

Millers and Grinders: Technology and Household Economy in Meso-America

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The introduction of European cereals into the ancient maize culture of Meso-America provides a comparative perspective on those barely visible, almost immutable elements of daily production that some have called "material culture" and others "material life." In the case at hand we turn our attention to the preparation of the daily bread which in Meso-America has meant for thousands of years the humble maize cake or tortilla. Precisely because the monotonous acts of daily life are so ordinary, they are rarely remarked upon by contemporaries and their unusualness little noticed by scholars. The extraordinary features of the maize-tortilla regime and its social implications can perhaps best be seen against a sketch of parallel development of the small cereal cultures of Mediterranean Europe.

Let us begin with a striking fact and an apparent puzzle. If one turns back some 5000 years to the frescos of Ramses II or to the early strata in the caves of Tehuacan and later terracotta figurines, a nearly identical and highly important instrument can be identified. In both cases, women are grinding grain, bent over the saddlestone in Egypt or its New World equivalent, the *metate* in Mexico.¹ Over the subsequent five millenia, however, the techniques of milling and grinding and the gender division of labor in those activities followed entirely different trajectories. From the saddlestone of the Third Dynasty there evolved lever and hourglass mills, querns and revolving millstones. These were adapted to animal power which in turn

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1. Richard S. MacNeish, "A Summary of the Subsistence" in *The Prehistory of the Tehuacan Valley*, Vol. 1, *Environment and Subsistence*, Douglas S. Byers, ed. (Austin, Texas, 1900), 301-03.

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opened the way for water powered mills and in the last century before Christ this new technology spread from the Eastern Mediterranean through Greece into the Roman world and then outward throughout the rivers of Europe.² Their acceptance was discontinuous and hesitant, as Marc Bloch's marvelous article on the subject shows, but water and wind powered grain mills were steadily perfected and enlarged and, in fact, grain mills became by the sixteenth century, Europe's "heavy industry."³ With the conquest and occupation of America, this technology accompanied European cereals to the New World. Within a decade of the landing at Plymouth Rock, water-powered mills were grinding the grain of the Massachusetts Puritans and with the inventions of Oliver Evans in Delaware in the later eighteenth century, the capacity of mills and the quality of flour took a great leap forward culminating in the giant operations of such companies as Pillsbury in Minneapolis in the later nineteenth century.⁴

In Spanish America, Mediterranean milling technology also followed wherever wheat was raised and water or wind available. In the course of this development the production and processing into food of the European small cereals came to be dominated by two central facts: (1) from plowing and planting, through harvest and threshing to milling and baking, *men* did most of the work. And this is especially true in Mediterranean culture where grain was threshed by animals rather than the flail and bread often baked commercially; and (2) milling itself was done on an ever larger scale. Already in ancient Rome, to take one example, there was but one grist mill for every 2000 people and by the late-nineteenth century when Minneapolis passed Budapest to become the world's principal milling center, individual mills turned out nearly 2000 barrels of fine flour a day and by 1915, a handful of mills in Minneapolis produced over 20,000,000 barrels a year, enough for the daily bread of several million people.⁵ I leave to others fuller speculation on the implications of this for the household and the role of women in development, but on the face of it, the diversified household economy and varied diet promoted by women in wheat cultures seems to be related to the fact that men, because of their greater role in preparing the principal ingredient for the daily bread, free women for other work. It is difficult, for example, to imagine the full and varied life of one Esther Lewis and her four daughters on a family farm in

2. A useful discussion of milling technology is John Storck and Walter Dorwin Teague, *Flour For Man's Bread: A History of Milling* (Minneapolis, 1952).

3. Marc Bloch, "The Advent and Triumph of the Water Mill" in *Land and Work in Medieval Europe*, selected papers by Marc Bloch (New York, 1966), 136–68.

4. Ruth Schwartz Cowan, *More Work for Mother* (New York, 1983), 46–53, has an interesting but to me unpersuasive discussion of the effect of new milling technology upon household work.

5. Storck and Teague, *Flour*, 210.

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Pennsylvania in the 1830s had they been bent over the Meso-American *metate* for six hours a day.⁶

Keeping in mind this sketch of small cereal milling and baking procedure, the equivalent path of Meso-American maize grinding technology is absolutely remarkable. For here, the metate hand grinder present in Tehuacan before 3000 B.C. was unchanged for the subsequent 5000 years, and into the late nineteenth century it remained the sole instrument for the production of the staff of life for millions of Mexicans and Guatemalans. This enduring neolithic technology began to be replaced only in the late nineteenth century by the electric, steam and gasoline powered grist mill (the *molino de nixtamal*) and even today in remote regions the mano-metate is still the indispensable tool in tens of thousands of households.⁷ Put another way, the preparation of the basic staple food in Meso-America was unchanged for thousands of years, into the industrial nineteenth century and remained decentralized to the level of the household; that is, if one miller-baker in Rome produced enough bread for some 400 households, in Teotihuacan, 400 women, each with her metate, would have risen at the first light of day to begin the six-hour daily grind. If the 600 households of Sturbridge village (Massachusetts) in the 1830s had their grain reduced to flour by a single water driven grist mill, 600 women would have been required for the comparable task in Tulancingo. This in turn means that for the past several hundred years while women in wheat cultures spent perhaps no more than 3 to 4 hours a week on bread (and less if bought from the village baker), maize women took 35 to 40 hours a week on tortillas alone. From these figures, which will be elaborated as we go along, one main question arises: How does one explain the persistence for over 5,000 years of a single and immutable maize-tortilla technology, one in which the industrial development associated with the power mill—that “parent of modern industry”—was unknown and one that even after alternative technology was available, remained unchanged?

The origins of tortilla making are lost in time, but the presence of grinders and griddles in the earliest archeological strata suggests that the ubiquitous maize cakes emerged almost with the domestication of maize itself. Part of the explanation for maize technology, the internal logic of the peculiar tortilla regime, must be sought in the details of food production. So let us begin by looking closely at the actual preparation. The several modern preparations can probably be extended into the past as there is no

6. Joan Jensen, *Loosening the Bonds* (New Haven, Connecticut, 1989), 129–44.

7. *Nuestro Maiz*.

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suggestion in the archeological record that practice varied over the several thousand years.⁸

The early stages of maize production—which we shall pass over lightly here—require much less effort than do the small cereals. With hoe and digging stick maize can be planted on hillsides too steep for plows and among rocks and stumps, whereas wheat demands the laborious tillage of the entire surface of the field. Maize yields more both in terms of ratio to seed and of area than the small cereals, two crops a year can often be taken in the tropics, harvest is relatively easy and because it can be left to stand for weeks and even months in the field, the harvest schedule is not rigid.⁹ All of these relatively easy stages, one should notice, were by and large men's work although women could and did assist under certain conditions. But if male labor was dominant through the harvest stage, if men picked the ears and stored them in the peasant loft or estate granary, from that point on it was—and is—women's work. Women shelled—the equivalent of small cereal threshing—by holding the ear of corn in one hand and stripping the kernels loose with the side of the thumb of the other. There were variations to this procedure: in some cases corncobs were gathered together and tightly bound and the ears rubbed over them to shell the grain.

Whatever the method, this was an arduous and time consuming procedure, a fact brought home to me during winter evenings of my childhood. One year my sisters and I decided to plant a small plot of our family farm in Kansas to popcorn for our own use. When it was picked we had a good sized pile of ears in the granary. Shelling, however, was another matter. After several hours and very sore thumbs, we had produced only a small tin pail of kernels. My father looked in and suggested we borrow the neighbor's small hand corn sheller which, to our enormous relief, accomplished the entire job in a brief morning. This very appropriate technology was virtually unknown in Mexico and is still not available in most peasant households in Africa or Latin America.

After shelling—we return now to Meso-America—the maize kernels were washed in a perforated clay pot, soaked in a more or less one percent lime solution and then heated, but not boiled, to around 80° centigrade for 20 to 40 minutes. The soaked and softened maize, now called by the Nahuatl term, *nixtamal*, was washed again to remove the pericarp and

8. Descriptions of household food preparation may be found in Nathan L. Whetten, *Rural Mexico* (Chicago, 1948), 304–05; Robert Bartley Taylor, "Teotitlan del Valle: A Typical Meso-American Community," (Ph.D. dissertation in Anthropology, University of Oregon, 1960), 89–92; and most interestingly in B. Travel, *Land des Frühlings* (Berlin, Büchergilde Gutenberg, 1928), 109–14. I am indebted to Ms. Fridel Baumann for translation.

9. Angel Palerm, "Agricultural Systems and Food Patterns" in *Handbook of Middle American Indians*, Vol. 6, *Social Anthropology*, M. Nash, ed. (Austin, Texas, 1967), 26–52.

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then laboriously ground and reground on the metate. This was, by all accounts, back-breaking work which occupied several hours of each day in the ordinary household. The resultant dampened flour or *masa* was then formed into round thin cakes, baked on a griddle and stored hot, covered by cloth, in a basket. This procedure was performed every day and often more than once because if the tortilla has marvelous qualities, its capacity for storage or preservation is not one of them. The tortilla must be eaten hot and it does not keep; few people in Meso-America, however humble, will accept a day old tortilla. One might note in passing that this decentralized procedure is highly energy inefficient and requires large amounts of charcoal, which helps explain the deforestation and erosion throughout much of central Mexico.

But to return to our question, how can the remarkable changelessness in maize grinding be understood? There is first of all the matter of the wheel, or rather the lack of its practical application in Meso-America. Wheeled toys were present but there were no potting wheels nor wheeled vehicles, a fact no doubt linked to the absence of draft animals. Old World wheeled culture surely suggested the use of rotary mills, but we must notice that while wheels were present from the Bronze Age on, their application to power, that is for water or wind mills for milling, did not occur for over 2,000 years more, until a few centuries before the Christian era. Marc Bloch believed that the more immediate antecedents of the water mill were the irrigation wheels that lifted water from one level to the next in the arid summers of the Mediterranean.¹⁰ In any case, their absence in Meso-America must be counted as an obstacle to the invention of power milling and to the entire course of industrial development that came out of milling. But this does not explain why Mediterranean water and wind-powered milling, introduced into Meso-America in the sixteenth century along with wheat and barley, was not applied to maize. Or more accurately, *to maize for tortillas* because here we must distinguish between the requirements of different kinds of food. Power driven mills of European origin *were* used in Spanish America to reduce *dry* maize kernels to coarse flour for meal and chicha—the fermented maize beer of the Andes—and a variety of other corn based foods.¹¹ But the first *molinos de nixtamal* were only installed in Mexico in the later nineteenth century and then, as we shall see, stoutly resisted for several decades more. Why then the resistance to power milling *after* it became available in the nineteenth century?

One explanation may lie in the quality of milling technology and the

10. Bloch, "Advent of the Water Mill," 139–40.

11. Brooke Larson, "Economic Decline and Social Change in an Agrarian Hinterland: Cochabamba (Bolivia) in the Late Colonial Period," (Ph.D. dissertation in History, Columbia University, New York, 1978), 173.

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problem of milling soaked grain. The tortilla requires an especially finely ground flour, in fact even today machine ground nixtamal is frequently reground by metate for fineness, so mills in use before the superfine mills of the later nineteenth century may not have been adequate. There was the additional problem of milling lime-soaked grain, a problem not faced in the countries where the original milling techniques were developed. But if wet grinding technology presented a serious obstacle, why, when the enormous labor savings of European mills became available, did people not shift to maize in a form other than the tortilla? In fact, it seems that the shift was toward more tortillas rather than less.¹²

Apart from the natural conservatism of taste and diet, there were decided advantages in eating maize in the form of tortillas, which can be demonstrated with reference to the disastrous experience of new maize eating societies brought into existence by the application of Old World technology to New World cereal. Wherever maize was treated as a European cereal—that is, milled into flour and eaten as meal, cornbread or polenta—and became the principal item in the diet, the consumers suffered from pellagra. This was true in the U.S. South where maize was native but processed and consumed as a European grain and in Lombardy, the Balkans or Asturias, where the plant was imported from America. Among dedicated corn eaters the sole exception to the plague of pellagra were the people of Meso-America and the humble tortilla claims substantial credit. Maize is low in pellagra-preventing niacin and, moreover, what is present exists in a chemically bound form. The addition of lime, however, frees the bound niacin so there is some evidence for the beneficial effect of this treatment. More important was the practice of eating tortillas in conjunction with beans and chiles which provide protection against pellagra. It may be difficult to imagine that pre-Columbian people consciously added lime to improve the nutritional qualities of maize, but it is plausible that the consumption of maize together with legumes “developed as a result of innate recognition that they were needed together for health. . . . In an instinctive way (Meso-Americans) warded off pellagra, the disease of the corn eaters who received no supply

12. In recent years large transnational mills have introduced radical change in the processing of maize into *masa*. Maize kernels are still cooked with lime, not in clay pots but in huge vats. The grain is then dried, ground into flour and soy bean ingredients added. The consumer merely adds water and mixes into *masa* for tortillas. This product, carried out on an industrial scale, recalls through its name of “harina de maíz nixtamalizado” (nixtamalized corn flour) the ancient practice of the Indian household. See, for example, *Nacional Financiera*, “La industria de la harina de maíz” (Mexico, 1982), 22–25. Industrial *masa* for tortillas has been stoutly resisted on grounds of taste and esthetics.

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of the preventive or of protein.”¹³ Whatever the process, conscious of nutritional benefit or not, the tortilla appeared early in pre-Columbian history, became more important as population grew and people concentrated in town and village, was more vital still as the fundamental Indian food as a European regime was imposed from above during the colonial centuries, and of course remains the staple today.

Perhaps the most satisfying explanation for the persistence of neo-lithic technology may paradoxically be sought in the broad social changes that have occurred in Meso-America together with the dietary changes that accompanied them. Although, as we have seen, metates and griddles were present in the very early strata at Tehuacan, maize occupied a relatively small percentage, perhaps no more than 15–20%, of the total diet around 3000 B.C.¹⁴ From then on as domestication advanced and settlement became more permanent, maize, in various forms but increasingly in tortilla, became more and more important. By the time we come to the decades preceding the European invasion, the people of Meso-America had worked out a complex diet with maize, beans, squash, chiles, and the maguey at the center but supplemented with algae from the lakes, honey from the stingless bee, ducks and dogs fattened for meat, and a wide range of mammals, birds, fish, reptiles, amphibians, crustaceans, insects, worms—in fact anything that could be eaten . . . a list of foods that made up the “basis for a rich and varied diet.”¹⁵

As in all stratified societies there were substantial differences in access to food by social class. Bernal Diaz and other eyewitnesses provide vivid—and controversial—descriptions of the Aztec elite’s Lucullan feasts where dozens of exotic dishes of game, fish, vegetables, fruit and grain were served.¹⁶ Borah and Cook cite the *Relaciones Geográficas* to show that even a half century after the Conquest, the “choicer products” were still reserved for the native upper class. Before the Conquest, access to more food and a more varied diet depended upon the ability of the elite to

13. Daphne A. Roe, *A Plague of Corn: The Social History of Pellagra* (Ithaca, New York, 1973), 11–19.

14. MacNeish, “Summary,” 301.

15. Sherburne F. Cook and Woodrow Borah, “Indian Food Production and Consumption in Central Mexico Before and After the Conquest (1500–1650)” in Cook and Borah, *Essays in Population History: Mexico and California*, Vol. 3 (Berkeley and Los Angeles, 1979), 134–40.

16. Bernal Diaz del Castillo, *The Discovery and Conquest of Mexico*, trans. from the Spanish by A. P. Maudslay, Intro. by Irving Leonard (New York, 1956), 109–11. “. . . for they daily cooked fowls, turkeys, pheasant, native partridges, quail, tame and wild ducks, venison, wild boar . . . and . . . (there were) two graceful women to bring him tortillas. . . .” “Montezuma’s Dinner,” or rather Bernal Diaz’s description of it, was ridiculed by Lewis Morgan. See the discussion in Benjamin Keen, *The Aztec Image in Western Thought* (New Brunswick, New Jersey, 1971), Chapter 12.

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extract a surplus through the mechanism of tribute and their success can be gauged from the record in several codexes. The peasants, who made up the overwhelming mass of the population, "ate a much leaner diet of maize, beans, chile and agave enriched with wild fruits, nuts, berries, roots and the like which could be gathered over the countryside." Borah and Cook conclude that the "Indians as a whole were exploiting in an amazingly efficient manner the total biomass of the environment . . .," and that when scarcity arose in years of crop failure, "the deficiency was quantitative not qualitative."¹⁷

To this primitive but yet sophisticated food regime, the European invasion in the early sixteenth century brought sweeping and catastrophic change. On one hand an array of new plants and animals were introduced.¹⁸ European livestock reproduced at an alarming rate in this fenceless world, grazing over and trampling native fields and shattering the local ecology; the oxen drawn plow increased production in the bottom land but led to erosion of fields previously planted with hoe and digging stick. Of the new animals the native population quickly saw the advantage of sheep and pigs and took them up when possible; horses and cows were either proscribed by the conquerors or judged of little value by a native population rapidly losing its land. European fowl were a valuable addition to native diet since they needed little care and were efficient scavengers, supplied eggs and "were a ready source of flesh in such small inexpensive amounts that peasants could wring the neck of a chicken without reflecting upon the loss of revenue."¹⁹ European cereals, several European vegetables such as lettuce, radishes, carrots and cabbage and an assortment of Old World fruits, also became available but only the fava bean was readily accepted.²⁰ Wheat and barley, like cows and horses, remained by and large under European control. The banana, introduced from Africa, became a native staple in the lower elevations.

On the other hand, however, even this incomplete list reveals the paradoxical effect of the European invasion: new and enduring additions were made, others were proscribed or not accepted; but all had far reaching impact upon the fragile biomass that provided the unusual and varied diet for ordinary people which has been described above, not to mention the demographic catastrophe that reduced the native population in Central Mexico from perhaps 12 to 15 million to less than a million a century later, with similar effects felt throughout Meso-America.

17. Cook and Borah, "Indian Food Consumption," 140.

18. A standard treatment is Alfred Crosby, Jr., *The Columbian Exchange* (Westport, Connecticut, 1972).

19. Cook and Borah, "Indian Food Consumption," 172.

20. Charles Gibson, *The Aztecs Under Spanish Rule* (Stanford, 1964), 319.

Interrelated with the biological and demographic features sketched above was the social impact of the European occupation on both the native elite and the peasant mass. After some experimentation the Spaniards settled on a model of “two republics” in which the priestly and warrior elite of pre-hispanic society was liquidated while an attempt was made to keep native social structure intact alongside the parallel European society in order to facilitate the task of conversion and the extraction of economic surplus. With demographic decline, however, unbearable pressure for labor and tribute forced a reduction in the status of the previously exempt native leaders. In the course of the sixteenth century the native social structure was compressed, rank and privilege reduced, and the entire mass pressed to the bottom of the new order imposed by the Europeans. This was accompanied by the appropriation of land and water. In two great waves of resettlement and appropriation (1553–1563 and 1585–1595), the European settlers and their descendants (and in rare cases surviving members of the native elite) placed the remnant population into new congregations and took over its land to extend European agriculture.²¹ Some of the best irrigated lands were planted to wheat, others to cane or used for grazing. The native population retained as a rule land sufficient only for its *milpas*, i.e., patches of maize land, or obtained access to arable through service tenantry or sharecropping on the emerging haciendas.

Even this brief sketch of a complex and long-term process should suggest the impact upon dietary regime: at the top of the abundant and fairly elaborate cuisine—“Moctezuma’s supper”—vanished with the Indian nobility; below, the access to foraging and the sophisticated exploitation of a wide range of resources in the environment on the part of the Indian mass was diminished by the invasion of European men and animals. The native diet was relentlessly compressed into what came to be known as the Holy Trinity of maize, beans and squash. By the early twentieth century, the maize tortilla had come to contribute some 70–75 percent of the total caloric intake of ordinary people, a much larger share than it represented centuries earlier.²² Thus we come to a cruel paradox: Meso-American people drew their sustenance from the humble tortilla, the simplest of plants to produce,

21. For a recent summary, see Enrique Florescano, “The Formation and Economic Structure of the Hacienda in New Spain” in the *Cambridge History of Latin America*, Leslie Bethell, ed. (Cambridge, 1984), Vol. II, 159.

22. See, for example, Ralph L. Beals and Evelyn Hatcher, “Diet of a Tarascan Village,” *América Indígena*, 3/4 (October 1943); 295; Whetten, *Rural Mexico*, 305; R. K. Anderson et al., “A Study of the Nutritional Food Habits of Otomi Indians in the Mesquit Valle of Mexico,” *The American Journal of Public Health* 36: 888; see also Harry Cross, “Dieta y nutrición en el medio rural de Zacatecas y San Luis Potosí” (siglos XVIII of XIX), *Historia Mexicana* 31:7 (July–Sept. 1981), 101–16; Herbert Nickel, “Suministro de Alimentos a los trabajadores de las haciendas,” *Forschungsmaterialien* 15 (Bayreuth, West Germany, 1987), 7–62.

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but of all cereal products in the world the one that requires the greatest investment of time in its preparation. The poorest stratum of society thus had more of a decreased range of food and in the case of tortillas, the calories were purchased at the cost of massive inputs of female labor. Under the circumstances, not only economic as we shall see but cultural as well, there was little interest in technology to improve the lot of women; the neolithic continued into the twentieth century.

Everyone agrees that tortilla preparation requires an extraordinary amount of hard work. From the 16th century codexes to modern travel accounts and ethnographic research there also is an agreement that tortilla making is women's work. Men may "in rare instances help shell corn but one never hears of a man who washes or irons or grinds corn to make tortillas." Even after the advent of the *molino de nixtamal*, "for a man to be seen carrying corn to the mill is a great humiliation."²³ In the hundreds of pre-Hispanic terra cotta figurines and pre and post-conquest codexes only women are seen over the metate. The amount of time women spend in grinding maize varied only with the energy they brought to the task. Dozens of nineteenth-century travelers from the wheat bread cultures of the USA and Western Europe write of making their way along the narrow streets of provincial Mexico to the sound of the "grit and grind of a dozen manos on their metates" and the gentle slapping into cakes of mounds of freshly ground *masa*.²⁴

Because the tortilla will not keep and few people can be persuaded to eat one a day old, tortillas are prepared each day and often twice a day. Women thus rose at the first light, long before the morning meal to begin the daily grind. This laborious task required for an ordinary family five or six hours of female labor every day of the week, 365 days a year. An astonished visitor to Mexico in the 1880s remarked that

"the labour of making tortillas is enormous, in a poor man's house the wife is occupied most of the day . . . in the sole purpose of making the tortillas for the family . . . until the Mexican turn from tortillas to grinding their corn (i.e., wheat) and making bread, the drudgery of manufacturing tortillas will prevent their women from rising in the social scale and keep them in their present overworked and degraded condition. So long as they have to go through this daily operation, so long will they keep neither themselves nor their houses clean, so long will they be unable to attend to their children nor perform that high characteris-

23. Oscar Lewis, *Tepoztlan: Village in Mexico* (New York, 1960), 25.

24. Paul Weatherwax, *Indian Corn in Old America* (New York, 1954), 99–101; B. Travel, *Land des Frühlings*, 109–14.

tic duty of women's civilization, the running of an American sewing machine."²⁵

Apart from the ingenuous and ultimately ironic notion of modernization expressed here (when the sewing machine became widely used in Mexico and Guatemala it soon became the "high characteristic duty" mainly of men, not women) we have in Mr. Brocklehurst's opinion a valid observation on the burden of women's work, borne out by innumerable village studies and ethnographic description.

If tortillas had to be made daily and their production was decentralized to the level of the household, how was food provided to workers on large projects or in armies? This question first occurred to me several years ago in a small village deep in the sierra north of Toluca. A dozen or so construction workers or *albañiles* were putting the final touches on a small rural clinic where I happened to be staying. At mid-day, they did not sit down with their lunch pails or drop into the local cafe; rather there would silently materialize a dozen white-clad women, each with tortillas and beans for her man. Such a scene, multiplied hundreds of times over, must have occurred in the early seventeenth century when thousands of men filled the labor quotas to cut the long tunnels and drainage canals at Huehuetoca in an quixotic project to control floods in the Valley of Mexico. The thousands of men were accompanied by hundreds and perhaps thousands of women, "serving as tortilla makers" on the drainage project.²⁶ The difference between wheat and maize cultures in the provisioning of armies can be seen in the supplies for the opposing sides in the U. S.–Mexican War of 1847. The North American army in one shipment received some 1,100 barrels (83,000 lbs.) of bread (or more likely hardtack), enough of that staple for several weeks' consumption. One can easily imagine that this entire supply was produced by a handful of millers on the Ohio River and a few bakers in New Orleans. In contrast, behind Santa Ana's army, one must visualize a smaller army of women, each armed with the familiar metate to provide the daily tortilla. I know of no modern study of military provisioning in Mexico but one author mentions that Santa Ana's was swollen "by large numbers of women, both for the officers and men. In truth, the women of the common soldier did a great deal of foraging, the cooking and general camp work, though so much can scarcely be said for the wanton crowd maintained by officers down the

25. Thomas Unett Brocklehurst, "Mexico Today: A Country with a Great Future" (London, 1883), 200. See also Carlos B. Gil, ed., *The Age of Porfirio Diaz: Selected Readings* (Albuquerque, New Mexico, 1977), 158–59.

26. Gibson, *Aztecs*, 311

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line."²⁷ The Mexican army, short of food, was hammered at the battle of Angustura. The same must have been true of the large groups of men on the move during the Mexican Revolution between 1910 and 1920. Their dietary needs implied the presence of hundreds of women and it seems reasonable to suppose that the famous *soldaderas* normally pictured as emotional companions of men may in fact have been more essential for their stomachs. John Reed, on campaign with Villa, noticed behind each company, "ten or twelve women on foot carrying cooking utensils on their heads and backs, and perhaps a pack mule loaded with sacks of corn." In several photographs of Mexican revolutionary armies on the move, women, with their grinding stones, crowd together on the tops of boxcars. There is marvelous snapshot reproduced in Raúl Guerrero Guerrero, *Toneucáyotl: el pan nuestro de cada día*, in which several soldiers stand, leaning on their rifles, while a woman in the foreground grinds maize in the middle of the field. The subtitle reads, "A pause in the campaign waiting until the lady (*la señora*) finishes the tortilla to eat a taco."²⁸

On the other hand there is scattered evidence of the efforts made by Meso-American women over the centuries to provide warriors and workers with maize in a form less perishable than the tortilla. Diego de Landa, the Franciscan Provincial in mid-16th century Yucatan, describes Maya women soaking maize overnight and then, "they grind it on stones and when half ground make into great balls and loads for the use of laborers, travelers and sailors. In that shape it lasts for several months, except for souring." Ross Hassig's recent work also describes the use of balls of baked *nixtamal* carried by Aztec warriors on campaign. More recently, during the American invasion of 1847–48, Mexican towns were required to provide "totopos" or toasted tortilla chips, which lasted several days, to soldiers on the march.²⁹ But as long as Mexican men insisted on fresh tortilla in their diet, and ancient custom and low cost were powerful reasons for that food, the path of production leads back to the metate and inevitably bent over it, the female grinder.

Toward the end of the nineteenth century the first rattlings of a techno-

27. *Chronicles of the Gringos: The U.S. Army in the Mexican War, 1846–1848, Accounts of Eyewitnesses and Combatants*, George W. Smith and Charles Judah, eds. (Albuquerque, 1968), 360; Wilfrid Hardy Callcott, *Santa Ana: the Story of an Enigma Who Once Was Mexico* (Norman, Oklahoma, 1936).

28. John Reed, *Insurgent Mexico* (Penguin Books, 1983), 148; Guerrero Guerrero, *Toneucáyotl* (Mexico City, 1987), 263.

29. Diego de Landa, *Yucatán Before and After the Conquest*, trans. with notes by Wm. Gates (New York, 1978), 34; Ross Hassig, *Aztec Warfare: Imperial Expansion and Political Control* (Norman, Oklahoma, 1988). I am grateful to Woodrow Borah for discussion on these points. On "totopos" as an element in soldiers' diets as revealed in mid-19th century documents, I am grateful to Dra. Brígida M. von Mentz de Boege of Mexico City. Written communication, 10 June, 1989.

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logical revolution in food processing began to be felt: someone worked out the appropriate mill for grinding soaked maize and power—first steam and then gasoline and electric—mills began to appear. Thus a change comparable to the introduction of the water mill in Mediterranean society over 2,000 years ago began to take place in the twentieth century. But even though the enormous advantages of the new molinos de nixtamal were readily apparent they were tenaciously resisted and it is in this resistance that additional explanation for the earlier absence of change may be found. The evidence for the presence of early mills as well as the reaction to them is scant; what follows therefore is highly tentative but apparently of fundamental importance in any discussion of social change in the 20th century.³⁰

Some of the very first molinos de nixtamal were established in the late-twentieth century by German coffee planters in the Soconusco (Chiapas, S.E. Mexico). They had been quick to install electric generators—their fincas had electricity before the state capital did—and used this power to drive modern processing machinery as well as the early molinos. The German estates settled a handful of permanent families and drew on the highland communities around San Cristóbal for seasonal workers. Rather than permit these workers to bring their wives to provide household tortillas, the planters installed kitchens and molinos on the estate and over the strenuous objections of the Chamula and Zinacantecan men adopted a system of modern industrial provisioning to supply the workers mill ground maize tortillas and rations of beans. At about the same time on modern sugar estates in the state of Morelos some planters “attempted to establish mechanical mills” so that women, normally at work over the metate, would be freed for other jobs on the plantation. But this effort at modernization, as the keen-eyed Karl Kaerger noticed in 1900, was only possible “where the authoritarianism of the owner” was able to impose such innovation.³¹ At the same time in the larger towns and in Mexico City itself a corps of specialized *molenderas* (female metate workers) produced masa for markets and sidewalk stands and in the final years of the Porfiriato (1882–1910), steam driven molinos de nixtamal began to appear to provision the growing urban working class.³²

30. This entire subject was suggested to me by Professor David Sweet at the University of California, Santa Cruz. I am also grateful to William Breezley, Paul Vanderwood, Morton Rothstein, and Dawn Keremitsis for suggestions and material.

31. I draw here on the forthcoming work by Ms. Fridel Baumann on the German coffee planters of the Soconusco. Ms. Baumann has published part of her research in *Mesoamérica*, Year 4, No. 5 (June, 1983), 8–63. Karl Kaerger, *Agricultura y colonización en México en 1900*, trans. from the German by Pedro Lewin and Dudrun Dohrmann, Intro. by Roberto Melville (Mexico, 1986). Originally published in 2 volumes in Leipzig, 1900, 251.

32. John Mraz, “‘En calidad de esclavas’: obreras en los molinos de nixtamal, México, diciembre, 1919,” *Historia obrera*, segunda época 6,24. (Mar 1982): 2–14. I am grateful to

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The diffusion of molinos de nixtamal at first, however, was slow. In the vast majority of haciendas and in the thousands of villages and hamlets throughout the region, the ancient techniques prevailed. Once again, a brief glimpse of parallel practice in the small cereal regimes of England and France helps place the extraordinarily individualized food preparation of Meso America in perspective. In medieval and early modern Europe, landowners with access to streams and the capital to do so, built water powered flour mills and soon began to require that the local peasantry bring their grain to the seigneurial mills. The monopoly and the fees (*banalités*) imposed by the seigneur on the grinding of grain became one of the principal complaints in the revolutionary *cahiers de doléance*. By comparison, in the maize tortillas culture of Mexican haciendas, inventories do not reveal single mills for the surrounding peasantry but rather hundreds of sets of metates for distribution to individual service tenants.³³

In those cases where haciendas drew upon neighboring communities for seasonal workers, a dual strategy was devised to supply the mid-day meals. Either these workers were accompanied by their women—or where it was cumbersome or especially impractical to do this—the estate hired a specialized runner. Here again is Karl Kaerger:

“At times seasonal workers bring their wives with them who are responsible for the preparation of food, especially for the elaboration of tortillas for all the workers of the same community. But more often . . . single men or married men without their wives come to work and in that case a so-called *tacualero* is needed for every 10 or 12 workers. This person is paid the going wage in return for which he must bring tortillas to the workers every day (or a two-days supply in the case of very distant villages) from their own communities. The offer on the part of the hacienda to supply tortillas to the workers has always been rejected since they insist on eating only those tortillas prepared by their own wives or mothers. These *tacualeros* must often cover some 40 kilometers a day, completely loaded down with individual bundles of tortillas kept separate for each worker.”³⁴

Much more so than in the small cereal cultures, the demand for maize tortillas put women squarely at the center of food production, the indispensable individual purveyor of the daily bread and so, “if for no other

Professor William Beezley, North Carolina State University, for bringing this item to my attention. See also, Dawn Keremitsis, “Del metate al molino: La mujer mexicana de 1910 a 1940,” *Historia Mexicana*, 130/2 (October–December 1983): 285–302.

33. For example, the inventory of two fincas in Chiapas in 1914. *Registro Público*, Tapachula, Sección 2, 1914.

34. Kaerger, *Agricultura*, 164.

reason than preparation of meals a wife is a virtual necessity."³⁵ The *tlacualero* served to maintain the link between male consumer and the individual female provider but the growth of an industrial work force, the availability of power and the social changes and new attitudes generated by the Revolution itself, began to push to one side the timeless metate and its tireless operator, and with this a virtually unnoticed revolution in the lives of women.³⁶

In the 1920s molinos de nixtamal, already present as we have seen, in the cities and on some of the more advanced coffee and sugar plantations, began to spread more widely into the countryside. Writing in the 1920s, Ernest Gruening noticed that "molinos de nixtamal are replacing the ancient metate wherever there is power—a spontaneous jump from the stone age to that of electricity."³⁷ In 1925, for example, the first mills were set up in the village of Tepoztlan near Cuernavaca. In 1930, the people of Mitla in Oaxaca installed an electric generator and shortly after their first mill others were established in several villages in Yucatan at about the same time.³⁸ Electricity seems to have been the most common power source although steam and gasoline engines were used in more remote places. Stuart Chase noticed in 1930 in the Yucatan, "a little corn grinder run by the remains of a model T Ford."³⁹ Knowledge of the new mills spread rapidly in the 1920s but they were only grudgingly accepted and, indeed, often actively opposed. Although here again, the information is scant and tentative, the evidence at hand suggests an explanation for the remarkable persistence of the metate over the previous centuries.

The first mill established in Tepoztlán in 1925 received such a feeble response from the villagers that the owner shut it down after two years and left. Robert Redfield, who lived in the village during these years, explained the resistance in Topoztlan to three things: "to many the slight cost is prohibitive; husbands assert that the flavor of the tortillas made of mill-ground nixtamal is very inferior; and finally, to bring her maize regularly to the mill to the neglect of her metate lowers a woman in her neighbor's eyes."⁴⁰ Oscar Lewis, who followed in Redfield's tracks a decade

35. *The Handbook of Middle American Indians*, Vol. 7 (Austin, Texas, 1969), 85.

36. A recent dissertation centered on the Morelos village of El Lago makes the point, based on interviews with women from that place, that "women's freedom . . . started with the coming of the mills and the release of the drudgery of grinding the day's maize." "We had backs of iron," one woman commented. Michael Foley, "The Languages of Contention: Political Language, Moral Judgment, and Peasant Mobilization in Contemporary Mexico," (Ph.D. dissertation in Political Science, University of California, Davis, 1986).

37. Ernest Gruening, *Mexico and Its Heritage* (New York, 1928), 85.

38. Oscar Lewis, "Social and Economic Change in a Mexican Village," *América Indígena* 4/4 (October, 1944): 304; Elsie Clews Parson, *Mitla: Town of the Souls* (Chicago, 1936), 18, 31; Robert Redfield, *The Folk Culture of Yucatan* (Chicago, 1941), 41, 43.

39. Stuart Chase, *Mexico, A Study of Two Americas* (New York, 1931), 133.

40. Robert Redfield, *Tepoztlán: A Mexican Village* (Chicago, 1930), 49.

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later, believed that it was not just that women had internalized the values of Mexican patriarchy but that men directly and strenuously opposed the new mill and “viewed with great distrust the prospects of their wives having some leisure.” The men, wrote Lewis, “firmly believe that the more occupied a woman is, the less are the possibilities of infidelity.”⁴¹ Kaerger, a few years earlier, reported the same male objection. The attempts to install mills on “progressive” haciendas drew strong opposition, especially among “padres de familia” since they believe “that their wives and daughters will be induced to sloth and various foolish behavior if they are not tied to the house by means of the metate.”⁴² In another case the mill was thought to lead to scandalous behavior more directly: “the nixtamal (here, the mill itself) starts early and so women go out before dawn to grind their own corn the way they used to at home. They meet boys in the dark and that’s why illegitimacy is caused by the nixtamal.”⁴³

It is of course impossible without field research to assess the full strength of male opinion in the opposition to new mills but there is no doubt that women had an active hand in pushing for their acceptance. In the late 20s, to follow the earlier case, another mill opened in Tepoztlan, this time with great success. Lewis claimed that this was due to “a campaign by a group of women who saw the advantage which the mill would bring.” By 1942 there were four mills in the village and “there is not a woman who does not regularly patronize the mills.” A male informant told Lewis in 1942 that the success of the mills was the result “of the revolution of the women against the authority of the men.”⁴⁴ With the radicalization of the Revolution in the 1930s and the incorporation of women into rural unions a formal channel was found to free women from their metates. In Chiapas and no doubt elsewhere a common demand in petitions to political leaders was for the installation of a molino de nixtamal.⁴⁵ Between 1935 and 1940, in only five years, the number of mills in Mexico increased from 927 to nearly 6,000, and in the following decade spread rapidly into neighboring Guatemala.⁴⁶ Thousands of women then brought their daily baskets of soaked maize to the mill and “sat entranced as they were reduced to flour in 60 seconds rather than 60 hours.” The next step was the

41. Lewis, “Social and Economic Change,” 304.

42. Kaerger, *Agricultura*, 251.

43. Mary Elmendorf, *Nine Mayan Women* (New York, 1976), 91.

44. Lewis, “Social and Economic Change,” 304. Some may object to placing too much weight on Kaerger’ and Lewis’s accounts of male objections to the new mills. They may have grumbled, but perhaps after the fact, and with little influence on the acceptance or not of new technology. Men everywhere seem to complain that their women are too loose.

45. *AGN*, Mexico, Lázaro Cárdenas, 432/626.

46. *Tercer censo industrial de los Estados Unidos Mexicanos, 1940*, “Molinos para nixtamal,” Secretaría de economía, Dirección general de estadística (Mexico, 1948), 9.

tortilladora, an elaborate contraption installed alongside the mill that flattened the masa into a thin sheet and cut out tortillas which ran on a conveyor belt through baking ovens. The two machines together did in a matter of minutes all of the previous hand operations of shelling, grinding, forming and baking. By the 1950s, the rural women of Mexico and Guatemala had at their disposal the labor saving devices for the preparation of their daily bread that had been present in Rome 2,000 years earlier.

The social and economic impact of this technological revolution on the lives of Meso-American women has not been systematically studied. Yet in a matter of two decades the number of hours a woman spent preparing the staple element in her family's diet fell from some 35–40 a week to three or four. A number of people noticed the difference. Lewis believed that women "got more sleep" and that time saved was used in sewing, knitting, and in many cases "turned toward gainful pursuits such as raising chickens, pigs and cows . . . and many women became merchants on a small scale."⁴⁷ Redfield, on the other hand, thought the replacement of hand by machine labor had but scant effect on the lives of Mayan women. No doubt the freeing up of such large amounts of female labor cannot be taken in isolation with other changes sweeping Mexico in the 1930s and 1940s and in Guatemala in the following decade. New roads, electricity, radios, a burgeoning tourist market, the extension of education into rural zones, the attraction of industry and domestic jobs in the cities must all be taken into account. But can we imagine for instance that Tonalá, the now famous pottery village in Jalisco, would have hundreds of female potters at work were they still chained to their metates? By the late 1950s in this town, "few women grind their own corn or make their own tortillas. The advent of nixtamal mills and tortilla shops has greatly lightened their household tasks and also provided wage employment for women."⁴⁸

We may resist an excessive reductionism but still imagine that the post war explosion in artisanal products and the movement of women into the industrial work force and domestic service are all related to changes in household economy and in those changes the revolution of the *molino de nixtamal* was fundamental. All of this lies beyond the scope of this chapter. The purpose here has been to examine the internal logic of food preparation in Meso-America and to offer a tentative explanation based on disparate evidence of a most important process. Or rather, a non-process: the remarkable absence of change, the absolute continuity in food processing and preparation over several thousand years, even when alternative methods were clearly present.

47. Lewis, "Social and Economic Change," 304.

48. May Diaz, *Tonalá: Conservatism, Responsibility and Authority in a Mexican Town* (Berkeley and Los Angeles, 1970), 215.