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RETHINKING RAMÓN: A COMMENT ON REINA AND HILL'S LOWLAND MAYA SUBSISTENCE

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A recent identification of ramón *in Miranda's sixteenth-century* relación *of Alta Verapaz more likely describes* achiote. *There is very little archaeological evidence to suggest that* ramón *was more than a famine food in ancient Maya times.*

In their recent article reaffirming the importance of maize as the caloric base of ancient Maya subsistence, Reina and Hill (1980:76) seem to have overemphasized the possible contribution of *ramón* by misidentifying it in Miranda's sixteenth-century *relación* of the Alta Verapaz in Guatemala (Miranda 1953–1954):

> Miranda also stated that between milpas and between houses there were trees with deep foliage, which was always green. They bore small edible fruits (*castañas*) which had small grains surrounded with a reddish substance. Miranda reports the Indians would take a large quantity of these seeds and boil them a long time to remove the "grease" and most of the color. From these they make tortillas and a spice to color their drinks [present authors' note: more precisely—"From these they make cakes which are like a spice which gives color to their drinks"]. He goes on to say that the "ladies" of this land were "good witnesses" for this preparation. Additionally, many Spaniards were using the seed instead of saffron to give color to the food [present authors' note: "*guisados*"—more precisely, "stews"].

Rather than describing a red variety of *ramón* as Reina and Hill imply, the above description more likely refers to *achiote* (*Bixa orellana* L.). *Achiote* (or *annatto*) is a large shrub or small tree with evergreen, heart-shaped leaves. For most of the year it bears brown capsules with soft spines that resemble a chestnut (*castaña*). Inside the capsule (~3 cm in diameter) are some two dozen small seeds covered with an oily red dye high in carotenoids. *Achiote* is commonly used to add color and some flavor to tamales and stews, and, because of this use as a "spice," it is an important item of commerce throughout modern Central America. When diluted and used with a

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mordant, *achiote* can be used as a yellow fabric dye (Donkin 1974; Ingram and Francis 1969; Pittier 1978). *Achiote* is still used commercially as a food coloring in butter, cheeses, and tomato sauces. Miranda's (1953–1954) reference to the use of the substance in question "to color their drinks" may allude to the Kekchi Maya practice of adding *achiote* (along with black pepper, chile, or allspice) to their cacao beverage or various other watery broths (Richard Wilk, personal communication). *Achiote* is still used as a body paint in Amazonian South America (Andrew Weil, personal communication).

The Gates translation of Landa's *relación* of the Yucatan (1937:106) gives almost precisely the same description as does Miranda of the plant in question, and Gates identifies it as *achiote*. McBryde (1945:148) contains a correct identification of *achiote* from the description given in the sixteenth-century *relación*, although he does not mention Miranda by name as the author of the document.

In contrast, *ramón* is a fairly large tree, also evergreen. At least twice a year, it bears small fruits (~2 cm in diameter) with a fleshy green pericarp that resembles the skin of an unripe orange. Inside the pericarp is a single seed about the size of a hazelnut. The usual method of preparing *ramón* is by boiling or roasting the kernel (Uphof 1968). The stored food reserve of *ramón* is mostly in the form of carbohydrates and proteins (which would not give it a "greasy" texture), whereas *achiote* has a high lipid content.

The red variety of *ramón* from the Peten, mentioned by Reina and Hill (1980:76), is morphologically distinct enough to be a separate species of *Brosimum*. Instead of having the gray, tight bark of *Brosimum alicastrum*, it has brown, peeling bark. After the fruit ripens and falls to the ground, the pericarp turns from green to an orange-red, hence the local name *ramón colorado*. Its pericarp has a very high sugar content which gives it a much sweeter taste than the typical variety of *ramón*. Nevertheless, the pericarp of red *ramón* does not have a high enough pigment content to be used as a food coloring as Reina and Hill (1980) suggest.

Henri Pittier, who worked in Costa Rica during the late 1800s, mentions *achiote* as being cultivated in tropical America since "remote times" (Pittier 1978). The spiny variety of *achiote* is a common plant in dooryard gardens throughout northern Belize and the Yucatan. The Kekchi Maya of southern Belize grow three varieties of *Bixa*, scarlet, light red, and white, all of which, unusually, have spineless pods (a distinct local cultivar [McBryde 1945:148]). In a survey of 110 kitchen gardens throughout Belize and in the eastern Peten we only saw one *ramón* tree. Its leaves were being used as animal fodder, but its fruits were not used for human food.

To our knowledge, no remains of *ramón* with secure archaeological context have ever been recovered from any site in Mesoamerica; one of only two taxa present in flotation samples from test excavations at Copan, Honduras (provided by Bill Fash of Harvard University and analyzed by C. Miksicek) was *ramón*, but the fruits were immature, uncarbonized, and most likely intrusive due to the activity of tree roots or burrowing animals. Over 200 large-volume flotation samples analyzed by C. Miksicek, K. Elsesser, and I. Wuebber from the Preclassic site of Cuello in northern Belize have failed to produce a single fragment of carbonized *ramón* pericarp, seed, or wood, although *ramón* is a common tree species growing in the vicinity today. On the other hand, seeds and/or wood from other tree crops including avocado, *nance*, hackberry, *jauacte* palm, allspice, hogplum, *sapodilla*, mamey, and *siricote* were relatively abundant and well preserved, and maize kernel and cob fragments were recovered from 83% of all Cuello flotation samples.

Several scholars have suggested that the *ramón* trees commonly found growing on Maya ruins could be relicts of ancient orchards (Lundell 1937; Puleston 1971; Puleston and Puleston 1979). We feel that this association could simply reflect the ecological pre-adaptation of *ramón* to disturbed habitats, because it is a disclimax species with poorly dispersed fruits. Data from Lambert and Arnason (1978) suggest that the apparent association between *ramón* and sites may be due to purely edaphic factors. They inventoried vegetation quadrats and analyzed soil samples from site and nonsite locales around Lamanai in Belize. The onsite plots which had higher densities of *ramón* also had 139% more nitrogen, 46% higher organic matter, 50% higher water holding capacity, 62% more magnesium, and 67% lower sodium content, any or all of which could account for the differences in *ramón* distribution.

Puleston (1971) tested the storability of various native Mesoamerican foods in an experimentally dug *chultun* at Tikal. All but the *ramón* seeds spoiled within 11 weeks. Unfortunately, Puleston failed to include any root crop, which is curious considering the obvious parallels with North American "root cellars." We are testing the storage potential of *camote* (*Ipomoea*), *jicama* (*Pachyrhizus*), manioc (*Manihot*), yam (*Dioscorea*), and cocoyam (*Xanthosoma*) in a recently excavated Preclassic *chultun* at the Cuello site. After Reina and Hill's suggestion, we are also including smoked maize. While maize smoked for only one day was 100% viable, maize smoked for a full 10 days no longer germinated. The full results will be reported in 1981, but after only five weeks, some unsmoked maize had germinated, a *camote* had some fungal growth, the unremoved pericarp of half of the *ramón* sample had decomposed, the other half of the *ramón* sample with the pericarps removed had started to germinate but was still edible, most of the smoked maize had some fungal growth, and beans and squash were completely inedible. (McBryde [1945:24] also contains a reference to smoking and storing maize in underground vaults from Miranda's *relación*.) Only shelled maize stored in an open vessel and the other root crops were in the same condition as they were when they were placed in the *chultun*.

After 16 weeks of experimental storage in the *chultun*, the squash, *camote*, one manioc rhizome, the *ramón* with pericarp, both types of beans, the unhusked maize, and the maize smoked for one and two days were essentially completely decomposed. The ears of corn smoked for five and ten days were fairly moldy. The yam and *ramón* kernels (without pericarp) had sprouted 7-cm, etiolated shoots but were firm and completely usable. The maize kernels stored in a container had some fungal growth but would have still been edible after they were washed. The *cocoyam*, *jicama*, and one manioc rhizome survived the four-month storage period in pristine condition.

It is our opinion that maize was the major staple of ancient Maya civilization, and that *ramón* was little more than a famine food used in times of crop failure. After deleting the misidentification of *ramón* in the Miranda reference, there is little noncircumstantial evidence to support even a secondary role for *ramón* in Maya subsistence.

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EGREGIOUS ENERGETICS

David L. Webster

Dickson's elaborate linear programming simulation of the agricultural carrying capacity of the Tikal sustaining area is flawed by an energetic miscalculation.

In his recent application of linear programming simulations to agricultural productivity and carrying capacity at Tikal, Bruce Dickson (1980) has made a simple but fundamental error which seriously affects his conclusions. Dickson's approach is to simulate a series of subsistence models on the basis of which he assesses a range of potential carrying capacities; linear programming aside, this approach is similar to those used by other Maya archaeologists (e.g., Sanders 1973; Rice 1978). Basic components of the model include three staple food crops (maize, roots, ramon), several rotational strategies under which they are grown, and four levels of dietary (i.e., energetic) contribution to the human populations.

Dickson's study is primarily one of productivity. By productivity (for agricultural populations) I refer to the nutritional/energetic yield available to human consumers from a given unit of cultivated land (note that this has nothing necessarily to do with efficiency). All productivity estimates are based upon three calculations—the yield of the crop which can be produced per unit of cultivated land using a given agricultural strategy, the contribution of that crop to the diet of the average consumer, and the nutritional/energetic content of that yield which may be metabolized by humans (only the caloric, or energetic part of the calculation is germane to this paper). Of these calculations the first is by far the most difficult to assess, since it assumes adequate knowledge of crops grown, subsistence strategies utilized, and variations in all of the factors which may affect crop growth such as soil fertility, rainfall, plant diseases, pests, etc. The second is notoriously difficult to reconstruct on archaeological grounds alone. If, however, these two components are known—or in this case simulated—the third part of the calculation becomes straightforward since we possess good data on energetic values for a wide range of cultigens. Surprisingly, it is in the calculation of energy equivalents of his yields where Dickson makes his error.

I have no fundamental quarrel with Dickson's estimates of maize yields per hectare. Although one could quibble with details of his interpretation, overall figures (586–1,597 kg/ha) coincide reasonably well with others used in studies of prehistoric Maya agriculture. Dickson's error lies in the use of an energetic value for maize of 1,340 kcal/kg—a figure drastically smaller than that commonly used by other Mesoamerican archaeologists (3,610 kcal/kg) whom he himself cites (e.g., Puleston 1968:104). The only citation he gives for this value is a cryptic one (USD HEW) which does not appear in his bibliography and which I have been unable to track down. Although I lack

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