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The Beginning of Agriculture in the Kunderu River Basin: Evidence from Archaeological Survey and Archaeobotany

D.Q. FULLER*, P.C. VENKATASUBBAIAH**, RAVI KORISETTAR***

Introduction

The beginning of agriculture in Andhra Pradesh remain obscure. In general terms, it is unclear whether agriculture began through the local domestication of plant species, the introduction of crops by immigrant farming communities, the adoption of crops by indigenous hunter-gatherers, or some combination of these processes. In this paper, we will discuss the available evidence from a small region, spread over two districts of Cuddapah and Kurnool in Andhra Pradesh, including the results of new fieldwork and archaeobotanical studies, which are beginning to shed light on the origins of agriculture. In particular, we focus on the evidence from Neolithic sites in the Kunderu river basin (Nandyal Valley) of the northern Cuddapah and southern Kurnool districts.

This region is geographically and ecologically distinct from the better-studied areas of the Southern Neolithic, such as the Bellary and Raichur districts (see Korisettar *et al.* 2001). The Kunderu River, and its numerous tributary streams and *nalas*, flow generally in a southerly direction and meets the Pennar River. The rock formations consist largely of shales, quartzites and limestones of the Archaean Proterozoic Kurnool Supergroup (Ramam and Murty 1997:122-136). This valley is framed by the Nallamalai Hills on the east and the Erramalai Hills on the west. The region is covered by black cotton soil *(regur)*, in contrast to much sandier soils of the granitic Bellary-Raichur region to the west. Average annual rainfall in this region is also higher than the latter area, and has been classified in bioclimatic terms as 'Tropical Accentuated Dry', with a dry season of some 7-8 months (Meher-Homji 1967). The somewhat wetter conditions than the adjacent region to the west provide for somewhat lush vegetation with the dry deciduous forests of the area being dominated by *Anogeissus latifolia* and *Hardwickia bipinata*, while towards and into the Nallamalai Hills it is even wetter, including a larger amount of teak *(Tectona grandis)* and *Terminalia tomentosa* as well as a number of wet deciduous forest elements (Legris and Meher-Homji 1977; Puri *et al.* 1983). Today, however, much of the region is under cultivation or is covered with degraded *Acacia* scrub and grassland vegetation. Until palaeoenvironmental data are available it will remain unclear to what extent a grassland mosaic was an important part of this environment in Pre-Neolithic times, although we suspect that some Savanna clearings would have been present, in some areas, such as areas well above the *nala*-valleys or those overlying quartzites. The beginnings of agriculture and pastoralism in this region can be expected to have increased the area of

* Institute of Archeology, UCL, 31-34 Gordon Square, London
** Ramakrishna Vidyalayam, M.S. Nagar, Kurnoll, Andhra Pradesh
*** Department of History and Archaeology, Karnataka University, Dharwad, Karnataka

deforested grassland and promoted the spread of thorny shrub vegetation.

Distribution of Sites and Provisional Chronology

When Paddayya (1973) compiled a distribution map of Southern Neolithic sites, relatively few sites were then known from his 'Variant 5'. Subsequent to that various archaeological explorations, including intensive survey in the northern Cuddapah district by Venkatasubbaiah (1988, 1992), have filled in the Neolithic site distribution to a considerable degree (see also Murty 1989). Some 43 sites in the Pennar river region of the Cuddapah district were located and surface collections made by Venkatasubbaiah (1988, 1992). Small test excavations/ surface scrapings were carried out at three of these sites, Hanumantaraopeta, Peddamudiyam and Balijapalle. In addition, Venkatasubbaiah has documented more sites in recent years in the Kurnool district portion of the study area. In archaeological terms, one thing that is notable about this region is the lack of evidence for ashmound sites, which are so distinctive of the adjacent Neolithic region to the west (Paddayya 1973; Korisettar *et al.* 2001). Nevertheless, ceramic forms and general aspects of their style, such as slip and paint colours, are similar to the ceramics from the Neolithic sites of the neighbouring region suggesting broad contemporeneity and cultural contact, although the Kunderu valley is known for its distinctive painted Patpad Ware (see Allchin 1962; Sarma 1967, 1968; Allchin and Allchin 1982; Venkatasubbaiah 1992; Korisettar *et al* 2001).

The known Neolithic sites in the region can be seen to be distributed near the Kunderu river, or its tributaries, including placement on the banks of seasonal *nalas*. As noted in the Cuddapah district, there is a range in the apparent site size, as judged by surface remains: out of 47 sites, 37 are in the size range of 0.25 hectare, 5 are in the size range of 0.25-0.5 hectares, 3 in the range of 0.5 to 1 hectare, 1 in the range of 1-3 hectares and 1 of 3 hectares (Venkatasubbaiah 1992). This pattern of sites can be contrasted with that known in the ashmound tradition region to the west, where the largest settlement sites were located on granitic hilltops away from river or stream valleys, although generally adjacent to other permanent water sources.

While the chronology of this Neolithic region requires further refinement, it is clear that a large proportion of it is equivalent to Phase III of the Southern Neolithic chronology (after Allchin and Allchin 1982). The Patpad Ware, distinctive to the region under consideration, is often related to the more widespread Peninsular 'Jorwe' phenomenon, which is most pronounced in the third phase. According to the calibrated radiocarbon chronology of Watgal (Devaraj *et al* 1995), this phase can be dated back to *Ca.* 1800 B.C., and may continue up to 1200/1000 B.C. The chronological evidence suggests that contrary to the naming of this painted pottery phenomenon, it is earlier in the Southern Neolithic province than further North (Shinde 1994; Devaraj *et al* 1995; Korisettar *et al* 2001). The two available radiocarbon dates from Peddamudiyam and Balijapalle (Venkatasubbaiah and Kajale 1991) when calibrated: 1540 B.C. (BS 811) and 1110 B.C. (BS 785), are in agreement with this periodization.

Stratigraphic Evidence and Site Formation Processes

In February 1997, we visited some 15 sites in the Kurnool and Cuddapah districts, where we conducted surface collection of artefacts, with test pit sampling or scraping of exposed sections at 8 sites. At those eight sites, soil samples were collected and subjected to flotation and wet sieving for the recovery of faunal remains and archaeobotanical evidence. On the basis of these diggings and scrapings, it is possible to propose a basic division amongst the sites in terms of site formation processes, which can be interpreted in terms of different occupational intensity and duration in Prehistory. We would propose that there are two broad divisions amongst sites. First, there are those sites which were inhabited for relatively brief periods of time for any given occupation but were presumably revisited repeatedly, perhaps as seasonal encampments in part of an annual or multi-annual settlement cycle; these sites provide no stratified archaeological deposits and consist of only surface finds. Second, there are sites which have habitational deposits, sometimes with distinct layers and lenses, of varying thickness containing pottery, lithics, bones and generally producing some charred plant remains upon flotation; these sites are presumed to have been long-stay occupations, occupied continuously for much of the year, and perhaps for several years at a stretch.

The basis for making these divisions is certain presuppositions about the nature of soil formation processes in this region and their effects on archaeological evidence. As already noted, this region is covered largely by black cotton soils (Uppal *et al* 1953; Spate and Learmonth 1967). These soils are high in montmorrilonite clays, and prone to extensive argilloturbation, that is wet season expansion and dry season contraction and cracking, leading to a net effect of churning and mixing. As indicated by Waters (1992: 299-300), this will tend to move large inclusions, such as potsherds or other artefacts towards the surface. If we assume that the refuse from short seasonal encampments were subjected to annual argilloturbation the long-term result would be surface scatters without any thickness of archaeological deposit. By contrast, for longer occupations with a greater build-up of refuse and anthropogenic deposits, we might expect that argilloturbation only served to blur the boundaries between layers and destroy fine stratigraphy. In the case of several sites studied, thickness of archaeological soils ranged up to 1.25 m (at Hanumantaraopeta), often with little or no discernible internal stratigraphy within the archaeological deposit. It is therefore presumed that the internal stratigraphy was destroyed by argilloturbation but higher rates of archaeological accumulation in spite of argilloturbation produced continuous and thick archaeological deposits. Argilloturbation is also likely to have obscured chronological ordering of such deposits, although broadly speaking we would expect some modicum of superposition to be preserved.

The Sites and their Archaeobotany

Chintalapalli (CTP): The village is situated east of the Pennar River in Kurnool taluk of Kurnool district. The archaeological finds are restricted to pottery from a ploughed up field dominated by black cotton soil. Stratified deposits are not observed in this area and the pottery collection was made from the plough zone surface. It was not suitable for archaeobotanical sampling.

Hanumantaraopeta (HRP): The village is situated on the Jammalamadugu-Tadapatri road, about 21.5 km north of the Jammalamadugu town, a taluk headquarter in the district of Cuddapah. The Tagileru nala flows in the east-west direction about a km to the north of the village, which is situated at the foot of the sandstone ridge. The Neolithic site is situated about 200 m south of the village. The Neolithic deposit, with an extent of 230 m in the east-west direction and 150 m in the north-south direction, is part of a cultivated field, under cotton in February 1997. The site was recognized by Venkatasubbaiah (1992) as a regional center and therefore one deep test pit to a depth of 1.4 m was dug into the site. Although the cultural deposit of 1.25 m did not reveal clear distinctive stratigraphic layers, seven arbitrary levels were selected for flotation sampling. Artefactual finds included pottery, microliths, lithics and animal bones. Pottery includes black-on-red ware, grey ware, brown ware, red ware, black ware and black-and-red ware. The lithics include pecked and ground stone artefacts and microliths.

Hanumantharaopeta has yielded a wide range of charred seed taxa including at least 30 distinct morphotypes. Most common were small millets, largely caryopses of *Brachiaria ramosa* and *Setaria verticillata* types but with a few probable specimens of *Echinocloa colona*. *Macrotyloma uniflorum* and *Vigna radiata* were also prevalent although a single probable specimen of *V. mungo* was noted from the lowest level. Several fruit/nut types are present, including *Ziziphus* cf. *Mauritania*. Wheat and barley are both present. Additional food plant crops present include one probable *Abelmoschus* type (okra/lady's fingers), which was earlier reported from Peddamudiayam, and a few cucurbitaceae types *(Cucumis cf. prophetarum)*.

Injedu (IJD): The village is situated in the Pennar valley in Kurnool district. The archaeological site is situated east of the village of Uyyalavada. The cultural material includes both Neolithic and Early Historic artefacts. About 60 cm of habitational deposit was exposed in a test pit. The cultural material included black-on-red ware, grey ware, burnished ware, brown ware, red ware, terracotta and stone artefacts. Trial samples for flotation were poor, due to small size, low charcoal concentrations and heavy bioturbation. Nevertheless *M. uniflorum* was present.

Mandlem (MDM): The village is situated in Nadikotkur taluk of Kurnool district. The archaeological site is situated east of Mandlem village. The surface scatter yielded lithics and pottery. The lithic debatage found at the site was indicative of a Neolithic factory. Two test pits were dug into the ploughed field. One of the pits yielded fragments of pottery and animal bones at a depth

of 26 cm. A lens of wood charcoal but without seeds was encountered at this depth.

Pandipadu (PNP): A suburban village of the town of Kurnool, the district headquarter. Three localities on either side of the Kurnool-Pandipadu road about 5 km south-west of Kurnool yielded Neolithic cultural material including pottery and a stone celt, but no subsurface archaeology was preserved.

Peddamudiyam (PMD): The village is situated on the left bank of the Kunderu River about 21 km northeast of Jammalamadugu. The Neolithic deposits occur at two sites on the left bank of the river: (a) Locality 1, on the east bank very close to the village and (b) Locality 2, a little to the south of the village on the left bank. Locality 1 measures 30 x 30 m and is thoroughly ploughed up. Neolithic stone artefacts, black-on-red ware and black ware are some of the ceramic varieties reported from this locality. Locality 2 measures 65 x 55 m in extent and rises slightly above the surrounding field. Pottery includes back-on-red ware, grey ware, black ware, buff ware and brown ware. The lithics include pecked and ground stone tools, microliths and disc beads. Animal bones were also collected.

The dug up sections in the area revealed a maximum habitational deposit of about 55 cm. Four trenches were dug in the area, two on the perimeter of the area containing the cultural deposit and two in the centre. There was no visible stratification in the cultural material and therefore three arbitrary levels were sampled for flotation. The upper portion in each of these trenches was found to be low in charcoal but five samples floats were collected from lower sediments. The flotation samples have yielded evidence for Setaria *verticillata caryopses*, *Macrotyloma uniflorum*, fruit/nut fragment and parachyma. Locality II yielded a few ancient fragments, including pulse *Vigna* cf. *mungo*, and *M. uniflorum*, chenopodiaceae/amaranthaceae type seeds. (also see Venkatasubbaiah and Kajale 1991)

Tangaturu (TGT): Both Palaeolithic and Neolithic artefacts have been reported from near this village. The Neolithic deposits are located to the northwest of the village. A collection of grey ware, black-on-red ware, burnished ware, red ware, coarse red ware, animal bones, and stone artefacts has been collected from the site. No subsurface deposits were preserved.

Rupanagudi (RPG): The village is situated in Kurnool taluk of Kurnool district, to the east of Uyyalavada, a few kilometers away from Injedu. The Neolithic site is situated on the Erravagu, a tributary stream of the Kunderu River. Three sections in the area revealed stratified cultural material.The cultural material belongs to both Neolithic and Early Historic periods. The cultural remain from this site included black-on-red ware, grey ware, burnished ware, red ware, stone artefacts and animal bones.

Rupanagudi had poor archaeobotanical preservation and low yield generally. One seed from here has been referred to cf. *Abelmoschus sp.*, i.e. okra. Other food crops present in the samples were the ubiquitous small millet caryopses of Setaria *Brachiaria* type, as well as a fragment of *Vigna* sp. and other pulse fragments.

Singanapalle (SGP): The Neolithic site is situated about 2 km north of the village in Kurnool district. The site covers an area of 400 x 350 m (IAR 1967-68:3). This is one of the well developed and stratified sites in the region of our study. The Archaeological Survey of India first studied the site during 1967-68. Four test pits were dug into the deposits at the site. Pottery representing red ware, burnished ware, black-on-red ware, coarse red ware and stone artefacts, steatite and shell beads occur profusely in the sections as well as on the surface. Singanapalle has yielded very few seeds despite reasonable concentrations of charcoal and relatively good stratification for a site in the Kunderu valley. Nevertheless the dominant categories overall were present: *Macrotyloma uniflorum, V. radiata, Setaria/Brachiaria* millet type and parenchyma fragments.

Neolithic Cultivation Practices

Sites of the long-occupation type, with thick archaeological deposits, were successfully sampled for recovery of plant remains. Soil volumes of approximately of 20L were taken for each discernible archaeological layer, and in the case of HRP, where no layers were discernible arbitrary sampling intervals were determined on the basis of depth. By comparison to evidence recovered by the same methods in the Bellary region and at Hallur the samples from these sites were poor (Fuller 1999; Fuller *et al.*

2001) and indeed some sites yielded very few seeds, although charcoal was present on all sites. Nevertheless, the presence of charred seed fragments, including a number of likely crops is significant and greatly augments the existing archaeobotanical dataset from the region, including the evidence of Ramapuram (Kajale 1996), Peddamudiyam and Balijapalle (Venkatasubbaiah and Kajale 1991; Kajale 1996). While there is high density of charcoal at the site of Hanumantaraopeta, the evidence from other sites is low which may be due to preservational conditions and taphnomic processes operating in the area. The somewhat high densities were dominated by wood charcoal. In terms of non-charcoal remains the site of Hanuman-taraopeta again shows larger quantities corresponding with the larger sample sizes. Thus the samples from HRP can be expected to be the most representative available.

The most extensive assemblage comes from HRP and other sites only confirm the presence of selected species from the HRP dataset. The species, which were noted in the largest amounts, include two pulses, horsegram (*Macrotyloma uniflorum* (Lam.) Verdc.) and mungbean (*Vigna radiata* (L.) R. Wilzc.) and two morphotypes of millets, browntop millet (*Brachiaria ramosa* (L.) Stapf.) and bristly foxtail millet-grass (*Setaria verticillata* (L.) P. Beauv.). All of these species were found throughout the arbitrary sampling units at HRP. In addition, charred fragments of parenchyma tissue, suggesting the use of as yet unidentified tubers were also found throughout HRP. In addition, at HRP a few grains of another millet grass, sawa millet (*Echinochloa* cf. *colona* (L.) Link) were identified, and a single *Vigna* cotyledon of probable black gram (*Vigna mungo* (L.) Hepper) was found. *V. Mungo* type was also identified at PDM. No clear evidence of pigeonpea (*Cajanus cajan* (L.) Millsp.) was found at HRP, although this species had been previously reported from PDM (Venkatasubbaiah and Kajale 1991), but a number of large cotyledon fragments, possibly of a leguminous species were noted at HRP. These fragments could be from *C. Cajan*, or *Lablab purpureus* (L.) Sweet, a species well documented from the Bellary region, although other taxa are also possible. From the highest sampling locus only (HRP.1-3), a few wheat and barley grains were recovered, which may represent a later addition to the Neolithic crop repertoire. A number of fragments of probable gathered fruit remains have also been identified, including ber (*Ziziphus* cf. *mauritania* Lam.), probable jamun (cf. *Syzygium cumini* (L.) Skeels), seeds of a wild relative of melons and cucumbers (*Cucumis* cf. *prophetarum* L.) and a few seeds that may be from a wild relative of lady's fingers (cf. *Abelmoschus sp.*), which had previously been reported from PDM (Venkatasubbaiah and Kajale 1991). In terms of assemblage composition at HRP, pulses are generally the most numerous identifiable category followed by the small millets. There appears to be a decrease in the number of parenchyma fragments as one move up through the sequence. While this pattern may reflect declining use of tuberous foods, due perhaps to increasing reliance on millet cultivation, it is also possible that soil processes, including recent ploughing, towards the surface led to differential destruction of parenchyma.

The evidence argues for crop cultivation, and it can be suggested that the crops involved had been introduced from the west although some local domestication cannot be ruled out. The pulses *Vigna radiata* and *Vigna mungo* derive from wild progenitors, which have been reported from the forests of the Western Ghats as well as the Nallamalai hills (Fuller 2001). For horsegram and millets, detailed distributional data on their natural distribution is still needed, but all are probably native to the dry deciduous and/or Savanna zones, and thus could potentially have been domesticated across much of the Peninsula. Nevertheless, given that these species occur together as a crop package across many Southern Neolithic sites, it might be suggested that they were brought into cultivation at roughly the same time and place and we must therefore look to the Malnad region towards the Western Ghats, or perhaps the transition from the Malnad to Maidan for their likely zone of initial cultivation. The available dating evidence from the Kunderu river valley also points to the beginnings of the Neolithic, including ceramics, later than regions to the west.

The evidence discussed above provides a basis for reconstructing in broad terms the nature of subsistence and settlement during the Neolithic in the Kunderu basin. The range of crop species present suggests cultivation largely during the monsoon *(kharif)* season, with probable winter cultivation added on small scale with the adoption of wheat and barley. The millets and pulses could have been readily dry cropped on the rainfall absorbed by the clay-rich soils. It is plausible that some system of shifting cultivation was employed, although further evidence is

needed. It is clear from the archaeozoological evidence (Venkatasubbaiah *et al* 1992) that domestic fauna were herded, supplemented by some hunting. As with the rest of the Southern Neolithic, cattle predominated (65% of surface collection from 7 sites; 67% of identifiable fragments from previous test excavations at HRP) and smaller herds of sheep and goat (11.5% of surface collections; 20% of identifiable fragments from previous test excavations at HRP). Chicken bones have also been recovered in small quantities of these sites, including HRP, and might be suggestive of some more sedentary occupation. Pigs, however, a sedentary animal *par excellence*, have not yet been recovered from this region. The presence of long-duration (possibly sedentary) occupations as well as seasonal encampments, might attest to some cyclical process of movement of herds across the landscape over the course of the year, probably following cycles of population concentration and dispersal, with dispersal acting as an effective means of minimizing the stress of the dry season.

Understanding of the Spread of Agricultrue Beyond the Ashmound Tradition

In placing the above evidence into a wider interregional context, we might suggest some of the possible processes involved in the establishment of agro-pastoral way of life in this region. In general terms the spread of agriculture may occur through migration of farmer communities or else the adoption of domesticated plants and livestock by hunter-gatherer groups. Alexander (1977, 1978) has discussed these processes in terms of frontiers, with moving frontiers in the case of immigrant agriculturalists, and static frontiers, often associated with environmental boundaries, at which agriculturalists interact with hunter-gatherers beyond the frontier. The importance of such interactions at the static frontier for understanding the process of agricultural adoption is widely discussed in the context of western and northern European Prehistory (e.g. Alexander 1978; Dennell 1985, 1992; Zvelebil 1986, 1996; Thomas 1996). Static frontiers may be 'closed', in which case there is minimal interaction between agriculturalists and hunter-gatherers or else they are 'open' and a range of inter-relationships develop. Static frontiers may involve a variety of processes, including symbiotic interactions and trade, emulation of one group by another, usually emulation of the agriculturalists by hunter-gatherers (Zvelebil 1986; Fewster 1996), or competition, and may involve intermarriage. In general terms three phases, which may also be somewhat spatially separated, have been proposed for open agricultural frontiers (Zvelebil and Rowley-Conwy 1984): an availability phase, in which domesticates and other technologies are available but not seriously taken up by hunter-gatherers, a substitution phase in which these are adopted on a small scale by some amongst the hunter-gather communities, and a consolidation phase in which agriculture becomes well-established and hunter-gatherer traditions decline or retreat. As discussed by Russell (1998) with regard to situations of marital exchanges, especially in the case of agro-pastoral systems in which cattle or other livestock play an important role as bride wealth, internal social drives within hunter-gatherer communities may be created that to promote the adoption of domestic herds. In such situations, we might expect the adoption of domesticated animals to precede cultivation. Details about the relative timing of these elements in the Kunderu basin, however, are not yet available.

A static frontier situation, perhaps corresponding roughly to the Erramalai hills, i.e. the geographic transition from the granitic peneplain of the Bellary region to the black soils of the Cuddapah and Kurnool regions, can be suggested to have developed between the agro-pastoral culture of the Southern Neolithic ashmound tradition and the Mesolithic hunter-gatherers of the Kunderu basin. Cultivation was present in the ashmound tradition by at least 2200 cal. B.C., and probably earlier, and thus this interaction between the cultivator-pastoralists on the west and the Kunderu hunter-gatherers on the east must have carried on for at least four centuries until *Ca.* 1800 cal. B.C. During this period some trade might be expected, although clear evidence for this is still lacking. However by 1800 cal. B.C. populations in the Kunderu basin had adopted the basic livestock and crops of the ashmound tradition but adapted them to a different settlement system, without the ashmound ritual tradition, and also developed some distinctive aspects of ceramic style. It is hoped that future investigation might focus on the nature of this transition and the extent to which selective adoption and emulation took place across the Erramalai agricultural frontier, and whether or not the European model of availability, substitution and consolidation phases is applicable in southwestern Andhra Pradesh. The persistence of hunter and forager traditions amongst groups such as the Chenchus and Yanandis further east (in the

Nallamalais and Velikondas) would seem to imply that some aspects of the frontier situation have continued until the modern era.

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