

Pots, Pans, and People. Material Culture and Nature in Mesoamerican
Ceramics



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POTS, PANS, AND PEOPLE

MATERIAL CULTURE AND NATURE
IN MESOAMERICAN CERAMICS

Eduardo Williams

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Cover: Tarascan potters working in their house patio (Zipiajo, Michoacán, Mexico. Author's photo, 1995).

Back cover: Hummingbirds on Tarascan ceramics (photos by Teddy Williams).

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This book is dedicated to my son Teddy,
to Warwick Bray, and to the memory of
Phil C. Weigand

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Preface

This book expands on my previous work in Michoacán, begun over 30 years ago, in which I adopted a holistic perspective that combines archaeology with ethnography and ethnohistory. My main goal has always been to produce processual information that is essential for interpreting the archaeological record by means of ethnographic analogy. My earlier books dealt with salt-making (Williams 2003, 2015), the aquatic lifeway in Michoacán (Williams 2014a, 2014b, 2022), and the ceramic tradition of the Tarascans of Michoacán (Williams 2017, 2018a, 2018b). All these books have an ethnoarchaeological and ethnohistorical orientation.

When I first arrived in Michoacán in 1990, I found that this was the ideal place for my chosen field of research, ethnoarchaeology. My first field project took place in Huáncito, a Tarascan village largely devoted to pottery making. After several years in Huáncito, I moved to the Lake Cuitzeo Basin, where I began working with the traditional salt-makers of Simirao, a town near the now virtually extinct lake (Williams 1999). Later, my research on salt-making took me to La Placita, a town on the coast of Michoacán where I was able to document a traditional salt industry that is no longer extant (Williams 2002). One thing led to another and after some time I returned to Lake Cuitzeo, this time to study the fishers, hunters, and artisans who were among the last remaining representatives of Mesoamerican aquatic lifeways in the whole of Mexico. In addition to Lake Cuitzeo, I worked in Lake Pátzcuaro, the former seat of the pre-Hispanic Tarascan Empire. There I was able to find crucial information for my study of the aquatic lifeway.

The present book is about ceramic production in Mesoamerica, following the perspective of material culture and human interaction with nature. But the book's scope goes beyond ceramics, for it includes many other cultural phenomena and activities explored in my previous studies, such as the Mesoamerican aquatic lifeway and salt-making. I also discuss such varied topics as agriculture, maguey (*Agave* sp.) exploitation, settlement patterns, household economy, and other aspects of Mesoamerican culture, all from an ethnohistorical perspective.

This extensive corpus of information provides a broad framework for understanding the main topic of the book; namely, the ceramic tradition of the peoples of several areas of Mesoamerica, from the northern frontier to the southern regions of that ecumene, over an extended period of time that runs from the era of the earliest villages and towns (some 4,000 years ago) to the arrival of the Spanish invaders in the 16th century.

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Chapter I. Introduction

*lumps of mud
through years of life
becoming vessels*
Derek P. Au

This book presents a systematic discussion of Mesoamerican pre-Hispanic ceramics following a holistic perspective that includes archaeology, ethnography, and ethnohistory as the author explores the theoretical background for the study of material culture and human adaptations to nature. The book is focused on three main topics: (1) Material culture, especially how people use ceramics and many other artifacts and tools to adapt to their environment. Material culture is the main source of information that archaeologists use to infer the economy, technology, social organization, and ritual practices of ancient societies. Thus, analyses of material culture play a crucial role in archaeological theory and methodology. (2) Cultural ecology, understood as the patterns of behavior that allow people to adapt to their environment, including their knowledge and use of specific natural environments and landscapes. Cultural ecology deals with many aspects of culture and the environment, including how humans solve their subsistence problems, how groups of people understand their environment, and how they share with others their knowledge of natural settings, resources, and landscapes. (3) The relationship between archaeology and anthropology, and the role of ethnoarchaeology as a possible bridge between these two disciplines. Both ethnoarchaeology and ethnohistory are indispensable for the interpretation of ceramics in the archaeological record, as the reader will see throughout this book.

In the chapters that follow readers will find descriptions of ethnoarchaeological research on ceramics and related topics. This is a good way to illustrate how material culture (ceramics in particular) interacts with nature through human action. The book contains a broad discussion of pre-Hispanic culture and life in general, which provides a context and background to the main subject: the ceramic traditions found in many places and periods of the Mesoamerican ecumene.¹

¹ The word ecumene comes from the Greek *Oikoumene*. For the ancient Greeks, this word meant 'the place inhabited by humankind'. It was used to define the known parts of the world where 'civilized' peoples lived, according to Arnold Toynbee (1976). For Phil Weigand (2000), the concept of the Mesoamerican ecumene refers to 'a sociopolitical and economic entity that encompassed not just extensive territories, but also a series of social systems that interacted with each other and collectively constituted the Mesoamerican

It is fair to ask what it is that makes ceramics a subject of study worthy of special attention. Carl Knappett *et al.* (2010) posed this question and answered with the following words: 'Ceramics are very often one of the most abundant categories of archaeological find... thus any archaeological analysis of material culture is bound to encounter ceramics sooner or later... ceramics are considered a key feature of human material culture because of what they are taken to represent in economic, technological, and evolutionary terms' (p. 588). The action of obtaining clay –a plastic substance that lends itself to making an endless variety of useful objects– and combining it with fire to create vessels, figurines, beads, and many other artifacts 'has frequently been assumed to mark a revolutionary (Neolithic) stage in the development of modern human thought and practice, forming with agriculture and sedentism a trinity of epoch-changing innovations' (p. 588).

Knappett *et al.* pondered why a pot should be marked out for special attention in an ethnographic setting, rather than a basket, a mat, or a stone tool. They asked if it would not be more worthwhile 'to examine categories of practice, such as "cooking", "containing", or "sheltering". In such a framework, the focus would fall on ceramics as containers first and foremost, to be considered alongside other kinds of containers such as baskets, gourds, and metal vessels' (p. 589). Knappett *et al.* 'believe that to treat "ceramics" as containers first, and as a technology of fired clay second, actually offers a rather different perspective on the innovation of pottery' (p. 589). Containers are among 'the most abundant categories of archaeological find... "containment" may well be the "function" offering archaeology one of the most important sources of... data and windows into the prehistoric mind, society, and culture; but very little is known about the cognitive, experiential, and evolutionary grounding of the concepts embodied in each and every container' (p. 590). Ceramics as a category of material culture encompass more than just containers, but once they became widespread with the advent of sedentism they became associated with two major forms of 'containment'. The first form, according to Knappett *et*

civilization' (Weigand 2000; Williams 2020).

al., is that of a pottery vessel, the second that of ceramic figurines. In the latter case, 'the association with containment is less direct but equally powerful, realized through the semiotic relation of these objects with the human or animal body, i.e., the biological container par excellence... it is not simply the knowledge about the properties of clay and fire that link these objects but a new way of thinking about the body that these objects bring forth' (p. 590).

In speaking of 'containment', Knappett *et al.* are not just concerned 'with the physical capacity of a clay vessel to contain... to hold a liquid, but rather with the interactive properties, possibilities, or affordances that emerge because of the vessel's ability to contain... Containers are not simply vessels but action possibilities that bring forth new forms of mediated action, agency, and material engagement, both in terms of use and manufacture' (p. 591). Indeed, these authors see pottery as a 'revolutionizing invention: an engine of social evolution, transforming people's capabilities and propelling them towards the modern world' (p. 598). This view is part of 'social evolutionary models of adoption that emphasize the superior performance of ceramic containers for storing, cooking, or serving food, and how these properties transform adaptive potential and create the possibility for socio-economic growth' (p. 598). Such models refer to a 'rational economy, retrodicting pottery as a fully formed technological complex in the assumption that its properties and potentials would have been... accessible and compelling to people of the past' (p. 598).

The relationship between technology and people could be seen in more dialectical terms, as a process of mutual determination, in which technology reacts to its social context, rather than revolutionizing it. Knappett *et al.* hold that 'innovation is a multistage process, beginning with invention in discrete centers of origin, followed by a wider dispersal along existing social networks... therefore, the decision to innovate is a straightforward question of adopting or resisting' external sources of knowledge and practice (p. 598).

Pottery is one of the elements of material culture most favored by archaeologists because it is abundant and durable, and because of the way in which each culture gave a particular shape and decoration to objects made of clay, thus distinguishing them from those produced by other peoples in other regions and times. But in order to interpret the archaeological record related to the human behaviors that produced and consumed the pottery we find, it is necessary to observe current pottery production and use. Compared to archaeologists, however, cultural anthropologists have generally shown scant interest in pottery artifacts and the activities and cultural traits surrounding them.

Like most other craft activities, pottery-making has been largely neglected by anthropologists, or deemed an activity of little relevance or importance (Arnold 1985).

This lack of interest in material culture is widespread among contemporary ethnographers and social anthropologists in Mesoamerica.² But archaeology is increasingly being nurtured by ethnology, though the two disciplines seem to have lost a once-shared interest and mutually understandable language. Hence, it is urgent to look for new common ground and a new dialogue between these two anthropological disciplines. In this regard, ethnoarchaeology has gained new meaning and serves as an unparalleled interdisciplinary bridge (Williams 2005a; see also Sugiura *et al.* 1998; Kramer 1985; David and Kramer 2001).

After examining the voluminous ethnographic literature describing pottery manufacture in Mesoamerica and other regions throughout the world, George Foster (1965) wrote that he was struck by the lack of attention given to the social, cultural, and economic contexts in which such work was carried out. Indeed, it is true that most extant descriptions refer only to manufacturing techniques and procedures, or to design elements. In general, beyond reporting whether pots are made by men or women, most recent studies reveal little about such matters as the potter's status in his or her community, the way in which potters see their own work from an artistic and economic viewpoint, the standards of the profession, or ranges of variability in a given community.

The development of ethnoarchaeology thus emerged as a direct response to the lack of interest in material culture among sociocultural anthropologists. Ethnoarchaeological research carried out among potters over the last 70 years or so has covered a wide range of topics, including technology, taxonomy, vessel function, as well as the longevity, recycling, and discard of pots. Other topics examined are the division of labor, learning processes, techniques, styles, ethnicity, distribution (of wares and styles), and technological and stylistic changes (Kramer 1985: 78). It might be said that archaeologists have been forced to become ethnologists—in the old sense of the word—in order to retain a direct link to anthropology in general, and to sociocultural anthropology in particular. This has not been a negative experience for archaeologists; indeed,

² This is characteristic of most recent studies, but not of ethnological works written in the early 20th century and before; for example, Boas (1948), Lowie (1912), and Kroeber (1948), among many others. This change in perspective came with the dominance of social anthropology over the ethnographic tradition, though the earlier authors (the best ones, in my view) had already adopted a material-culture perspective (e.g., Evans-Pritchard 1937).

quite the opposite is true: it has reinvigorated links with our ‘mother discipline.’

Objects made of clay were the first ‘synthetic’ materials created by humans, a sort of ‘artificial stone.’ For their manufacture, early artisans combined the four basic elements of nature identified by the ancient Greeks: earth, wind, fire, and water (Rice 1987: 3). The importance of pottery and ceramics in world culture since earliest times is evidenced by its role in one of the best-known creation myths. According to the *Book of Genesis*, when God created humankind, he used ‘dust from the ground’ (i.e., earth, the main component of pottery) and ‘breathed into his nostrils the breath of life, and man became a living thing’ (*Genesis 2: 7*). The word ‘ceramics’ is derived from the Greek *keramos*, which could be translated as ‘burnt thing’ or ‘clay ware’, though this pertains more to the fired product than the raw material; that is, clay. Ceramics can be defined as ‘the art and science of making and using solid articles that have as essential component non-metallic inorganic materials’ (Rice 1987: 3-4). The other term used in this study –pottery– is defined as ‘articles made of fired clay; the craft or profession of making such ware; a factory or workshop where such ware is made’ (*Concise Oxford Dictionary 2003: 886*), while the term potter (from the French *potier*) is defined as ‘one whose occupation is to make earthen vessels’ (*Webster’s International Dictionary 1898: 1121*).

Ceramics are one of the first and most enduring products of the ‘pyrotechnic revolution’ that, to a great extent, has defined humankind, and that still separates us from the rest of the animal kingdom. We know that the first stone tools in Africa have an antiquity of several million years (Jelínek 1975: 84), but it is impossible to ascertain the date of the inception of pottery-making and use by our early forebears. What we do know is that the oldest known ceramic objects date back only tens of thousands of years, but humans could have been experimenting with soft, malleable sandy or earthy materials in considerably earlier times, probably as long ago as hundreds of thousands of years. Those first clays manipulated by early peoples could have been used for ephemeral products such as body paint or decoration with naturally colored earths. But the defining moment for the history of the use of clay came with the application of heat that transformed that raw material into a hard, durable resource. This transformation was a relatively recent achievement in prehistory, and it has allowed fragments of baked clay to survive for millennia to be found and studied by archaeologists in the present.

The earliest archaeological evidence for the use of baked clay objects goes back to the artistic traditions of the Upper Paleolithic (ca. 22,000 BP) in central-western

Europe. In many Paleolithic caves one can see designs made with wet clay on walls and floors (Jelínek 1975: Figure 508), while another striking example of this emerging art form are the well-known ‘Venus’ figures, female representations with exaggerated sexual features like the ones made of raw or baked clay found in Dolni Věstonice, Czechoslovakia and dated around 32,000 BP (Bahn 1996: 215-216). These examples show that by the Upper Paleolithic people knew the principles of working with clay: its plasticity, its capacity to harden when heated, and the need to add ‘temper’; that is, solid substances to improve its qualities and make it easier to work (Rice 1987: 6-8). According to V. Gordon Childe, the need to prepare and store edible grains gave clay vessels unprecedented importance in early farming societies. By Neolithic times (ca. 8000-2000 BC), the manufacture of pottery vessels was a universal feature of all human cultures (Childe 1981 [1935]: 83).

The use of baked clay vessels did not originate in one single place or time in prehistory; in fact, it appears that this technique was invented independently in several unknown centers around the same time. In this regard, we should mention the Jomon complex of Japan, dated some 14,000 years ago (Clark 1977: 324-325). In many places, the earliest ceramic items known archaeologically show shapes and decorations similar to those of earlier artifacts made of tree bark, gourds, wood, leather, or woven baskets. This similitude raises the possibility that items made of baked clay may have evolved from earlier practices of using this material to cover, repair, or reinforce containers such as baskets made of reeds, rushes, or twigs (Rice 1987: 8).

In the New World, several archaeological sites have been found where ceramic traditions appeared for the first time, usually in small quantities compared to later periods. This pottery is associated with hunter-gatherer societies that were nomadic or semi-sedentary. Kennett *et al.* (2010) discovered ceramic deposits dated to between 7500 and 3800 BP on the Pacific coast of southern Mesoamerica at sites that may have been locations where foragers harvested shellfish and other estuarine resources. The Archaic period populations in that area were slash-and-burn farmers prior to the adoption of pottery and the proliferation of permanent villages and full-fledged agriculture during the Early Formative (ca. 1500 BC).

Several theoretical models have been proposed to explain the development of ceramic technology in the New World. The main ones emphasize the following factors: (1) food-processing; (2) food storage; and (3) feasting activities and food-serving (Pratt 1999: 71).³

³ To these functions for early ceramics we should add the manufacture and use of objects that served as ‘status markers,’ and so expressed the first symbols of social differentiation between small

The transition from the Archaic (ca. 8000-2000 BC) to the Formative period (ca. 1500 BC-AD 200) is one of the least understood aspects of Mesoamerican archaeology, though this transformation of groups of hunter-gatherers (who lacked pottery) to sedentary societies has been studied in the Oaxaca Valley, among other areas (Joyce Marcus and Kent Flannery 1996). According to this body of research, at some point between 1900 and 1400 BC, people in the Oaxaca Valley began to make objects of baked clay in a limited number of shapes, including hemispheric bowls and globular pots with or without necks. Generally speaking, the shape of those vessels mimicked that of vegetal containers, such as gourds. Extant samples of these early ceramic types are limited to no more than 400 potsherds found in archaeological contexts (Marcus and Flannery 1996: 74-75). Another example that suggests early pottery manufacture was uncovered in the Soconusco region of the state of Chiapas, Mexico, where the first phase of human occupation –Chantuto– pertains to the Archaic period. The general settlement pattern for this phase consisted of small nomadic groups whose lifeway depended on hunting, fishing, and gathering. Artifacts found in association with those people are scarce, just hammer stones and grinding stones made of pebbles, with a few obsidian flakes, but no pottery (Blake *et al.* 1995: 165-166). The following archaeological phase in this region is called Barra (ca. 1550-1400 BC); the first phase documented for the Formative period on the Pacific coast of southwestern Mesoamerica. Pottery made its appearance in this phase, but is remarkable for its high quality of manufacture and wide range of decorative techniques (Blake *et al.* 1995: Figures 5 and 6). At that time, potters used not only monochrome slips but also two- or three-colored slips, incised decorations, zone stamping, and grooves combined to form a wide variety of surface finishes. The two known shapes are *tecomates* (neckless jars) with flat bottoms (85% of the sample) and deep bowls (the remaining 15%). The people who made and used these clay vessels have received the name ‘Mokaya culture’. They used ceramic technology to complement, or replace, decorated gourds, likely for the purpose of serving food and drinks at public functions, rather than for utilitarian or domestic uses, such as food preparation or storage (Blake *et al.* 1995: 167-168). The term Mokaya comes from the Zoque-Mixe language, the one they probably spoke, like the later Olmecs. The most notable characteristic of the Barra phase is its pottery (Clark 1994: Figure 3.2), a highly decorated ware (primarily by burnishing) with a wide range of elegant shapes. This phase marks the beginning of an agricultural way of life with permanent settlements and a reliance on domesticated plants, including beans, avocado, maize and, perhaps, sweet potatoes and cacao. Fishing, hunting, and gathering continued in and around the

human groups (Blake *et al.*, 1995).

region’s many rivers and lakes, but as a complement to agriculture rather than full-time occupations (Clark 1994).

In later periods of Mesoamerican cultural development, ceramic traditions reached high levels of sophistication in both artistic and technological terms. Several manufacturing techniques have survived to the present: for example, firing pots in the open without a kiln. Although pre-Hispanic potters generally used open hearths to fire their clay objects, recent archaeological finds at Monte Albán, Oaxaca (Winter and Payne 1976), Comoapan, Veracruz (Arnold *et al.* 1993), and Tlaxcala (Abascal 1973; Castanzo 2004, 2009), among others, attest to the presence of potters’ kilns in the technological inventory of Mesoamerican ceramists. Known examples include, as well, complex pottery-firing techniques in the U.S. Southwest (Blinman 1993). Firing clay in kilns instead of open fires has many advantages: protection from wind and rain, higher temperatures, and better fuel efficiency, among others (Arnold 1985; Rice 1987; Shepard 1980). It is interesting to note that various archaeological sites in Oaxaca and Veracruz provide evidence of the coexistence of both firing types: specialized structures like kilns and open-air bonfires (Pool 2000). These cases not only remind us that the advantages of kilns are not absolute, but also refute the once widespread belief that kilns were introduced into Mesoamerica by the Spaniards in the 16th century as part of a technological complex that included the potter’s wheel and glazing (Foster 1955).

European methods and techniques of ceramic manufacture contrast with pre-Hispanic technology, which was based on hand-modeling, the use of molds and –as was also believed until recently– open air firing (Pool 2000: 61; Williams 2017). We now know, however, that kilns were used long before the Spanish Conquest, with cases reported in ancient and modern Oaxaca (Feinman and Balkansky 1997) and the Sierra de los Tuxtles, Veracruz, as mentioned above. According to Pool, in both ancient and modern contexts this variation in technology between two firing methods is a consequence of the level or intensity of production (Pool 2000: 61, 72). Based on his ethnoarchaeological work among potters in the Sierra de los Tuxtles, Veracruz, Philip Arnold (2005) linked the use of kilns or open fires to the availability of working space inside the potting compound.

Historical Background of Ceramic Studies in Mesoamerica

Here I present an overview of research on ceramics in Mesoamerica and other areas over time. Potsherds are usually a good source of chronological information for dating the archaeological contexts where they are

found, because changing styles provide one of the best clues for assigning time depth to the different strata or layers where pottery remains are unearthed. For this reason, archaeologists must learn everything possible about ceramics –their shape, decoration, and the slips and tempers used in manufacturing, and how pots were fired, among many other features– in order to contextualize pottery-making from a technological perspective. The value of simple classifications based solely on vessel design or shape, however, is limited. The creation of so-called ‘ceramic provinces’ that in time became ‘cultures’ (a custom particularly evident among archaeologists in Western Mexico in the first half of the 20th century) was a consequence of this simplistic (and normative) use of formal features that ignores other types of analysis, such as x-ray diffraction and neutron activation, which can help us study pastes, clays, slips, and pigments (Weigand 1995a). Also omitted from those early studies were the ethnographic and ethnohistorical components of Mesoamerican pottery production.

Because of its durability, pottery is often the most abundant material found in archaeological excavations. Many ancient indigenous peoples produced huge amounts of clay objects, which were discarded after breaking or becoming useless, thus forming superimposed layers of deposition. Once scholars recognized this phenomenon, a new chapter began in the history of archaeological thought and practice in Mesoamerica and elsewhere (Bernal 1981: 162). In 1784, Thomas Jefferson –later the third president of the United States– set out to investigate the nature of some funerary mounds on his property in Virginia. Jefferson had the unusual idea of performing a relatively well-controlled excavation that consisted in carefully digging a trench through the mounds. This allowed him to recognize different strata, making him a precursor of archaeological stratigraphy. Jefferson’s excavations were ahead of their time by at least one hundred years, and he is now regarded as a pioneer in the methods and approaches of modern archaeology (Willey and Sabloff 1980: 28).⁴

In 1894-1895, Sir William Matthew Flinders Petrie excavated the Pre-dynastic site of Naqada on the west bank of the Nile River, a cemetery with over 2,000 tombs that gave its name to the Naqada period of Egyptian prehistory. Petrie ordered the ceramic materials he found using a technique he called ‘sequential

dating,’ based on typological changes seen over time in superimposed burials (Daniel 1981: 118). While Petrie was working in Egypt in the late 19th century, several archaeologists in North America, notably Frank Cushing among the Zuñi Indians of New Mexico, were pursuing a functional explanation of the shapes of prehistoric artifacts that involved comparing them to products manufactured by modern native informants. Around the same time, Franz Boas recognized the potential of stratigraphy (a concept he borrowed from geology) for archaeology in the New World (Willey and Sabloff 1980: 79). Also in the late 19th century –1892 to be exact– Max Uhle began the fieldwork that would keep him occupied intermittently for the next 30 years in the Andean area of South America. Uhle developed a four-period cultural sequence using the concept of ‘horizon style,’ based on stylistic changes observed in pre-Hispanic ceramics. This method is still in use today, despite the time that has elapsed since its inception (Willey and Sabloff 1980: 79).

Moving forward to the early 20th century, we find that the first archaeological research in Mesoamerica that used the stratigraphic method occurred in the Basin of Mexico. Manuel Gamio, influenced by Boas, his teacher (who was in Mexico at the time, teaching at the International School of Archaeology and Ethnology), explored a deep pit in Culhuacán and a mound in San Miguel Amantla. Gamio called these explorations ‘the first and only excavation carried out with scientific methods in the Valley of Mexico’ (Gamio 1928). This research led him to define the Archaic-Teotihuacan-Aztec sequence, though he could not extend it to the rest of the Valley, much less to areas beyond it (Bernal 1981: 164). Gamio’s unique place in the history of Mexican anthropology was cemented because he pioneered a holistic approach to research, as is evident in his monumental work, *La población del valle de Teotihuacan* (Gamio 1979 [1922]).

In the same period that Gamio was working in central Mexico, Alfred Kroeber led an archaeological expedition to Nazca, Peru (1926) that allowed him to produce ‘the largest documented collection of Nazca mortuary goods in existence. No collection of this nature and size has ever been published in such detail... the reader will find individual descriptions of over 350 ceramic vessels, and... [many] nonceramic artifacts’ (Carmichael 1998: 18). The volume based on this significant archaeological project is *The Archaeology and Pottery of Nazca, Peru* (Kroeber and Collier 1998). According to the book’s editor, ‘this volume... represents Kroeber’s final thoughts on Nazca pottery –a subject that occupied him throughout much of his career. Introduced to Nazca studies by Max Uhle in the early years of [the 20th] century, Kroeber published Uhle’s collection from the Ica valley... in 1924.’ One year later, ‘Kroeber worked

⁴ Though Jefferson has traditionally been credited with the first archaeological excavation in the New World (Daniel 1981), we should remember an earlier instance of systematic excavation, performed by Don Carlos de Sigüenza y Góngora in Teotihuacan. This illustrious Mexican scholar was responsible, in 1675, for the first truly archaeological exploration, with goals and methods that distinguished it from a mere ‘search for treasures’ (Schavelzon 1983: 121-122).

in several valleys on the central and northern Peruvian coast and made a short reconnaissance down to Nazca... Kroeber's first two seasons in Peru were remarkably productive' and 'in later years, he devoted much of his Andean writings to documenting the 1925 findings' (Carmichael 1998: 18). The field methods employed during the 1926 excavations 'were remarkably thorough for the era; indeed, such standards were not applied in the region again until the 1950s' (p. 19). Kroeber was also ahead of his time in the use of stratigraphy. In fact, his work in Peru 'marked the first systematic use of stratigraphic excavation... Although standard practice today, the principles and applications of stratigraphy were largely unrecognized in 1926... Kroeber's work... is as valuable and applicable today as it was in 1926' (p. 19).⁵

The mid-1950s brought the first published synthesis of scientific analyses of Mesoamerican ceramics, penned by Anna O. Shepard (1980). Her book, *Ceramics for the Archaeologist* (original 1956, 10 re-printings up to 1980), is the definitive source of information on archaeological ceramics, and its publication was a watershed event in archaeological literature; one that inspired a wide range of specialized analytical procedures, including x-ray fluorescence, spectrographic analysis, and neutron activation, among others. Shepard's book is an indispensable source of information for archaeologists, as it presents with great clarity the essential facts concerning ceramic processes and materials. Indeed, it gives new meaning to the properties inherent to ceramics by evaluating analyses and descriptive methods in relation to their archaeological goals. Also covered in detail are the properties and sources of ceramic materials, with a summary of existing knowledge on this subject as it pertains to archaeological interests. The section on 'ceramic practices' is based largely on the methods used by non-industrial or 'peasant' potters, because Shepard believed that they offered many parallels to prehistoric techniques. The book provides suggestions for ethnologists as to how knowledge about pottery will enable researchers to produce more complete and useful recordings of material culture (i.e., ceramics), while the discussion of ceramic analysis touches on such key variables as shape and decoration, physical properties, the composition of materials, and manufacturing techniques. Shepard's study ends with a discussion of the interpretation of information on ceramics that deals with the following aspects: identification of 'intrusive' (i.e., out of context) ceramic objects; relative dating based on pottery; social relations between different groups in the past suggested by distinct ceramic styles; economic aspects

of pottery; and finally, the contribution of ceramics to the study of cultural history (Shepard 1980).

Another important and momentous contribution to ceramic studies appeared a decade after Shepard's book: Frederick Matson's (1965) *Ceramics and Man*, which set out to establish the basis of what would come to be known as 'ceramic ecology,' an analytical method that I will discuss at length later in this chapter. In the same period as Shepard and Matson, George Foster (1948, 1955, 1960, 1965) emerged as another pioneer in the anthropological study of ceramics from a holistic perspective by publishing some of the first works that can be called 'ethnoarchaeological' (though this word was not used at that time). In this context, we should also mention May Diaz's work in the village of Tonalá, Jalisco (today a suburb of Guadalajara), which is now a craft center of worldwide reputation. In her book *Tonalá: Conservatism, Responsibility, and Authority in a Mexican Town*, Diaz examines 'the nature of culture change in general and of industrialization in particular'. She was 'concerned with ascertaining the social and cultural changes which come to traditional societies... as a response to economic growth' (Diaz 1966: 2). This research was carried out among potters in Tonalá as that former Indian village was being absorbed by the growing, bustling urban growth of Guadalajara, the state capital, and a thriving industrial center.

Also in the mid-1960s, Eduardo Noguera published an encyclopedic volume called *La cerámica arqueológica de Mesoamérica* (1965, second printing in 1975), which was at the time the most exhaustive discussion of the different pottery traditions in Mesoamerica over time. It was a landmark when it appeared, and is still a fundamental work for archaeologists, anthropologists, and other scholars interested in this subject. A decade later, a particularly important addition to the anthropological literature on pottery-making in Mesoamerica appeared: Rubén Reina and Robert M. Hill's *The Traditional Pottery of Guatemala* (1978). It provides a comprehensive description of the different styles and techniques of manufacture found in Maya communities throughout Guatemala, enlivened by excellent photographs and vivid descriptions of a disappearing craft and a wider cultural tradition with still-discernible pre-Hispanic roots that was extant at the time.

In 1987, Prudence M. Rice published a book of encyclopedic scope on pottery based on her long record of scholarly research in Mesoamerica and South America, and an equally long list of publications on a wide range of topics: Maya political science; the collapse, transition, and transformation of ancient Maya civilization; the origins of pottery; the prehistory and history of ceramic kilns; and Peru's colonial wine industry and its European background, among others.

⁵ But we should note that Alfred Kidder, George Vaillant, and others were working in the Basin of Mexico and the Maya area at the time, applying similar ideas and methods to those of Kroeber.

The book that interests us here is Rice's *Pottery Analysis: A Sourcebook* (1987, second edition, 2015). The new edition (2015) incorporates more than two decades of growth and diversification in the archaeological and ethnographic study of pottery, and examines the raw materials used by potters worldwide in terms of their physical and chemical properties. Rice's study uses archaeological, materials science, ethnographic, and ethnoarchaeological perspectives on pottery production, and discusses how analyses of artifacts can provide insights into their culture of origin, be it prehistoric, recent, or contemporary.

Another important book, this one edited by Rice (1984), is *Pots and Potters: Current Approaches in Ceramic Archaeology*. This volume was conceived as a continuation and updated version of Matson's *Ceramics and Man*, with a primarily anthropological emphasis that sought to show how ceramics from different geographic and time contexts, when studied with the appropriate methods and analytical approaches, can provide valuable information about the people who fashioned and used the myriad ceramic artifacts found by archaeologists. Another important publication from that period is Dean Arnold's *Ceramic Theory and Cultural Process* (1985), in which the author sets out to develop a 'theory of ceramics' to further our understanding of the complex relationships that exist among pottery-making, culture, and society. His use of the theoretical perspectives of systems theory, cybernetics, and cultural ecology allows Arnold to make transcultural generalizations to explain the origins and evolution of the potter's craft. This study offers an innovative approach to archaeological interpretations of pottery that considerably increases our ability to comprehend the social, cultural, and environmental processes that encompass ceramic production.

In the book *Acatlán: A Changing Mexican Tradition*, Louana Lackey (1982) describes the materials, methods of manufacture, and forms of decoration characteristic of the pottery of Acatlán, Puebla. She discovered that Acatlán's Mesoamerican ceramic tradition dates to the Classic period (ca. AD 100-900). By studying pre-Hispanic potsherds, she was able to establish that potters there were working within a tradition that had considerable time depth. Lackey's conclusions are based on ethnographic research and archaeological fieldwork carried out in 1974, 1975, and 1977 in Puebla, where she worked with a family of craftspeople learning to make, decorate, and fire the ware in the kiln according to the *Acatleco* –i.e., native Acatlán– style. Although current vessel shapes may be new, the clay used to make them is identical to that employed to produce the famous pre-Hispanic ware known as Thin Orange, or *Anaranjado Delgado*, a ceramic type pertaining to the Classic period

that was traded throughout Mesoamerica, and whose exact provenience was only discovered recently.⁶

The book *Ceramic Ecology Revisited, 1987: The Technology and Socioeconomics of Pottery*, edited by Charles C. Kolb (1988), consists of two volumes with a collection of papers that report studies of ceramic artifacts and manufacturing processes, spanning aspects from raw materials procurement to methods of manufacture and decoration, to firing techniques and the distribution of finished products, with reflections on the cultural implications of all these observations. These contributions deal with a wide range of subjects including, among others, technical analyses of specialized ceramic products like *tuyeres* (blow tubes used in casting iron) and *candeleros* (portable incense burners). Also considered are ethnographic studies of the manufacture of clay pots, processes of innovation, and the diffusion of technologies (like some kinds of kilns and the *tornete*, or turntable), physical-chemical analyses of materials (clays, aplastics, potsherds) and, finally, functional and sociocultural interpretations of the pottery vessels and the people who made and used them. In their discussions of ceramic containers and other baked clay artifacts, all the authors sought to explore the interrelations between technical aspects of production and distribution and the sociocultural parameters linked to them.

A companion volume presented a second collection of essays also edited by Kolb (1989), entitled *Ceramic Ecology 1988: Current Research on Ceramic Materials*. Here we find new concepts, methods, and paradigms that include ceramic ecology, ceramic theory, and ethnoarchaeology. The chapters reflect the multi- and interdisciplinary approaches used in the study of ceramic materials and in analyses of the production and use of pottery artifacts. Most of the papers pertain to Mesoamerica, but there are also contributions based on many other regions of the world, such as North America and Asia.

Another collective volume published around the same time is *Kalinga Ethnoarchaeology*, edited by William Longacre and James M. Skibo (1994), a book based on twenty years of research in the highlands of northern Philippines. The papers assembled there examine pottery and basket-making in several Kalinga villages, revealing how people in a cultural setting pertaining to a tribal group like the Kalinga make, use, break, and discard their clay objects, and how pottery, woven baskets, and other items of material culture are related to human behavior. The contributing authors analyzed

⁶ Archaeological research by Evelyn Rattray (1990) in southern Puebla offered new data on pre-Hispanic ceramic workshops where the manufacture of Thin Orange ware –the most important trade pottery of Teotihuacan culture– took place. Rattray's report includes data on manufacturing techniques, production contexts, and the economic and social organization of the craftspeople involved.

a single set of ceramic data from different angles that reflect both traditional interests and new trends in the studies of village ethnoarchaeology. These essays adopt different perspectives of archaeological method and theory to examine the question of the correlation (or lack thereof) between social and material limits; how the use given to vessels may be inferred from the physical alterations caused by that use; why more large pots are broken in larger households; the relationships between household wealth and material possessions; how a system of ceramic distribution operates; and, finally, how and why technological change comes about.

Many other works could be mentioned, but for reasons of space I cite only the following titles and authors: *A Pot for All Reasons*, edited by Charles Kolb and Louana Lackey (1988); *Ceramic Ethnoarchaeology*, edited by William Longacre (1991a), and *The Many Dimensions of Pottery: Ceramics in Archaeology and Anthropology*, edited by Sander E. van der Leew and A. C. Pritchard (1984). In all these volumes, the reader will find innovative approaches that explore the anthropological, ecological, and ethnoarchaeological dimensions of potting activities and ceramic production in general, in both ancient and recent times. Last but not least, this holistic approach to ceramic studies has been carried on by Dean Arnold in several recent volumes that set the agenda for future research in the 21st century: *Social Change and the Evolution of Ceramic Production and Distribution in a Maya Community* (2008); *The Evolution of Ceramic Production Organization in a Maya Community* (2014); and *Maya Potter's Indigenous Knowledge: Cognition, Engagement, and Practice* (2018).

In the late 1950s and early 1960s, physical-chemical analyses of ceramics became increasingly popular among archaeologists, and this is still a commonly used technique. The most common methods of chemical characterization today are optical emission spectroscopy, x-ray diffraction, x-ray fluorescence, atomic absorption spectroscopy, and neutron activation analysis (NAA, see Rice 1987: 312, 373). The latter was first used in the 1930s and came to be applied to archaeological problems in the 1950s. It has since become the most important technique for studying the elements present in ancient artifacts. The principle behind NAA is as follows: as the radioisotopes present in a ceramic sample decay, they produce radiation with distinct types of energy, each one corresponding to a certain element. This energy is measured with a spectrometer to identify the different elements present. NAA is highly sensitive, as it is able to detect 75 of the 92 elements that usually appear in trace amounts (Rice 1987: 396-397; Glascock 1992).

All these studies emphasize research that employs scientific methods to solve archaeological problems

related to the production and use of ceramics. For example, detailed composition analyses of ceramics have often been performed to explore such processes as ancient trade, but they can also offer inferences concerning ceramic production in general, since the selection and processing of raw materials in antiquity is reflected directly in compositional data (e.g., Nieves *et al.* 2003: 27). Such scientific analyses help detect the use of resources from outside the production area that were procured through some sort of exchange pattern, involving either finished products or clays and other raw materials (Bishop *et al.* 1982: 275-276). It has become apparent, however, that scientific studies alone are insufficient to obtain a complete picture of ceramics in cultural and historical context. As a result, ceramic ecology and ethnoarchaeology entered the scene, as discussed below.

Material Culture and Nature in Ceramic Production: Ethnoarchaeological Perspective

In this section I discuss several cases that illustrate how ceramic ecology and ethnoarchaeology can open a window onto the interaction between culture and nature across the world and over extended periods of time. The goal of including this information is to underscore the processual approach followed throughout this book.

According to Arnold (1985), 'the cultural ecological approach seeks to generalize about cultural similarities and differences by analyzing the relationships of the technologies of cultures to particular environments. The ecological approach gives methodological priority to working out the relationships of the environment and the exploitative or productive technology' (p. 13), or 'the material culture of a society... Since ceramics are one kind of material culture and are part of the "exploitative technology", an ecological approach to ceramics should first analyze the relationship of the ceramics to the other subsystems of culture like the social and belief subsystems' (p. 14).

Although anthropologists have studied the ceramics of living people for a very long time, for Arnold 'one problem of interpreting ancient ceramics is that very little is known ethnographically about how ceramics articulate with environment and culture. What is needed is a ceramic theory drawn from ethnography which can be applied to the past' (p. 14). This is what Arnold accomplished in his book *Ceramic Theory and Cultural Process* (1985). In this book, written from an ethnographic perspective, Arnold makes a strong contribution to developing such a theory. The book 'provides cross-cultural generalizations concerning a series of relationships of ceramics to the environment and the rest of culture... in many societies around

the world... it provides an understanding of these relationships in space before the variable of time is added' (p. 15). Arnold combines the generalizing power of cultural ecology (and cultural materialism) with ethnoarchaeology to obtain general universal principles that are useful in interpreting ancient ceramics.

In a later book, Arnold (1993) calls ceramic ecology 'one of the most fruitful paradigms for developing a theory of ceramic production' (p. 3). In his view, the culture ecology approach 'seeks to generalize about cultural similarities and differences by analyzing the relationships of a culture's environment to its technology and social organization... the environment permits a range of choices that human beings can use for survival... cultural ecology is concerned with adaptation and the contribution that a culture's environment makes to its technology, social organization, and beliefs' (p. 3). Furthermore, the ecological approach 'gives methodological priority to working out the relationships of the environment and the... material culture of a society' (p. 3). Because 'ceramics are part of the "exploitative technology" the study of ceramics is compatible with the paradigm of cultural ecology' (p. 3).

The village of Quinoa, Peru, where Arnold's (1993) study took place, lies in the Ayacucho Valley in the south-central Andean highlands. The community of Quinoa consists of a nucleated village surrounded by dispersed rural settlements. The yearly weather pattern is characterized by two seasons: a wet season (December through March) and a dry season (May through August). The months of April, September, October, and November represent transitional periods. The first signs of the wet season appear in September with the amount and frequency of rainfall gradually increasing until precipitation reaches its climax in January and February. Most of the annual rainfall comes between December and March before letting up rather abruptly in April (p. 16).

There is a great difference in altitude from the top of the mountains to the bottom of the valley, and different elevations have different mean temperatures and amounts of cloud cover, sunshine, and rainfall. These differences account for the five major ecological zones on the eastern side of the valley (p. 21). The ecological zones discussed by Arnold (1993) 'have varying resource potentials for human populations, are exploited differently, and have a profound effect on population sizes' (p. 21). The first of the five ecological zones discussed here is the alpine rain tundra/subalpine wet paramo, a natural area encompassing the high mountainous area above 4,100 m. This zone does not support agriculture but serves as grazing land for llamas. The second ecological zone is the montane prairie,

located between 4,000 and 4,100 m above sea level. The montane prairie covers the upper parts of the steep slopes east of Quinoa and serves as an important food resource for the animals that graze there. Agriculture is practiced in this zone in addition to herding (p. 22). Agriculture in the prairie is limited to tubers, a high-altitude variety of quinoa, and a variety of Old-World crops like wheat, barley, peas, and broad beans. Much of the land is uncultivated since one to five years of rest are required for every three years of cultivation. Many wild plants grow in this zone, and they are used as fuel for firing pottery, in basket-weaving, and for culinary and medicinal purposes.

Below the prairie is the third ecological zone, the montane moist forest that consists of dense underbrush of small trees and shrubs 2.5 to 3 m in height. This zone covers the lower portions of the mountains. The fourth ecological zone is the lower montane savannah, which lies between 3,400 and 2,850 m above sea level. The upper boundary of the savannah coincides with the upper limit of irrigation and maize agriculture. Arnold calls the savannah 'the single most important agricultural zone in the entire region. The largest percentage of the population of the district lives here and it has the highest population density of all of the ecological zones of the district... The nucleated settlement of the village of Quinoa is located here as well as most of the highly dispersed rural households... The savannah is also the most important zone for irrigation' (p. 25).

The lowest ecological zone is the montane thorn steppe, which lies between 2,500 and 2,850 m above sea level. Less rain falls in this zone, and it is warmer and sunnier than those mentioned above. More moisture is lost in the lower montane thorn steppe through evapotranspiration, and there is less agriculture and little, if any, irrigation there. The last major ecological zone of the district of Quinoa is the irrigated alluvial flood plain which lies at the bottom of the valley. Crops grown in this zone include a variety of those cultivated in the higher zones (such as maize), and various fruits and vegetables. Cultivation is practiced year-round.

In summary, as one moves down the slope, the amount of sunshine increases, the mean annual temperature rises, and the amount of rainfall decreases. Similarly, 'the amount of evapotranspiration increases so that effective moisture content of the soil is reduced from zone to zone down-slope... Population is concentrated in the lower montane savannah while the remainder of the zones have very low population sizes' (p. 26).

In his discussion of the ecological interrelationships of the community of potters of Quinoa (chapter four), Arnold says that 'in an ecological approach to ceramics, the adaptation to the environment occurs through a

community of potters. The population of potters is the interface between ceramics and the environment, on the one hand, and the society, on the other' (p. 48). Although Quinua is widely known for its pottery, census data reveal that only about one percent of the population was engaged in ceramic production in 1967. Almost all these potters lived in the same sector of the community, while some who resided in dispersed rural settlements outside the village were considered to have a lower social position than the former.

Arnold concluded that Quinua potters lived in an ideal ecological niche for pursuing a combination of pottery making and agriculture. He wrote that 'the climate is generally favorable for agriculture, [although] the production of fired pottery is limited to the few months of the dry season and is prevented from developing into a full-time craft. Consequently, potters must turn to agriculture for subsistence. The agricultural land available to them, however, is marginal' (p. 69). At the same time, the land 'provides potters with basic ceramic resources (clay, temper, and paints) and because it yields a single wet-season crop, it gives them more time for making pots than they would have elsewhere. Pottery making thus helps compensate for the low productivity of the agricultural land upon which many potters live' (p. 69). Arnold concludes that 'the combination of pottery making and agriculture in the Quinua region therefore represents a complementary adaptation to a marginal agricultural area' (p. 69).

The systemic relationships linking the population of potters in Quinua to the region's environmental and cultural context are complex. Climatic patterns provide regulatory feedback for the craft because ceramics cannot be dried and fired during the rainy season. Limited household space also restricts production because the area required for making and drying vessels competes with living space (p. 70). As stated above, Quinua potters live on poor agricultural land that has limited moisture from rainfall and irrigation, and is sloping, traversed by gorges, and eroded. The erosion that creates poor agricultural land, however, also exposes valuable raw materials for ceramic production, such as clay, temper, paints, and slips, thus presenting an alternative to subsistence agriculture. In conclusion, environmental factors in Quinua combine to make agriculture and pottery manufacture complementary in both the seasonality of production and the location of many of the potters' households.

Another study of ceramic manufacture following the perspective of material culture and cultural ecology was conducted by Michael Deal (1998) among indigenous Maya communities in the Chiapas Highlands in southern Mexico. Deal recounts how, in his view, during the 1970s there was a perceptible shift in emphasis in

Mesoamerican archaeology from elite to residential excavations, and many archaeologists 'recognized that a better understanding of individual households was necessary before reliable inferences could be made about larger, more abstract social units (clans, lineages, etc.) and before a clearer understanding of the economic basis of... civilization could be attained' (p. i). Deal regards the household as the basic unit of ceramic production throughout Mesoamerica, holding that 'variability and patterning within a potting household are strongly affected by the level of pottery production, which is geared to household economic needs (both consumption and exchange)'. Other variables considered are 'the level of specialized knowledge and skill of the potter, the diversity and quantity of available pottery-making resources, and the efficiency of production' (p. 23).

Deal's study recognized three levels of household production, characterized in terms of differential household economic needs: domestic production, elementary specialization, and artisanal specialization. In the first level, domestic scale pottery manufacture 'was characterized by a low frequency of pottery making events, small quantities of a few vessel forms, and local consumption of the finished products... the goal of this level of production was to complete the household ceramic assemblage, replacing vessels broken during use, and adding new ones if necessary'. The second level involves elementary specialist pottery manufacture, which 'presents a more complex situation, since potters are influenced by social and economic forces outside of their own household. Pottery specialization is often equated with the relative intensity of production' (p. 23). In Deal's study, elementary specialists were usually 'women who were forced to contribute to the household economy by producing beyond the requirements of the immediate family. They might sell or barter surplus vessels to other members of the community, or... in the regional market' (p. 25). The third and last level of production involved artisanal specialists who '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, was carefully scheduled' (p. 25).

Deal mentions that, counter to archaeological expectations, the potters in his study did not always use the resources closest to their homes, but sometimes traveled long distances to fulfill ritual obligations or honor kinship ties. This contradicts the 'least effort principle' expounded by George Zipf in 1949. According to Zhu *et al.* (2018), Zipf held that 'based on the principle of least effort, it is human nature to want the greatest

outcome at the least amount of work... Zipf showed that useful behaviors were performed frequently. Frequent behaviors became quicker and easier to perform over time'. In short, 'people often chose their entire behavior along the direction of minimizing the effort. Basically, Zipf's law describes people's social behavior in space' (p. 1).

Deal adopted an ecological perspective to study the environmental constraints on production levels in his study area. He affirmed that 'the physical environment of the area in which the community is located is a factor that at the same time allows and constrains the level of production within a potting household' (p. 37). According to this author, 'pottery-making is a resource-exploiting technology... [and] the behavior involved in the production of pottery is related to various environmental conditions. These conditions are particularly important in terms of the procuring of resources, the seasonality of pottery production, and the scheduling of pottery-making activities' (p. 37). In the case under discussion, 'several environmental factors affected the time and location of pottery production, and... [the] paste composition, forms, and quality of the vessels produced... Varying outlays of time were necessary for the procurement of clay, tempers, and fuels... Resources were gathered from the nearest available source as they were needed. This was seldom outside a five km radius of the community' (p. 43).

Certain activities, such as the drying and firing of clay vessels, were highly susceptible to seasonal fluctuations of weather and climate, and these fluctuations also affected the scheduling of pottery-making because they might conflict with other activities like festivals, agricultural tasks, and childcare. Deal reports that potters would wait for the ideal weather conditions to completely dry the vessels. Newly formed pots 'were dried before firing to reduce plasticity through dehydration... special care was taken to ensure that vessels would dry properly' (p. 48). Pots were dried outside in the shade on sunny, windless days, but in rainy weather '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... Breakage due to cracking or accidental disturbance was very likely to occur during this process' (p. 48).

The final step in the production process is the firing of finished vessels, where three fundamental principles are involved: (1) the fuel used must generate temperatures of 500-1000°C; (2) heat radiation must be minimized; and (3) the burning fuel must not be allowed to touch the objects being fired. Because kilns were not used in the study area, potters had to meet these challenges in

several ways, like minimizing heat radiation by building a pyramid of fuel (e.g., firewood) 'around the vessels to be fired and using stones to hold the fuel and vessels in place... this arrangement' is called 'a temporary kiln' in which potsherds called 'wasters were placed between the fuel and the pottery to prevent the burning fuel from touching the vessels being fired' (p. 49).

In another part of the Maya area, Arnold (2008) studied traditional pottery production in Ticul, an indigenous Maya community in northwestern Yucatán. His research there follows a paradigm that involves pottery and social change, 'focusing on the relationship of changes in technology to changes in production organization, and how those changes can be read from ancient ceramics to infer increasing social complexity. Such complexity involves an increase in the number of social groups in a society and their interconnections' (p. 2).

Following Prudence Rice (1987), Arnold (2008) mentions several transition points linked to emerging socioeconomic complexity, observing that 'the first transition point... was the division of labor when some households became potters rather than farmers and exchanged their pots for food... the second transition point occurred when pottery making became more efficient, technological changes made economics of scale possible, and pottery became more standardized' (p. 3).

Arnold refers to the work of Cathy Costin (2005), who affirms that the production of all crafts should be considered together, as a systemic whole. According to Costin (2005), 'in recent years, the study of craft production has become a significant component of archaeological enquiry... This is due in large measure to the relevance of such investigations in broader studies of material culture, economic organization, political economy, sociopolitical organization, and exchange' (p. 1032). In Costin's discussion of technological complexity and specialization, we read in part that 'technological complexity is often cited as evidence for production specialization. The rationale is that only specialists... can invest the time or other resources necessary to acquire and master complex tools and bodies of knowledge'. The problems with assessing technological complexity include 'the lack of empirical evidence to support the assumption that there is a strong correlation between technological complexity and organizational complexity (such as specialization or the establishment of workshops)' (p. 1069). However, Arnold (2008) disagrees with Costin in that he believes 'pottery production is uniquely different from other crafts. These differences include the unique nature of clay minerals that require certain environmental conditions for fabrication, drying, and firing' (p. 4).

Social change among Ticul potters is at the center of Arnold's (2008) research interests in the book under discussion. The author tells us that in the three decades he worked at Ticul (1965-1997), the town underwent 'many social changes. The population has almost doubled... and the transportation infrastructure has expanded, facilitated travel to Mérida [the state capital] and to communities in the interior of the peninsula [of Yucatán]... During the same period, the Mexican government invested in additional infrastructure, such as schools, piped potable water, and electricity' (p. 31).

In discussing the evolution of full-time pottery specialists in Ticul, Arnold mentions that 'one of the principal ways in which the social context of pottery production has changed is the increase in its intensity from part-time to full-time specialists. Up until the 1960s, many potters were part-time specialists and cultivated maize using slash-and-burn agriculture' (p. 37). According to Arnold, this farming method was compatible with pottery making for four reasons: (1) slash-and-burn agriculture provided potters with their basic subsistence crop, maize; (2) this form of agriculture provided ceramic specialists with a crucial by-product for their craft (that is, fuel for firing the pots. In each trip to the field for clearing, planting, and weeding, the farmer could transport one or two bundles of firewood back to his home); (3) the amount of labor required by this cultivation system allowed the potter to grow maize (and perhaps other cultigens as well) and still make pottery on a part-time basis; and (4) most activities linked to traditional agriculture, 'such as cutting the forest, burning, planting, cultivating, and harvesting can be scheduled so that they can complement, rather than compete with, pottery-making activities' (p. 37).

Arnold reports that 'the importance of slash-and-burn agriculture for potters has declined greatly since 1965 as the craft has become increasingly full-time. In 1965 and 1966, many swidden farmers still existed in Ticul, but... only a few potters planted maize plots... by 1984, potters' use of slash-and-burn agriculture had declined greatly and only one elderly potter practiced it' (p. 38).

Arnold also posits the following question: 'How has firing technology changed?' In response, he narrates how 'in spite of its critical role in the behavioral chain of pottery making... firing has not figured prominently in theories of specialization, or in theories of the evolution of the craft. Differences in degree of firing have been inferred as the result of a more efficient firing technology' or explained by the fact that 'some firing techniques provide more control over the firing process than others' (p. 281). Arnold discusses changes in kiln-making technology at Ticul, pointing out that 'traditionally, Ticul potters have used two different

types of firing technology: one for cooking pottery, another for non-cooking pottery' (p. 284). Each type of firing 'utilized a different beehive kiln of probable Moorish origin...[however] the production of cooking pots has been largely abandoned since 1965' (p. 285), so Arnold's focus shifted to changes in firing technology that occurred in the production of non-cooking pottery.

Arnold holds that 'in general, the changes in firing technology since 1965 have paralleled... changes in other production steps in the behavioral chain of pottery making... First, as a result of the segmentation of tasks in the production sequence, firewood procurement specialists and firing specialists have emerged parallel to the development of specialists in clay and temper mining' (p. 304). Second, although the Mediterranean beehive kiln is still the predominant type in the study area, 'potters have innovated and expanded their repertoire of kiln types... [ranging] from the more traditional beehive kiln to the capital-intensive gas kiln that was introduced in the modern ceramics industry' (p. 304).

In analyzing these processes of change, Arnold holds that 'enhancement has been the most widely adopted category of innovation. These enhancements include the use of cement facing on the outside of the traditional kiln to make it more maintenance-free' (p. 305). For Arnold, 'the total number of kilns, their increased size, and the mean kilns per production unit are... surrogate measures of the increased scale and intensity of production'. Those potters have developed new techniques that reduce maintenance for their kilns. As a result of this change, nowadays 'increased task specialization separates those who fabricate the pots from those who fire them' (p. 306).

Ceramic ethnoarchaeology is concerned primarily with material culture in systemic context, as shown by Carol Kramer's (1997) work with traditional potters in Jodhpur and Udaipur, two urban centers in Rajasthan (northwest India) during the 1980s. Kramer's 'archaeologically oriented ethnographic fieldwork was designed to identify and characterize vessels' sources, to examine the scale and diversity of ceramic assemblages in settlements of differing size, and to evaluate patterns of ceramic distribution in the context of sociological relationships linking producers and sellers' (p. 1). Kramer explores sociological relationships between the producers of fired-clay wares and those responsible for their distribution, affirming that 'details of ceramic distribution, encompassing a variety of strategies for moving commodities through space, are comparatively underreported ethnographically' (p. 1).

We saw earlier that 'archaeologists often assume that movement-minimizing and "least effort" principles

affect the spatial distributions of artifactual remains' (p. 2). But Kramer found in her research in India that 'some of the... data discussed here suggest that such assumptions... are not always correct, in some circumstances, sociological proximity overrides spatial closeness, and in distributing commodities kin and other kinds of corporate social groups travel further than they need to' (p. 2).⁷

Additional archaeological questions addressed by Kramer 'concern the spatial organization of ceramic production... and material correlates of ceramic specialists' work and sales or distribution areas'. In this regard, she writes that 'archaeologists need empirical information about the scales at which pottery moves across the landscape, and about objects and facilities associated with ceramic specialists' (p. 3). Kramer discovered that in her study area 'in addition to commercial sales in the market economy, pottery is distributed within the *jajmani* (patron-client) system, which entails the exchange of goods and services and links families over generations' (p. 38). It is important to note that shops in both Jodhpur and Udaipur 'offer earthen wares imported from a number of external sources in addition to locally produced wares. These and local pottery are distributed by a variety of mechanisms and at diverse scales' (p. 38).

According to Kramer, some 50 vessel types were made in both Jodhpur and Udaipur by members of the Hindu *Kumhar* caste, and by Muslim potters in villages surrounding Jodhpur. She found that household production could vary with household size and composition, or with the existence of other activities, such as farming. In both urban and rural settings, men produced the vessels, and women decorated them. Pigments were occasionally imported from distances greatly exceeding those from which the clays were brought. Urban potters used a variety of clays, and the distances over which clays traveled were typically below 50 km (p. 79).

Kramer wrote that 'both urban and rural Rajasthani potters can be considered craft specialists, and their workplaces are characterized by features that should leave archaeologically recoverable traces' (p. 80). Many urban potters store their clays inside their house compounds, and workshops include storage areas for fuel, clay, and recyclable sherds and vessels, as well as

an area for bonfires for firing pottery (see Kramer 1997: Figure 35). She further found that 'utilitarian earthen wares are often sold from shops, many of which are attached to the homes of potters and vendors... Many pottery vendors... also sell a wide variety of other goods, including fresh produce, fast foods, diverse dry goods, and fuels... Pottery shops in both Jodhpur and Udaipur are morphologically diverse, and some are very ephemeral' (p. 107).

In discussing ceramic distribution, Kramer says that 'pottery... moves into and within Jodhpur and Udaipur on a variety of conveyances, ranging from human bodies to trucks. It is purchased in bulk in one-time arrangements as well as on routinized, repeated consignment; some such sales involve export from the cities, but most sales seem to involve pottery that is already within a city, regardless of where it was manufactured' (p. 133).

Kramer also discusses many external sources of pottery. She wrote that 'large quantities of utilitarian pots are imported to both cities from settlements of varying size and at varying distance, most of them... small and within a radius of 30 km... the relationship between distance of source and cost of commodity is sometimes more complex than is often assumed by archaeologists... imported wares found in the cities tend to be distributed in neighborhoods nearer their external sources' (p. 166).

The archaeological implications of Kramer's work are relevant to the present study of Mesoamerican ceramics. One example is the distance within which Rajasthani potters take their own wares for distribution (usually on foot). A range of 10-20 km was mentioned frequently, and similar distances have been reported for a wide range of societies in which ceramic distribution is by foot, including Mesoamerica and other areas of the New World. Without access to draft animals, wheeled vehicles, trains, boats, or planes, 'one might reasonably expect to find the highest density of wares made in a particular settlement within a radius of approximately 20 km... pottery and other goods are often moved greater distances by consumers who extend the range... middlemen bring pots to localities 50 km and more from the places in which they are made' (p. 176).

Daniel Miller (1985) studied pottery manufacture in the village of Dangwara, in central India. Miller holds that material culture is a neglected source of evidence in the social sciences, while archaeology's goal is to use ancient artifacts to understand past societies. He believes that material culture studies can assist in the 'highly problematic task of translating objects into peoples' (p. ix), since artifacts are objects created and interpreted by people, and 'embody the organizational

⁷ In their study of traditional ceramic manufacture in the Valley of Guatemala, Arnold *et al.* (1991) found that compositional analysis of pottery on its own cannot be used to search for the clay source(s) exploited by ancient potters. Instead, they hold that a middle-range (i.e., ethnographic) theory must be used to understand the relationship between raw materials (clay, temper, pigments) on the one hand, and cultural conventions behind resource selection and paste preparation, on the other. The trade structure of the region in question should also be considered. Clearly, 'least-effort' criteria are not always warranted as the sole basis of explanation.

principles of human categorization processes... the artefactual environment [is] one of the main products of social action' (p. 1).

Miller's study 'takes the form of a micro-analysis of the pottery found in a single village, including the details of rim form, body angularity and decorative technique which are the familiar domain of... archaeological analyses' (p. 1). His intention is to explore the information about social relations that these typically archaeological procedures can reveal when applied to contemporary as well as ancient artifacts (p. 1).

The major source of evidence used in Miller's study is the material world, and the primary subject of analysis is material categories, which 'represent an order that is imposed upon the world through the creation of material objects. As such they are part of the overall creation of cultural order and may be used for the study of the social and material relations of which they are a product' (p. 10). For Miller, 'the physicality of objects is most significant when they transcend the individual life to provide the material environment for the reproduction of society... there may come a point at which significant social change manifests itself in changes in the material world, which itself serves as a prime source for the objectification of social relations and conceptions as to the nature of society' (p. 12).

Miller does not see clay vessels as 'facts' with unproblematic, measurable variability explicable in terms of general laws. Rather, he sees pottery 'as a "construct", a part of the creation of a cultural environment in which to live out practical pursuits and interests... Manufacture creates a "text", which is subject to reinterpretation according to the differences in perspectives of individuals and groups in the society, and the different contexts in which interpretation occurs' (p. 13).

In discussing the context of his fieldwork, Miller states that the choice of vessels made of fired clay followed from the aims of the project. Pots were chosen because of their importance in archaeological research, and also because 'of the variability of earthenware in many societies past and present, compared to other artefactual remains' (p. 15). The research method was designed to understand the variability represented by pottery in Dangwara by relating it to its social context. For this purpose, an Indian village presented several advantages, including 'a developed, literate, classical tradition, with detailed commentaries on the organization and interpretation of many of the ideals relating to social organization and ritual' (p. 15). What interested Miller the most was the physical creation of material categories, or the relationship between the process of pottery manufacture and the variability of the pottery forms. In his view, the most basic aspects

of an ethnographic account of ceramic production are the descriptions of the various processes of pottery manufacture and an account of the various types of pottery produced. However, 'the two may be placed in juxtaposition, [and] how precisely the latter emerges from the former is often quite unclear. This problem... should be seen in the general context of ceramic ethnography' (p. 34).

Since the pottery studied by Miller is produced by a series of physical processes, he suggests that the resultant shapes are in part the product of the tendencies of the technological processes involved. However, if pottery is analyzed as a series of material categories, one could argue that 'a certain pattern is required of this series of shapes. This leads to the... question [of] the kinds of technological methods required by the demand for a particular type of material object' (p. 35). In Miller's opinion, 'neither technology nor product should be regarded as "given"; rather, the dynamic of the relationship between them needs to be explored... under the notion of "style". This term... may refer to numerous aspects of a set of material objects' (p. 35). Style, then, is 'that which makes possible the recognition of an individual item as a member of a group, which in turn is associated with a given place, time and people' (p. 35).

According to Miller, 'the factor which allows style to operate in this manner is the structured relationship between attributes of the members of a set of material objects.' This notion of style 'provides a perspective from which to investigate the processes of manufacture. Each stage in the manufacturing process may be considered as contributing its measure of differentiation, by creating a dimension upon which variability, as style, may be structured' (pp. 35-36).

Miller found that the production of pottery vessels at Dangwara comprised four major stages: throwing on the wheel, beating out the base, decorating, and firing. When analyzed from the perspective of the production of variability, each stage contributes in different ways to the final product. The four stages may be summarized as follows: (1) throwing the pot on the wheel creates differences in shape; indeed, all vessels are to some extent differentiated at this stage; (2) forming the base of the vessel is achieved by using a wooden beater held to the exterior and a stone 'anvil' inside the pot; (3) decorating may involve a form of indented design applied during the throwing on the wheel; (4) firing, finally, provides a simple dichotomy between red or red-and-buff wares on the one hand, and black ware on the other.

The activities outlined above help put these manufacturing processes in context. However, according to Miller they 'tell us little about the use

of particular techniques in relation to the general “style” of Dangwara pottery... The techniques do not determine the form of the distinctions used in creating the pottery series. Rather, certain “dimensions” may be viewed as having been selected, and used as a focus for differentiation, exploiting particular aspects of the production process’ (p. 49). The use of these ‘dimensions’ presents a strong argument ‘for analyzing the material as a corpus rather than as individual forms, since... it is the very elements which divide the categories that also unite them in the creation of a distinctive style’ (p. 49).

Miller’s study included an analysis of the paintings on Dangwara pottery, finding a ‘bewildering... array of variability’, an impression ‘reinforced by observing the rapidity of execution and the subsequent “loose” style. The term “style” is... appropriate here since any individual example can be recognized as characteristic of the region’ (p. 94). Miller searched for the underlying dimensions of variability that help identify such a style, while simultaneously ‘looking for patterns in the way these dimensions are exploited to generate the observed paintings, and then [attempting] to find evidence for the further manipulation of these designs in relation to cognitive and social codes’ (p. 94).

Another line of enquiry that Miller followed dealt with the relationship between the variability of the material culture under discussion and the society that produced it, a relationship usually presented in archaeology ‘in terms of a general notion of social information or interaction, rather than as an analysis of material culture in its specific context’ (p. 95). Miller mentions ethnographic work by Hodder (1982) that ‘challenges the assumptions underlying both the social-interaction and the information-exchange theses... Hodder’s own analysis relates the structural principles underlying style in a variety of media, in order to construct a more genuinely contextual approach’ (p. 95).

In the course of his research, Miller ‘developed a formal system for recording the designs used on pottery’. In his view, this was ‘the most efficient method of reducing the observed variability’ since it accords ‘closely with both the order in which painting is carried out and the order in which it is learnt... this formal order can be used as a criterion for distinguishing primary representation from secondary interpretation of individual designs’. Miller also found that ‘some of the underlying structural principles may be related to Hindu devotional symbolism’ (p. 119). In his study of pottery types as categories among the Dangwara ethnic group, he sought to understand ‘the factors which generate the variability of the Dangwara’s pottery assemblage as a set of material categories. The dominant theme... [is] the relationship between those processes which may create a formal order or normative structure and

the contextual practices which result in the observed variability’ (p. 161).

In conclusion, Miller’s work, as discussed here, is relevant to my study of Mesoamerican ceramics because it offers ‘an approach to material culture by which the variability of artifacts is interpreted through their analysis as categories. The majority of the theoretical models and methodological problems discussed... have derived from archaeology... it has often been assumed in archaeology... that archaeologists are searching in their classifications for something which is self-evident to the anthropologist or student of contemporary material culture’ (p. 197). According to Miller, it is often assumed ‘that there are relatively unproblematic cultural categories in the living population to which the archaeologist is attempting to approximate’ and that the problems faced in this endeavor ‘are peculiar to archaeology and the nature of the archaeological record, and therefore that the approaches to be developed are also unique to the discipline’ (p. 197).

One of the major implications for archaeology of Miller’s book (1985) is the ‘demonstration of the fallacious nature’ of the assumptions presented in the previous paragraph. Instead of that approach, he holds that ‘the importance of material culture lies in the ineliminable relationship by which subjects and objects are mutually constituted’ (p. 205).

The last book discussed here is *People and Things*, by James Skibo and Michael Schiffer (2009). Rather than adopting an ethnoarchaeological approach, this book adds a behavioral outlook to studies of material culture. In discussing their behavioral orientation, the authors point out that the ultimate goal of archaeology is to discern the relationship between people and things. Due to the lack of informants and, in most cases, written sources from the distant past, archaeologists must reconstruct past life through the analysis of artifacts; that is, things made, used, and modified by people while performing their everyday activities. Behavioral archaeology holds that our ability to understand the relationship between people and things in the present is the basis for archaeological reconstructions of the past.

Skibo and Schiffer hold that ‘the study of the human-made world, whether it is called artifacts, material culture, or technology, has burgeoned across the academy. Archaeologists have for centuries led the way, and today offer investigators... conceptual programs for engaging the things, ordinary and extraordinary, of everyday life’ (p. v). In the days of Gordon Childe (1892-1957), they write, the emergence of pottery seemed like a sudden, easily understood phenomenon. The thinking was that by making pottery sedentary farmers heralded the beginning of the Neolithic revolution

worldwide. While this is still generally true, 'more recent research and better dating techniques have made this once simple equation between pottery and sedentary agriculturalists much more complicated... We now know that mobile hunter-gatherers made pottery... and some cultivators... actually abandoned pottery technology' (p. 37).

This study by Skibo and Schiffer explores the emergence of ceramics on the Colorado Plateau of the Southwestern USA (a region encompassing parts of Utah, Colorado, Arizona, and New Mexico). They focused their study on a sample of clay vessels dating from AD 200 to AD 600, applying a 'performance-based analysis' in their research in which 'the functions of the... vessels are inferred through an analysis of morphological characteristics and use-alteration traces' (p. 37). The study collection, drawn from three sites in northeastern Arizona, was 'dominated by globular neckless jars... these vessels would have performed very well... as storing, cooking, or processing [containers]... use-alteration analysis suggests that some... were not used over a fire, whereas others were used [for] cooking... many... were used for alcohol fermentation that caused extreme interior surface attrition' (p. 37).

Skibo and Schiffer explore several scenarios for the origin and spread of ceramics worldwide. They claim there is a 'relationship between pottery making and sedentism, and... [a] correlation between pottery and more intensive forms of food processing'. An important reason for 'the correlation between pottery and sedentism is that pottery making is a technology that takes some investment... among contemporary potters' (p. 38). For example, once a good clay source is found it may be exploited for a very long time because of its known and acceptable working properties. Skibo and Schiffer hold that 'at least seasonal sedentism may be required for pottery manufacture'. Sedentism is important for ceramic manufacture because of scheduling conflicts, so 'potters must be near a good clay source during a season of the year when potting is possible and when they have time, free from other tasks, to make pots' (p. 38).

The second generalization discussed in this book concerns pots as tools for food processing. The authors affirm that potsherds 'are the most ubiquitous artifact found at Neolithic... villages worldwide because ceramic vessels had become an essential tool for the processing of staple cultigens' (p. 39). Clay vessels allowed high temperature food processing for long periods of time. High temperatures are essential for making many foods palatable and digestible, and 'compared with other cooking containers, pottery vessels permit direct heating with less constant attention... Ceramic vessels also provide sturdy processing containers for

preparation techniques such as fermentation or alkaline soaking that may break down other types of containers. Clearly, ceramic containers provide many advantages as cooking and processing tools, permitting the exploitation of many new foods and the more effective processing of others' (p. 39). Food processing, however, cannot explain every instance of early pottery. In some regions of both the Old and New Worlds, the earliest ceramic vessels were not used for food processing but, rather, were important artifacts of ritual activity.

Skibo and Schiffer review two models that have been proposed to explain the origins of pottery on the Colorado Plateau. The first (espoused by James Brown, cited in Skibo and Schiffer 2009: 40) takes an economic approach and suggests that 'pottery is adopted when other types of containers, such as baskets or skins, fail to meet the increasing demand brought about by new types of food processing, new forms of storage, or the emergence of food presentation as a form of social expression... Thus, pottery was not used because of some foreseen potential but rather because it was a container that could be made cheaply and quickly by semisedentary groups' (p. 40).

The second model, presented by Brian Hayden (cited in Skibo and Schiffer 2009: 41) looks at prehistory 'and does not see people trying to solve the practical problems of life, but rather... individuals involved in economically based competition'. In this view, technological advances and more sedentary settlement and subsistence systems are prerequisites for the emergence of pottery. As people settle down and food sharing 'is no longer required for survival, there is a worldwide tendency for increased economic competition along with more pronounced inequality. In this context, pottery first appears as a prestige food container made by individuals in direct competition with their neighbors' (p. 41).

In discussing the emergence of Ancestral Pueblo pottery, Skibo and Schiffer state that it 'is known worldwide for the elaborate forms, made without the help of the [potter's] wheel, and its intricately painted designs' (p. 41).⁸ From an artistic perspective, Ancestral Pueblo ceramic containers are among the most sophisticated examples of the potter's trade. From the viewpoint of Southwestern archaeology, 'no single artifact class has played a more important role. From defining culture groups and marking the passage of time, to inferring population size and social organization, pottery from the Colorado Plateau is usually at center stage. But... very little attention has been given to the origins of

⁸ The bibliography for Southwestern pottery is too voluminous to consider here in detail. For ethnographic examples, see Dillingham and Elliott (1992), Hayes and Blom (1996), Marriott (1989 [1948]), Trimble (1987). For a pre-Hispanic example see Leblanc (1983).

this pottery' (p. 42). Skibo and Schiffer tell us that the first pottery in the Colorado Plateau was probably made sometime before AD 300. This pottery 'is a plain polished brown ware... in most... cases the pottery appears to be locally made... this early brown ware represents a pan-Ancestral Pueblo ceramic tradition... made using the coil and scrape technique with the possible exception of [the] Adamana Brown... which may have been finished using a paddle and anvil' (pp. 42-43).

Skibo and Schiffer's research involved 'both an analysis of whole vessels and a preliminary clay resource survey from parts of Arizona to parts of New Mexico'. Their objective was 'to... understand why people started making pots at this place and time, and why the technology changed so rapidly to the typical gray wares' (p. 44). Initial laboratory analyses focused on collections of whole vessels, recording their formal characteristics to draw inferences about their intended function. The use-alteration patterns of interior carbon and exterior soot deposits, as well as attrition patterns, were recorded in an effort to determine actual vessel function. Most of the ceramics are an early brown ware referred to as Adamana Brown. This ware is lightly polished and tempered with fine sand that may be naturally included in the clay source or augmented by the potter. Many of the vessels are globular neckless jars known in Southwestern vernacular as 'seed jars' (this shape is almost identical to the Mesoamerican *tecomates*) (p. 45).

According to Skibo and Schiffer, 'the globular shape of these vessels is a very strong structural design that would impart strength in both the manufacturing and use stages. Shapes approaching spherical... would be more likely to survive drying without cracking' (p. 46). The same formal properties would also give the vessel a good deal of strength in use, since 'curved surfaces have greater structural integrity and thus can better withstand the strains imposed by both thermal shock and physical impact... In the seed jar shapes, the strength of the pot increases as the orifice diameter decreases... Moreover... the restricted opening would limit loss of heat during cooking or spillage during transport or storage' (p. 46). Polishing or burnishing can also greatly influence vessel performance, especially impermeability. The technical properties of these seed jars 'create vessels that would perform well in both cooking and storage... The two most important performance characteristics of cooking with water are thermal shock resistance and heating effectiveness... the early brown ware seed jars could have adequately performed cooking, storage, transport, or food processing. These designs are multifunctional' (p. 47).

Most seed jars analyzed in that study were examples of the Obelisk Gray type from the Prayer Rock Caves

collection. Skibo and Schiffer mention that some cooking pots had exterior soot stains, suggesting they were placed over the fire on rocks or on some form of support. The interior of one of the vessels had a carbon pattern typical of pots that heat food without water. This can indicate that seeds or some other foods were roasted or boiled in the pot until all or most of the water had evaporated. Cooking a thick gruel would also create this pattern. One of the vessels in the study collection had an interior carbon pattern more typical of cooking food with water, since when one boils water some organic particles usually spatter from the water surface, adhere to the vessel wall, and carbonize (p. 48).

The best evidence for cooking comes from three seed jars from Sivu'ovi, an archaeological site in the Petrified Forest National Park (Arizona). One of these vessels 'demonstrates the classic carbon pattern associated with boiling food. The exterior base is slightly oxidized, which is created by having an intense fire under a pot that is raised on rocks or some type of support... The lower third of the exterior wall has a heavy patch of soot, which gradually fades above the midsection toward the rim. The interior of this vessel has the band of carbon that forms in pots used to boil food' (p. 49). The largest of the seed jars has a similar soot-carbon pattern. This vessel also has a heavily abraded interior, most likely caused by the fermentation of some liquid (p. 50).

Skibo and Schiffer conclude their study by stating that 'the correlation between seed jar design and function suggests that the vessels could perform well as cooking, storage, or food-processing vessels. There is evidence that some of the vessels were used for cooking, while others were not, although the exact function of the noncooking vessels is not known. The heavy interior abrasion visible in some vessels suggests a chemical erosion most likely caused by fermentation' (p. 51).

The earliest pottery on the Colorado Plateau was made by semi-sedentary pit house dwellers who early on began to cultivate maize and other domesticated crops. Skibo and Schiffer suggest that the adoption of pottery on the plateau was 'a family-by-family decision. The evidence for the brown ware pottery, though widespread, is very scattered. It is likely that between AD 200 and AD 400 there were families that made and used pottery living next to people who did not adopt this technology' (p. 51). The range of technological variability in early brown ware suggests that individuals might have been copying a design, for example a seed jar form with sand temper and a roughly polished exterior, but attempted to make it with local resources. New variants of maize were appearing at that time, and may have prompted different ways of processing in ceramic vessels. Thus, the adoption of pottery could be explained by Brown's

model mentioned above, in which ‘people had a greater demand for vessels to store food, soak maize, or store water, but they could not meet the demand with baskets, skins, or some other nonpottery container’ (p. 52). Skibo and Schiffer hold that beans (*Phaseolus* spp.) are the second most important cultigen in the corn, beans, and squash triad. The most common method for cooking beans worldwide is boiling. Since cooking beans can often take from two to three hours, the one great advantage of ceramic vessels is their ability to boil foods for long periods of time with little monitoring.

The ethnographic accounts discussed above serve to illustrate the two key concepts around which the narrative of this book revolves: material culture and nature in the manufacture, use, and discard of ceramic artifacts in Mesoamerica.

Content and Structure of This Book

Chapter I contains the Introduction, where I present the goals and methods of the book, accompanied by an overview of ceramic production in Mesoamerica and other areas. The chapter ends with a discussion of material culture and nature in ceramic production from ethnoarchaeological and behavioral perspectives. Chapter II deals with the theoretical background of the book, highlighting material culture, cultural ecology,

and the role of ethnoarchaeology and ethnohistory as indispensable bridges between archaeology and sociocultural anthropology. In Chapter III the reader will find a discussion of the early periods of Mesoamerican cultural development: the Formative and Classic. First, I deal with the Olmecs of the Formative period, the earliest complex culture in Mesoamerica. I then discuss Teotihuacan, the first urban center in Mesoamerica in the Early Classic period, including the influence of the Teotihuacan state throughout the Mesoamerican ecumene.

Chapter IV deals with the Early Postclassic period, beginning with the Toltec culture and its capital city of Tula, followed by an account of the Azatlán archaeological tradition in northwest Mexico. The focus of Chapter V is the Late Postclassic period, where I begin with the Aztec Empire, and follow with the Mixteca-Puebla phenomenon in central Mexico and southern Mesoamerica. This Chapter ends with a discussion of the Tarascan Empire that includes aspects of modern Tarascan ceramics from an ethnoarchaeological perspective, and the Tarascan worldview as seen in modern pottery designs from the Tarascan community of Huáncito, Michoacán. The volume ends with Chapter VI, where I present a general discussion of research findings and the conclusions I reached while writing the book.