The discovery that canals and ridged or raised fields, as they should be more correctly called (Denevan and Turner, 1974: 24), formed a major component of the ancient Maya landscape has provided a broad opportunity for new insights on old data. Following the initial identification and description of these features for the Maya lowlands (Siemens and Puleston, 1972), it is certainly to his credit that the first to look for these new insights was J. Eric S. Thompson himself. In a vigorous and perceptive paper (Thompson, 1974), he argued that the "canals" of the Rio Candelaria basin functioned primarily as artificially constructed fish refuges from which fish were collected for food. While I intend to challenge his argument for primacy of function of these canals and his correlative hypothesis that they did not serve for canoe transport, his contribution remains fundamental. It was his recognition of the potential contribution of fish that brought us to the realization that we had been underplaying the potential of the canals in our eagerness to investigate "fields". With the advantage of his perspec-

As a product of the Rio Hondo Project, supported by Canada Council and the University of Minnesota's Graduate School and Office of International Programs, this paper draws on the contributions of many people. The author wishes particularly to acknowledge his debt to Alfred E. Siemens, Co-director of the Project, John P. Bradbury, Jamie E. Thomerson and those members of the project staff who participated in the north Belize survey. Also gratefully acknowledged are Ellen Bradbury, Donald Collier, and Bennet Bronson who read and commented on the first draft.
tive we have come to realize that the potential contribution of canals has been overlooked and that where they occur with fields they combine into a single fascinating system, one constructed to serve a civilization that understood and commemorated in its iconography the ecological interrelationships it was built on. Our preliminary insights into these interrelationships and what appears to be Maya recognition of them is to be the subject of this paper.

The possible existence of chinampa-like intensive agriculture in the Maya and Gulf Coast lowlands was considered by Palerm and Wolf (1957: 28; see also Wolf, 1962: 78) and Caso (1965) years before the first raised fields were identified. From the time that the fields were recognized we were thus inclined to believe they served the purposes of field agriculture in some form. Assuming that the roughly rectangular raised platforms were planting surfaces we wondered what crops might have been grown on them. Though maize seemed a logical choice, we had no basis for eliminating other possibilities including root and tree crops. The ethnohistoric record appears to be scanty on references to anything which might be considered raised-field type systems in the Maya lowlands. Perhaps this is because the early chroniclers saw nothing remarkable in ditched fields which they had already seen in such abundance in the Valley of Mexico. It may also be that these forms of intensive agriculture were abandoned in the wake of post-Conquest depopulation (Thompson, 1970: 48-83) and for that reason were not included in the later more complete descriptions. Evidence in support of the supposition that functioning raised fields and transport canals existed in the Maya lowlands at the time of the Conquest, however, can be inferred from references in various sources including Bernal Diaz' account of Cortes' march across the Yucatan Peninsula to Honduras.

In the province of Acalan, which Scholes and Roys (1968) on the basis of exhaustive analysis have identified as the upper Canderlaria River basin, Diaz (1904: 289) reports that some of the towns were on "tierrafirme" while others were on "something like islands". Perhaps in some areas houses were located on the raised fields that occur here, though in light of what Siemens and I have seen along this river it seems more likely that he refers to sites which had access canals coming up to them from several directions across the flood plain or, like the site of El Tigre (= Itzamkanac), were actually located on an island of high ground on the flood plain. Diaz is quite explicit about communication between the various townships being solely by canoe. After they reached Itzamkanac Diaz went out with Mazariegos and 80 soldiers to obtain food from these outlying settlements for Cortes' starving army. They left by water and returned by water bringing back with them 100 canoe loads of maize, fowls, honey and salt.
Acalan, the name for this province, is a Nahuatl word, derived from *acalli* ("canoe"). It is translated as "place of canoes" (Scholes and Roys, 1968: 50). In a region where everyone seems to have travelled by water, Cortes' was out of his element. His army, like Napoleon's in Russia, was at a constant disadvantage. Ill-equipped and ill-advised they floundered through flooded swamps for weeks, attempting to overcome the difficulties here and there by constructing elaborate bridges. Unfortunately, once the bridges were completed and had been crossed there was more of the same ahead and the bridges had to be left behind. Canoes, and canals for use when seasonal swamps were not under water, seems to have been the *modus operandi* in this region.

One of the major reasons for Thompson's rejection of the hypothesis that the Candelaria canals served canoe travel was that on our published map (Siemens and Puleston, 1972, Fig. 2) very few are shown to connect with the river. This absence of outlets, however, is more apparent then real. Wherever we actually investigated the crucial intermediate areas on foot, along the Candelaria and more recently in northern Belize, evidence for the connection of canals to the river was quite clear. The connections do not appear on the map because of their invisibility on the aerial photographs where they are shielded from view by the heavier vegetation on the river banks and levees. It should be noted that this does not eliminate the possibility that they functioned as fish refuges.

Where did this food Diaz and the others brought back come from? On the basis of Cortes' description of the province, as "a very important place (*may gran cosa*) with many towns, a numerous population" and plentiful food supply, (Scholes and Roys, 1968: 123) we might surmise that it was maize harvested from intensively cultivated raised fields.

A second somewhat more explicit source, Villagutierre (1933: 61) informs us that in 1559 during the advance on the Lacandon fortress in Lake Miramar, Chiapas, Spanish horsemen were unable to get their mounts to cross deep ditches or canals that surrounded lakeside maize fields. They were attempting to save the life of a Negro boy who had entered one of the fields to obtain green maize for food when he was ambushed by eight or nine Indians who cut out his heart with a flint knife on the spot.

A third source, with references to ditches or canals, is found in the prophecies of the Books of Chilam Balam. In the books of Tizimin and Mani unfavorable prognostications for the year 13 Kan in Katun 4 Ahau include rabbit-sky Chacs, "standing erect at the muddy pond, standing erect at the end of the water ditch" (Roys, 1949: 165). Later, for the year 5 Muluc, "They stand at the muddy pond, on the inundated land (?). [Exhausted] is their drink at the water ditch" (Roys, 1949: 168). Roys
suggests that these references to ponds and ditches refer to features found in an ancestral homeland of the Mani people to the south which makes sense in the light of present knowledge about the distribution of raised fields on the Yucatan Peninsula.

Outside the Maya lowlands altogether there is at least one other reference pertaining to this discussion that deserves mention. On the plain of Xaragua, Hispaniola, Peter Martyr records reports of a system of ditches used by the Indians of the fifteenth century to irrigate their fields "as intelligently as did the inhabitants of" Cartagena and Murcia (MacNutt, 1970: 388). As Sauer (1966: 53) notes, "This was no casual diversion of water but an extensive system of canals considered equal to those built by the Moors of Spain". The cacicazgo of Xaragua was the richest and most powerful on the island. Its principal crop, undoubtedly a product of the irrigated plain, was cotton (probably Sea Island or Egyptian cotton, *Gossypium barbadense* L.).

These references combine to suggest that raised fields were in use in the lowlands of Middle America at the time of the Conquest. Further, we might surmise they were used at least for the cultivation of maize and cotton, probably in areas where intensive land use would have been favored by high population densities. Having presented a case for the maintenance of raised fields in the lowlands at the time of the Conquest we may now consider how far back in time evidence for utilization of these features can be extended. The dating of chinampas and raised fields has a history of being somewhat problematic. In the Valley of Mexico little more than inferential evidence exists to indicate the use of chinampas before the Aztec period. In South America early dates have recently been obtained by Parsons (personal communication, 1977) but these are not yet published.

In the Maya lowlands excavations carried out in raised fields along the Candelaria River in Campeche, Mexico produced two large fragments of wood (*Bucida*) which yielded a date of A.D. 229 i 50 (Siemens and Puleston, 1972: 234). Since these fragments came from apparently naturally deposited sediments beneath the strata showing evidence of field construction they could not provide more than a *terminus post quern*. In 1973, we began excavations of raised fields in Belize and found Classic Period ceramics mixed into the marl fills, out of which the more recent fields were constructed. It was not until 1974, in the process of excavating a deep canal, that we found a cut wooden post that gave us a better measure of how old the fields were. The post, trimmed at one end with an axe or adze and driven into the sediments on the edge of the canal, produced a date of 1110 i 230 b.c. (I-7877A). This surprisingly early date for canal use is in part confirmed by an even earlier date of approximately 1800 b.c. for
Fig. 1. Rectangular raised fields in northern Belize and Quintana Roo occur with great abundance along the Hondo River flood plain. They also frequently appear on the margins of interior swamps as shown here on an oval, sawgrass (*Cladiumjamaicense*) covered bajo near the site of Nohmul.
Dennis E. Puleston

sediments containing maize pollen brought up by John P. Bradbury from the nearby, raised-field encircled, Laguna de Cocos. Maize pollen in sediments dating to 2000 b.c., have also turned up in a core taken by Ursula Cowgill in Lake Petenxil (Tsukada, 1966). Tentatively then, it appears that raised fields were in use in the Maya lowlands for at least two and a half millenia. Over this span of time they seem to have achieved considerable importance. Ground and aerial surveys of the bajo swamps and river flood plains of northern Belize indicate they covered minimally an area of 75 km² (Fig. 1). Peter Harrison's survey of the aerial photographic coverage of Quintana Roo suggests that even greater areas were converted to this form of land use north of the Belize border. While I question his identification of major raised field areas in the vicinity of Tikal, on the basis of an on-the-ground investigation of two such areas in the Santa Fe bajo in October of 1975, there is no doubt that these systems were of great importance in Campeche, Quintana Roo and Belize.

Perhaps one of the most exciting aspects of our studies of raised fields in northern Belize has been the identification of prehistoric cultigens through the examination of fossil pollen extracted from prehistoric canal sediments. Primarily thanks to the work of John P. Bradbury, we have identified the pollen of maize (*Zea mays* L.) and cotton (*Gossypium* sp.) in comparative abundance in these contexts (Fig. 2). The pollen grains of these two cultigens are heavy and consequently poor travellers in air. As it is rare for them to be borne more than a few yards from their point of origin we can be virtually certain they are from plants that once grew in the immediate vicinity, that is, on the adjacent field surfaces (Bradbury and Puleston, 1974). These cultigen pollens occur against a background of grass and weed pollens which confirms the hypothesis that the fields were used for open-field agriculture rather than tree-cropping of something like cacao, as recently suggested by Bruce Dahlin (personal communication). This, of course, does not eliminate the possibility that in other areas, as yet untested, cacao groves did not occur but it now seems less likely. On the other hand, it is highly probable that other open-field crops were cultivated on the fields but to date we have not identified the presence of more than the two mentioned above.

Now we may consider the question of why these fields were constructed. How were they built? How were they used? What advantages did they have over other types of cultivation, including slash-and-burn? How much labor was involved in their maintenance? Could they be used for permanent agriculture without the requirement of fallowing? These questions would be extremely difficult, if not impossible, to answer on the basis of archaeological data alone. In an attempt to circumvent some of the limitations
inhomherent in a strictly archaeological approach and perhaps shed light on some of the data we already had, a prehistoric field was rebuilt for experimental cultivation in 1974. This involved laying down a laboriously transported limestone marl foundation, and then surfacing it with previously removed topsoil and the peat removed in the clearing out of the long abandoned and naturally filled-in canals. Approximately four months after the reconstructed field was completed, at the end of December 1974, it was planted with local varieties of maize, squash, beans, tomatoes and cotton (Fig. 3). It was at this point, aided by the insights provided by Thompson's paper, that we began to realize at least the potential contribution of the canals. It should be noted that I refer here to the canals that immediately surround the raised fields rather than the long straight ones illustrated in the Candelaria paper (Siemens and Puleston, 1972, Fig. 2) which were the principal focus of Thompson's discussion. Over the four-month period the re-excavated canals had acquired a substantial fish population. Trapping of these fish revealed the presence of no less than 13
species (Table 1), of which many individuals were of edible variety and size. The latter included an abundance of tasty cichlids of 20-60 g and even a large eleotrid (*Gobiomerus dormitor* Lacepede) of 390 g. This appearance of edible fish in the re-excavated canals certainly offers new support to Thompson's (1974) arguments for the use of canals for fish production. I suspect these fish could be expected in the longer straight canals as well as those referred to here. But was this the only role the fish were playing in the system? As we continued working on the field, scooping what was now a soupy muck from the bottoms of the canals onto its surface, it became obvious that fish feces were probably making a substantial contribution to the nutrient content of the canal sediment. Samples of this muck were collected and are presently undergoing analysis for nutrient content. Even at this point, however, it seems possible that we have something here which is akin to the fish manuring systems used in the rice paddies of Java and Malaya (Hickling, 1961: 264-268) though it differs insofar as the presumably enriched sediments in our experiment must be cast up onto the fields.

With this insight before us a possible explanation for the evident magnitude of the prehistoric Maya commitment to this system became evident.
Table 1

Fish species captured in experimentally re-excavated raised field canals, San Antonio, Albion Island, Belize. (Identifications by J. E. Thomerson, Southern Illinois University.)

<table>
<thead>
<tr>
<th>Species</th>
<th>Edibility</th>
<th>Weight range</th>
</tr>
</thead>
<tbody>
<tr>
<td>(g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SYNBRANCHIDAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synbranchus marmoratus</td>
<td>edible</td>
<td></td>
</tr>
<tr>
<td><strong>CHARACIDAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astyanax fasciatus</td>
<td>eaten</td>
<td>&lt;1-28</td>
</tr>
<tr>
<td>Hyphessobrycon milleri</td>
<td>?</td>
<td>&lt;1</td>
</tr>
<tr>
<td><strong>POECILIIDAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belonesox belizanus</td>
<td>?</td>
<td>2-14</td>
</tr>
<tr>
<td>Poecilia mexicana</td>
<td>?</td>
<td>&lt;1—9</td>
</tr>
<tr>
<td>Poecilia petenensis</td>
<td>?</td>
<td>&lt;1-23</td>
</tr>
<tr>
<td><strong>CICHLIDAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petenia splendida</td>
<td>eaten</td>
<td>14</td>
</tr>
<tr>
<td>Cichlasoma friedrichstali</td>
<td>eaten</td>
<td>29-33</td>
</tr>
<tr>
<td>Cichlasoma hyorhynchum</td>
<td>eaten</td>
<td>8-22</td>
</tr>
<tr>
<td>Cichlasoma salvini</td>
<td>eaten</td>
<td>11-28</td>
</tr>
<tr>
<td>Cichlasoma synspilum</td>
<td>eaten</td>
<td>5-20</td>
</tr>
<tr>
<td>Cichlasoma urophthalamus</td>
<td>eaten</td>
<td>5-61</td>
</tr>
<tr>
<td><strong>ELEOTRIDAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gobiomoris dormitor</td>
<td>eaten</td>
<td>390</td>
</tr>
</tbody>
</table>

With a procedure for replenishment of depleted soil nutrients land could be converted to use for permanent cultivation. With the need for 5-10 year fallows thus circumvented, the carrying capacity of the land could be greatly increased.

To date, the evidence for the utilization of raised fields for permanent cultivation is circumstantial, but detailed examination of the fossil pollen record should provide us with the means for determining if the fields were fallowed with any frequency. In the mean time experimental planting and continual testing of soil nutrient levels over a long period of time should permit us to demonstrate whether or not it would have been possible.

Let us turn now to the Maya. Surely a cultivation system of such potential, in use for perhaps two and a half millenia on both sides of the
peninsula, would have had significant impact on Maya perceptions of the world, particularly since it involved production of their beloved maize. Certainly the perceptions of archaeologists, art historians and Mayanists in general have been colored by the assumption that maize production was based on shifting, slash-and-burn cultivation techniques such as used by the Maya today. Discussions of Maya iconography in relation to food production traditionally focus on the importance of the rain-bearing Chacs and their critical influence on the nature and timing of rainfall. Frequent reference is made to the abundance of water symbolism in Maya iconography with the implication that this is further evidence of the primary concern of the Maya throughout the lowlands with the vagaries of precipitation.

This has always been an acceptable interpretation but with the realization of the existence and importance of raised field agriculture new patterns begin to emerge which were not so obvious before. The first, as has been noted by Tamayo and West (1964, see Harrison, Chapter 22, this volume), is that Maya water symbolism has a strong aquatic element which can be distinguished from the long recognized pluvial symbols. This aquatic element permeates Maya hieroglyphics as well as iconography and includes the frequently encountered fish, water lilies, water birds, turtles, snails, eels, water snakes, and crocodiles. Frogs, which seem to be more unequivocally associated with pluvial symbolism (Thompson, 1970: 251) are excluded from this list. As Harrison (Chapter 22) notes, the associations of these creatures (along with the water lily) are with standing water. This would include sluggish streams, rivers, ponds, aguadas, swamps and, I would argue, most typically the lowland river flood plain environment in general. Now we may begin to ask if perhaps the pervasiveness of these aquatic symbols may not have something to do with the apparently early importance of raised fields. To investigate this possibility we might examine these symbols and their associations more closely. Water lilies which are a particularly pervasive element in this assemblage provide a useful entry.

The flower of the water lily \[Nymphaea ampla\] (Salisb.) D.C., naab, with its handsome and showy white flowers is common in slow-moving and still water throughout the Maya lowlands. Colonies were quick to establish themselves in the re-excavated canals around our experimental fields and by the fall of 1975 were so thick that we had to uproot them to enable easy passage of our canoe loads of sawgrass mulch and palmetto to the plots under cultivation. Maudslay (1889-1902, IV: 37), noting the scarcity of Maya depictions of vegetation, seems to have been the first to comment on the curious frequency of the appearance of the water lily and its association with fish which frequently seem to be nibbling at the flowers. In Plate 93
of Volume IV of his magnificent folio he illustrates eight representations of water lilies selected from sculptures of Palenque, Chichen Itza, Quirigua, and Copan to illustrate a short essay on the "water plant" motif. Rands (1953) in a more recent review of the subject records no less than 330 representations of the plant.

The water lily also makes an appearance in hieroglyphic writing. Significantly, its flower is the glyph for the first of the twenty named days, Imix. Thompson (1960: 72) argues persuasively that as well as being a day-name, the imix glyph has meaning as a symbol of abundance. Linked to the symbol of maize to form the Kan-Imix compound found in the auguries of the codices, he shows that it seems to signify abundance of maize and perhaps abundance of food in general. We might well speculate as to why the water lily achieved such prominence in Maya iconography? Why was it chosen as a symbol for esculent abundance? Without the knowledge of how maize and water lilies might come to be associated with each other in the context of raised fields and their canals, Thompson (1960: 72) suggested it may have been because the water lily flower was edible. Dobkin de Rio (1974: 150) in a vacuum of supporting ethnobotanical and pharmacological data has suggested that it derived its importance from use as a psychotropic drug. Heine-Geldern and Ekholm (1951) argue that in at least some forms its presence is the result of trans-Pacific contacts. I would now argue that these explanations are of doubtful validity or at the very least insufficient but let us explore a little further this link between water lilies and maize suggested by the meaning of Imix.

Glyphs in Maya writing often seem to be symbols for concepts or objects of much greater complexity which can be revealed in various ways. In the case of numerals and day names, illumination may occur when these glyphs are personified. All personified forms of the Imix glyph show the head of a reptilian monster "with a long pendulous rose . . . and with the Imix glyph or the flattened u as his headdress, from which vegetation usually sprouts" (Thompson, 1960: 72). The identity of this reptilian becomes clearer with the realization that the equivalent of Imix in the Nahuatl calendar is the crocodile, Cipactli. Furthermore the Quiche Maya "associate Imox, their form of the day Imix, which is M'ox in Pokomchi, with M'ox, their earth god" (Thompson, 1970: 220). The great crocodile of Central Mexico was also an earth god. In Nahuatl mythology he floated in a great pond, his gnarled back forming the surface of the earth. Thompson (1970: 217) brings to light ethnohistoric evidence to suggest that a similar "croco-dile-floating-in-a-pond" concept obtained among the Maya.

We will now turn to the more complex, non-hieroglyphic representations of this creature, the most magnificent and naturalistic of which is found on
Fig. 4. The crocodilian earth monster, Itzam Cab Ain, as he appears on Altar T at Copan. Note the water lily flowers tied to his wrists, the fish, and the *bil* vegetal ornaments. The epidermal shields on the back and limbs seem to show the keels and circumferential ridges visible in Fig. 5. (After restoration sketch by Maudslay, 1889-1902, I, Pl. 95.)
Fig. 5. The back of the crocodile (in this case Crocodilus moreletii, photographed at the Guatemala City zoo) served as a metaphor for the food producing surface of the world over much of Mesoamerica. It is suggested here that the metaphor ultimately derives from the analogy to be drawn between the regular configuration of the reptile's epidermal shields and typical arrangements of rectangular raised fields on the riverine flood plain.
Altar T at Copan. In the copy of Maudslay's sketch shown in Fig. 4 the four paws almost become human hands. Water lilies are attached at the wrists with fish sporting and feeding about the flower heads. From the temple regions sprout leaves, presumably of maize plants which Thompson (1970: 224) equates with the bil, "growth", affix (No. 130) in his catalog (Thompson, 1962). The epidermal shields characteristic of the reptilian loricates are represented by paired ovals and a central column of poorly preserved glyphs. Taken together these form a pattern which is comparable to that seen on the back of *Crocodylus moreletii* Dumeril and Dumeril (Fig. 5), a species we have collected modern skulls of in villages along the Rio Hondo in Belize. At Palenque, on the Panels of the Cross and the Foliated Cross, massive heads, clearly those of the earth monster (Thompson, 1970: 218) adorned with innumerable symbols of vegetation, support alternatively a world directional tree and a maize "tree" complete with heads of the maize god in place of maize ears. As Thompson (1970: 219) indicates, the same concept occurs on the balustrades of the stairway of the north temple of the great ball court at Chichen Itza where "trees of abundance" are rooted on the giant heads of long-volute-nosed reptiles. Similar trees, probably ceibas, rise from the heads of long-nosed gods in the Dresden and Madrid codices.

Elsewhere, the monster, frequently identified by the same forehead Imix symbol that is seen in glyphic representations, has elaborately detailed water lily plants complete with leaves and flowers coming from his head (Thompson, 1960, Fig. 12). Naturalistic representations of maize or the bil (growing vegetation) sign are also usually present, emerging from his temples. Thompson (1970: 216) identifies this earth monster as Itzam Cab or Itzam Cab Ain which he translates, on the basis of a definition in the Vienna dictionary, as "Iguana Earth" or "Iguana Earth Cayman". I suspect "Iguana Earth Crocodile" would be more correct since the Central American cayman [*Caiman crocodilus fuscus* (Cope)] is not reported for Campeche, Yucatan, or Quintana Roo (Smith and Taylor, 1950: 212).

Thompson's assertion that the earth monster is Itzam Cab Ain, with considerable overlap into another deity, Itzam Na Kauil, "Iguana House Bountiful Harvest," makes him something more than a "crocodile-floating-in-a-pond". He becomes the terrestrial manifestation, or floor, of the all encompassing Itzam Na, "Iguana House", greatest god of the Yuca-tec Maya. Any attempt to present a straightforward conceptualization of Itzam Na quickly runs into an appropriate series of baffling contradictions and riddles. Thompson's reconstruction, analogous in some respects to the Christian mystery of the Trinity, utilizes a four, or perhaps five or six, in one theme with giant iguanas at the four quarters of the world arching up
to the sky to form walls but with their heads downwards. A fifth iguana, "Itzam Cab Ain", forms the floor, with possibly a sixth for the roof (Thompson, 1970: 214). Thompson argues that these are all manifestations of a single godhead which would explain, in part, the confusing facility with which the attributes of one are transferred to another.

Apparently these two conceptually distinct traditions concerning the earth monster are both Maya (Thompson, 1970: 219), but this need not trouble us here. In either case he is consistently associated with earth and the underworld, indicators of an aquatic environment, growing things, particularly maize, and symbols of abundance including the ubiquitous water lily.

The discovery of the importance of raised fields provides us with a rationale for this seemingly unlikely assemblage. With successful crop production tightly interwoven with the complex, manipulated, interrelationships between canals and their fish, piscivorous birds and reptiles, the transport of upland marls and the field surfaces themselves, it is not hard to see how these elements became incorporated into Maya religion and iconography. In short, the Maya were deeply involved in flood plain ecology socially, economically, and intellectually.

The crocodile (probably *Crocodylus acutus* Cuvier as well as *Crocodylus moreletii* Dumeril and Dumetil) seems to have assumed a special role, perhaps because of the position of respect it occupied as top carnivore in the limnic food chain. It is probably here amongst the lily pads of the flood plain swamps and canals that the exposed back of this creature became a metaphor for the food producing surface of the land, an idea which later seems to have found its way into the highlands where modern Crocodylidae do not occur. The concept is explicitly illustrated in the Codex Borgia (1963), page 27, where what is almost a field of maize plants is shown growing from the back of the earth monster (Fig. 6). It does not require any stretch of the imagination to appreciate the obvious analogy which must have been drawn between the regular arrangement of epidermal shields on the back of the crocodile (Fig. 5) and the patterns formed by the rectangular raised field surfaces as they spread out over the riverine flood plain.

How far back in time can the use of this metaphor have extended? Clearly the relationship of the Maya earth monster to earlier saurian motifs in Olmec and Izapan sculpture deserve careful scrutiny.

In another paper it has been argued that the progenitors of Maya culture entered the Maya lowlands via the rivers principally as levee cultivators of maize, a diet generously supplemented by the exploitation of available riverine protein resources (Puleston and Puleston, 1971). The discovery in Belize of a hewn log dating to 1110 i 230 b.c. in man-made
Fig. 6. Highlands version of the earth monster from the Codex Borgia (p. 27) with maize plants growing on his back. The codex seems to have come from the vicinity of Tehuacan Valley in southeastern Puebla (Chadwick and MacNeish, 1967). Color symbolism follows Smith (1971, 2:2).
canals containing maize pollen, which dates back to 1800 b.c. in a nearby lake, lends new credence to this hypothesis. In short, it is not unlikely that the utilization of raised fields in this region began quite early perhaps as early as or even earlier than, intensive "hydraulic" agriculture in the Mexican highlands. At the present time archaeological evidence for the utilization of chinampas in the Valley of Mexico does not go back further than the beginning of the Aztec Period or about A.D. 1000 (Millon, 1973: 47; Blanton, 1972: 171), though Millon (1957), on the basis of indirect evidence, suspects they were in use around Teotihuacan considerably earlier. In the Tehuacan Valley the earliest direct evidence for the manipulation of water resources dates to initial construction of the Purron dam complex at about 700 B.C. (Woodbury and Neely, 1972). "Pot-irrigation" involving the drawing up of water from wells goes back to the Middle Formative Guadalupe phase (900-600 B.C.) in the Valley of Oaxaca (Flannery et al., 1967: 50). Despite the possibilities, much more work needs to be done on both highland and lowland forms of hydraulic agriculture before any conclusions can be drawn about relationships and origins.

By way of conclusion we can profitably refer again to the still undated raised fields of South America and the need for further work there. Do they represent an independent but convergent response to the limitations and potentialities of flood plain agriculture or can it be that we are dealing with a classic example of diffusion in which one area clearly developed the technology of raised fields first? Certainly in regard to the latter the Chavin cayman on the handsomely carved Tello obelisk deserves our attention. Supposedly of lowland origin, the body of this saurian monster sprouts a whole range of food plants (Lathrap, 1973, 1974) which, despite the absence of maize, is distinctly reminiscent of Itzam Cab Ain, the Maya earth monster. Whatever the case a doorway on new and challenging vistas has opened before us, one which would have remained closed were it not for the leadership, enthusiasm and scholarship of J. Eric Thompson.

References