

is much more widely distributed than was previously thought, occurring in small quantities on many Early Neolithic sites in northeastern France, Belgium, and Holland, even as far to the southeast as Alsace-Lorraine. It may well emerge that this anomalous pottery has implications for understanding the relations between indigenous foraging bands and immigrant Early Neolithic communities in this area.

The papers of Burkill and Howell describe the consequences of the introduction of food production into northeastern France. Howell characterizes the Late Neolithic societies of the Paris Basin as having an "expanded village" settlement pattern, in which individual family units were dispersed across the landscape, leaving ephemeral archeological traces. The principal animal domesticate during this period was the pig. Similar developments took place in other parts of temperate Europe at this time. In the lowlands of north central Poland, for example, the communities of the Globular Amphora culture exhibit an almost identical pattern.

The authors of the regional studies that make up the balance of the book discuss areas in southern and western France, where the earliest evidence of food production dates to about 1500 years before that of northeastern France. In many cases the issue of the adoption of domesticates by indigenous foraging populations is more clearly defined. The earliest Neolithic economies of the Pyrenees, discussed by Bahn, appear to have been animal-based, where Mesolithic economies based on ibex, boar, and deer were transformed into ones based on sheep/goat, cattle, and pigs, with agriculture integrated into this system only later. In Provence and Languedoc, Mills suggests, the archeological record may be biased against sites on the coastal plain (which has been submerged in areas) and toward cave sites in the uplands. Agriculture was possibly established fairly early on the Languedoc coastal plain, around 5500 B.C., whereas an animal-based foraging economy persisted until a fairly late date in the upland zone.

Scarre's contribution on west central France treats an area in which food-producing communities encountered the coastal ecosystem along the Atlantic seaboard. An important feature of Late Neolithic settlement in this region is the existence of over 60 fortified sites. Scarre proposes that these were established as a result of competition to control limited areas of pasturage in the coastal wetlands. Hibbs's chapter on the

Neolithic of Brittany and Normandy is of necessity focused on the funerary monuments, since few Neolithic settlement sites have been excavated in northwestern France. One hopes that the number of known settlements will increase as a result of ongoing research, for it is in this area that the problem of interaction between foragers and agriculturalists is crucial. The Breton peninsula supported Mesolithic populations that produced the famous Tévéc and Hoëdic cemeteries, while the extent of the westward penetration of Linear Pottery-derived agricultural communities is only now becoming known.

Archeologists interested in continental Europe may have a tendency to skip over Lewthwaite's chapter on the Neolithic of Corsica, since the island lies 160 kilometers from mainland France and presents a situation that cannot be directly related to the cultures of the continent. This chapter has considerable anthropological interest, however, in that Corsica has one of the longest archeological records for an island its size. The earliest food-producing communities of Corsica appear to have been established around 5600 B.C., yet the foraging component of the economy persisted well into historical times. The exploitation of

forest resources, especially acorns, was a central element of the subsistence pattern.

Ancient France makes two major contributions to European archeological literature. First, it provides an English-language description of the Neolithic period in France, and for this it will be a useful reference and source book for both research and teaching. More important, it establishes a baseline for future research by defining the current state of knowledge of the primary archeological data for particular regions as well as the degree to which it is currently possible to make inferences about prehistoric society and economy. The fact that many of the data contained in this book have become available only in the last decade reflects the vigor with which research into the French Neolithic is being pursued. One can only hope that the type of collaborative efforts that led to the essays in *Ancient France* will continue, and perhaps France can finally stop being the area on the map of Neolithic Europe where the arrows converge but of which little has been known.

PETER BOGUCKI

Princeton Inn College,
Princeton University,
Princeton, New Jersey 08544

Raised-Field Farming in Mesoamerica

Pulltrouser Swamp. Ancient Maya Habitat, Agriculture, and Settlement in Northern Belize. B. L. TURNER II and PETER D. HARRISON, Eds. University of Texas Press, Austin, 1984. xvi, 294 pp., illus. \$22.50. Texas Pan American Series.

Pulltrouser Swamp is a Y-shaped depression in the limestone terrain of northern Belize, linked by narrower depressions to parallel rivers, the Rio Hondo and the Rio Nuevo, that flow north-northeast in structural folds in the landscape to debouch into the Caribbean in Chetumal Bay. The limestone ridges that divide the river valleys are low, and the pyramids of the important ancient Maya sites of Nohmul, Cuello, and San Estevan are the most prominent points in the landscape. The inhabitants of these centers and their satellite settlements exploited the wetlands of the region, including Pulltrouser Swamp, for various economic purposes during the Preclassic (2000 B.C.–A.D. 250, according to uncalibrated radiocarbon dates) and the Classic (A.D. 250–900) periods; this book presents a preliminary report on a careful, innovative, and effective at-

tempt to demonstrate how and when such manipulation occurred.

Wetland exploitation in the form of ditched or raised fields, though long discussed by geographers and archeologists working in South America, was first noted for the Maya lowland zone of southeastern Mexico and adjacent Central America in 1972, with Siemens and Puleston's report of an area of such fields on the Rio Candelaria in Campeche. Over the next few years riverine fields, created by digging canals into riverside swamps and piling the backdirt to either side to provide a surface above water level, were located in other areas, including northern Belize, where the important sites of Lamanai, Nohmul, and Cerros had small areas of associated fields. Puleston himself began a project on the Rio Hondo in the region, in collaboration with Siemens, which yielded substantial areas of riverine fields, together with one radiocarbon date of 1110 ± 230 B.C. (uncalibrated) for a canalside post that suggested field construction could have begun toward the end of the Early Preclassic, a period of occupation in the Maya lowlands then

only recently substantiated by the discoveries at the nearby Cuello site.

At the same time others were noting similar patterns of canals and fields in non-riverine wetlands such as the Bajo de Santa Fe near the great site of Tikal and the Bajo de Morcoy in southern Quintana Roo, between the two major centers of Becan and Tzibanche. Puleston, however, was unwilling to admit that others had found such phenomena and suggested that the regular patterns in the bajos were a natural feature called *gilgai*, the result of shrinking, cracking, and swelling of montmorillonitic clays.

The editors of this volume planned a project in southern Quintana Roo, where both had done extensive fieldwork in the early 1970's, to investigate the bajo fields and establish their artificial origin, as they believed it to be, as well as the date and purpose of their construction. This project fell foul of what, in their introduction, they nicely call "procedural requirements": the Mexicans slapped a 15-percent levy on foreign projects, and the National Science Foundation refused to pay it. As a result, Turner and Harrison moved their entire operation, conceptually intact, across the Rio Hondo into northern Belize, where similar though smaller areas of wetlands were known in which patterns of canals and fields had been detected on aerial photographs. Pulltrouser Swamp happened to be one of the nearest such bajos to the base camp at Cuello, and thus, serendipitously, has one of the most evocative names for any research project made its way into the literature.

The 1979 season, on which this book reports, was designed to accomplish two major things: to demonstrate beyond cavil that the canal-field complexes were artificial, and then to link them with the known archeology of the region by recording and excavating sites along the edges of the swamp.

The first task was accomplished neatly, by a combination of pedology, botany, and archeology. It was shown that the morphology and hydrological regime of the swamp had remained constant through the period of Maya occupation of the region (although with some possibility that former areas of shallow open water had become swamp owing to sedimentation resulting from human activity on the adjacent dry ridges) and that the canal-field complexes, covering a total area of 3.118 square kilometers, occurred only where soils remained wet throughout the year. In Pulltrouser Swamp West, where seasonal drying supports a grass savanna today used for cattle grazing, and where the conditions

for *gilgai* formation would be best, neither *gilgai* nor canal-field complexes were found.

The presence of fields was confined to the escoba-botan forests on the margins of the basin, except for a few toward the south center of the western arm, where a small area of such forest lies at the lowest point. Excavations showed that two types of field were present: "channelized" fields on the edge of the depression, forming the margin of the mainland and sharing the same profile of a solum over the sascab (unconsolidated limestone) bedrock; and "raised" fields in which a mottled fill lies between solum and sascab, which occur further out in the swamp.

The channelized fields were created by simply ditching into the margin of the mainland to a depth of about two meters, an operation that may have been intended to just drain off surface water more quickly and thus allow planting earlier at the end of the wet season in December. The raised fields were constructed in a more complex way, by scraping the swamp solum off down to the surface of the sascab, piling on to it the mottled fill derived from ditching alongside the fields, and apparently replacing the solum as a planting surface.

The artificial nature of the fields was consistently attested by the presence of sherds and other artifacts in the fill, and the nature of this material also suggested that the earliest fields at Pulltrouser Swamp date to the Late Preclassic period (400 B.C.–A.D. 250), a date supported by some of the radiocarbon dating done by the Cambridge University laboratory.

Given the deliberate construction of the fields and their interstitial canals and the archeological evidence for their use from the Late Preclassic through Late Classic periods, when Maya culture was at its apogee, how were they used? The editors calculate that the local population supportable by maize agriculture on the fields would have been large enough to supply a labor force that could have constructed the entire 3.118 square kilometers in between 0.7 and 3.3 years (assuming 1000 workers): a short period of intensive work would have had a long-term payoff in higher crop yields.

While they point out that only a village level of social organization is needed for such agricultural facilities to be built (as in modern New Guinea), their dating of the Pulltrouser Swamp fields shows that they were in fact constructed within a social environment that included the nearby presence of a large centralized community, at Nohmul, and a regional

population explosion that shows, on present evidence, four times as many sites occupied in the Late as in the Middle Preclassic. Though the settlements around the edges of Pulltrouser Swamp were themselves small, they formed part of a larger regional economy (as is indicated by the supply of chert tools for field construction and tilling, made at the major factory site of Colha, and by rare imported pottery vessels) that persisted throughout the Classic period.

Together with the canal-field networks around Nohmul itself, currently under study, it would seem that those in Pulltrouser Swamp were designed to supply additional foodstuffs to the growing and, in the case of Nohmul, dense population of northern Belize (although export of food to the Peten, along the cultural corridor of the Rio Hondo, is another possibility canvased in the book). But what foodstuffs? The botanical evidence, although fairly abundant as to species, is equivocal as to the precise crops grown on the fields. Maize is present, in pollen and macrofossil form; but maize could have been grown, as it is today, on the dry ridge only a few score meters away and have easily made its way into the swamp sediments.

Cotton is another possibility, although we are cautioned that the *Gossypium* pollen could be from wild species (but Puleston found that his experimental field at San Antonio would grow cotton successfully, and artifacts of cotton processing such as spindle whorls are found at sites in northern Belize with some frequency).

Cacao is a third crop suited to the constant-moisture regime of these fields, and one for which this region was famed in protohistoric and early historic times, but direct evidence for its production is confined to a wood sample from one of the swampside settlements, and the editors argue, in taking issue with my earlier advocacy of cacao as a raised-field crop, that some greater evidence should have manifested itself by now. True enough, but the problem is more that evidence for *all* crops is minimal in quantity and equivocal in nature; my suspicion is that all three of the above crops were grown, for consumption or cash, and that the canals were used not just for drainage but as pens for farming turtles and fish as a protein source (as the late Sir Eric Thompson suggested more than a decade ago).

Pulltrouser Swamp formed part of a regional, not just a local, economy, in which its riparian inhabitants produced primary materials and consumed secondary manufactured goods. As a study of

one aspect of the economic foundations that underpinned the rise and florescence of Maya civilization this book is in more than one way fundamental.

NORMAN HAMMOND
Archaeology Program,
Rutgers University,
New Brunswick, New Jersey 08903

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