XV. THE CIVILIZATIONAL CONSEQUENCES OF VARYING DEGREES OF AGRICULTURAL AND CERAMIC DEPENDENCY WITHIN THE BASIC ECOSYSTEMS OF MESOAMERICA

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An appraisal of the origins, form, diffusion, and role of both ceramics and agriculture in the emergence of Mesoamerican civilization is a large order, to which we must add some remarks about parallel developments in the Old World. Farming systems and pottery appeared at different times in separate regions of Mesoamerica, and their traditions subsequently also developed unequally. Both technologies must have very complex and as yet very little known diffusion histories.

As in many other parts of the world, human subsistence in Mesoamerica was always partly based upon wild plant and animal foods which were absolutely necessary supplements to the domesticated crops. In any given ecological situation furthermore, the relative degree of dependency upon (or freedom from) hunting and gathering affected the development of local sociopolitical and religious controls. In an attempt to evaluate the role of pottery use and crop domestication as modifiers of the more ancient regionally varied hunting and gathering economies in the emergence of Mesoamerican civilization, I will compare here the early spread of agriculture (farming systems rather than individual plants) with the evidence at hand for the origins and diffusion of some of the earliest distinctive ceramic complexes.

Should any significant patterns emerge from a study such as this, they could be referred to as "agro-ceramic", one supposes, but that point will not be reached in the present paper.

BELATED BEGINNINGS

The appearance of a ceramic complex in any archaeological sequence usually indicates a degree of sedentariness and presumably an agricultural or at least partly agricultural way of life. It is noteworthy that both farming villages and pottery making appear relatively late in Mesoamerica in comparison to much of the Old World:

> . . . the formation of settled village communities relying mainly on agriculture probably had taken place by 7,000 B.C. in the Near East and then, essentially independently, by 2,000 B.C. in Middle America. While the process of selecting suitable domesticates and developing the techniques for their cultivation and consumption had extended over several thousand years in both

> cases, the consequences of the new mode of subsistence were immediate and profound. . . With the introduction of storage facilities for agricultural products (here the invention of pottery played a vital role), it also gave far greater assurance of secure, continuous occupation than was possible with the fluctuating returns from hunting and collecting. (Adams 1964:127).

As far as is known at the present time, there was no well developed ceramic complex anywhere in Mesoamerica until about 2,000 B.C. or somewhat later. A fully agricultural people are actually not clearly discernible in the area until some centuries after this. In contrast, there was in Iran, for instance, a "basic 'barley and sheep' economy by 4,000 B.C.," which had been preceded by over 2,000 years of agricultural and painted ceramic traditions (Hole and Flannery 1967: 179, 197). The unusually late, uneven, and often incomplete dependence upon domesticated crops and animals even in the core areas of Mesoamerica requires an explanation. It is true that many regions of our area are inadequately known archaeologically, so that some surprises may yet await us, but the outline for at least one gradually developed basic subsistence pattern now seems clear enough (see Figure 1, column 5, page 216).

Hunting and gathering people in early Mesoamerica, as probably everywhere, began farming only when they had to, and they made and used pottery only when it was economically or socially essential to their survival in increasingly competitive situations. This generalization appears to explain in part the relatively tardy development of civilization in Mesoamerica (and other tropical regions) as compared to seemingly more precocious Old World nuclear areas. It simply was easier to survive with acceptable comfort (if not to grow or expand much) within some ecosystems than within others without resorting to the trouble of planting crops and making pots.

The not always appreciated but apparently real advantages of the hunting and gathering way of life, particularly in tropical climes, have been explained in detail by Lee, Sahlins and others (in Lee and Devore 1968:33-43, 85-95). Tropical Middle America with its unusually varied vegetation and large numbers of humid and subhumid valleys, moist forests, wooded seacoasts, small rivers, and warm climates, must have been a true promised land for bands of non-agriculturists.

Hunting and Gathering Villages

Viewing the situation in world-wide terms, it might be supposed that the delayed necessity for relying upon domesticated plants and animals in Mesoamerica could be explained better by the relatively late populating of the American continent. The earliest arrival of Asiatic hunters and gatherers to America is speculated to have taken place between 40,000 and 20,000 years ago, with the earliest evidence for true hunting bands coming in only at the

end of the Wisconsin glaciation, about 10,000 to 7,000 B.C. (see discussion by Willey, 1966:29-37). Notwithstanding this late arrival, by 3,500 B.C. Middle America apparently was widely populated by small groups of people methodically hunting and collecting back and forth across definite territories; this activity supplied their needs with very little cultivation, if any, and without ceramic vessels (MacNeish 1967a: 308; Flannery and others 1967:450). After this date, some of these people were already sedentary at least for certain periods of the year (MacNeish and others 1967b:11).

A few especially favored hunting and gathering as well as some coastal fishing localities may have been occupied the year around as well as seasonally prior to 2000 B.C. There possibly were, then, both temporary and permanent villages functioning in early Mesoamerica with either very little or no need for either farming or pottery (MacNeish 1967b:311).

Uneven Regional Domestication Rates

Apparently it is safe to conclude that the relatively late dependence upon domesticated plants in America is due not only to a lack of early heavy population pressure but also to a natural bounty provided by unusually varied landscapes within small areas whose wild products were available and interchangeable long after agricultural possibilities were known:

> The pre-ceramic levels found by Charles Brush at Puerto Marquez, Guerrero, had many shellfish and fish and animal bones, and no mortars, manos, or metates . . . The bones and shell suggest that the people of these cultures were predominantly hunters, fishermen, and gatherers of shellfood, and perhaps did some plant collecting . . .
>
> This suggestion that some of the lowland cultures of the period before 2,300 B.C. did not have corn agriculture is bolstered by the absence of corn in the pollen profile of Santa Marta Cave [Chiapas] with a slightly different environment. It must be added, however, that the late Santa Marta remains reveal a still different subsistence pattern, one of plant collecting and animal hunting and collecting. (MacNeish 1967a: 308).

As in North America to a much later date, so for a long time was it also most economical in ancient Mesoamerica to fish and collect in the streams and lagoons, gather food plants across the valleys and hills, hunt in the nearby mountains and forests, and to trade with the next vale in a different ecological niche. There was little incentive to devote much time and work to the selection and cultivation of specific species or to the manufacture of pottery. (It is perhaps true that most plant domestication has been gradual and "accidental", but even thus the Middle Americans were at a disadvantage in that they had no herds to care for across extensive topographic

extremes which in the Old World subjected gathered and transported seed crops to repeatedly selective situations.) The hunting and gathering situation, idyllic or not, seems to have prevailed free of planting seasons only as long as population densities remained very low. The balance between subsistence methods and perishable containers apparently reached a state of non-equilibrium very quickly once reliance was placed upon cultivated crops.

To demonstrate the uneven regional record for the beginning adaptations of ceramics and agriculture in Mesoamerica, I have prepared the chart included as Figure 1. This chart includes a suggested ecological division of Mesoamerica into six basic ecosystems (described below on pages 232-235) and shows the estimated chronological positions for a representative selection of early site phases and some of the earliest ceramic and subsistence traits within those ecosystems. It is notable that pottery had spread across most of subhumid-to-arid highland and estuarine-riverine Mesoamerica within a few centuries of its first known appearance in Mexico, and that we do not see subsistence farming anywhere before this time. By about 1500 B.C. only the peninsular tropical forest (or "Lowland Maya") and the humid Guatemala highland regions seem to have still lacked ceramic complexes; these same humid zones probably lacked maize or other cultigens as well until much later times, a point dramatized by the chart.

The most favored explanation for the relatively late appearance of agriculture in the more humid ecosystems is the longer time needed for maize (and possibly bean) varieties to develop which would survive disease-prone humid conditions and successfully compete with newly cleared forest regrowth. Maize as we know it today is perhaps the most remarkable domesticated plant in the world in terms of its ability to resist disease, insect, bird, and animal enemies. But these characteristics, as well as adaptation (via area-specific varieties) to a uniquely wide range of climate and soil differences, were acquired by maize only after a long history of hybridization and selection which must have included a great deal of human trial and error as less naturally favored latitudes and environments were populated by greater numbers of people. An exciting hunting-and-gathering equilibrium (or "forest efficiency") in the humid ecosystems may also have delayed domestication there (see below and Figure 2). It must be admitted, also, that we do not <u>know</u> whether preceramic peoples in humid Mesoamerican regions had maize or other cultigens or not, for we have judged it to be present only when and where metates for grinding the dry grain have been found. A non-stone-ground and non-pottery utilization of maize (or other cultivated or gathered crops) remains a possibility, again only in relation to a very small population: seed-grinding in hard-wood "tree-trunk" mortars is a normal forest practice.

The Figure 1 chart, as indicated, is a trial outline of regional developments, showing horizonal relationships and their possible chronological overlappings. In no sense is the chart intended to be complete in its coverage. Most of the included phases have appeared elsewhere (compare, for instance,

SIX MAJOR ECOSYSTEMS OF MESOAMERICA, ORDERED BY PAN MESOAMERICAN CULTURAL HORIZONS

(A Trial Chart)

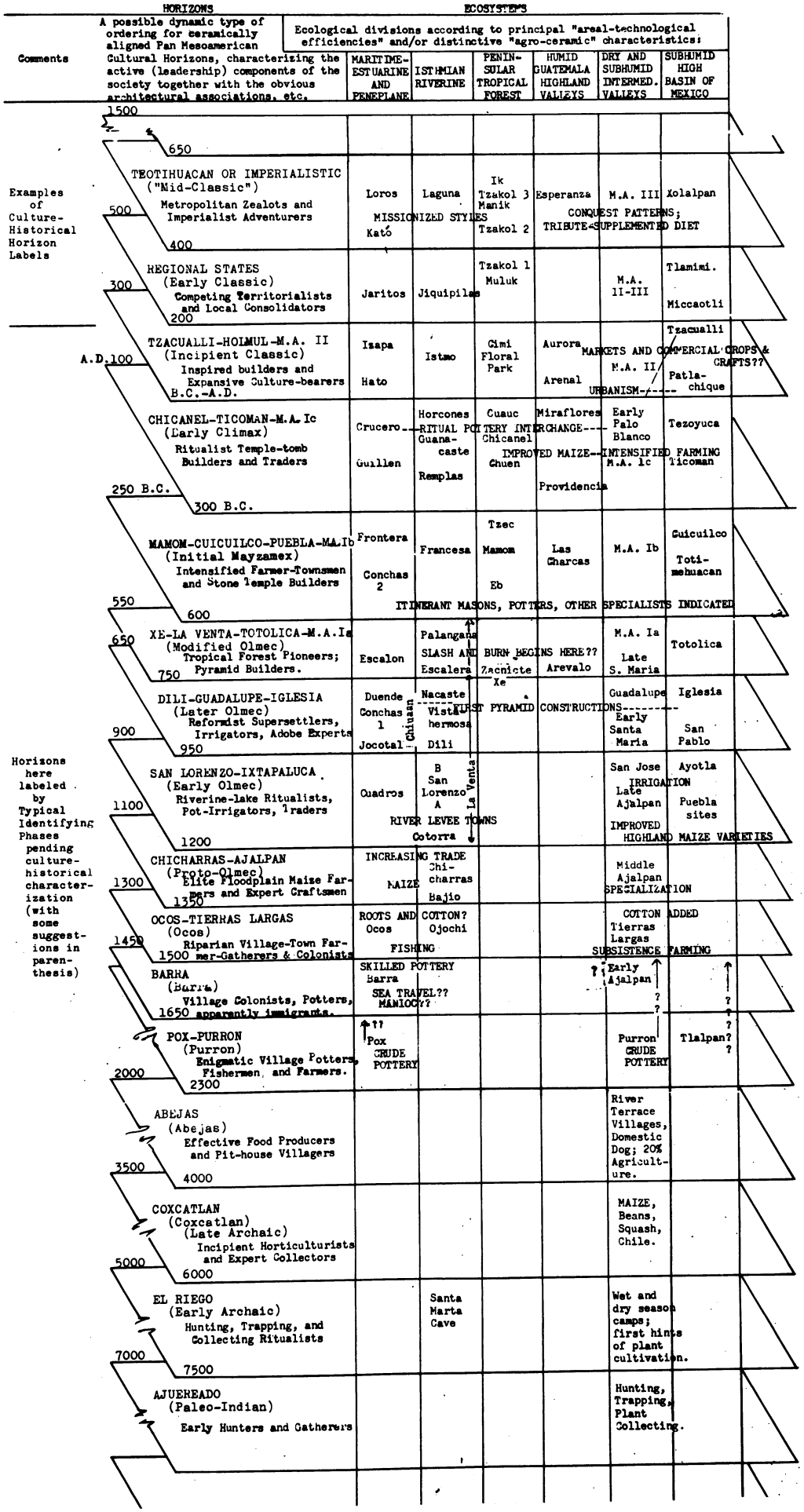


Fig. 1. TRIAL CHART PROPOSING PAN MESOAMERICAN CULTURAL HORIZONS AND RELATING THESE TO SIX MAJOR PROPOSED ECOSYSTEMS.

papers by Bennyhoff and Bernal at this conference); the phases Escalon to Loros in Column 1 are from an unpublished Izapa sequence (Lowe, Lee, and Martinez, in preparation).

CERAMIC DIFFUSION AND ITS ANTECEDENTS

Mesoamericanists have noted the earlier appearance of pottery in other areas of the New World (by 3000 B.C. in northern South America), and generally believe that the earliest known ceramic complexes in Mexico and Guatemala developed from a borrowing of ideas rather than from any independent local invention or outright intrusion of an intact cultural complex. Present evidence does seem to indicate such a conservative application of ceramic techniques to already existing container traditions in central Mexico. If this is true, it implies that pottery making in that area was gradually adapted to local circumstances and that its introduction was not associated with any noticeably disruptive cultural diffusion. Such a gradual developmental supposition, however, will not be acceptable for all of Mesoamerica if ceramic vessels were first introduced in some regions by immigrant people as functioning or traded objects, a probability for the Isthmian lowlands discussed below. In that region a dominant trait was the frequent use of the restricted pottery bowl or "neckless" olla or jar which copies the form of the tecomate gourd or pumpkin, thus raising questions of both developmental and regional character, as will be seen below. The possibility of stone vessel antecedents to pottery has also been suggested and needs to be considered, though such labor-expensive containers probably were always much less common than the natural cucurbit receptacles.

Early Non-ceramic Vessel Traditions

The long-persistent lack of ceramics in Mesoamerica may perhaps be explained in part by the fact that gourds, tree calabashes, and the thick rinds of squashes and pumpkins were widely available in a variety of shapes from at least 5000 B.C. (Cutler and Whitaker 1967: 212-219). The tree gourd or calabash (Crescentia Cujete, but called jicara in Mexico) was not found in the early levels of excavations at either Tehuacan or in Tamaulipas (MacNeish 1967a: 294), but as it is a rather common wild and rarely a planted tree, it undoubtedly was availed of from earliest times. Many of the squashes were cultivated and others collected wild. The bottle gourd (Lagenaria siceraria) was apparently a cultivated crop, inasmuch as this most useful of the gourds has a long record of use in both the New and Old Worlds beginning many thousands of years B.C. The bottle gourd and the jicara have ritually prescribed ceremonial importance for various Maya and other indigenous groups in Mexico and Guatemala to this day, with little question perpetuating traditions whose roots go back many thousands of years.

Gourds and baskets probably filled Mesoamerican container needs very adequately until bean boiling, for instance, began to create problems. Both

beans and early maize were plants at first restricted to the drier intermediate valleys apparently due to narrow disease and temperature tolerance limits; their seeds originally may have been masticated raw or were ground or roasted, but the effects of soaking must have been at once apparent, with logical extensions to the advantages of boiling. It is not surprising, therefore, that the first known manufactured vessels capable of being used for boiling directly over the fire come from the dry intermediate Tehuacan valley and similar Tamaulipas regions and that they are deepened stone mortars. These early stone containers are called "tecomate" mortars, only just possibly made to simulate the function of deep gourds (MacNeish and others 1967b: Fig. 96). The eventual cultivation of improved corn and beans in the lowland regions, on the other hand, seems not to have occurred until pottery was already introduced there, and no provenly preceramic stone bowls have been identified in such zones.

With regard to early cooking practices, it is worth noting here that archaeological evidence is lacking in Mesoamerica for boiling by dropping hot stones into water in gourds or tightly woven baskets, a technique employed by numerous primitive societies. There is suggestive evidence for such a practice in Mesoamerica only in the ethnological literature, to my limited knowledge. At Chan Kom in eastern Yucatan, for instance, hot stones were placed in a vessel with squash seeds and the mixture was stirred in a toasting operation (Redfield and Villa Rojas 1962: 40). This custom, noted in 1934, may be a surviving old tradition and, if so, it would be only one step from that to stone boiling in pots and another step back to stone boiling in perishable containers. The latter practice might have delayed the adoption or development of ceramic vessels, particularly if it was part of an only semi-sedentary subsistence pattern.

A number of authors have noted the similarity between the stone vessel shapes from the Tehuacan caves and the earliest pottery forms from the same region, suggesting that there may have been, there and elsewhere, a ceramic development influenced by stone prototypes (MacNeish and others 1967b:11; Coe and Flannery 1967:105; Green and Lowe 1967:63). This now appears to be an exaggerated possibility, just as is the supposed developmental significance of the crude "Purron" pottery itself (see below). The Tehuacan "stone-bowl tecomates" (4 excavated) have been explained above as elaborated "tecomate mortars," possibly inspired by the utility of gourd vessels; there is no reason to suppose that they in turn would have inspired pottery vessels, including at Tehuacan necked jars which were closer in form to common bottle gourd or calabash containers.

The more distinctive Tehuacan flat-bottomed stone bowl fragments appear to be identical to those represented by a few stone bowl rims and bases found at Altamira mainly during the Barra phase (Green and Lowe 1967, Fig. 98) and elsewhere in the Early Preclassic, but the only illustrated Tehuacan example is from the surface! The one example, said to be of this type, that was

recovered from the Abejas phase at Tehuacan is unillustrated and is not individually described. None of the 5 excavated Tehuacan hemispherical stone bowls (3 from preceramic levels) are illustrated, and their shape is in any case too general to be of any significance for our problem. I think it highly unlikely that Tehuacan stone bowls had any influence whatsoever upon pottery manufacture. On the contrary, it is most probable that the one excavated flat-based example from Tehuacan (if it actually does approach the ceramic norm) and the one from the surface that is illustrated, as well as an illustrated stone effigy bowl (MacNeish and others 1967b:118, Fig. 97) are all copies of ceramic prototypes, and therefore not likely to pre-date Purron.

As indicated above, it also seems probable that the very small Purron pottery sample is overrated as a cultural forebear. MacNeish and others summarize the phase as follows:

> The next phase, Purron, probably falls between 2300 and 1500 B.C. It is the least clearly understood phase in the sequence and is represented by only two excavated floors. The excavated materials include a few plant remains, . . . and a number of very crude, crumbly pieces of broken pottery. The pottery, the earliest so far found in Mesoamerica, has the same vessel forms as the stone bowls of the previous period. (MacNeish and others 1967b:11, underscoring mine).

It would seem much more to the point to emphasize that these Purron vessel forms are the same as those of the Early Ajalpan phase which follows. If we move these few pieces of pottery toward the late end of this tremendously long phase (they can hardly span all 800 years of it!), then there seems little need to project any meaningful gap between them and the beginning of the Early Ajalpan subphase. Additional Purron-like material is clearly needed, as the Tehuacan excavators readily agree; MacNeish favors the view that Purron pottery was a local adaptation of ceramic techniques developed elsewhere, possibly via the Gulf Coast, and such a diffusion process may have been very gradual.

Earlier ceramic horizons may yet appear in one or more regions of Mesoamerica, though the obvious anxiety to discover pre-1500 B.C. pottery is one that requires caution. I have taken this approach in my own interpretation of the Barra phase at Altamira. With reasonably comprehensive decorated ceramic and stone artifact complexes found below Ocos horizon materials, the Barra phase stands as a good candidate for being an original site-intrusion in Mesoamerica (Green and Lowe 1967:55-60, 85-86, 97-104, 130). It is to be supposed, nevertheless, that there exist somewhere more extensive and perhaps earlier and simpler Barra-like occupations than that found beneath Mound 19 at Altamira. A questioning attitude should be taken also toward the Pox pottery of Puerto Marquez, Guererro, where a few apparently mainly non-rim sherds are dated to ca. 2400 B.C. by a single radiocarbon date (Brush 1965); only more adequate samples and dates will justify conjectures about the role of this intriguing site complex in the development and diffusion of New World pottery.

Cultural Borrowing and Migrations: The Early Necked and Neckless Jar Traditions

Outstanding regional differences in the typical form of the common cooking, storage, or water jar on the earliest discovered ceramic horizons in Mexico support the idea of at least two rather separate pottery geneses in Mesoamerica. Except for the "Pox" pottery found on the coast of Guerrero as just noted above, the earliest known Mesoamerican lowlands pottery occurs in the Central Chiapas and Isthmian Gulf Coast regions (isthmian riverine ecosystem) and, more abundantly, along the southern Pacific Coast (maritime-estuarine-peneplane ecosystem); as previously noted, much of this Barra and Ocos horizon pottery, to all appearances, was modeled closely after neckless gourd and squash prototypes despite its sudden appearance and rapid spread. The beginning highland (dry and subhumid intermediate valley ecosystem) ceramic tradition, on the other hand, relates most closely to the bottle gourd, with the basic pottery forms for the Tierras Largas (Oaxaca), Purron and Ajalpan (Tehuacan) phases being the necked jar and the deep or shallow but open round-side bowl. The deeply buried Tlalpan complex at Cuicuilco (subhumid high basin of Mexico ecosystem) also fits this mainly necked olla or water jar tradition (Bennyhoff, personal communication).

The initial southern Mesoamerican ceramic horizons lacked the necked jar form and emphasized large and small neckless jars or "tecomates" which have restricted mouths and, on the smaller and finer examples, often fluted, lobed, or grooved walls; these shape preferences might reflect a customary contemporary or even more ancient use of calabash and squash-rind containers. The tecomate tradition appears in the Barra phase at Altamira on the Pacific Coast plain of Chiapas and continues only slightly modified in the Ocos horizon over an extensive area; the tecomate form is dominant in both horizons. The Ocos horizon ceramic complexes are best known at Altamira, Izapa, and Aquiles Serdan in Chiapas and at La Victoria in Guatemala, with a similar horizon occupation (Ojochi phase) identified at San Lorenzo in the Isthmian region of southern Veracruz (Green and Lowe 1967; Ekholm 1969; Navarrete, in preparation; Coe 1961, 1970). Before reviewing the distribution of the Ocos horizon sites and its consequences, something needs to be said about the apparent overseas connections of this horizon style which was unknown to archaeology until a dozen years ago.

It has been noted elsewhere that the grooved and incised Barra phase tecomates generally resemble the constricted orifice jars and bowls of the late Machalilla phase of the Ecuador coast as well as those of Barlovento and Puerto Hormiga on the north coast of Colombia (Green and Lowe 1967:60-61, 98-100). It was not supposed that South America was the immediate source for the Chiapas ceramic complex or its makers, but only that the two areas seem to have shared a related incised neckless jar or tecomate tradition which appears to be older on the south. A postulated intermediary region of

diffusion in Honduras (Green and Lowe 1967:61-62) continues to merit exhaustive investigation in this regard, as do the coastal zones of Central America in general. In a differing direction, the recent discovery (see below) of deep "pre-Olmec" deposits, with some Ocos-like traits, in the Chontalpa region of Tabasco (Sisson 1970:44) indicates that overseas contact may have been made on the southern Gulf coast at this early time (if Barra and Ocos are indeed not indigenous cultures).

Diffusion via the Gulf Coast is a particularly attractive possibility in view of the resemblances noted between traits of the Barra phase ceramics and the Tick Island and Orange Incised ceramic complexes of Florida (Green and Lowe 1967:100-102); Ford compares the latter tradition with the Barlovento ceramics on the Caribbean coast of Colombia (1966:786-794; see also Ford 1969 for his unrivalled discussion of this diffusion problem). Of perhaps equal importance is the fact that the Florida complexes include flat-bottom "pans" as early as 1600 B.C. (Ford 1969:101), which is as early as they are thought to have appeared anywhere if we favor the late option for dating some rare Purron fragments, as suggested above (flat bottom bowls are common to Purron, Barra, and Ocos phases). Additional evidences of Gulf-Caribbean movements undoubtedly will be found eventually, a research aim that Ford hoped in vain to see realized in his lifetime.

On the Pacific coast, there are similarities between Ocos pottery at La Victoria, Guatemala, and Chorrera phase ceramics in Ecuador of so striking a nature that some sort of direct contact (assumedly seaborne) between the two widely separated cultures is required as an explanation (Coe 1960). Neither this nor previously cited overseas resemblances to the Barra and Ocos ceramics however, require an immigration of groups of people to explain them. Diffusion may have been slower and less direct than our presently very spotty archaeological investigations indicate, or it may have resulted from objects quickly passed along by visitors or traders who returned to their point of origin, or conceivably from the ideas alone that were purveyed by such persons, or from traveling craftsmen. At the same time, the possibility that small groups did indeed migrate need not be discarded and remains a subject for investigation. Chronicled history, certainly, is replete with allusions to migrations across Mesoamerica in the centuries preceding the Spanish Conquest, so that an extending of the observed pattern farther back in time appears logical where seemingly justified. Sanders (1965:185) stresses the importance of small-group migration.

The consistent distribution pattern presently known for the earliest Mesoamerican ceramic complexes at least supports a supposition that early highland and lowland Mexican civilizations resulted from somewhat different developmental histories, assuredly benefiting very early from regional cross-fertilization. The apparent identification of a slightly Ocos-like ceramic complex at San Blas, Nayarit, may complicate our picture (Mountjoy 1970), just as does already the varied character of known Ocos horizon complexes nearer the center (for instance: a wide variety of Ocos vessel supports found

only on the Pacific coast; early bottles known only on the Gulf coast; shared Ecuadorian Chorrera phase traits well identified only at La Victoria in Guatemala). Clearly there is still much to learn about the earliest ceramic horizons in southern lowland Mesoamerica.

We have neglected a consideration of function in this discussion of apparently disparate ceramic origins in Mesoamerica, which would involve a period of postulated dependence of the early coastal cultures upon root crops (manioc principally?) while maize and beans were undergoing perfected domestication in the highlands and intermediate zones. Previously I have speculated that it was the wholesale adoption of maize-growing ways (made possible by improved maize varieties) which allowed the rapid termination of all known Ocos horizon settlements and their eventual reoccupation by people or peoples utilizing a basically Olmec pottery complex (in Green and Lowe 1967:65-71). When we know more about the disrupted period of transition from Ocos to Olmec, to oversimplify, we may have a better base for determining whether maize farming had anything to do with it. We may likewise learn whether the so-called "Olmec intrusions" involved an outside people or only an acculturating and shifting local population, perhaps responding to the different needs of the maize plant and beans vs. their old seafood-aided horticulture. Newly located Ocos-horizon sites widen the population base for this culture and make it less likely that it was ever "replaced" by a separate Olmec-related people. Marked differences in the facial features of Ocos and Olmec figurines on the Pacific Coast, nevertheless, indicate that such an ethnic turnover should continue to be considered (Navarrete, in preparation). Local population displacements are normal events in the course of history.

Whatever the processes at work, the remaining fact is that the lowland Olmecs had achieved civilization (San Lorenzo phase) in less than 500 years from the appearance of the first ceramic stage (Barra phase) in the Isthmian regions. This is a rarely equalled rags-to-riches career in the history of the world's civilizations and implies that something more than ceramics diffused to the area.

The Probable Ocos Horizon Origins of the Basic Lowland Olmec Ceramic Tradition

Whether there was important subsequent diffusion into the isthmian lowlands region or not, the Barra-Ocos socioeconomic structure must have been well developed; there can be little doubt that it formed much of the foundation underlying development of the Olmec society. Present ceramic evidence plus total carved stone monument distribution data suggest that southern Veracruz, western Tabasco, southeastern Oaxaca, and southern (and possibly central) Chiapas constituted a Lowland Olmec unit in both geographic and cultural terms. I have elsewhere called this unit "The Olmec Isthmian Block", (Green and Lowe 1967:71); more recently I have termed it the "Greater Isthmus Area" (Lowe in preparation), a designation that is more adequate. A similar geographic and cultural unity has been discussed by others (see

Parsons and Price contribution in this conference).

The relative cultural uniformity characterizing the Greater Isthmus Area is first seen in the pattern of Ocos horizon sites which underlie most of it, though we can not yet speak very knowledgeably of regional variations on this level. Four Ocos horizon sites have been identified recently on the Upper Grijalva River in Central Chiapas; these inland riverine locations modify the strictly estuarine-to-piedmont orientation of the Ocos culture as previously known at 12 Pacific Coast sites in Chiapas and Guatemala and at an additional site near Juchitan in the Tehuantepec Isthmus region. The Grijalva sites also complement the riverine position of the Ojochi phase at San Lorenzo in southern Veracruz. The river-levee Ocos-like sites in Tabasco are more problematical, inasmuch as Sisson (1970:44) says of these "Molina phase" (equivalent to the "Proto-Olmec" Bajio and Chicharras phases at San Lorenzo) sites only that "A few sherds from surface collections resemble Ocos types. . ." Without question, many more Ocos horizon sites will be found, with the probability that chronological and regional distinctions will be made.

Ocos pottery even as presently known is already so sophisticated in form and so well made that there can be no doubt that it is the product of full-time specialized craftsmen. One can well ask what these lagoon fishermen, peneplane farmers, and piedmont pioneers were doing with such excellent pottery; certainly it indicates that known groups are only segments of a more complex society.

The Ocos horizon pottery tradition seems to have spread very rapidly across the Greater Isthmus Area between about 1500 and 1400 B.C. Coe considers the Ojochi contemporaries of Ocos at San Lorenzo to be "colonizers" (1970:21), but we can not pretend to know from what point or centers the colonizing was being carried out if we agree that the Barra complex in Chiapas will prove to be only one of a number of pre-Ocos occupations awaiting discovery. Whatever the origins of the Ojochi culture, it obviously represented an intelligent and enterprising population once established. The prompt and steady development from this base of the Bajio and Chicharras phase people who undertook major platform and terrace leveling and began the stone sculpture tradition at San Lorenzo between about 1350 and 1150 B.C. indicates a high order of social organization accompanying a constant buildup of population pressure (Coe 1970:18-20). The general situation suggests that the expanding Ocos populace very quickly sought out both the wetter forestlands and tree fruits of the piedmont slopes, including cacao (as at Izapa), and the annually flooded alluvium along the great river systems of the Isthmus (the Grijalva, Coatzacoalcos, Tonala, lower Usumacinta) and their tributaries. Family possession of these key commodities--cacao orchards and constantly humid fertile croplands--conceivably led to the high-status lineages and social stratification which would result in stimulating the rise of the civili-

zation we have come to call Olmec (Flannery and Coe 1968:281-282; Coe 1969; Rands 1969:10).

Following the Ocos horizon there was developed a "domestic Olmec" ceramic style whose transitional Bajio-Chicharras stages have been well identified at San Lorenzo and less positively so in the Chontalpa region of western Tabasco and in western Chiapas at San Isidro on the Middle Grijalva River (Coe 1970; Sisson 1969; Lowe in preparation). The stylistic and technological limitations of a basic Olmec pottery inventory became well crystallized over a wide area throughout the San Lorenzo-Nacaste, Cuadros-Jocotal, Cotorra-Dili, earliest La Venta Complex A phases, and in the Chiuaan complex at Trinidad, eastern Tabasco (see respectively Coe 1970; Coe and Flannery 1967; Green and Lowe 1967; and Ekholm 1969; Dixon 1959; and Lowe and Mason 1965; Heizer, Graham, and Napton 1968 including the Appendix 1 by Hallinan and others 1968; Rands 1969:6, 10-11). These lowland manifestations of the Early and Later Olmec horizons were practically restricted to the Greater Isthmus Area, where more than 80 sites of these periods have been identified exclusive of Guatemala. Similarly Olmec-related sites are known in southwestern Guatemala; Coe and Flannery (1967) indicate ten Cuadros-Jocotal sites in the Pacific Coast region adjacent to Chiapas (including the original type site of Salinas La Blanca), and many others no doubt exist following along the Guatemalan coast to the southeast. In El Salvador a strong Cuadros-like component has been identified at Chalchuapa (Sharer 1969; Sharer and Gifford 1970:445), and comparable traits appear in a less conclusive context in northern Honduras (C. Baudez in this conference).

It is not yet known how closely the more southerly early site-complexes will conform to the standard Olmec inventory of the San Lorenzo phase (intact ceramic complexes must be compared and not mere horizon-style markers). Also still awaiting clarification is the nature of the Olmec period ceramic complexes in the vicinity of Tres Zapotes and the Tuxtlas mountains of southern Veracruz, which must be numerous (R. Squier, personal communication). The same may be said for related highland Mexico site-complexes, although present evidence indicates that both central Mexico, Puebla, and Oaxaca show more divergence from San Lorenzo norms in Veracruz than do Tabasco and Chiapas; this apparent situation is an expectable result of the distinctive regional differences existing in the earlier horizons, as discussed above. Many perplexities remain in the picture of the lowland Olmec ceramic development, not the least of which is the genesis of the peculiarly Olmec excised art style itself. Not until more is known of southern Veracruz (and perhaps of Guerrero, Morelos, Puebla, and Oaxaca as well) will these developmental lacunae be filled; the known sequences in Chiapas do not seem to contribute the needed "Proto-Olmec" horizon data.

Planned research on the Pacific Coast of Chiapas is expected to shed light on the problem of ceramic beginnings and elaboration in that region (M. Coe and K. Flannery, personal communication). At present it appears that at least some of the Pacific Coast shell middens were made by a people

who exhausted the most easily obtained estuarine resources before pottery use arrived, and who left the area. Research on the Oaxaca coast in recent years has discovered no good evidence of Early Formative or preceramic settlements in that region (D. Brockington, personal communication) though the possibility is not rejected and investigations continue. The delayed appearance and ultimately irregular survival of pottery in the Maya Lowlands is a separate problem (see pages 231-232 and Addendum), but its fate there seems irrevocably tied to the peculiar ecological exigencies of forest agriculture and the rarely adequate (for civilization) human responses made in these circumstances.

DIETARY DEFICIENCIES AND HUMAN DEMOGRAPHY

Whether due ultimately to diffusion or local causes, population and social pressures even in the "tropical paradise" of Middle America eventually forced man to take increasingly artifical measures to insure dependable plant harvests. Here as elsewhere, a consequent intensification of sedentariness and improved or stablized foodstuff supplies seems to have required or facilitated the use of ceramic vessels for storage, preparation, and serving:

> The more advanced modes of cooking which became at first necessary and later desirable in the preparation of the diet available to the first agriculturists inevitably affected material culture, and the development of pottery-making techniques must have a primary relationship to the preparation, storage and service of forms of food and drink not hitherto exploited. Archaeologists on occasion get hooked on pots and take ceramic trips, forgetting that one should not rate the container above the contents, the stew-pot over the stew. (Piggott 1969:559).

Increased dependence upon agriculture not only created more uses for pottery but presumably also freed more time for their manufacture by specialists. Staple crops harvested during relatively brief seasons, along with subsistence drawn increasingly from storage (rather than from daily foraging and hunting), released not only individual but mass labor forces for longer periods; this situation favored intensified task specialization, status ramifications, advanced social organization, and public works. Improved farming techniques, increasing population, and cultural complexity are thought normally to go hand in hand, though not necessarily in that order; thus, it appears that

> . . . With more efficient technology and a more specialized deployment of members of his community, man, like any animal component of an ecosystem, could attain a higher population density and a higher level of organization. . . Whenever human groups, by technological or sociopolitical means, significantly increased their ratio of energy consumption to energy expenditure, they made possible increasing organizational complexity. And just as often, this

> higher degree of organization made possible more efficient use of the environment. (Hole and Flannery 1967:197-198);

but, on the other hand,

> Esther Boserup (1965). . . has marshalled impressive evidence from around the world to show that agricultural systems are elastic and highly responsive to changes in population. In other words, demography would be the independent variable, and agricultural systems dependent. The "new demography" can demonstrate that population growth in a given area is a response to a number of factors which may be social, cultural, or ceremonial, religious, and perhaps not even subsistence or consumption-oriented (Wrigley 1967) . . . the response to such population pressures might be the stepping up of labor input and only secondarily the adoption of new techniques of production. The eventual result is that as total production rises, because of rising population per capita income may actually be falling, and the amount of free time away from agricultural pursuits becomes negligible. This "agricultural involution", as Geertz calls it leads to a very definite lowering in the qualities that make a farmer's life worth living (Coe 1969:20).

It is possible that the Late Classic Maya populace was experiencing "agricultural involution" at the time that the Mexican intrusions upset their herarchy, and that a thorough popular reaction to this situation is what prevented any surviving elite from re-establishing significant leadership. Discussion of the nearly permanent Classic Maya collapse is beyond the intended scope of this paper (see Addendum), but similar cultural breakdown may have occurred earlier or elsewhere in Mesoamerica and its ecological significance should be watched for. The more complex social patterns which suggest variations in the intensity of agriculture are difficult to recognize archaeologically, though some clues are provided by the type of studies which relate tillable space to other community elements, for instance (Puleston 1968). In general, however, the subsistence evidence provided by potsherd and structural distributions needs to be buttressed by other classes of information, especially those more directly related to the procurement, preparation, and consumption of food (cf. Heizer 1960). Such evidence is hard to come by in the tropics, though a few recent projects in the drier regions of Mesoamerica with this deliberate emphasis upon subsistence have been remarkably successful (Flannery and others 1967; MacNeish and others 1967a, 1967b).

The recent adoption by anthropology of the longstanding biological emphasis upon ecology has resulted in an increased recovery of plant and

animal remains from ancient sites, together with increased study of existing environments. A great many aids to ecological interpretation were summarized by Meighan and others in 1958 with the expressed hope that more biological remains would be collected and studied by archaeologists and their collaborating scientists; the Ucko and Dimbleby volume (1969) bears remarkable testimony to the progress made in this regard within a decade. Nevertheless, a recent review of the latter work (Isaac 1970) notes the helplessness of ecology to explain why domestication did occur when it did rather than when it could have. This review also faults the volume for "the omission of culture-historical or ethnological approaches to the problem of domestication. . ." and for not considering possible Old World/New World relationships. In the conclusion to the Ucko and Dimbleby volume, we are offered a final warning as to the possible social selectivity manifest in the recoverable fragments from past diets (Piggott 1969:558):

> . . . food refuse is the product of meals, and cooking, eating and drinking are essentially social activities with complex rules, conventions, tabus and prohibitions unrelated to nutrition as such. Religious dictates take no account of a nice balance of proteins and carbohydrates; Custom, not Calory is King.

The final remark above has its application in Mesoamerica (Aguirre Beltran 1956) where calories were, and are, destroyed or ignored with some frequency. A recent study of the deficient dietary customs in Sudzal, Yucatan, revealed the following (Bonfil 1962:129, 134): "The masa loses approximately 30% of its nutrients because the nixtamal is washed from 8 to 10 times." (Washing of the corn dough is done to remove all traces of lime and produces a white color.) And ". . . the consumption [of beans] in Sudzal is not sufficient to cover the necessities. . . of essential aminoacids." Daily average consumption of corn in Sudzal was 419 grams, and that of beans only 55 grams. That this reluctance to eat beans is not restricted to the henequen zone is shown by a quotation from the Redfield and Villa Rojas 1934 Chan Kom study (p.38): ". . . in some houses beans may not be cooked even if beans are available in abundance." The same authors list the 1931 Chan Kom bean production as only 31 cargas (there are about 42 kilos per carga) for a total of 54 farmers (only 9 of whom planted beans), as opposed to a corn production of 2,962 cargas. It is interesting to note that harvested squash seeds comprised 27 cargas, almost equalling the beans (squash seeds are the traditional and almost exclusive part of the squash to be eaten; they contain about as much protein as beans and have over 15 times the fat content but lack the aminoacids).

Inadequate consumption of beans (in terms of a balanced diet based on maize and little or no meat) may be typical of much of present-day Mesoamerica where European influence has made socially unacceptable the eating of pozole agrio (soured corn gruel), insects, frogs, snails and many other molluscan foods all of which formally filled needs for proteins and aminoacids (Aguirre Beltran 1956:229, 239-240). Beans themselves are also difficult for many

people to digest, particularly children (mothers in some indigenous groups pre-masticated food for their babies until this practice also became socially unpopular in a European-influenced society - Aguirre Beltran 1956:231, 239-241). It is claimed by some that the enzymes in squash make a favorable reaction when consumed together with beans, but we have noted the general failure to eat much of either food in many areas; bean and squash consumption in the Maya region appears to be particularly sporadic. Beans are also difficult to grow under many circumstances, notably those in northern Yucatan, a state which imports many of its beans today and which anciently relied heavily upon seafood for part of its protein needs (Andrews 1969:57-61).

Problems such as the preceding, which may not be entirely modern and which in any event can be as much social as ecological, explain a persistent need in Mesoamerica for animal protein, in spite of a much-vaunted theoretic maize-bean-squash-and-chile nutrient balance:

> The principal elements of the Mixtec diet corresponded to the typical Mesoamerican dietary complex of maize, beans, chili, salt, and squash. . . The 1580 Relaciones and Herrera indicate that the native diet was supplemented to considerable degree by wild berries, fruits, herbs, roots, leaves, nuts, and various plants collected from the countryside. In addition, the meat of rodents, snakes, lizards, and other small animals was consumed. The more important domesticated or game animals such as the turkey, edible dog, deer, and wild fowl were reserved for the nobility and the ruling caste. (Spores 1967:7-8)

The Mixtec situation seems to have been typical for Mesoamerica as a whole and in many respects represents a world-wide tendency to always supplement cultivated crops with some of whatever wild resources are available.

The Unusual Persistence and Importance Of Hunting and Gathering in Mesoamerica

It is clear that the intensive, rather than casual, exploitation of local wild resources was a complementary way of life in Mesoamerica long after it had ceased to be important (apart from fishing) in nuclear sectors of the Old World. Hunters and gatherers occupied a center-stage position in most of Mesoamerica until well after 2000 B.C.--not until 1500 B.C. does MacNeish (1967b: 314) believe that anyone in Mesoamerica obtained even as much as 40% of his sustenance from agriculture!

Apparently for lack of adequate animal domesticates, the elite of all Mesoamerican civilizations were provided with meat from game animals as a matter of course. In many regions the Mesoamerican common folk never gave up much of their hunting, fishing, and gathering ways; Middle Americans not

only depended upon this wild protein source throughout pre-Hispanic times, no matter how civilized they were, but in many instances continue to do so up until the present, or near-present:

> . . . "In my milpa," said a milpero, "we have a good area. There is water to attract animals, and we use our dogs to catch tepescuints (similar to the suckling pig), tusa (a bird), puerco de monte (a wild pig), pheasant, and deer. My family likes to be here with me spending a temporada; there is a great deal of meat ....."
>
> In historical times San Joseños faced periods of near starvation, times when only the Ramon seed, obtained from a jungle tree, was available for tortilla making....
>
> Many of the older informants remembered this period and indicated that some families had migrated at that time to British Honduras; others tried only to purchase corn there, but the trip was painful; and the rest collected Ramon seed and used it in the making of tortillas. Hunting, gathering, and fishing barely supported the population." (Reina 1967:17, 20n)

The latter instance cited by Reina was said to be aggrevated by cattle in the milpas, but whether the famine around Lake Peten Itza was due to this as much as to drought is irrelevant to the demonstration of the milperos' continuing ability to fall back upon hunting and gathering alternatives.

A persisting reliance on game is also typical of Yucatan, as described for Chan Kom in 1934 (Redfield and Villa Rojas 1962:38, 48): "So far as meat enters into the diet, it is chiefly the product of the hunt. The average inhabitant eats venison, wild pig, or agouti about once a week." The close relationship between Yucatan deer herds and their milpa clearings has been remarked upon by many authors; the Maya appear to have typically treated their territory as a game preserve, hunting for food only and almost at will. Even in 1950, Redfield could write of Chan Kom revisted: "Deer are growing scarce, and meat is hard to come by" (1962:60). With numerous cattle and hogs overrunning the town plaza and their milpas, these recent Maya still thought of meat as coming from the bush. Domestic, introduced, animals were valued property and to be sold, not eaten; meat was something that the forest and milpa clearings provided.

It may be argued that it was the persistent natural availability of desirable game animals in the extensive forested lowlands of Middle America which made relatively unnecessary more animal domestication. Whether this be true, or whether there simply were no Mesoamerican animals capable of domesti-

cation beyond the dog and turkey, the vast tropical forest habitat surely did play an important role in the dissimilar directions of cultural development taken by the highlands and lowlands, on the one hand, and by Mesoamerica and the Near East on the other. The great variety of natural vegetation found in Mesoamerica, particularly in the lowlands after partial clearing, also probably worked against a greater degree of dependence upon agriculture; the forest dweller was always but a step removed from the possibility of a hunting and gathering subsistence, no matter how much corn he was accustomed to planting. Only sheer denudation of vast areas would have changed this situation, or will change it now (see Addendum).

Environmental Destruction And Human Response

The really quite different role of agriculture in the tropical forest will be more sharply contrasted if we compare it with the Basin of Mexico, or with the Near East where the consequences of farming are summarized by Flannery (1969:95) as follows:

> The real consequence of domestication was (1) to change the means of production in society, (2) make possible divisions of labour not usually characteristic of hunter-gatherers, and (3) lay the foundations for social stratification by continually reducing the zone of "optimum" productivity while allowing the population to expand at a geometric rate. It also (4) increased man's potential for environmental destruction, so that eventually it would have been impossible for him to return to his former means of subsistence, had he wanted to.

The consequences of domestication as seen in the Near East seem equally visible in parts of Mesoamerica. Consequence No. 4 seems to have occurred fully only in the central highlands of Mexico and to lesser degrees in the subhumid valleys of Oaxaca and Puebla and elsewhere. Certainly in the tropical forest lowlands the population densities and land clearance were never of a degree that would prevent large numbers of people from surviving by any "former means of subsistence."

At the 7000-foot elevation of the Basin of Mexico, a combination of widespread subsistence farming, friable erodable soils, light rainfall, and cool climate had probably brought about almost complete despoilation of the most readily accessible natural vegetation and the wild life its shelters by 1 A.D. or very soon after, at the hands of an increasingly dense population. The early settlers, who then as now found the Valley a pleasant, healthful, productive and invigorating place in which to live and exploit a wide variety of resources, were faced very soon with problems resulting from the slow or non-existent natural ability of the region to recuperate itself in their

presence. The compensatory human responses to this situation are those which Sanders--probably quite rightly--feels led to the peculiarly (for Mesoamerica) centripetal urbanistic Central Highlands civilization: regional agricultural specializations and intensification (including plant selection, irrigation, terracing, fertilization, crop rotation, drainage, and eventually, chinampas and commercialized craft and trade patterns (1968:94-101). We are familiar with the civilizational results of these measures and may not have to be reminded that increasing socio-economic interdependence as well as competition inevitably lead to complex social systems and centralized political organizations, both of which have a direct relationship to population expansion and a decreasing dependence upon hunting and gathering (see especially Harner 1970, "Population Pressure and the Social Evolution of Agriculturists").

The higher natural game and plant recuperation rates in most other regions of Mesoamerica (where swidden farming maintained semi-wilderness conditions) may have been more influential in retarding the evolution there of urban civilization than were missing "symbiotic" opportunities as a result of the lack of a more diversified regional geography (Sanders 1968:105). Population densities in the less healthy forested lowlands never reached a stage wherein the rather low-intensity cultivation practices necessary to maintain them were any real threat to the forest habitat; second growth forest may provide even better hunting and gathering conditions than does virgin forest. Some authors have noted that normal slash-and-burn milpa activity seems to encourage game increase, and many plant products normally available in the milpa system (firewood, cordage, bark, thatch, timber, edibles) have to be replaced by domesticates or by trade where no forest is maintained. The result is that the more forest there is, the less need there is for domestication and trade and the less ecological pressure there is for the responses leading to civilization. This situation was described by Sanders (1963:239) as follows:

> Carniero (1961) has recently demonstrated that slash-and-burn farmers in large, almost limitless areas of forest, tend to have "fronteristic" attitudes toward land use, and population density tends to be low and the growth of civilization is, therefore, retarded. In circumscribed areas the situation is different and the exhaustion of these smaller regions is quick, so that a filling-in demographic process occurs with increasingly more efficient and more intensive patterns . . .

In other words, agriculture in the warmer and wetter regions which were extensively forested apparently had a relatively minor role in "forcing" the emergence of civilization, and highly advanced societies did, in fact, develop in other ecosystems long before they appear in the moist peninsular forest lowlands. Social equilibrium, furthermore, was always maintained at a less urban level in the forest ecosystem than in others. One is impelled to see almost strictly human and non-ecological explanations for the rise and maintenance of the Maya civilization in its forest environment, remembering, of

course, that it was the presence of the forest, at least, which permitted a civilization of this type to exist. Non-subsistence-related factors, at any rate, do seem to have been more important in this area, and we have many clues as to what these were. Inasmuch as Preclassic Maya sites appear repeatedly to have had sudden and near-simultaneous beginnings as well organized communities, we can assume them to be the product of competitive, if pioneering, feudal and/or religious leadership and, in their early stages, dependent almost entirely upon cultural borrowing rather than upon local inventions. Successive expansion apparently was the result of such equally non-ecological factors as the development of architecture, engineering, pharmacology and other sciences, paving and drainage or water storage projects, status warfare, and so forth. Admittedly, these are responses to environmental limitations, but they do not always appear, and, in fact, have only rarely done so in lowland American forests.

Beginning in the "Early Climax" or Late Preclassic horizon, the peninsular tropical forest communities tended to replace the forest in certain localities, and from this point forward it was the maintenance of these larger and larger centers, with their many stone structures, pavements, reservoirs, causeways, and elegant (by present forest standards) housing platform-patios, that was the response-creating mechanism largely responsible for the long-lasting success of the Maya society. It is unlikely that devotion to the corn agricultural cycle and/or Maya religion per se were nearly as effective in keeping the Maya farmer-townsman in equilibrium as was his dedication to the "bricks and mortar" of his complex society. We can not omit the spiritual factor in this situation either, as modern society continues to demonstrate (see Addendum).

ECOSYSTEMS AND CULTURE HISTORY

Two foremost proponents of an "ecoysystem" explanation of cultural development are Hole and Flannery (1967:197) who have argued that

> . . . An approach dealing with man's use of his environment concentrates on production and distribution--and relegates, to the secondary position of symptoms, such clues as the spread of pottery styles, the building of shrines, and the migration of human groups.
>
> A recent trend in archaeology and ethnology has been the adoption of an ecosystem approach, which focuses on the reciprocal relationship between man and the various other species involved with him through time. . .
>
> . . . it is oversimplified to view this as "man's struggle against nature". Man is not in competition with his environment, nor is it likely that prehistoric man viewed nature as something to be conquered or subdued. He worked, within the context of the ecosystem,

to extract more energy from certain species of plants and animals than he expended in obtaining them.

In the above context, then, we have to recognize that agriculture is part of a more complex production and distribution system, and that ceramics are a symptom (and witness) of that (and other) systems. Furthermore, in Mesoamerica it is necessary to consider not one or two but several basic ecosystems. Within the confines of this paper it has been possible only to outline the ecosystem divisions seen to be desirable for such an ecological analysis (Figure 1). Before discussing further the rationale of the Figure 1 chart, it is convenient to review a recent beginning effort in a similar theoretical direction which will demonstrate the need for a more discerning multi-ecosystem approach to Mesoamerican culture history.

The Favored Highland-Lowland Interaction Theory of Civilization

In a brief appraisal of the relative contributions of "highlands" and "lowlands" to the development of the agricultural village and ceremonial center pattern in Mesoamerica, MacNeish (1966:184-185) adopted Sanders' widely known cultural use of the biological term "symbiosis" to form an admittedly speculative hypothesis. MacNeish envisioned five steps or stages, which may be paraphrased as follows:

1) After 7000 B.C.: Highlands emphasized plant gathering subsistence and wet-season macroband, dry-season microband existence. Lowland coastal dwellers gathered sea resources and formed macrobands in relatively permanent communities.

2) From 5000 to 3000 B.C.: Highland plant collectors began to domesticate more and more plants, with a more sedentary way of life as somewhat larger macrobands. Lowlanders utilized more efficient techniques exploiting sea resources and small coastal habitations became permanent stable villages.

3) From 3000 to 2000 B.C.: The Highlands use of more domesticated plants resulted in an agriculture-based subsistence and small semi-sedentary pit-house villages. The Lowlands began to receive a diffusion of highland subsistence techniques so that the addition of agriculture to an already existing village life based upon a stable food supply from the sea meant acquisition of food surpluses; this may have resulted in a rather explosive development of ceremonial or religious activities among the lowland villages. [Although MacNeish does not say so, it may have been the continuing dependence upon the increasingly difficult hunting of game and gathering of diminished marine-riverine resources combined with the uncertainties of early moist-land farming (all activities very much "in the hands of the gods")

which led to any increase in religious activity in the lowlands; the scheduling made possible by storable surpluses did not contribute to exaggerated ceremonial activities, to our knowledge, until almost a thousand years later.]

4) From 2000 to 500 B.C.: Highlands people with improved agricultural economies began to accept the religious ceremonial aspects of the Lowlands culture as the latter reached a climax in terms of the population concentration and economic potential attainable from their food collecting and slash-and-burn and/or flood plain agricultural techniques.

5) From 500 B.C. to 1500 A.D.: The Highlands cultures continued to change as their agricultural potential was expanded by irrigation use, so that ceremonial centers formerly peripheral to the lowlands gradually developed into larger centers and eventually [a few] became true cities. In the Lowlands there were no more fundamental changes in the way of life achieved already in Stage 4, though new and different ceremonial centers rose and fell; the lowlands throughout this period were on the receiving end of the major developments being made in the highlands.

MacNeish concludes the above speculation with a statement that, for as far as it goes, may now be universally acceptable:

> If this speculative outline of the rise of Mesoamerican agricultural villages and even of civilization itself is correct, then there was no such thing as a unilinear cultural evolution in all parts of all ancient Meso-America. Rather there were two fundamentally different developments which stemmed from the exploitation of two different ecological zones. One was a lowland marine or riverine ecological zone and the other was a relatively dry highland ecological zone, and these in turn inter-stimulated each other, in a sort of symbiotic relation, through all stages leading to village agriculture, and even into civilization itself.
>
> . . . In fact, was there not a symbiotic highland lowland development of village life and civilization not only in Meso-America, but also in Peru and Near East?

The most obvious shortcoming of MacNeish's conclusions for Mesoamerica, insofar as "civilization itself" is concerned (and apart from the fact that

we really do not know what was going on anywhere at 2000 B.C.!), is that it seems to ignore a major and certainly fundamental Mesoamerican civilization involving a third "ecological zone" which was neither marine-riverine nor dry highland, namely the tropical forest and mainly water-hole ecosystem of the peninsular Maya Lowlands. This relatively large cultural area was a quite uniform environment which held the New World's most intellectually advanced (and most populous?) Classic period civilization; failure of the Maya area to participate in the earlier stages of Mesoamerica's cultural development is a problem demanding more detailed consideration (see Addendum). The Preclassic Maya settlements may in fact have resulted from a geographical expansion influenced by highland-lowland inter-stimulation, but the subsequent rise of the unique Maya civilization can hardly be attributed to a position "on the receiving end of the major developments being made in the highlands". An oversimplified subdivision of the complex cultural ecology of Mesoamerica obviously will not do justice to a complicated culture history, a fact which simply strengthens MacNeish's arguments against a unilineal theory of development.

The Basic Ecosystems of Mesoamerica And Their Unifying Ceramic Horizons

The subdivision of central and southern Mesoamerica into six principal ecosystems (Figure 1) is a trial effort. The great diversity of land forms, climates, soils, vegetation, and plant life typifying Mesoamerica have been discussed and classified at too great length by too numerous authors to allow summarizing here (see especially Palerm and Wolf 1957 and the articles in West 1964). I have tried to make a realistic selection of key areas, drawing freely upon the general framework provided by Sanders and Price for their "Ecological Types" and "Typical Areas" (1968:104), combined with the important riverine and estuarine orientations provided by Coe (1969) and Coe and Flannery (1967). The unique recovered hunting and trapping-to-irrigation agriculture sequences in the Tehuacan and Oaxaca Valleys (dry and subhumid intermediate valleys ecosystem) are of course the work of MacNeish and others (1967a, 1967b, Flannery and others (1967), and Flannery 1968.

Each of the proposed basic ecosystems merits study as a meaningful unit within Mesoamerica. The participation of each ecosystem in the general Mesoamerican interaction sphere is most clearly indicated by ceramic style similarities--if not always trade or tribute objects--identifiable over most of the ecosystems within each of the suggested Pan Mesoamerican cultural horizons, which have chronological limits of varying depth. The useful, if not perfect, ability of pottery for gauging interregional relationships is obvious, just as are its qualities for showing internal culture change. Our knowledge of the diffusion between, and relative civilizational consequences of agriculture within, each of the ecosystems, on the other hand, is much too imperfect to justify attaching more than very general regional culture-historical importance to specific subsistence practices.

Conclusions

It is apparent that once ceramics were developed or (more commonly) adopted in Mesoamerica they had little further direct affect upon the course of civilization and are most useful as instruments of cultural diffusion and style change. The varying consequences of ecologically determined agricultural practices were more important, if not all-important, cultural determinants. Ecology became an intensified factor to the degree that agriculture upset nature's balance; this disequilibrium was always more severe in the drier, cooler regions that it was in the wetter and warmer localities. From this standpoint, the "response to challenge" theory (Sanders 1968:89) works well to explain the rise of a more urbanized, highly commercial, and imperialistic irrigation civilization in the Mexican highlands where subsistence had to depend upon intensified agriculture supplemented by imported foodstuffs and many other trade goods.

Most ancient Mesoamericans were part-time farmers who relied to varying degrees upon never-eradicated hunting, collecting, and gathering possibilities throughout their history; the wild resources available varied in direct relationship to the amount of forest land at hand, either virgin or second growth. Only where this forest products reliance did not persist (because of thorough environmental transformation by heavy population densities and intensive cultivation), did truly urban civilization result; such instances were few in number and always associated with a cool and relatively arid climatic zone.

In the lowland ecosystems the degree of dependency upon agriculture and trade was much lower, with consequently less intensification and specialization needed. The great number of elaborate ceremonial centers in the moist forest regions probably did not require the extremely complex social, commercial, and political organizations developed to build and maintain a few somewhat similar large centers in the highlands. We may suppose that both the Lowland Maya and humid Highland Maya centers depended more upon relatively simple politico-religious domination of a closely knit local farm population by an aristocratic power structure. As a result, the Mesoamerican tropical forest civilization, when controlled by the Maya hierarchy, was both more pervasive and apparently more stable than any other known in the New World, but it was never truly urban, as it had little need to be.

ADDENDUM

The comments made at this conference have favored the human approach to culture--some have called it"considering the spiritual factor." There is apparent here an unwillingness to credit ecological factors, ecosystems, or materialistic considerations generally, for the emergence pattern of civilization in Mesoamerica. Nevertheless, if it be acknowledged that unique

historical events and persistent great idea systems can determine many aspects and even the eventual outcome of particular culture developments, it is also evident that there are some distinctive response-producing environmental factors for human society in any given ecosystem. The result is that differences within and between individual ecosystems do assume explanatory value for both culture history and culture process, as many investigators have tried to demonstrate. In sum, human response probabilities to certain circumstances can be predicted, but the ultimate role of the human will, never.

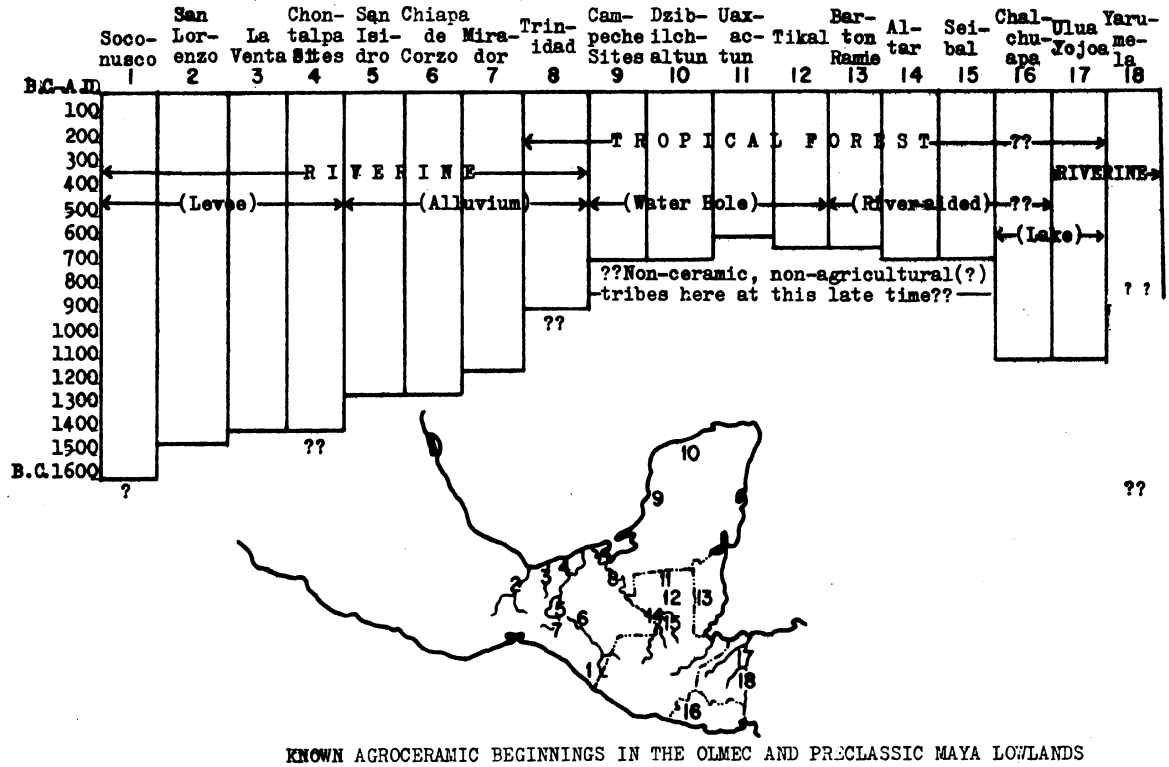
Some civilizational consequences of human versus non-human ecological factors can perhaps best be demonstrated through a summary appraisal of settlement history in the largest, most uniform, and most enigmatic of our proposed ecosystems, the peninsular tropical forest. This area, loosely known as the Maya Lowlands, includes northeastern Chiapas, the Peten, western British Honduras, Campeche, Quintana Roo, and Yucatan. With little doubt this is the least desirable environment for human occupation in Mesoamerica; most of the southern and more humid two-thirds of the area is practically unpopulated today. These same forest regions, nevertheless,"produced" a most remarkable Late Preclassic and Classic period civilization which endured for a millenium and was characterized by unique intellectual and technological attainments, despite a puzzling late start dramatized in Figure 2 on the following page. Acceptable reasons for the unusual developmental history in the Lowlands, from much-delayed beginnings to unequalled civilization have not been made plain, in spite of their obvious importance.

In his admirable summary of "Hydraulic agriculture, economic symbiosis, and the evolution of states in Central Mexico," Sanders (1968:89) declares as the 4th and 5th postulates of the ecologist that:

> 4. Responses to environmental challenges may be technological, social, or ideational . . .
>
> 5. . . . certain kinds of responses are more likely to occur than others and to be repeated throughout the culture history of a given area.

It appears in the Lowland Maya area that the civilizationally important responses were first and foremost those of an "ideational" nature, and only secondarily those that were social and technological. This reversal of the order of human progress, if correctly perceived, was the one <u>least</u> "likely to occur" in most ecosystems, and is one that seems not to have been "repeated" ever in the southern two-thirds of the peninsular tropical forests, though it may yet do so, as explained below. As has often been observed, the wet tropical forest areas form an ecosystem which man normally prefers not to enter in large numbers (Meggers 1954). Apparently only under remarkable leadership will this ecosystem undergo an intensive human population buildup and maintain it.

It has been emphasized in this conference that we do not know whether part or all of the peninsular tropical forest ever had a preceramic occupation,



KNOWN AGROCERAMIC BEGINNINGS IN THE OLMEC AND PRECLASSIC MAYA LOWLANDS

FIG. 2

one assumedly based upon hunting and the gathering of roots and tree crops, but I have indicated the possibility on the Figure 2 chart. If it did exist, such a forest efficiency might have been a deterrent to the development of a more advanced culture, as has been pointed out previously. Regardless of this possible situation, the appearance of pottery is sudden, associated with a rather sophisticated culture which was established at a number of approximately coeval sites across the breadth of the peninsular forests by about 750 B.C. These communities appear to be the product of an enlightend immigrant population coming in from adjacent ecosystems. Presumably these people brought with them both improved lowland maize varieties and competent swidden techniques. It is only for their remarkable progression from this already advanced pioneering threshhold in an unfriendly environment that we can give exceptional credit to Maya spiritual leadership; location of the first pioneering communities seems to have been determined by the ecological prerequisites of water transportation, drinking water, and the availability of a shellfood protein supplement to their simple agriculture.

Progress of the Preclassic Maya communities was not constant, and their archaeology records a falling away at some sites prior to the "cultural surge" which began about the time of Christ and resulted in the Maya civilization. We do not know if there were ecological reasons for the decline of certain sites while others progressed, but they offer the most plausible explanations. In the fronteristic and uncircumscribed tropical forest it would seem to have been always too easy for groups of village farmers to melt farther back into the forest, intensifying many of their normal hunting and gathering ways, whenever the going got too tough locally (too many neighbors, bad crops or scarce wild resources, or domineering rulers). This facility to find unexploited resources and homesites worked against the development of a high dependence upon domesticates, the concentration of population and power, and the rise of urbanized centers. Anyone who wanted to maintain a tight regional or even community organization in this ecosystem clearly had his work cut out; the presence of a slave class, warriors, and eventually tight community sustaining area boundaries are probable responses to this difficult situation in the Lowland forests in Classic times (Puleston and Callender 1967; Rands 1952; 1967:145-150; 1969:10).

Apparently there are three good but overlapping ways to establish and maintain a civilization (with relatively high population densities) in a natural forest region: (1) destroy the forest; (2) destroy the forest dwellers' basic hunting and gathering culture, substituting an immigrant culture and people if necessary; and (3) convert or subjugate all citizens to a fanatically ethnocentric and highly sophisticated ritualistic belief system. The Classic Maya made some progress in all three of these directions, and were spectacularly successful in the third regard. The "Mexican" invader-immigrants into the area after 850 A.D. and the later Spanish conquerors seem to have failed miserably in all three respects insofar as the wetter forest regions are concerned, just as have modern governments.

It seems that we must attribute to the organized Lowland Maya of Classic and Preclassic times a spiritually effective leadership far superior to any visible in their area during historic times, even in northern Yucatan at the time of the Conquest; no one has put forth purely environmental explanations for the rise (and fall) of Classic and Postclassic Maya civilization that are acceptable. When functioning, the ancient Maya leadership, whether religiousor secular, logically might have put some science and discipline into agriculture as well as into architecture, astronomy-astrology, art, genealogy, and religion. Nevertheless, we see no evidence of advanced agricultural techniques among the Lowland Maya. They seem to have added no new domesticated animals or plants, nor to have developed irrigation systems nor terracing. I think, however, that a tightly structured and numerous Classic Maya nobility dependent upon locally contributed foodstuffs surely commanded the necessary respect to have lands worked more intensively than is commonly done today (Haviland 1968; Reina 1968:568).

Some conjectured Classic Maya intensifications of their agricultural system would include participation of the entire family for the constant hand pulling of both grasses and breadleaf weeds, the hand-picking of insects, and hand-watering from stored reserves when necessary in difficult times. Present-day Maya do not do these things as a rule, and probably never did them willingly. Other farm practices expectable from the record-keeping Classic Maya, and sporadically encountered today, would include close seasonal observations, seed selection including specific seed-to-soil type matching, crop as well as land rotation, composting, and the studied use of a wide variety of native crops other than maize combined with dooryard cultivation and fertilization. The arguments which Puleston (1968) makes for the garden orchard production of the breadnut or Ramon tree seed and its storage in chultuns, for instance, can, of course, also be made for the storage of dry maize grains continuously harvested from patio lots perpetually fertilized by their human, canine, and avian occupants. More farsighted regional administrative duress and more dense demographic conditions would also overcome the modern tendency of self-centered forest farmers to avoid weedy ground and to plant nothing at all anywhere whenever there is abundant stored corn already on hand despite the favorable conditions which may exist for additional production.

Projecting our viewpoint forward, the re-establishment in the lowland Mesoamerican forests even now of productive farmlands and sizable communities may need nothing more miraculous and technologically meaningful than an inspired leadership with a devoted following. Today, for example, there is an unprecedented movement of highland Tzotzil and Tzeltal Maya Indians recently converted to Protestantism down into the unpopulated forests of lowland northern Chiapas. Lands are being occupied which were abandoned by the Classic Maya perhaps a thousand years ago. Hardscrabble villages, one after another, are being founded in this region, as much from land hunger as from spiritual motivations. Whether these communities survive and prosper or not, however, may be more dependent upon the leadership, unity, and inspiration provided by

the religious element in the populace than upon the eventual ability of the soil to produce a dependable livelihood. Offhand, it would appear that the belief system of these new but humble immigrants is neither sufficiently sophisticated nor ritualistically demanding enough to make any outstanding new civilizational imprint in the region. Neither can we be certain that the much-bewailed destruction of the forest will be sufficiently thorough so as to precipitate the intensifying mechanisms characteristic of civilized status. It is, perhaps, significant that the Mexican government is beginning to promote the building of terraces on the abundant hill slopes around northern Chiapas communities as the one most direct method of stabilizing both the soil and the population. And, perhaps more significantly for the future, the development of cattle pastures, tree crops, and crop rotation on these fixed communal lands is also being encouraged.

The more probably successful modern alternative to the small-farm, often communal, type of response to the peninsular tropical forest challenge will be land clearing on a tremendous scale with bulldozers, followed by improved pasture grasses and imported disease-resistant cattle. This increasingly favored course of action will be a typical human response to environmental challenge in which improved technology does overcome ecological limitations in predictable order. If such a modified land use pattern is to result in increased population densities, however, it will be because of man-dictated factors of a religious or sociopolitical nature rather than because of environmental determinants; the normal direction of intensified livestock ranching is toward low-density human participation.

There appears to be little that is "inevitable" about the progress of any ecosystem in which man participates. It may be supposed in the present instance that only time, and not theory, can tell whether the efforts of dispassionate missionaries, government agents, or cattle barons will in any way match the exploits of those remarkable Preclassic elite who captured the strategic waterholes and imagination of another tropical forest populace over 2500 years ago in the Maya Lowlands.

We may venture to say that many of the vital civilizing factors identified in this conference are still missing in most of the peninsular tropical forest today. "Great ideas," a "sense of history and continuity, a sense of horizons," and "knowledge, a feeling for history, expansion, permanence, and continuity" are all spiritual qualities which, to the casual observer, appear to be rather much in absence. The lack of such elements, if in fact true, does not portend an immediately great society, but neither does it preclude the development or arrival of a more forceful ideology at some moment in the future.

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