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Early Agriculture in Orissa: Some Archaeobotanical Results and Field Observations on the Neolithic

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Abstract

The development of agricultural communities is poorly understood in the state of Orissa. This is not due to a lack of archaeological sites, because there appear to be many, but the result of no systematic environmental sampling and flotation. Orissa is potentially an important area in terms of agricultural development and may be crucial for understanding broader patterns of early agriculture in India as a whole. A number of crops may have originated in this region including rice, pigeonpea, urd and mung bean, several gourds, and root crops such as taro and yams. The investigations into these particular issues began with intensive field explorations and the recovery of archaeobotanical samples from a number of sites across the state by the Deccan College, Pune. Preliminary results of analysis for macro-botanical remains from some of these sites are presented here along with a review of the types of sites found so far and a summary of what this means in terms of the development of agricultural communities in this area.

Introduction

Food production is arguably the most important cultural change since the Palaeolithic, providing in many parts of the world a basis for sedentism and in all cases the basis for surplus subsistence production that could support states and "civilisation". The transition in any particular region from a reliance entirely on hunting and gathering to primarily food production through herding and cultivation is therefore of prime archaeological interest. This interest may occur through the local domestication of species available in the wild or through the adoption of crops/ animals by hunter-gatherers or by the immigration and colonization of a region of farmers from elsewhere. In order to investigate which process was at work in an area's past, and before it is even possible to speculate about causes, it is necessary to know what the basis of early food production was, and which crop species and animals contributed to this transition. The most direct evidence for crop cultivation in the past comes from archaeobotany; the study of plant remains preserved at archaeological sites. Such remains are normally preserved in carbonized form, by ancient contact with fire, and can be recovered through the processing of sediment using flotation (Kajale 1977; Buth *et al.* 1988; Fuller 2002: 257ff.). Those species recovered and identified can then be considered with regards to evidence from modern botany, genetics, and geography as to the regions in which they occur wild and therefore must have been domesticated (for a recent review see Fuller 2002: 284-316; Fuller 2003a). This can then be used to compare the food production in different sites, regions, and periods. Currently available evidence from prehistoric/protohistoric India is patchy, which means the beginnings of agriculture in many regions are completely unknown. The relationship between early agriculture and the emergence of Neolithic cultural traditions, although often assumed, needs to be documented, and the present paper reports results from new investigations in Orissa that aim to shed light on these issues (Fig. 1).

Orissa provides interesting prospects for archaeological investigation of early agriculture as well as being potentially a crucial region for understanding broader patterns of early agriculture in India as a whole. The topographical and ecological diversity of Orissa and adjacent regions, especially the tribal zones of Western Orissa, Chattisgarh (formerly eastern Madhya Pradesh) and Jharkhand (formerly southern Bihar), provide the natural habitat for a wide diversity of edible plants, including the wild relatives of many crops. Table 1 provides a list of crop species that are candidates for domestication in the region based on the presence of wild progenitors in this area, although many of these species are also distributed more widely in India (see Fuller 2002).

Of particular note is the presence of candidate populations of the wild progenitors of *indica* type cultivars of Asian rice (*Oryza sativa* subsp. *Indica*). Genetic

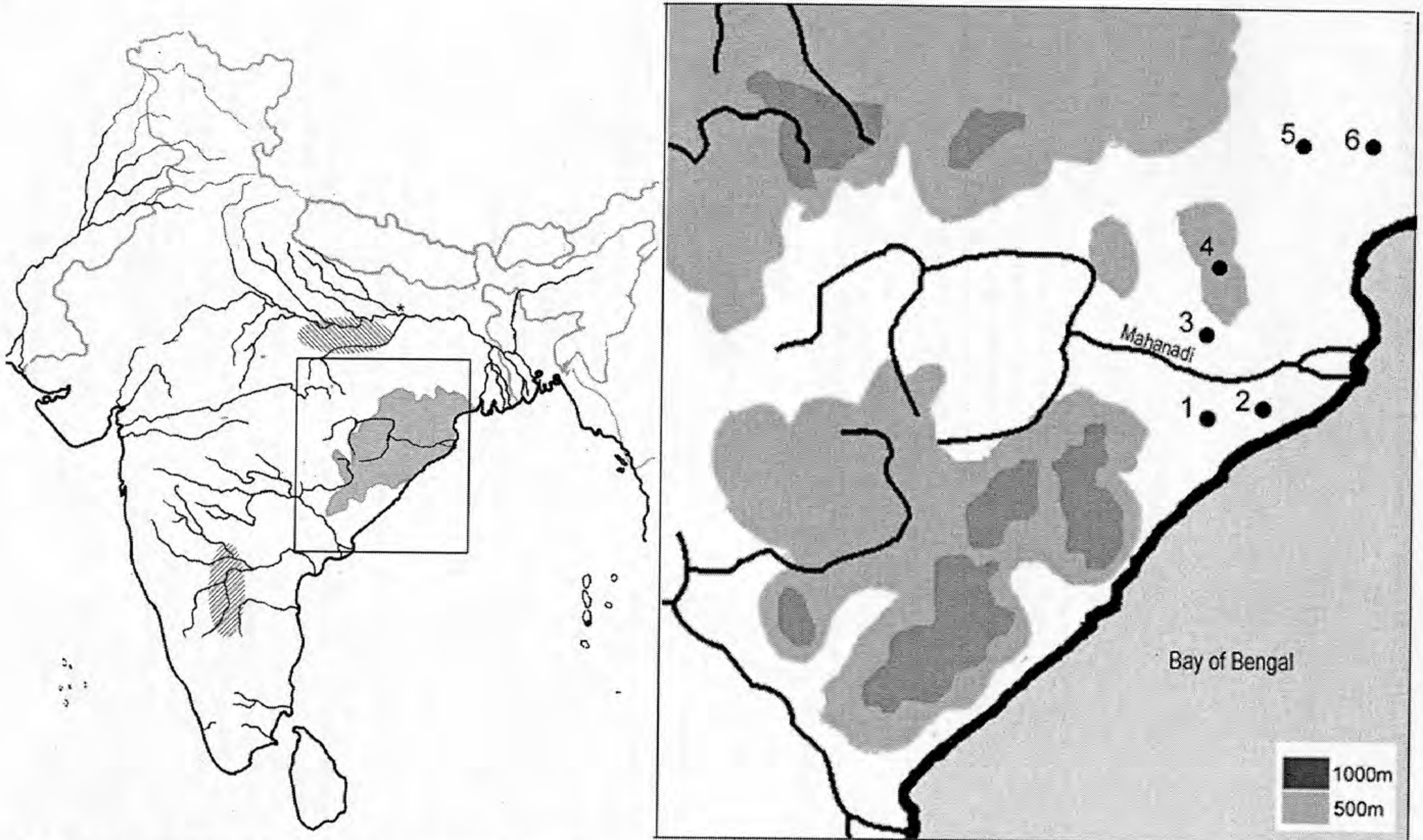

Fig. 1: Map of Orissa marked with sites. Map of India indicates the state of Orissa (grey) and other Neolithic regions (hatched) of possible indigenous domestication of the same or related crop species to those found in Orissa, the Vinhdyan Neolithic and the Southern Neolithic/ Ash Mound Tradition. Key to sites: 1 - Gopalpur; 2 - Golbai Sasan; 3 - Khameswaripalli; 4 - Malakhoja and Bajpur; 5 - Banabasa; 6 - Kuchai

Table 1: List of crop species that are candidates for domestication in Orissa

Crop	Common name	Region of Origin
Oryza sativa L.	Rice, vrihi	Tract from Central Uttar Pradesh, Chattisgarh, Bihar, west and south Orissa
Pulses		
Vigna mungo (L.) Hepper	Black Gram, Urd	South Asia – northern extent of wild progenitor could include Vindhyas and Orissan hills (?)
Vigna radiata (L.)	Green Gram, Mung	South Asia – northern extent of wild progenitor could include Vindhyas and Orissan hills (?)
Macrotyloma uniflorum (Lam.) Verdcourt	Horsegram, Kulthi	South Asia: savannahs or dry deciduous woodlands
Cajanus cajan (L.) Millsp.	Pigeonpea, Red Gram, Tuvar	South Orissa, Bastar
Cucurbits (Cucurbitaceae)		
Cucumis sativus L.	Cucumber, khira	Wild in the Himalayan foothills, possibly also the high hills of Orissa
Coccinia grandis (L.) Voigt	Ivy gourd, kunduri	Wild/feral in Himalayan foothills, hills of central and eastern India
Trichosanthes cucumerina L.	Snake gourd, chachinga	Wild/feral in Himalayan foothills, hills of central and eastern India
Praecitrullus fistulosus (Sticks) Pang.	Tinda, Indian squash melon	Wild/feral in Himalayan foothills, hills of central and eastern India
Momordica charantia L.	Bitter gourd, karela	Wild/feral in Himalayan foothills, hills of central and eastern India through Southeast Asia
Momordica dioeca Roxb. Ex Willd.	Small bitter gourd, murela, jangli karela	Wild/feral in Himalayan foothills, hills of central and eastern India through Southeast Asia
M. balsamina L.	Balsam apple, mokha	
Luffa cylindrical (L.) M.J. Roem.	Sponge gourd, loofah	Wild/feral in Himalayan foothills, hills of central and eastern India through Southeast Asia
Luffa acutangula (L.) Roxb.	Ridged gourd, angled loofah	Wild/feral in Himalayan foothills, hills of central and Eastern India
Tubers		
Colocasia esculenta	Taro	Eastern India and/or SE Asia
Dioscorea spp.	Yams	Eastern India and/or SE Asia

evidence is clear in indicating a minimum of two domestications for *Oryza sativa* (reviewed in Fuller 2002: 296-300; Chen *et al.* 1993; Wan and Ikehashi 1997; Sato 2002; Vaughan et al 2003; Cheng *et al.* 2003), including one from perennial wild rice (*Oryza rufipogon sensu stricto*) that led to *japonica* type cultivars, and probably occurred in the Neolithic of the Yangzi basin China (Cohen 1998; Zhao 1998), and the other from annual wild rice (*Oryza nivara*) giving rise to *indica* cultivars. For ecological reasons we would expect the *nivara-indica* domestication to have occurred in the seasonally dry tropics as argued by Sato (2002). This brings tracts of India into consideration from central Uttar Pradesh, through Chattisgarh, Bihar, and western/southern Orissa.

Other crops may have also originated here. The Northeastern limits of the wild form of mung and/or urd (*Vigna sublobata sensu lato*, giving rise separately to *Vigna radiata* and *Vigna mungo*) probably extends to this area but requires botanical field investigations. Horsegram (*Macrotyloma uniflorum*), although definitely of South Asian origin, has a poorly documented wild progenitor and its region of origin, or multiple loci of origin, within South Asia cannot yet be localized, although at least one domestication from southern India has been argued (Fuller 2002; Fuller *et al.* 2004). One species which is clearly of eastern Indian origin is red gram/ pigeon pea (*Cajanus cajan*), the wild form of which (*Cajanus cajanifolia*) is distributed in the Bastar region of Chattisgarh, in Southern Orissa, and adjacent northern Andhra Pradesh (van der Maeson 1986; Fuller 2002: 295). Several gourd types (family Cucurbitaceae) are native to the northern half of India (Walters 1989; Decker-Walters 1999), including this region, although separating a realistic wild distribution rather than the spread of weedy forms associated with escapes from cultivation remains problematic. The case of tuber crops, such as taro (*Colocasia esculenta*) and various yams (*Dioscorea* spp.), which remain important in parts of Orissa, requires further research, although the cultivated forms of these species found today could be largely introductions from Southeast Asia.

In addition to the possibility of local domestication there is clear evidence for the introduction of domesticates from elsewhere. This is most obviously the case with domestic fauna such as sheep and goats, but may also be true of domesticated forms of cattle and water buffalo. Wheat, barley, and pulses of winter seasonality and Near Eastern origin are largely absent from the region today. That some input into the subsistence systems came from further east (Southeast Asia) is suggested by the presence of Munda-speaking groups (e.g. the Santals, Mandari, Bhumji, Juangs, Khoria), who are linguistically related to the diverse Austro-Asiatic language family located mainly in Southeastern Asia, including the states of Northeastern India. Linguistic attempts to reconstruct their earlier vocabulary suggests that they may have arrived with domestic animals (perhaps water buffalo and pigs) and perhaps some crops (whether they were rice cultivators remains controversial), but many other crops that reconstruct proto-Munda are likely loans from other groups in India (cf. Zide and Zide 1976; Fuller 2003b). On the basis of probable loanwords from Dravidian languages relating to native peninsular crops, such as horsegram (*Macrotyloma uniflorum*) and possibly a small millet term, it has been speculated that contact between Dravidian speakers and intrusive Munda agriculturalists might have occurred in the early second millennium B.C., and thus during the later Neolithic (Fuller 2003b). What is needed first and foremost to move beyond speculation is hard evidence, collected systematically, about the bases of food production in the region.

Orissa is one of the most poorly studied areas of India in terms of archaeological investigations and in particular agricultural origins. Few excavations have taken place in this state and there is a complete lack of archaeobotanical sampling and flotation. This is not the result of a deficiency in archaeological remains as Orissa appears to have abundant archaeological sites of all periods (Basa and Mohanty 2000; Sengupta and Panja 2002) and therefore, offers the potential for new investigations into the prehistory of this area. The only well known multiphase site in Orissa, showing the transition from a Mesolithic to Neolithic community, is Kuchai in Mayurbhanj (IAR 1961-62: 36; Thapar 1978; Basa 1997). This site has been reported to have rice remains and also wild rice impressions in the ceramics (Vishnu-Mittre 1974, 1976) but no systematic sampling was conducted. We report the first results from a research program aimed at building up a picture of early agriculture across the region. This can be achieved in the first instance through field exploration, limited section scrapings or excavations and the collection of archaeobotanical evidence, following the principles that have proved successful in recent investigations of Southern Neolithic subsistence (Fuller *et al.* 2001a; 2001b; 2004; Korisettar *et al.* 2001; Fuller 2003a).

Methods

Fieldwork in Orissa was conducted in September-October 2003 by the Indian authors and this produced samples from a number of sites with long temporal sequences and also short lived semi-sedentary sites (Fig. 1). Sites were selected that had been previously excavated or surveyed by the Indian collaborators and were thought to have the potential to recover archaeological plant remains, especially through the cleaning of exposed or eroding sections. Two lowland sites in South Orissa, Gopalpur (GPR) and Golbai Sasan (GBSN), have been previously explored and the latter excavated but no archaeobotanical sampling took place (Sinha 1993, 2000; Mohanty 1994; Kar 1995, 2000; Kar *et al.* 1998). These sites are both extensive mounds with cultural sequences spanning the Neolithic through to the Iron Age. Therefore, systematic sampling was conducted at both of these sites by exposing a clean section at the side of the mounds by the Indian authors. Bulk samples (20 L) and phytolith samples were taken from all the stratigraphic layers (see Figs. 3-4). Sampling at Gopalpur was hindered by a high water table, which prevented some of the lower levels being sampled but Neolithic deposits were still sampled.

In the Central and Northern highlands of Orissa, a number of sites were sampled but none of these had long sequences and probably represented more short lived sites or seasonal camps. The sites sampled were Bajpur,

Fig. 2: Simple bucket flotation in Orissa

Malakhoja, and Banabasa. Malakhoja was sampled from an exposed section as described above. Sampling was conducted at the other two sites by digging 1 x 1 m test pits and taking samples (20 L bulk samples and phytolith samples) every 10 cm until sterile deposits were reached.

Samples were processed using simple bucket flotation, in particular the wash-over method (Fig. 2). This consisted of adding filtered water to the sediment in a bucket, mixing, and then pouring into a 500 micron sieve bag to collect the flot. Once all the flot has been collected the heavy fraction left in the bucket is passed through a 2 mm sieve to retrieve any artefacts and heavy environmental remains. The flotation samples consisting of charcoal and charred seeds were sorted between x 6 and x 40 under a binocular microscope. Identification of Indian plant species is not always straightforward and therefore the millets and pulses were identified using the criteria developed by Fuller (1999) and also see discussion in Fuller *et al.* (2004) and for pulses Fuller and Harvey (in press). Distinguishing between wild and domestic species of rice is also problematic and has not been attempted at this stage. Part of this project is to carry out a study comparing macroscopic and microscopic morphometric identification methods for rice and therefore more refined identifications can be presented once this study is completed.

Lowland Sites: Gopalpur and Golbai Sasan

Prehistoric settlements in the coastal alluvial plain of Orissa seem to have been established by the 3rd millennium B.C. and are located close to Chilka Lake and the Mahanadi delta, which feeds into it (Misra 2002). These sites are substantial mounds with continuous sequences from the Neolithic through to the Iron Age (1st millennium B.C.). Three of these sites have been explored previously: Golbai Sasan (Sinha 1993, 2000; Mohanty 1994), Gopalpur (Kar 1995, 2000; Kar *et al.* 1998), and Khameswaripalli (Behera 2002). These sites have produced extensive ceramic assemblages, animal bones, and when excavated bone tool assemblages (Sinha 2000; Behera 2001), including projectile and harpoon points, which suggests some importance for fishing. Golbai Sasan is the most extensively excavated of these sites and therefore offers the best evidence of early farming settlements in this area (Fig. 3). This site has the only radiocarbon date recorded for this area and the beginning of the Chalcolithic deposits are dated to 4100 ± 100 BP (PRL 1637, 2300-2100 cal B.C.). The site is located on the left bank of the river Mandakini a tributary of the Daya River, which flows into Chilka Lake.

The excavators have recognised three distinct periods: Neolithic, Chalcolithic, and Iron Age. The Neolithic horizon contained evidence of structures, a handmade pottery assemblage of coarse red and grey wares with cord and reed impressions, and bone tools but no stone tools. After this period new technologies are found, such as stone tools, copper tools, and different pottery wares, which led to the suggestion of an influx of people (Sinha 2000). Previously recovered bio-archaeological remains suggest a subsistence pattern consisting of rice and pulse

Fig. 3: Sampled section at Golbai Sasan

Fig. 4: Gopalpur, Orissa

(horsegram) agriculture, domestic animals, hunting, and fishing. The last period is seen as a continuation of the previous period but with the addition of iron artefacts.

Although excavations have not taken place at Gopalpur (Fig. 4), this site is considered to have an affinity with Golbai Sasan. However, Golbai Sasan (200 x 200 x 11 m representing length, width, height) is a somewhat larger sized mound than the mound at Gopalpur (140 x 115 x 9 m). From surface explorations, similar pottery to that found at Golbai Sasan was recovered including the earlier red and grey wares, and the subsequent black and red wares associated with the Chalcolithic. There is less evidence of a rich bone tool industry but bones of domestic as well as wild animals were found. No surface bone finds appear to be sheep and goat. This may suggest they were adopted later then cattle. No plant remains have been reported from Gopalpur and therefore inferences could not be made concerning agricultural activities of these people prior to the current investigations.

Preliminary Archaeobotanical Results

Flotation samples (29 samples) from Gopalpur and Golbai Sasan have been sorted and identified (Table 2 and 3). These samples offer the main bulk of data for macro-remains collected from this region but only represent the coastal sedentary tradition. At present, no phytolith samples have been processed or analysed and therefore this data can not be presented here but will hopefully add a great deal to the overall knowledge of the economy of this region.

The macro-remains found at Gopalpur and Golbai Sasan are similar in content and are evidence of the economy of the sedentary prehistoric settlements of the Orissan lowlands (coastal plain). The main crop plants represented at these sites are rice and a number of pulses including horsegram (*Macrotyloma uniflorum*), pigeon pea (*Cajanus cajan*) mung (*Vigna radiata*), and urd (*Vigna mungo.*). Millets are also present (*Panicum sumatrense*, *Paspalum* sp., and *Setaria* sp.) but are all small varieties likely to be weeds of the rice crop rather than exploited as crops as is the grass *Ischaemum cf. rugosum* (Fig. 5).

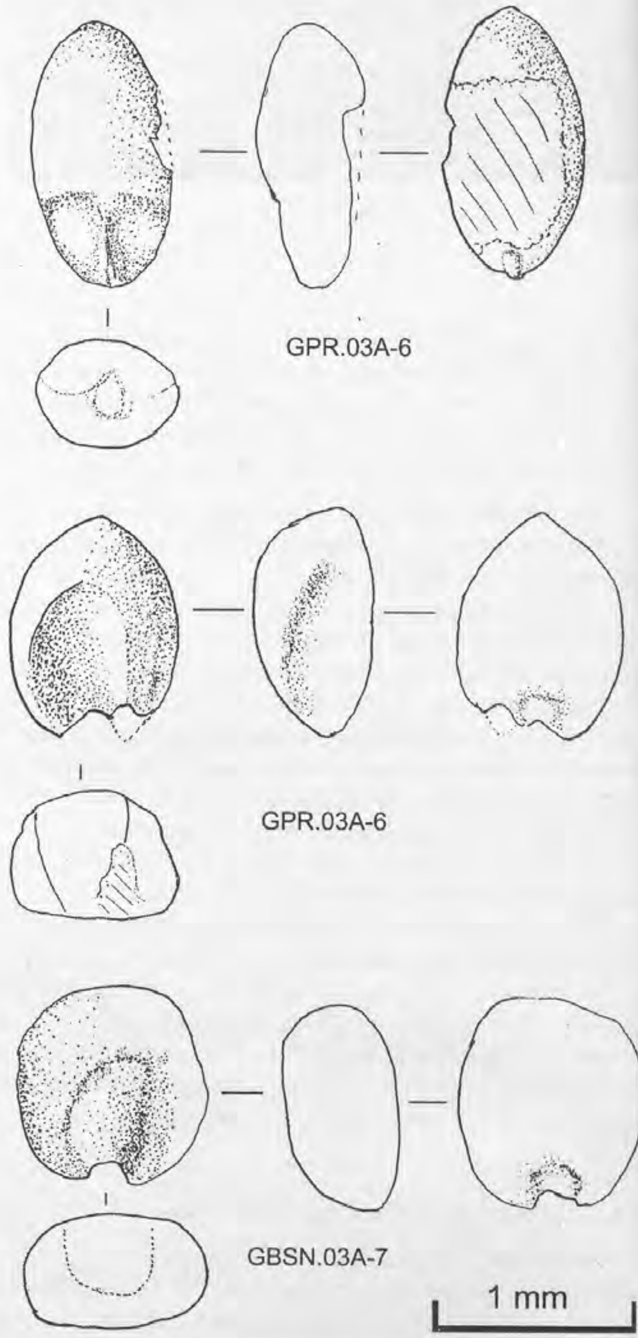

Fig. 5: Representative specimens of recurrent millet grasses of the Orissan Neolithic. These species are all probable weeds of rice. Top: cf. *Ischaemum rugosum*; Middle: *Panicum sumatrense*; Bottom: *Setaria* sp.

Table 2: Crop plants from Golbai Sasan

Sample Golbai Sasan	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Vigna sp. (whole)	2														
Vigna sp. (cotyledon)	30					2		2	4			2	2	1	
Vigna sp. (frag)	43							5			2		1		
Vigna cf. mungo (cotyledon)	3														
Vigna cf. radiata cotyledon)	5														
Vigna cf. radiata (whole)	2														
Macrotyloma (whole)			1												
Macrotyloma (cotyledon)						3	1	1	5		1				
Macrotyloma (frag)						6			3				2		
Cajanus (whole)						1									
Cajanus (cotyledon)	1					2	1								
Cajanus (frag)															
Cajanus/ Lablab?															
Pulse frags	76	6		3	4	13	29	23	24	8	11	17	9	3	4
Panicum sumatrense															
Setaria sp.							1	1		1				1	
Panicum sp.						1									
Paspalum sp.										1				3	
Indet. millets									3						
Oryza sp. (whole caryopsis)	1					3		3	1	1			3	2	2
Oryza sp. (caryopsis frags)	14	15	5	6	7	102	33	35	42	4	15	9	11	18	34
Indet. Graminae (caryopsis)	2	2				24	12	7	14		2		5		2
Ziziphus sp.						1	2	5							
Fruit stone unidentified						54	2		5		1	1	9		16
Weeds seeds						20	16		2	7	6	6	7	3	7
Charcoal	xx	xx	xx	x	x	xxx	xx	xx	xx	x	xx	x	xx		
Unknowns	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Total fragments	179	23	6	9	11	232	98	82	102	21	38	35	49	31	65

Key: Y = present, x = rare, xx = common, xxx = abundant.

1 GBSN-03A- 3 2 GBSN-03A-5 3 GBSN-03A-7A 4 GBSN-03A-7B 5 GBSN-03A-8 6 GBSN-03A-9 7 GBSN-03A-10 8 GBSN-03A-11
9 GBSN-03A-12 10 GBSN-03A-13A 11 GBSN-03A-13B 12 GBSN-03A-13C 13 GBSN-03A-13D 14 GBSN-03A-14A 15 GBSN-03A-14B

Table 3: Crop plants from Gopalpur

Sample Gopalpur	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Vigna sp. (whole)														
Vigna sp. (cotyledon)														
Vigna sp. (frag)														
Vigna cf. radiata														
Macrotyloma (whole)		8	8			1	1							
Macrotyloma (cotyledon)		19	10			1	1							
Macrotyloma (frag)		38	73			10	8	2	1					
Cajanus (whole)														
Cajanus (cotyledon)		2												
Cajanus (frag)														
Cajanus/ Lablab?														
Pulse frags	37	85	156	3	3	27	12	6	5	2	1			
Panicum sumatrense				1				1						
Setaria sp.							3	1						
Panicum sp.						8								
Paspalum sp.														
Echinochloa						1								
Indet. millets								2			1			
Oryza sp. (whole caryopsis)								2						
Oryza sp. (caryopsis frags)	3	1	5	3	3	23	11	18	4	6	18	5	9	
Indet. Graminae (caryopsis)						1								
Ziziphus sp.												1		
Weeds seeds	2	28	18	4		13	3	9		1	4	1		1
Charcoal	xx	xxx	xx		xx	xx	xx		x	x	xx	xx	x	x
Shoots		Y												
Unknowns	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Total fragments	42	181	270	11	6	85	39	41	10	9	24	7	9	1

1 GPR-03A-1 2 GPR-03A-2 3 GPR-03A-3 4 GPR-03A-4 5 GPR-03A-5 6 GPR-03A-6 7 GPR-03A-7 8 GPR-03A-8
9 GPR-03A-9 10 GPR-03A-10 11 GPR-03A-11 12 GPR-03A-12 13 GPR-03A-13 14 GPR-03A-15

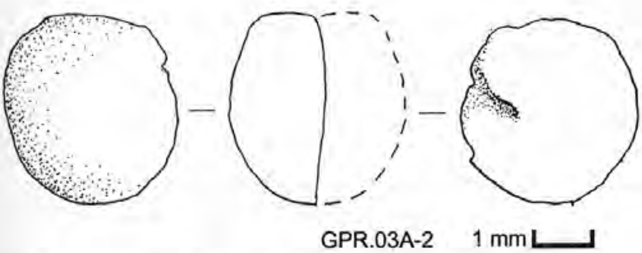

Fig. 6: Drawing of cotyledon of *Cajanus cajan*, from Golpalpur, sample level 2 (Neolithic)

Crops are present in the earliest levels sampled at each site. However, there are differences that may suggest more variation between these sites than previously thought.

The plant assemblages from Gopalpur are dominated by pulses and particularly Horsegram. Although, urd and mung are not present at this site. The richest samples at Gopalpur are found at the bottom of the sampled sequence and suggest that, as thought, the bottom of the deposits was not reached. Two *Cajanus cajan* cotyledons are present in sample 2 (Neolithic level) from Gopalpur and may represent the earliest find yet of this species in India (Fig. 6). This crop is likely to have originated in this region as the wild progenitor is only present today in South Orissa and Bastar. Thus the present find indicates that the cultivation of this species had begun by the mid-third millennium B.C. This crop has been found in a number of sites in South India in 2nd millennium B.C. deposits.

Rice dominates the samples from Golbai Sasan and there are also a substantial number of pulses (Horsegram, urd, mung, and pigeon pea). Small millets and fruit stone fragments (some being Indian jujube, *Ziziphus mauretania*) are also present in the samples.

This area of Orissa shows similarities to the archaeobotanical remains found at the Vindhyas culture sites in the Belan River Valley (Harvey *et al.* 2005). Both areas exploit rice, small millets, and native pulses, all of which are indigenous crops to India. There are also similarities with sites in Gujarat, which have been suggested to cultivate native pulses (*Macrotyloma uniflorum* and *Vigna mungo*) and small millets (*Panicum sumatrense*) from the fourth millennium B.C. but do not have definite evidence for rice cultivation (Weber 1991; Fuller 2002, 2003a). The Southern Neolithic is initially based on a native crop package similar to that found in Orissa; two small millets (*Bracharia ramosa* and *Setaria verticillata*) and two pulses (again *Macrotyloma uniflorum* and *Vigna radiata*). This is followed by the introduction of non-native taxa such as wheat, barley, possibly rice, Hyacinth bean, African pearl millet, and pigeonpea (presumably from the southern Orissa region) (Fuller *et al.* 2004). While this clearly supports the idea of independent plant domestications in India, this raises the question of where and when these native species were domesticated. Does this indicate multiple areas of domestication of the native pulses and small millets in India or are we seeing domestication in a certain region which then spread? Establishing a clear chronology for the appearance of these crops will enable these questions to be addressed further.

Upland Sites: Bajpur, Banabasa, Malakhoja

In the highlands of Orissa, a difference in the archaeological sites is apparent. They appear to be more ephemeral and therefore do not have the depth of deposits found in the coastal lowlands. Some highland sites near Chilka Lake have been suggested as being Mesolithic hunter-gatherer sites from microlithic finds, which may represent the people who later moved to the lowland sedentary sites (Misra 2002). However in North Orissa, these ephemeral sites are probably more contemporaneous with the settled farming societies in the lowlands and may represent a subsistence choice of shifting cultivation or more mobile people with seasonal camps. Shifting cultivators still exist today in the North Orissan Highlands and areas of adjacent states (Mohanty 1998, Pratap 2000) and therefore suggest a different pathway for prehistoric people to the settled life of the lowlands.

Bajpur is situated on the left side of the National Highway, 6 towards Keonjhar and 1 km from Pallahara College (Fig. 7). The original excavations exposed an area of about 200 sq. m and contained surface finds of finished and unfinished axes, chisels, flakes, chips, and potsherds (Basa *et al.* 2000, Mohanta 2002). Previous trial trenches revealed little organic remains except a small amount of charcoal. The site consists of three layers with a total depth of approximately 0.85 m. There are two Neolithic levels preceded by an underlying Mesolithic level.

Fig. 7: Sampling at Bajpur

Environmental samples were taken from an area not under cultivation down to 50 cm and therefore the site was sampled down to the Mesolithic deposit. Rice cultivation has encroached extensively on the site including the central part where earlier observations were made.

The site of Banabasa is a small hillock close to the left bank of the river Khairi in Mayurbhanj, North Orissa and was found by Mohanta (2002). There are three distinct locations at the site covering an area of 125 x 27 sq.m. Banabasa 2 was sampled for environmental remains because it was thought to have the greatest depth of deposit; up to 50 cm at the most. Lithic scatters are found on the surface including axes, adzes, chisels, and microliths. The site of Kuchai unfortunately has been put under cultivation and is now flattened. Therefore, no environmental sampling could take place at this site.

The site of Malakhoja is located close to the reported site of Sankerjang (Yule and Rath 2000). At Sankerjang, there are number of mounds, which contained burials dating to the late Neolithic/Early Chalcolithic period. However, Malakhoja is probably later in date and does not have the same depth of deposit as Sankerjang. A number of environmental samples were taken from this site and are in the process of being analysed.

Archaeobotanical analysis has not been fully completed but initial analysis demonstrated little organic remains corresponding with the suggested short-lived nature of the sites. Hence, two different trajectories are apparent at the same time in Orissa; a move to settled agricultural life in the lowlands and a more mobile life incorporating shifting cultivation or seasonal mobility in the highlands.

Discussion: Characterising Two Neolithic Traditions in Orissa

We now have the first firm evidence for considering the origins of agriculture in Orissa. As a working hypothesis, one can suggest two quite different Neolithic traditions, one associated with the coastal plain and major river valleys and another in the foothills and uplands, often in what are traditionally considered tribal areas. The Neolithic of coastal Orissa (which we might call the Eastern Wetland Tradition) is represented by some impressive mound sites, with well-stratified and substantial sequences that begin sometime in the early third millennium B.C. and continue into the Iron Age (early first Millennium B.C.), as at Golbai Sasan, Gopalpur, and probably also Khameswaripalli (Behera 2002). The harpoon points as well as the environmental context of these sites (on perennial streams and rivers in the wet lowlands), suggests the likelihood that fishing was a significant part of the economy, in addition to animal husbandry (Kar 2000) and cultivation. Whether the full complement of sheep, goat, cattle, and water buffalo were present from the beginning of this tradition requires clarification from systematic faunal sampling and reporting, although the apparent absence of sheep and goat from the surface bone assemblage of Golpalpur could hint at a more interesting process of gradual livestock adoption (cf. Kar 2000). As discussions of the artefacts have indicated there is a general affinity between the ceramic and bone tool assemblage of these Orissan sites and those of Chirand in the Ganges valley of Bihar (Sinha 2000; Dash 2000). It is indeed conceivable that these sites are all connected as part of a rapidly dispersing subsistence culture, based on fishing, domestic fauna, and rice-pulse agriculture. However, as the archaeobotanical evidence now indicates, there is a rather different tradition to that found at Chirand, which has winter crops of western origin. The introduction of wheat, barley, lentils, and peas into Chirand (Vishnu-Mittre 1974, 1976) does not appear to have continued to the Orissan lowlands. What does this tell us about the contact between these two areas; was it just an exchange of material culture, a conscious choice not to adopt these new crops into the predominantly wet areas of Orissa, or was there no contact at all between these two areas?

As for the upland Orissan Neolithic, small-scale excavation and flotation seem unable to shed light on early agriculture. These sites appear to be largely superficial with little depth of deposit, nor clear archaeological strata and sparse find densities, including the absence or very low presence of any charcoal. What this pattern suggests is a very different nature of site occupation, of shorter longevity and/or longer lapses between occupation episodes. Either we are dealing with seasonally occupied sites, perhaps for special activities such as lithic/celt manufacture, or the loci of settlements of shifting cultivators, or both. The absence of any more substantial sites and pottery points to a much less sedentary tradition, and one wonders whether the absence of pottery might also suggest an emphasis on crops like tubers, which can be readily pit-roasted, rather than seed crops. Pratap's (2000) model of shifting cultivation in the Rajmahal Hills offers some comparison to the kind of evidence found by us in the northern Orissan uplands.

This study has only just touched the surface of Orissan prehistory and much more work is needed to form a detailed picture of the economic strategies of these peoples. Future work will concentrate on phytolith analysis on the sampled sites, and landscape investigations including geoarchaeology and pollen coring to explore the prehistoric environment of this region in more detail. The macro-botanical material recovered so far will also be put forward for radiocarbon dating so that a chronology can be built of the sites. Therefore, the introduction of crop species in this area can be fitted into the larger framework of Indian prehistory and the suggestions of pristine domestications can be confirmed.

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