, Chanal unslipped, San Pedro unslipped, San Fernando unslipped, Pinola (Villa Las Rojas) unslipped, Yocnajab unslipped, San Jose unslipped.

**Emic terminology:** Chanal term is *chikbin* and Aguacatenango terms are *chikpin* or *sharu* (Spanish *jarro*); when this form is used for mixing lime it is sometimes called *puk'tan* (Spanish *olla por cal*) in Chanal. Chanal term for spout is *yosholye* (Spanish *pice* or *vertedera*).

**Sample size:** Chanal 27 glazed (2 with spouts), 9 slipped, *$\star$* 51 unslipped (9 with spouts); Aguacatenango 49 glazed, *$\star$* 657 unslipped (90 with spouts).

**Shape:** glazed vessels have an ovaloid body with the maximum width below the centre of the vessel, while most unslipped vessels have an elliptical (vertical axis) or ovaloid (both forms) body shape; two Aguacatenango potters make a jar body that resembles 2 frustum shaped with the bases joined to form an angular ridge at the centre of the vessel height (ridge angle is approximately 130 degrees); divergent neck; rim thickness is indeterminate; wide (unrestricted or flaring) mouth; flat base; basal ridge is common; one vertical handle; restriction on rim to form spout on 104 vessels.

**Size:** height range 1-38 cm., width range 2-34 cm., and rim diameter range 2-28 cm., maximum width of spout 2-9 cm at rim.

**Primary function:** heating water for coffee in Chanal and for heating water for coffee, corn gruels (*pozol* and *atole*) in Aguacatenango; occasionally used for boiling other vegetables or mixing lime water. Slipped vessels used to serve cold liquids.

**Comments:** glazed vessels are often decorated on the upper body and glazed on the exterior (except for the base and underside of handle); unslipped vessels have a calcite temper; often crudely formed body; normally partially burnished; occasionally coiling rings are visible on the exterior of the vessel. Slipped vessels have a white slip; sand and calcite temper; body and neck decoration; floral or geometrical designs.

(9) Large perforated jar:

**Ware classes:** Amatenango slipped, Aguacatenango slipped, Chanal unslipped.

**Emic terminology:** in Chanal *chixnajab'il*; in Aguacatenango *chichina* (Spanish *pichacha*).

**Sample size:** Chanal 3 unslipped; Aguacatenango 96 slipped.
Shape: ovaloid (with maximum width above centre) or elliptical (vertical axis) body shape; neck divergent; rim thickness indeterminate; flat, perforated base; perforated body.

Size: height range 20-33 cm.; width range 25-29 cm.; rim diameter range 18.5-22 cm.

Primary function: straining corn kernels and lime-water mixture.

Comments: calcite tempered; red to red-orange slip; burnished body; perforations with incised circle around each (made with a large U-shaped fencing nail); plainware vessel perforations are made with a metal spike or twig; bodies are often crudely formed.

(Water carrying and storage: type 10)

(10) Narrow-mouth jar:

Ware classes: Amatenango slipped, Aguacatenango slipped

Emic terminology: kib (Spanish: cantaro), and huruxi-kib (cantaro without handles: Chanal term only)

Sample size: Chanal 343; Aguacatenango 389

Shape: body shape ovaloid (with the maximum body width below the centre of the vessel) or elliptical; divergent neck; rim thickness is exterior, medial, abrupt; generally 3 horizontal handles (5 have 2 handles, 2 have one handle, and 4 have no handles).

Size: height range 3-54 cm.; width range 7-43 cm.; rim diameter range 3-14 cm.

Primary function: 2-3 handle vessel is a water-carrying and water storage jar; one handle and handleless jars are storage vessels for dry goods; miniature forms are children's toys.

Comments: tempered with a fine-grained dolomite sand (Heyman n.d.); thick base; uniform wall thickness, red to red-orange or white slip; upper body, handle, and neck decoration; occasionally embossed design; painted designs of flowers and occasionally roosters; burnished exterior.

(Ritual vessels: types 11-19; Figure 23b)

(11) Large hemispherical bowl:

Ware classes: Amatenango slipped, Amatenango unslipped, Chanal unslipped, San Pedro unslipped.

Emic terminology: poket grande (Spanish: apastli grande).

Sample size: Chanal 19 slipped, 30 unslipped; Aguacatenango 56 slipped, 54 unslipped.

Shape: ovaloid (with maximum width above centre of vessel) and occasionally spherical body shape; rim thickness, exterior, medial, abrupt for slipped vessels and indeterminate for unslipped vessels; flat base; thick base and vessel walls; basal trim common on unslipped vessels.
Figure 23b: Line drawings of Chanal and Aquacatenango vessel-forms (Ritual vessels).
**Size:** slipped vessels have a height range of 18-41 cm., rim diameter range of 29-47 cm., and a volume range of approximately 8000-41,494 cubic cm.; unslipped vessels have a height range of 17-46 cm., rim diameter range of 22-49 cm., and a volume range of approximately 6653-48,556 cubic cm.

**Primary function:** ritual beer (chicha) mixing bowl.

**Comments:** calcite temper; red to red-orange slip and exterior and interior burnishing on Amatenango slipped vessels; unslipped vessels are often crudely formed.

(12) **Small unrestricted bowl:**

**Ware classes:** Chiapa de Corzo glazed, Mexican glazed.

**Ethnic terminology:** Porcelana (Spanish: porcelana or cajete).

**Sample size:** Chanal 251; Aguacatenango 406.

**Shape:** ovaloid (with maximum width above centre) body shape; rim thickness indeterminate; flat or slightly ringed base, unrestricted orifice.

**Size:** height 4-13.5 cm.; rim diameter 7-23 cm.

**Primary function:** ritual serving and general utility.

**Comments:** Chiapa de Corzo glazed bowls have interior and exterior (except for base) glaze; decoration on interior; floral designs. Mexican glazed bowls (probably representing various sources in Central Mexico) are highly vitrified; interior (except for base) glaze; undecorated.

(13) **Single-handle bowl:**

** Ware classes:** Chanal unslipped.

**Ethnic terminology:** neochab (Spanish: none).

**Sample size:** Chanal 9; Aguacatenango none.

**Shape:** 3 have an ovaloid (with maximum width above centre of vessel) body shape; 3 have an elliptical (vertical axis) body shape; 2 have a frustrum body shape and on has a spherical body shape; rim thickness indeterminate; flat base; single vertical handle.

**Size:** height range 8-17.5 cm., rim diameter range 12.5-19 cm.

**Primary function:** making beeswax candles for a single fiesta.

**Comments:** calcite temper; some are crudely formed; made on order by Chanal potters for one specific occasion and kept by the users family as an heirloom.

(14) **Pedestal-base bowl:**

**Ware classes:** Amatenango slipped, Aguacatenango slipped, Chanal unslipped, San Pedro unslipped, Tzajala unslipped, and Yocolajab unslipped.
Emic terminology: In Chanal they are called chik'pom and in Aguacatenango they are called akolbil (Spanish: incensario, and less frequently bracero).

Sample size: Chanal 7 slipped, 101 unslipped; Aguacatenango 57 slipped, 1 unslipped.

Shape: slipped vessels have an ovaloid (with maximum width below centre) shaped bowl; hollow pedestal base; 3 nodes spaced equidistantly around rim; rim thickness indeterminate; unslipped vessels have an ovaloid (with maximum width below centre) or spherical bowl shape; solid or partially hollow base; rim thickness indeterminate; orifice unrestricted.

Size: height range 6-22.5 cm., bowl diameter range 5.5-18 cm., basal diameter 3.5-17 cm.

Primary function: receptacle for offering incense.

Comments: slipped vessels have sand temper; red to red-orange or white slip; decoration on bowl exterior and base; floral design; burnishing on bowl; one vessel had a frustrum-shaped bowl and flat-tipped nodes; unslipped vessels had calcite temper; interior fire-blackening; often crudely formed.

(15) Pedestal cylinder:

Ware classes: Amatenango slipped, Aguacatenango unslipped, Chanal unslipped.

Emic terminology: somjebal cantela or yahuil cantela (Spanish: candelero).

Sample size: Chanal 1 slipped, 20 unslipped; Aguacatenango 1 slipped, 2 unslipped.

Shape: small cylindrical body with trumpet-like base; sometimes resembles an hyperboloid; hollow body to base; slightly hollow or flat solid base; rim thickness indeterminate.

Size: height range 4.5-17.5 cm., rim diameter range 3.5-5.1 cm., and basal diameter range 5-15 cm.

Primary function: candle holder.

Comments: slipped forms have a white slip; sand and calcite temper; body decoration; floral and geometrical designs; unslipped forms have calcite temper; often crudely formed.

(16) Large wide-mouth jar:

Ware classes: Amatenango unslipped, Aguacatenango unslipped, Chanal unslipped, San Pedro unslipped, San Agustine unslipped, Siberia unslipped, Yola unslipped, San Antonio unslipped, San Fernando unslipped, San Jose unslipped.

Emic terminology: oxom grande in Chanal and pin grande in Aguacatenango (Spanish: olla grande).
Sample size: Chanal 200; Aguacatenango 81.
Shape: elliptical (vertical axis) or ovaloid (with maximum width above the centre of the body) body shape; divergent neck; rim thickness is indeterminate or exterior, medial, abrupt; flat base.
Size: height range of 43-81 cm., width range of 23-58 cm., and rim diameter range of 18-37 cm.
Primary function: cooking meals for large groups of people (generally ritual gatherings), and for storage of dry goods between gatherings.
Comments: tempered with relatively coarse-grained calcite; vessel walls and base are thick; often crudely formed body; normally partially burnished on exterior; occasionally coiling rings are visible on exterior.

(17) Large composite jar:

Ware classes: Amatenango slipped, Aguacatenango slipped.
Emic terminology: tenosha grande in Chanal and mucuc tencha in Aguacatenango (Spanish: tinaja grande).
Sample size: Chanal 14; Aguacatenango 64.
Shape: ovaloid (maximum width above the centre) body shape; divergent neck; rim thickness exterior, medial, abrupt; 1 vessel has 3 handles; unrestricted orifice.
Size: height range 26-73 cm., width range 32-52 cm., and rim diameter range 20-50 cm.
Primary function: fermentation of corn beer (chicha) for festivals and the storage of dry goods between festivals.
Comments: temper consists of fine-grained sand and calcite; vessels walls and base are thick; red to red-orange or white slip; upper body and neck decoration; floral designs most common; occasionally embossed design; burnished on exterior.

(18) Small perforated jar:

Ware classes: Amatenango slipped, Chanal unslipped, Aguacatenango unslipped.
Emic terminology: Chanal term is chixnajab'il; Aguacatenango term is chichina (Spanish pichacha).
Sample size: Chanal 10 slipped and 31 unslipped; Aguacatenango 36 slipped and 1 unslipped.
Shape: slipped vessels have an ovaloid (with maximum width above the centre of the vessel) or spherical body shape; unslipped vessels are usually elliptical (vertical axis) in body shape; neck divergent; rim thickness is indeterminate; flat, perforated base; perforated body form base to neck; 4 have handles.
Size: height range 10-21 cm., width range 10.5-17 cm., and rim
diameter range 8-16.5 cm.

**Primary functions:** straining corn gruel (*atole*) on ritual occasions.

**Comments:** calcite temper; red to red-orange slip; a U-shaped fencing nail is used to make the perforations and an incised circle around each perforation (on slipped vessels only); perforations on unslipped vessels are made with a small straight nail or twig; slipped vessels are burnished on exterior; unslipped vessels are often crudely formed.

(19) Pedestal jar:

**Ware classes:** Amatenango slipped; Aguacatenango slipped.

**Epic terminology:** *yaail nichim* (Spanish: *florero*).

**Sample size:** Chanal 10; Aguacatenango 12.

**Shape:** ovaloid (with maximum width below centre of vessel) body shape; divergent neck; rim thickness exterior, medial, abrupt; filleted (*"pie crust") rim common; hollow pedestal base; vertical opposed lugs common; one vessel had a single vertical handle.

**Size:** height range 5-23 cm., width range 4.5-19 cm., and rim diameter range 2.7-16.8 cm.

**Primary function:** recepticle for ritual offering of flowers.

**Comments:** fine-grained sand and calcite temper; red to red-orange or white slip; burnishing on exterior neck and body; decorated on all of exterior; interior of bowl and pedestal base not slipped; floral and geometrical designs; opposed lugs have one or 2 perforations.

(Spinning; see Figure 23c)

(20) Whorl:

**Ware classes:** Chanal unsliipped.

**Epic terminology:** *pe'tet* (Spanish: *malacate*).

**Sample size:** Chanal 62; Aguacatenango 3 (of unknown origin).

**Shape:** segmented ovaloid (width maximum width below centre) and frustum solid, with base of frustum joining the truncation of the ovaloid; perforation through the centre of the object (from frustum truncation to curvature of ovaloid); coils on frustum exterior.

**Primary function:** flywheel for spindle (*spindle-whorl*).

**Comments:** calcite temper; perforation made with a nail or twig. Whorls sold in San Cristobal l.c. pottery shops were made in Oxchuc—the 3 Aguacatenango whorls may have originated in that community.
Figure 23c: Line drawings of Canal and Aucaquatenango vessel-forms (Spinning, Tourist and obsolete types).
(Tourist trade, types 21-29)

(21) Tripod bowl:

**Ware classes**: San Ramon glazed.

**Emic terminology**: none (Spanish: molcajete and pajador).

**Sample size**: Chanal 1; Aguacatenango 1.

**Shape**: spherical body shape; filleted (pie crust) rim; rim thickness exterior, medial, abrupt; interior coils; round base; 3 equidistantly placed legs; rim thickness indeterminate; round base.

**Size**: height range of 4.5-8.4 cm., and rim diameter range of 8-16 cm.

**Primary function**: mortar and pestal for grinding chile peppers.

**Comments**: glazed vessels have an interior and exterior glaze; no decoration; a pestle consisting of a solid bar with a disk at one end accompanies each bowl; the bar section and upper part of disk are glazed, while the base of the disk is coiled, flat and not glazed.

(22) Effigy vessel:

**Ware classes**: Amatenango slipped.

**Emic terminology**: none (Spanish: alcancia).

**Sample size**: Chanal 4; Aguacatenango 5.

**Shape**: hollow elliptical (horizontal axis) body shape; pig effigy; 4 legs; slot for inserting money.

**Size**: height range 10-14 cm., width range 12-16 cm.

**Primary function**: child's moneybank.

**Comments**: calcite and sand temper; white slip; decorated on exterior with features of a pig; burnished on exterior.

(23) Figurine:

**Ware classes**: Mexican glazed, Amatenango slipped, Chanal unslipped.

**Emic terminology**: none (Spanish: animalito or estatuilla).

**Sample size**: Chanal 3 glazed, 2 unslipped; Aguacatenango 6 glazed, 4 slipped.

**Shape**: anthropomorphic or zoomorphic shaped; both unslipped forms have 2 shallow depressions on back of zoomorphic figure.

**Size**: height range 10-21 cm.

**Primary function**: glazed forms are Christian icons, slipped forms are children's toys and unslipped forms are candle-holders.

**Comments**: glazed forms are probably from various sources in Central Mexico; unslipped figurines are calcite tempered and crudely formed; slipped forms have red to red-orange or white slip and the features of animals are painted on.
(24) Small composite jar:

**Ware classes:** Amatenango slipped, Aguacatenango slipped.

**Epic terminology:** tenosha in Chanal and tencha in Aguacatenango (Spanish: tinaja).

**Sample size:** Chanal 10; Aguacatenango 10.

**Shape:** ovaloid (with maximum width above the centre) body shape; divergent neck; rim thickness is exterior, medial, abrupt; 1 vessel has 2 vertical handles.

**Size:** height range 9-25 cm., width range 7-31 cm., and rim diameter range 6.5-16.5 cm.

**Primary function:** wet and dry storage.

**Comments:** temper consists of sand and calcite; bases are thick relative to vessel walls; red to red-orange or white slip; upper body and neck decoration; occasionally embossed; flower designs predominate; burnished exterior.

(25) Flaring-mouth dish:

**Ware classes:** Amatenango slipped.

**Epic terminology:** none. (Spanish: cenicero).

**Sample size:** Chanal none; Aguacatenango 1.

**Shape:** elliptical (horizontal axis) body shape; slight ring base; burnished interior and exterior; thick base; rim indeterminate.

**Size:** height 9 cm., and rim diameter 16.5 cm.

**Comments:** sand and calcite temper; red-orange slip.

(26) Single-handle cup:

**Ware classes:** San Ramon glazed, Mexican glazed, Amatenango slipped, Chanal unslipped.

**Epic terminology:** basso (Spanish: vasso).

**Sample size:** Chanal 4 glazed, 2 unslipped; Aguacatenango 12 glazed, 3 slipped.

**Shape:** ovaloid (with maximum width below centre) body shape; rim indeterminate; flat or low ring base; single vertical handle.

**Size:** height range 2-9.5 cm., rim diameter range 6.5-9 cm.

**Primary function:** serving hot liquids.

**Comments:** Mexican glazed vessels are highly vitrified and probably represent various sources in Central Mexico (one vessel had HECHO EN MEXICO on its base); thin transparent glaze with no decoration; San Ramon glazed vessels have an exterior glaze (except for base and under handle); upper body and neck decoration; floral designs; slipped vessels have sand temper, red to
red-orange or white slip; burnished exterior; floral
designs; unslipped vessels have calcite temper; often
very crudely formed.

(27) Wide-mouth vase:

**Ware classes:** Amatenango slipped, Chanal unslipped, Aguacatenango
unslipped.

**Epic terminology:** none (Spanish: maceta).

**Sample size:** Chanal 4; Aguacatenango 16.

**Shape:** ovaloid (with maximum width below centre) body shape;
thick base; uniform wall thickness; rim thickness
indeterminate; 2 have flat bases, while 18 have round bases
and 3 equidistant legs.

**Size:** height range 6.5-30.5 cm., and rim diameter 7.5-31 cm.

**Primary function:** flowerpot (for young seedlings).

**Comments:** calcite temper; crudely formed body. Slipped forms
have sand and calcite temper; white slip; shoulder to rim
decoration; floral designs.

(28) Loop-handle bowl:

**Ware classes:** Amatenango slipped.

**Epic terminology:** mochelur (Spanish: canasta).

**Sample size:** Chanal none; Aguacatenango 2.

**Shape:** elliptical (horizontal axis) body shape; filleted
("pie crust") rim; flat base; single loop handle.

**Size:** height range 7-11 cm., width for both examples 16 cm., and
rim diameter for both 13 cm.

**Comments:** sand and calcite temper; red to red-orange slip;
burnished interior; thick base; uniform wall thickness.

(29) Incurving rim bowl:

**Ware classes:** Aguacatenango slipped.

**Epic terminology:** poket (Spanish: batea).

**Sample size:** Chanal none; Aguacatenango 1.

**Shape:** elliptical (horizontal axis) body shape; slightly
incurving rim; rim thickness indeterminate; flat base.

**Size:** height 12 cm., maximum rim diameter 32 cm.

**Primary function:** general utility or washing clothes.

**Comments:** sand and calcite temper; decoration on interior rim
and base, and exterior rim; red-orange slip; floral and
geometrical designs.
(30) Cylindrical jar:

Ware classes: Chanal unslipted.
Emic terminology: balal' oxem (Spanish: olla or tecomate)
Sample size: Chanal 3; Aguacatenango none.
Shape: cylindrical to ovalcid (with maximum width below centre)
body shape; narrow mouth; rim thickness indeterminate;
flat base; basal ridge.
Primary function: temporary storage of coffee, limes, or
tobacco-lime mixture (peligo).
Comments: calcite temper; crudely formed body; no longer made
(all examples recorded were heirlooms).

(31) Pedestal vase:

Ware classes: Amatenango slipped.
Emic terminology: chpirin (Spanish: jarra).
Sample size: Chanal none; Aguacatenango 5.
Shape: spherical body shape; rim thickness indeterminate;
hollow pedestal base; one vertical handle.
Size: height range 6-18 cm., width range 13-15 cm., rim diameter
range 9-11 cm., and basal diameter 6-11 cm.
Primary function: support for serving bowl and storage of
dry goods.
Comments: calcite and sand temper; red to red-orange slip;
decoration on body; floral and geometrical designs;
burnished exterior.

Probable Precolumbian forms

Three complete vessels and two slipped potsherds were
recorded in Chanal and Aguacatenango which do not seem to have
originated from any of the known pottery sources. The two
potsherds were stored with fragments of human bone on a family
altar in Chanal. They are probably of Precolumbian origin since
the household head claimed to have found them in one of the
sacred caves in the nearby hills. These caves are the home for
ancestral deities (the poca winic).
Also of unknown origin are a long-neck jar with orange slip and elliptical (horizontal axis) body shape (height 23 cm., width 19 cm., and rim diameter 5.5 cm.), and a large wide-mouth jar with reddish-brown slip, elliptical (vertical axis) body shape, straight neck, and exterior, medial, abrupt rim thickness (height 56 cm., width 42 cm., and rim diameter 24 cm.). Our informants in Chanal claimed that both forms were made in the pottery centre of Tenango (Tenam). The relative fine quality of both vessels suggests that this is unlikely. Both may have Precolumbian origins.

A large orange slipped, tripod bowl with an elliptical (horizontal axis) body shape was recorded in an Aguacatenango household (and is now in the possession of the New World Archaeological Foundation, San Cristobal las Casas, Chiapas). Although the owners of the vessel claimed that they had purchased it in San Cristobal, it is obviously of a better quality than any local ware. The modern community of Aguacatenango sits on a Postclassic settlement, so that, this vessel may have been found within the community, or it may have been procured from the nearby Classic site of Yerba Buena.
Appendix C

Graphs accompanying Chapter Three

Figure 24: Channel: graphic relationship between family size and vessel frequency.
FAMILY SIZE

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<tr>
<th>Size</th>
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</tr>
</thead>
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<tr>
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<tr>
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<td>1</td>
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<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

POTTERY VESSEL FREQUENCY

35  65  95  125  155  185
Figure 25: Channel graphic relationship between family size and type diversity.
FAMILY SIZE

POTTERY TYPE DIVERSITY
Figure 26: Aquacatenango: graphic relationship between family size and vessel frequency.
Figure 27: Aquacatenango: graphic relationship between family size and type diversity.
FAMILY SIZE

16

13

10

7

4

1

POTTERY TYPE DIVERSITY
Figure 28: Graphical relationship between economic rank and (1) vessel frequency (left), and (2) pottery type diversity.
Figure 29: Aquacatenango: graphic relationship between economic rank (1) vessel frequency (left), and (2) pottery type diversity.
Figure 30: Graphical relationship between economic rank and (1) pottery and industrial type diversity (left), and (2) ritual set diversity.
Figure 31: Channel: graphic relationship between economic rank and
(1) food preparation and serving set diversity (left), and
(2) imported type diversity.
Figure 32: Graphic relationship between economic rank and the number of industrial replacements for pottery bowls.
ECONOMIC RANK

NUMBER OF INDUSTRIAL POTTERY BOWL EQUIVALENTS
Figure 33: Channel: graphic relationship between social rank and (1) vessel frequency (left), and (2) pottery type diversity.
Figure 34: Aquacatenango: graphic relationship between social rank and (1) vessel frequency (left), and (2) pottery type diversity.
Figure 35: Channel: graphic relationship between social rank and (1) pottery and industrial type diversity (left), and (2) ritual set diversity.
Figure 36: Graphical relationship between social rank and (1) food preparation and serving set diversity (left), and (2) imported type diversity.
Figure 37: Graphic relationship between civil cargo rank and (1) vessel frequency (left), and (2) pottery type diversity.
Figure 38: Aquacatenango: graphic relationship between civil cargo rank and (1) vessel frequency (left), and (2) pottery type diversity.
Figure 39: Chanal: graphic relationship between civil cargo rank and (1) pottery and industrial type diversity (left), and (2) ritual set diversity.
Figure 40: Graphical relationship between civil cargo rank and (1) food preparation and serving set diversity (left), and (2) imported type diversity.
Figure 41: Chanal: graphic relationship between ritual cargo rank and (1) vessel frequency (left), and (2) pottery type diversity.
Figure 42: Aquacatenango: graphic relationship between ritual cargo rank and (1) vessel frequency (left), and (2) pottery type diversity.
Figure 43: Chanal: graphic relationship between ritual cargo rank and (1) pottery and industrial type diversity (left), and (2) ritual set diversity.
Figure 44: Channel: graphic relationship between ritual cargo rank and (1) food preparation and serving set diversity (left), and (2) imported type diversity.
References

Adams, Robert R.

Adams, R. E. W., and Woodruff D. Smith

Arnold, Dean E.


Ascher, Robert

Ashmore, Wendy
1981 Some issues in method and theory in Lowland Maya settlement archaeology. In *Lowland Maya settlement patterns*,

Baer, F., and M. Baer
1950 Materials on Lacandon culture of the Petha (Pelha) region. University of Chicago, Microfilm Collection, Manuscripts on Cultural Anthropology, Series 6, Number 34.

Baerreis, David
1961 The ethnohistoric approach and archaeology. Ethnohistory 8:49-77.

Baker, Charles M.

Balfet, Helene

Ball, Joseph W.

Barker, Philip

Basauri, Carlos

Baumhoff, Martin A., and Robert P. Heizer

Bawden, Garth

Beale, Thomas W., and Paul F. Healy
Becker, Marshall J.  

Becquelin, Pierre  

Berlin, Brent, Dennis E. Breedlove and Peter H. Raven  

Binford, Lewis R.  


Birmingham, Judy  

Bishop, Ronald L.  

Blake, Michael
1979a Household features and social processes in a modern Maya community. Paper presented at the 44th Annual Meeting of the Society for American Archaeology, Vancouver, B. C.


Blake, Michael, and Susan Blake
1978 Coxoh Ethnoarchaeological Project 1978--Community assessment for future intensive investigation. MS on file, Office of the Coxoh Ethnoarchaeological Project, Department of Archaeology, Simon Fraser University, Burnaby, B. C.

Blake, Susan
1979 House material type variation in Highland Chiapas Maya communities. Paper presented at the 44th Annual Meeting of the Society for American Archaeology, Vancouver, B. C.

Blake, Susan, and Michael Blake


Blom, Frans

Bogucki, Peter I., and Ryszard Grygiel

Bonnichsen, R.
Borhegyi, Stephen F., De

Bradley, Richard, and Michael Fulford

Braun, David P


Bray, Alicia
1982 Mimbres Black-on-white, melamine or wedgwood? A ceramic use-wear analysis. The Kiya 47:133-149.

Bray, Warwick, and David Trump

Brew, J. O.
1946 Archaeology of Alkali Ridge, Southeastern Utah, with a review of the prehistory of the Mesa Verde Division of the San Juan and some observations on archaeological systematics. Harvard University, Peabody Museum of Archaeology and Ethnology, Papers 21. Cambridge.

Brockington,

Bromitsky, Gordon
Brose, David S.

Brown, James A.

Brulotte, Russell
n.d. Untitled manuscript concerning two recently abandoned house-sites in Aquacatenango, Chiapas, Mexico. Ms. on file, Office of the Coxoh Ethnoarchaeological Project, Department of Archaeology, Simon Fraser University, Burnaby, B.C.

Bryant, Douglas
1979 Personal communication concerning Amatenango pottery production and the results of his 1979 house-site excavation at Yerba Buena, Chiapas.

Burgh, Robert F.

Butzer, Karl W.

Calnek, Edward E.


Campbell, Lyle

Cannon, Aubrey
Carrillo, Richard F.  

Chatterjee, Samprit, and Bertram Price  
1977 Regression analysis by example. Wiley and Son, New York.

Chernela, Janet  

Clark, John E.  
1979 Personal communication concerning pottery production in Amatenango, Chiapas.

Clarke, David L.  


Collier, George A.  

Colton, Harold S.  

Condamin, J., F. Formenti, M. O. Metais, M. Michael, and P. Blond  

Cook, Shelburne F.  

Culbert, Patrick  


Daltabuit, Maqali, and Carlos Alvarez

David, Nicholas


David, Nicholas, and Milke Hennig

Davidson, Thomas E.

Deal, Michael


Deal, Michael, and Brian Hayden

Deboer, Warren R.

Deboer, Warren R., and Donald W. Lathrap

Deetz, James


Dickens, Roy S., Jr., and James H. Chapman

Dillehay, Tom D.

Donnan, Christopher B., and C. William Cleulow, Jr. (editors)

Doran, J. E., and F. R. Hodson

Eqloff, B. J.

Emery, Walter B.

Ericson, Jonathon E., and Suzanne P. Atley
Ericson, J. E., D. W. Read, and C. Burke

Ericson, J. E., and E. Gary Stickel

Evans, J. D.

Fauvet, Marie-France

Fehon, Jacqueline R., and Sandra C. Scholtz

Feinman, Gary M., Steadman Upham, and Kent G. Lightfoot

Folan, William J., Stauros Daoutis, and Karla Kreklow
1979 Ceramica y codices: un analysis de ceramic Maya desde el punto de vista del observador precolombina. *Boletin de la Escuela de Ciencias*
Antropologicas de la Universidad de Yucatan. Year 6 (35): 36-43.


Gotthilf, Vivian 1982  Maize storage strategies: an ethno-archaeological perspective. Unpublished Masters thesis, Department of Archaeology, Simon Fraser University, Burnaby, B.C.

1983  Personal communication concerning the use of pottery vessels in the burial of afterbirths in Oaxaca and the Guatemala Highlands.
Gould, Richard A.


Gould, Richard, and Patty Jo Watson

Grayson, Donald K.

Grebinger, Paul

Green, Ernestene

Green, H. J. M.


Griffiths, Dorothy M.

Guillini, Giorgio
Halstead, Paul, Ian Hodder, and Glynis Jones  

Hammond, Gawain, and Norman Hammond  

Hammond, Norman, G. Harbottle, and T. Gazard  

Hammond, Philip C.  

Harris, Marvin  


Hartwig, Frederick, and Brian E. Dearing  

Harvey, Byron, III  

Haury, Emil W.  

Hayden, Brian  


n.d.b Contemporary cutting requirements of the Maya. *Papers of the New World Archaeological Foundation*, in press.


n.d. Craft learning frameworks among the Maya. MS. on file, Office of the Coxoh Ethnoarchaeological Project, Department of Archaeology, Simon Fraser University, Burnaby, B.C.


Hill, James N., and R. K. Evans

Hinton, David A.

Hinton, Thomas E. (Editor)

Hill, Robert M.

Hodder, Ian


Hodder, Ian, Glynn Isaac, and Normand Hammond

Hodges, H.

Holland, William R.

Honigmann, John, and Irma Honigmann

Horsfall, Gayel
Howry, Jeff C.


Hughes, P. J., and R. J. Lampert

Hulthen, E.

Hunt, Muriel Eva Verbitsky

Hunter-Anderson, Rosalind L.

Hurst, John G.

ICA (International Congress of Americanists)

Irwin, G. J.
Jelinek, A. J.

Joesink-Manevelle, L. R. V.


Keighley, Jenifer

Kelsall, R. K., and H. M. Kelsall

Kempton, Willet

Kent, Susan

Kidder, Alfred V.

Kirkby, A., and M. Kirkby

Kohler, Timothy A.

Kobayashi, Tatsuo
Kroster, Paula Kommerger

Lange, F. W., and C. R. Rydberg

Lathrap, Donald W.

Lauer, P. K.

Lee, Thomas A.


Lee, Thomas A., Jr., and Sidney D. Markman

Leone, Mark

Lewis, Kenneth

Lewis, Oscar

Lind, Michael

Linton, Ralph


Lischka, Joseph J.


Lister, Florence C., and Robert H. Lister

Longacre, William A.


Longacre, William, and James E. Ayers

Lothrop, Samuel K.

Lowe, Gareth W.

Lucas, A.

Majewski, Teresita

Marascuilo, Leonard A., and Mervellen McSweeney

Markman, Sidney, D.

Matheny, Ray T.

Matson, Fredrick R.


Morris, Craig

Moseley, Michael, and Carol Mackey

Murray, Priscilla

Nash, June

Nash, Manning


Nations, James D.

Nations, James D., and John E. Clark

Nations, James D., and Ronald E. High

Nelson, Ben A.
Nelson, Margaret M.
  n.d.a Site formation processes of metate manufacturing. 
  Papers of the New World Archaeological Foundation, in press.


Newell, H. P., and A. D. Krieger
  1949 The George C. Davis site, Cherokee County, Texas. 
  Society for American Archaeology, Memoirs #5.

Wicklin, Keith
  1971 Stability and innovation in pottery manufacture. 

Nisson, Hans J.
  1968 Survey of an abandoned modern village in southern Iraq. 

O'Neal, Lila H.
  1976 Notes on pottery making in Highland Peru. 

Orton, Clive R.


1982 Computer simulation experiments to assess the performance of measurements of quantity of pottery. 

Papousek, Dick A.
  1974 Manufactura de alfareria: en Temascalcingo, Mexico, 

Parsons, E. W.
  1936 Mitla: town of the souls: and other Zapoteco-speaking 
  Pueblos of Oaxaca, Mexico. University of Chicago Press, 
  Chicago (1966).

Pastron, Allen G.


Rands, Robert


Rands, Robert, Paul H. Benson, R. L. Bishop, P. Chen, G. Harbottle, B. C. Rands, and E. V. Sayre


Rands, Robert L., and Ronald L. Bishop


Rathje, William L.


Read, Dwight W.


Reddy, G. P.

Redfield, Robert, And Alfonso Villa Rojas

Redman, C. L.
1979 Description and inference with late Medieval pottery from Qsar es-Seghir, Morocco. Medieval Ceramics 3:63-79.

Reina, Ruben E.

Reina, Ruben E., and Robert M. Hill

Renfrew, Colin

Rey, Reynoso

Rice, Prudence M.


Ricketson O. G., and E. B. Ricketson

Robbins, L. H.

Rock, James T.
Russ, Jan

Rye, Owen S.


Sabloff, Jeremy A.
1975 *Excavations at Seibal, Department of the Peten, Guatemala: the ceramics.* *Harvard University, Peabody Museum of Archaeology and Ethnology*, 13(2).

Sabloff, Jeremy A., and Robert E. Smith

Saler, Benson

Salmon, Merrilee H.


Sanders, William T.
1961 *Ceramic stratigraphy at Santa Cruz, Mexico.* *Papers of the New World Archaeological Foundation* 13, Publication 9. Provo.


Scheufler, Vladimir
Schiffer, Michael B.


Schiffer, Michael B, Theodore E. Downing, and Michael McCarthy

Shaughnessy, Roxane, and Paula Luciw
n.d. Untitled preliminary report on a regional survey of Maya communities in Western Guatemala, 1979. MS. on file, Office of the Conoh Ethnoarchaeological Project, Department of Archaeology, Simon Fraser University, Burnaby, B.C.

Sheets, Payson


Shepard, Anna O.


Siegel, Sidney

Smith, A. Ledyard

Smith, R. E.
1955 Ceramic sequence at Uaxactun, Guatemela. Tulane University, Middle American Research Institute, Publication 20. New Orleans.


Smith R. E., and J. C. Gifford

Snow, Bryan E., John M. D'Auria, Richard Shutler, Jr., and John G. Payne

Solheim, W. G.

South, Stanley

Spier, Robert F. C.

Stanislawski, Michael B.


Stanislawski, Michael B., and Barbara B. Stanislawski

Steponaitis, Vincas Petra
1981 Ceramics, chronology, and community patterns at Moundville, a late prehistoric site in Alabama. Unpublished Ph.D. Dissertation, Department of Anthropology, University of Michigan, Ann Arbor.

Stevenson, Marc G.

Stiles, Daniel

Stockton, E. D.

Sullivan, Alan P.

Taylor, Walter W.

Thomas, David Hurst

Thompson, Raymond H.

Tozzer, Alfred M.

Trens, Manuel B.
1942 *Historia de Chiapas, desde los tiempos mas remotos hasta el gobierno del general Carlos A. Vidal* (?...1927). La Impresora, Mexico.

Tschopik, Harry, Jr.
1941 Navaho pottery making. *Harvard University, Peabody Museum of American Archaeology and Ethnology, Papers* 17(1).

Turner, C. G., and L. Lofgren

U. C. (University of Chicago)


Whallon, Robert


Whitaker, Thomas W., and Hugh C. Cumler

Whittlesey, S. M.

Wilk, Richard, and William L. Rathje (editors)

Wilk, Richard, and Michael B. Schiffer

Willey, Gordon

Willey, Gordon R., W. R. Bullard, J. B. Glass, and J. C. Gifford

Willey, Gordon R., T. Patrick Culbert, and Richard E. W. Adams

Wisdom, Charles

Wolf, Eric
Wood, W. Raymond, and Donald L. Johnson

Wright, J. V.

Wylie, Alson

Yellen, John E.

Younger, Mary Sue