Ceramics, seeds and culinary change in prehistoric India

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Cuisine, argues the author, is like language – it can be adopted, adapted or modified through time. The evidence from actual words for food is also used, together with seed assemblages and types of pottery to chronicle changing food cultures in Neolithic and later India. While some new food ideas (like African millets) were incorporated into existing agricultural practice as substitute crops, others such as the horsegram and mungbean appear to have moved from south to north with their pots (and probably the appropriate recipes) as a social as well as a dietary innovation.

Keywords: Neolithic, India, palaeobotany, agriculture, food culture, culinary practice

Research

Introduction

We all recognise that culinary practice, or cuisine, selected foods and the way they are prepared and flavoured is regionally and culturally distinctive. We have a sense of what to expect when we go to an Indian restaurant and we know that all the dishes there will have some commonalities of taste that differ from Italian or French cuisine. Thus regional cuisines are associated with cultural identities, and while these distinctive cuisines are in part a product of the available food resources of a given region, they also reinforce choices about what local populations will want to grow. For the purposes of this paper I will define culinary practice as the combination of foodstuffs (i.e. species) and the methods for preparing them, and I will attempt to look at the processes by which practices changed. Change might involve the adoption of new crops from adjacent regions, or changes in agricultural methods or in the technology of consumption. I will address how the processes of agricultural change have been affected by culinary choices, as well as ecological constraints. I aim to propose a framework for moving beyond evidence for the mere presence and absence of species, and the reconstruction of agricultural production, towards an archaeobotanically oriented perspective on culture-history and the dynamics of archaeological cultures.

While several archaeologists, such as Zvelebil (1986, 1996, 2000) and Bellwood (2001), have looked at interactive models for the spread of agriculture, I would like to focus both on the diffusion of materials (e.g. crops) and the potential cultural meanings attached to them (Hodder 1991: 93). The adoption of a food package involves the transfer of practices between individuals within a social context, and social acceptance is crucial (Kroeber 1948; Childe 1951; Trigger 1968: 28). Mufwene (2001) has made similar observations with regard to the spread and acceptance of linguistic practices, namely that there is a social and historical

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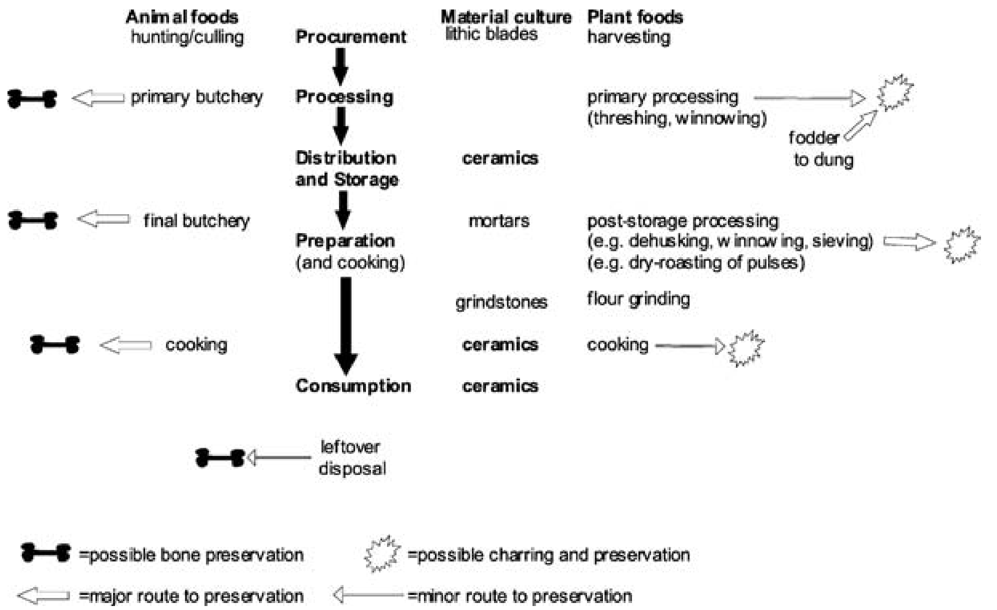

Figure 1. The trajectory of food and possible archaeological data sets.

context in which variants of words or syntax are selected by individual speakers and by wider communities.

For foodstuffs, production and consumption are inseparably linked, and while production choices will constrain what is consumed, changing consumption practices and desires will necessarily affect decisions about production. Smith (1999) has argued that consumption, even of everyday products such as utility ceramics, plays an important role in enacting and signalling cultural affinities. Food consumption also plays an important material role in reinforcing and embodying cultural identities, and it is from this basis that cuisine can play an important role in signalling social distinctions (Douglas 1975: 249-75; Khare 1976; Dumont 1980: 83-90; Appadurai 1981; Goody 1982; Braudel 1981: 183-265; Chaudhuri 1990: 151-81). Thus a holistic understanding of change must link agricultural production and food consumption. Within archaeobotany, and indeed in archaeology in general, there is great emphasis placed on production – e.g. the origins of food production, the intensification of production – yet much of social history emphasises the importance of consumption (e.g. Mennell *et al.* 1992), promoted elegantly in archaeology by Sherratt (1995, 1999).

In order to link these two we can consider food as passing through a trajectory from procurement to consumption (Figure 1: see Goody 1982: 43ff), filled out by models developed from ethnoarchaeology (e.g. Hillman 1981; Jones 1984; Reddy 1997; Stevens 2003). While much palaeobotanical evidence provides indications of production, processing and storage practices, pottery may relate more directly to consumption. Certain cultural behaviours, especially those relating to the handling and consumption of foods, can be inferred from ceramic form (see Arnold 1985: 234; Rice 1987: 211-17, 236-42; Adams & Adams 1991: 285; Orton *et al.* 1993: 28-9; Dietler 1996), with potential confirmation through chemical residue analysis (Heron & Evershed 1993). A combination of the evidence of seeds and ceramics can therefore lead us to the cultural behaviour that is here termed *culinary practice*.

In this paper, reasons for changes in the production and consumption of food will be deduced by drawing on these different but complementary types of evidence, using a case study from peninsular India. I first summarise the current evidence for food crops, highlighting the contrasts between the north and south Deccan. The patterns for the selective spread of crops are then contextualised in relation to patterns in the development of ceramic assemblages, in particular the spread of new form types. These two lines of evidence suggest that different processes of diffusion affected different types of crops. A general framework of four models for culinary diffusion is outlined with reference to analogous historical linguistic processes. This provides a framework for considering the specific examples from India, as well as a more general approach to studying the evolution of culinary traditions.

Evidence for crop diffusion in peninsular India

In peninsular India today we have a diverse range of cultivars, for which biogeographical evidence indicates origins in Africa, the Near East, China and the Indian region itself (see Fuller 2002). These crops include rice, wheat and barley (although these are quite rare in this region today), sorghum, 10 species of millets, and numerous pulse crops, oilseeds, and various gourds and cucumbers (from the family Cucurbitaceae). This diversity attests to a history of adoption and adaptation of agricultural and culinary practices in the past. In addition, the Indian peninsula features an important linguistic frontier between Indo-European languages and Dravidian languages, both of which share and have exchanged words and linguistic features (Emeneau 1956; Fuller 2003a), indicating important cultural diffusion and interchange in prehistory (which may have involved some migrations). We are also in the fortunate position of having a fairly well-studied archaeological record for the late prehistoric period, including some of the more extensive archaeobotanical studies available for India (Figure 2). In the south Deccan is situated the Southern Neolithic, while on the northern Deccan is the Malwa-Jorwe Tradition. Similarities and differences in the food ways and agricultural practices of these two cultural traditions in the third to second millennium BC will be highlighted (Table 1).

The Ash Mound Tradition was a distinctive archaeological culture of northern and eastern Karnataka, and parts of south-western Andhra Pradesh, dated broadly between 2800 BC and 1200 BC (Allchin & Allchin 1982; Korisettar *et al.* 2001a). It can be distinguished from other regional varieties of India's Southern Neolithic by the presence of the distinctive mounds of dung ash up to 8m in height, which were formed through the episodic burning of large quantities of accumulated cattle dung (Allchin 1963; Korisettar *et al.* 2001a; Boivin *et al.* 2002; Johansen 2004). The character of these mounds, restricted in both space and time, suggests that they were intentionally burnt perhaps as part of cyclical or episodic rituals. Bone evidence from the ashmound of Budihal has been suggested to indicate feasting episodes associated with these sites (Paddayya *et al.* 1995). In general terms, Southern Neolithic herds were dominated by cattle, with a small component of caprines (Korisettar *et al.* 2001b). Depictions of longhorn, humped zebu cattle typical of south Indian breeds dominate the rock art associated with the Neolithic of this region. In addition to the ashmounds, there

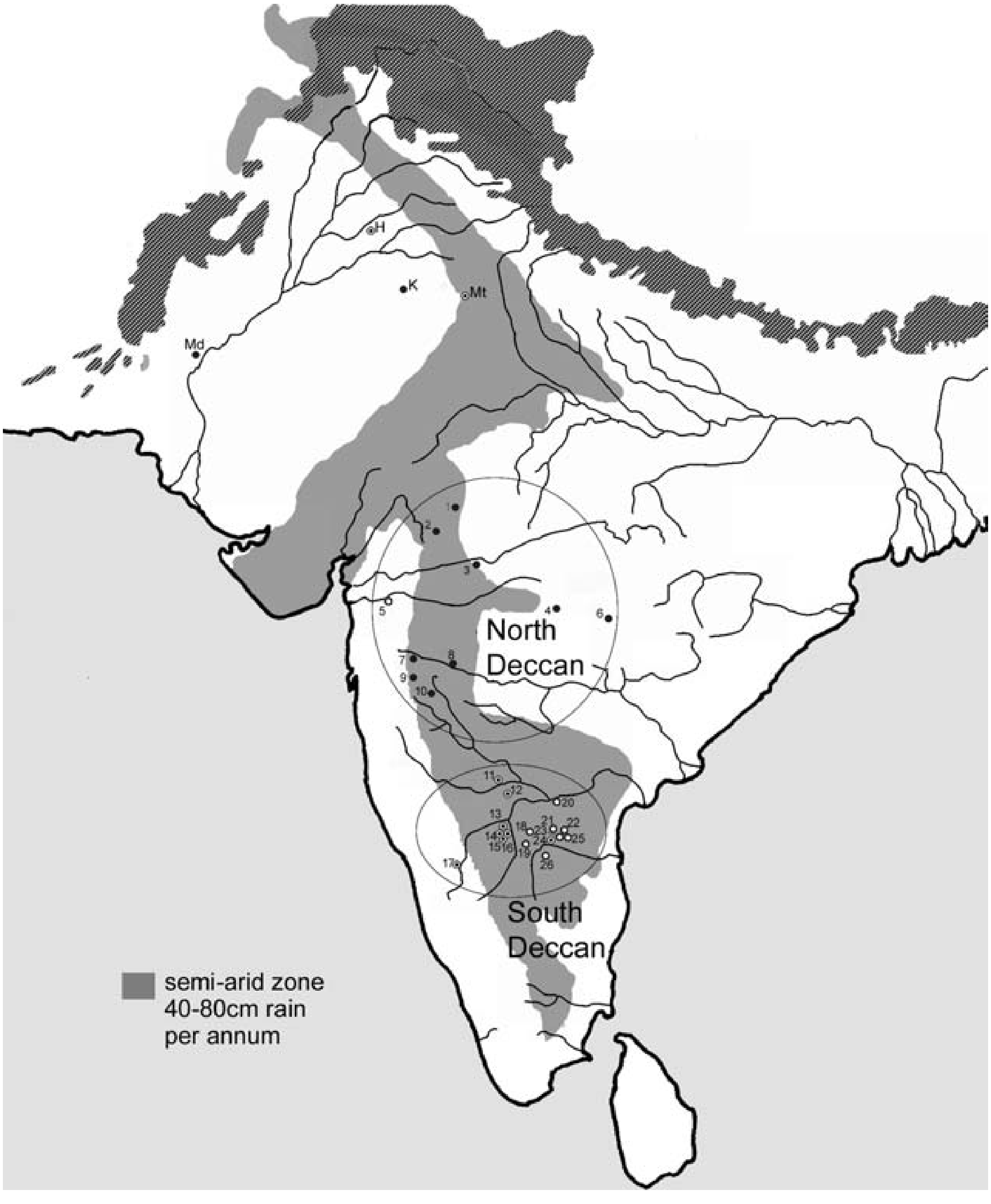

Figure 2. Map indicating locations of sites with archaeobotanical evidence on peninsular India and other sites mentioned in paper. Sites with presence of winter cereals and pulses indicated with black circles. Sites without winter crops indicated with open circles. Sites with predominantly summer crops, but with winter cereals also present indicated by combined symbol. The semi-arid zone with annual monsoon rainfall between 40 and 80cm is shaded. Selected sites of the Harappan northwest indicated by letters: Md, Mohenjo Daro; H, Harappa; K, Kalibangan; Mt, Mitathal. Peninsular sites numbered as follows: 1, Kayatha; 2, Dangwada; 3, Navdatoli; 4, Tuljapur Garhi; 5, Kaothe; 6, Adam; 7, Daimabad; 8, Apegaon; 9, Walaki; 10, Nevasa; 11, Inamgaon; 12, Budihal; 13, Piklihal; 14, Kurugodu; 15, Sanganakallu; 16, Hiregudda; 17, Tekkalakota; 18, Hattibelagallu; 19, Velpumudugu; 20, Ramapuram; 21, Singanapalle; 22, Rupanagudi; 23, Injedu; 24, Hanumantaraopeta; 25, Peddamudiyam; 26, Bilijapalle; 27, Hallur.

Table 1. Table contrasting the crops of northern peninsular India (Deccan Chalcolithic) and the south Indian Neolithic. Key to symbols in table: X = dietary significance based on high ubiquity (>30 per cent) and/or high relative frequency within samples, x = low significance based on low ubiquity (<30 per cent) and/or low frequency within samples, + = present, but data insufficient to assess significance (due to sampling or reporting), – = absent, o = absent, but may be problematic due to lack of systematic sampling. Data for northern peninsula reviewed in Fuller 2002, with primary sources cited therein; data for southern Neolithic from Fuller *et al.* 2004, summarised in Fuller *et al.* 2001

	Winter crops						Summer crops										
	Wheat(s)	Barley	Lentils	Peas	Chickpeas	Grasspeas	Rice	Sorghum	Pearl millet	*Brachiaria ramosa*	Other small millets	Mungbean	Urdbean	Horsegram	Pigeonpea	Hyacinth bean	Cowpea
Northern peninsula																	
Adam	x	x	X	X	–	X	X	–	–	–	x	x	X	x	–	X	–
Apegaon	x	x	x	X	–	x	–	–	–	–	–	x	–	x	–	x	–
Daimabad	X	X	X	x	+	x	+	+	–	x	x	+	+	X	–	X	x
Dangwada	+	–	+	o	–	o	+	–	–	–	–	+	+	o	–	–	–
Inamgaon	X	X	X	X	x	x	–	X	–	x	x	x	x	X	–	X	–
Kaothe	–	–	–	–	–	–	–	–	X	?	?	–	x	–	–	–	–
Kayatha	+	o	o	o	–	o	–	–	–	–	–	o	o	+	–	–	–
Navdatoli	X	–	X	X	–	X	x	–	–	–	–	x	x	–	–	–	–
Nevasa	–	–	–	+	–	+	–	–	–	–	+	+	+	–	–	–	–
Tuljapur Garhi	x	x	X	–	x	x	X	X	–	–	–	x	x	x	x	X	–
Walaki	+	o	o	o	–	o	+	–	–	?	?	–	–	–	–	–	–
South India																	
Budihal	+	+	–	–	–	–	–	–	–	+	+	+	–	+	–	+	–
Hallur	x	–	–	–	–	–	X	–	X	X	X	X	x	X	x	x	–
Hiregudda	x	x	–	–	–	–	–	–	–	X	X	X	–	X	–	–	–
Sanganakallu	X	X	–	–	–	x	–	–	–	X	X	X	–	X	X	X	–
Tekkalakota	x	x	–	–	–	–	–	–	–	X	X	X	–	X	–	–	–
Kurugodu	X	x	–	–	–	–	–	–	–	X	X	–	–	X	–	–	–
Hattibelagallu	–	–	–	–	–	–	–	–	–	x	x	x	–	X	–	–	–
Velpumudugu	–	–	–	–	–	–	–	–	–	X	X	o	–	o	–	–	–
Singanapalle	–	–	–	–	–	–	–	–	–	x	x	X	–	X	–	–	–
Hanumantaraopeta	x	x	–	–	–	–	–	–	–	X	X	X	x	X	–	–	–
Injedu	–	–	–	–	–	–	–	–	–	o	o	o	–	X	–	–	–
Rupanagudi	–	–	–	–	–	–	–	–	–	?	x	x	–	o	–	–	–
Peddamudiyam	–	–	–	–	–	–	–	–	–	?	X	x	x	X	x	–	–

are non-ashmound habitation sites, which represent early villages (Korisettar *et al.* 2001a). The vast majority of these habitation sites are located either by the base or on the tops of castellated granite hills that rise in clusters above the flat plains of the south Deccan. In some cases these developed alongside or overlying previous ashmound sites. In regions adjacent to that of the Ash Mound Tradition, other related Neolithic cultural traditions are found.

Archaeobotanical evidence from the Ash Mound Tradition, although dominated by a package of native domesticates, also provides evidence for introduced species (see Figure 2, Fuller 2001, 2003b; Fuller *et al.* 2001, 2004). The most consistently encountered taxa are the pulses horsegram (*Macrotyloma uniflorum*) and mungbean (*Vigna radiata*), and a small millet complex, including predominately *Brachiaria ramosa* and *Setaria verticillata*. These species have the most widespread distribution, in addition to being of highest relative frequencies in the samples. Both of the millet taxa are known to be cultivated and/or utilised from wild harvests today, although in very restricted regions (see, e.g. Gammie 1911; Kimata *et al.* 2000). These Neolithic finds imply that they were much more widely used in prehistory. Thus, these species (two pulses, two millets) can be considered the 'basic Neolithic package' of the south Indian Neolithic and the Ash Mound Tradition in particular, and indigenous to the area.

During the course of the south Deccan Neolithic a number of other crops originating elsewhere were added to the subsistence system (and domesticated herd animals may have been also introduced: Fuller 2001, 2002, 2003b; Fuller *et al.* 2001, 2004; Korisettar *et al.* 2001b). Almost always occurring together were emmer (*Triticum dicoccum*), free-threshing wheat (*T. durum/aestivum*) and barley (*Horduem vulgare* L. *sensu lato*, including both hulled and naked forms, and some twisted grains of six-row forms). These cereals form the south-west Asian package and were found in small quantities on some but not all sites. At the site of Sanganakallu there is a trend towards increasing frequency of these cereals, suggesting that they became more important through time, starting at low quantities *c*. 2000 BC and growing to slightly higher levels by the time of site abandonment (*c*. 1000 BC). Crops of African origin, including sorghum, pearl millet, hyacinth bean, and cowpea, had arrived in India at an early stage of the second millennium BC, although they had not apparently become of widespread importance (Fuller 2002, 2003c). Additional crops from elsewhere in India are also first documented in the south during the course of the Neolithic. This includes pigeonpea (*Cajanus cajan*), a native of the eastern peninsula in the region of Bastar and Orissa, which occurs during the latest levels at Sanganakallu, and a fibre-gourd *Luffa cylindrica* (normally cooked as food when immature), which probably derives from domestication in northern or eastern India.

The evidence from the Southern Neolithic can be contrasted with more or less contemporary evidence from the northern peninsula, such as from Maharashtra. The Maharashtra Chalcolithic tradition of the north Deccan included the widespread Malwa (from *c*. 1700 BC) and Jorwe (from *c*. 1500 BC) cultures and their more localised predecessors, including the Kayatha Phase 2500-2100 BC, Harappan-related occupation at Kaothe (2200-1800 BC), and Savalda and Daimabad Phases (2100-1700 BC) (see Allchin & Allchin 1982; Shinde 1994; Chakrabarti 1999). These phases are represented by habitational mounds on the plains adjacent to the rivers and tributaries that flow from the west to east across the Indian peninsula. Archaeobotanical data is mostly from the Malwa and Jorwe period, although some sites like Daimabad and Kaothe have earlier evidence (reviewed in Fuller 2002, also Kajale 1991). The data indicate a different agricultural system from that of the Southern Neolithic. On most of these sites wheat and barley are by far the most widespread and frequent crops, contrasting with their rarity further south. Winter pulses are also of widespread importance, including lentils, peas and grasspea, with chickpea in the latest period. Apart from two probable grasspea specimens, these winter pulses are entirely absent in the Southern Neolithic. In addition to these, tropical pulses (*Vigna radiata*, *V. mungo*, *Macrotyloma uniflorum* and *Lablab purpureus*) are also as important as they are in the Southern Neolithic. Small summer millets are present, probably including the species of the Southern Neolithic, as well as some African crops.

The environmental context of these sites argues against an explanation of this pattern on the basis of ecological constraints or agricultural efficiency. Climatic conditions in India were near modern conditions from the late third millennium BC (Fuller & Madella 2001: 355-66; Enzel *et al.* 1999). Under modern conditions the southern and northern Deccan semi-arid zones (see Figure 2) share fundamental circumstances, including rainfall between 400 and 800mm in the summer season, and 7–8 dry months without rainfall (Meher-Homji 1967, 2001: 11-31; Huke 1982); however, the Bellary region in the heart of the Southern Neolithic is somewhat more arid, with more months of water deficiency. Throughout this semi-arid zone the cultivation of winter crops requires either artificial watering or cultivation with perennial water sources such as rivers. This is true whether one is cultivating cereals or pulses. Thus the selective uptake of the cereals and not pulses in the South is not attributable to an ecological barrier.

Taken together, what this evidence suggests is that we have at least two distinct sources of groups of crops and a counter-current of diffusion between them. Winter-grown species of ultimate Near Eastern origins diffused from the north-west towards the south and east, with native south Indian species diffusing northwards. In neither case is diffusion of the entire suite of crops indicated, but rather we have a selective process in which some crops spread and some do not. Understanding why some species spread and not others requires assessment of the cultural context of diffusion, which can be approached through other lines of archaeological evidence, such as ceramics.

The cultural context of crop diffusion: ceramic evidence

Ceramic evidence from peninsular India indicates changes in the range of vessel forms through time, suggesting the development or adoption of new forms of food preparation and consumption. As was evident to Allchin (1960), there are distinct forms (see below) that enter the archaeological record during the course of the Southern Neolithic. These could be connected either to the adoption of new foodstuffs or to the elaboration of ways of preparing those already present. In general there is implied culinary diversification, as fewer forms drop out of the repertoire than are added (Korisettar *et al.* 2001a; cf. Allchin 1960). An examination of the Southern Neolithic ceramic sequence in relation to ceramic data from the northern peninsula suggests that some forms may have spread southwards, while others spread northwards (chronology from the synthesis of Possehl & Rissman 1992, see also Shinde 1994). From the early Neolithic, the basic and recurrent ceramic forms are simple flared bowls and everted-rim jars, which remain predominant throughout the Southern Neolithic sequence (Figure 3). Two intriguing developments in vessel form, however, appear to relate to new ways of storing/preparing liquids, and to perforated strainer vessels that have been variously interpreted in relation to food preparation (type numbers taken from Allchin 1960).

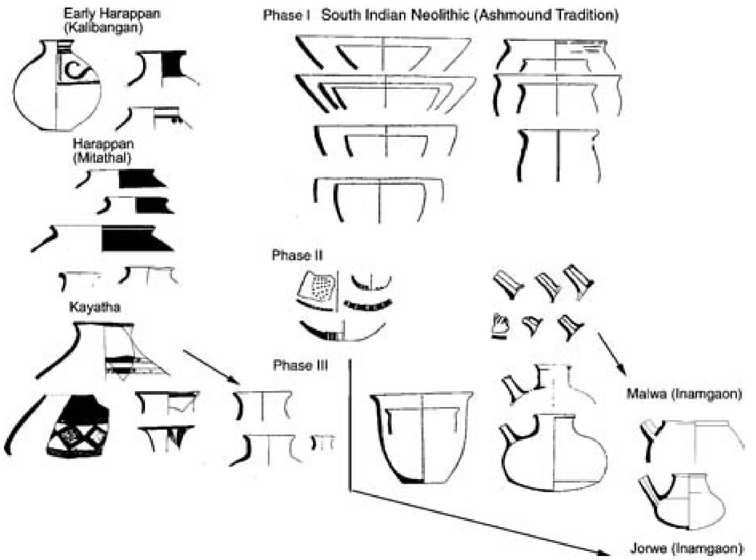

Figure 3. Major currents in ceramic vessel form evolution in peninsular India. In the centre of the diagram major new forms are indicated for southern Neolithic phases I-III. Forms deriving from probable northern diffusion are indicated on the left-hand side (with earlier examples from source regions illustrated). Diffusion northwards on the peninsula is indicated to the right-hand side.

Amongst the new liquid vessels are spouted jar forms (Piklihal types 44, 55) and a channel spouted form (Type 24; also Nagaraja Rao 1971: Figure 12.8; Subbarao 1948: Plate VIII, Xve; Wheeler 1948: 229, T44). Allchin (1960) suggested that these were used in milk preparations. They enter the repertoire in later Phase II (2000-1800 BC) or III (1800-1200 BC). Such vessels are known also from the Malwa phase of Central Maharashtra, from *c*. 1700 BC at Inamgaon (Dhavalikar & Ansari 1988: 348), and further north from the later Jorwe Phase (*c*. 1500 BC) e.g. at Navdatoli (Sankalia *et al.* 1971: 192). They occur in the Kunderu Valley's Patpad ware generally equivalent to the Malwa/Jorwe horizon (e.g. Foote 1916: 115, Plate 26; Allchin 1962: Figure 1.1; Sarma 1967). The fact that the dating of occurrences outside of the Ash Mound Tradition are all later suggests that this spouted type evolved in the South Deccan and spread elsewhere.

Another development in the later half of the Neolithic sequence is the appearance of perforated bowls, for which numerous functional interpretations have been offered: incense braziers, covers for boiling milk, steam cooking, colanders, or for the preparation of a 'macaroni-like' dish of 'milk-tubes', actually a sorghum flour paste boiled in milk (Allchin 1960: 45; Paddayya 1969; Nagaraja Rao 1971: 36; Venkatasubbaiah 1992: 208). Recently, a more complete specimen recovered from Watgal indicates that some of these perforated bowls had spouted lips for pouring, in addition to straining functions (Devaraj *et al.* 1995). Meanwhile another complete specimen from Bilajalipalle (Cuddapah District) has a lipless rim (Venkatasubbaiah 1992: Figure 47). This could indicate vessels with different functions or regional variation, and highlights the potential for future residue analysis. Nevertheless, the Watgal evidence might lend support to an alternative interpretation that sees these vessels as curd strainers. Perforated vessels also occur in ceramic repertoires further north on the Peninsula but only from the Late Jorwe period, *c*. 1200 BC (Dhavalikar & Ansari 1988: 476): with current chronological resolution it is hard to pinpoint a region of origin and direction of spread, although it is clear that these vessels indicate culinary developments shared between the northern and southern Deccan.

A form added to the Southern Neolithic repertoire, that clearly has earlier precursors to the north, is the tall, restricted-neck jar (Type 27). In general, there is a diversification in the range of jar types, such as Type 17/18, Types 19 and 52, interpreted by Allchin as 'milking pails' (Allchin 1960: 37). Precursor forms are known from the pre-Harappan and Harappan northwest and the earlier Chalcolithic of the northern Peninsula, e.g. Kayatha. Although some of Allchin's liquid-carrying or milking-jar types occurred in the Lower Neolithic (Types 16, 20), additional types in this category evolved in the later period, and could represent diffusion from the north. This expanded range of jar forms suggests that there may have been a range of new liquid-related functions added to the culinary repertoire. It seems overly simplistic to assume that they all relate to milk products, and other new beverages might also be considered, such as fermented grain drinks – made all the more likely given the chronological and directional correlation with the selective uptake of wheat and barley.

Ceramic evidence also argues against the adoption of the winter cereals for the production of bread in the Southern Neolithic, as forms, such as flat plates, associated with bread occur much later in the south. The Harappan ceramic repertoire of the Indus valley includes large flat forms that are plausible bread platters from at least the early third millennium BC (cf. Allchin & Allchin 1982: Figures 6.24, 8.5; Dales & Kenoyer 1986: 203-9), and they occur in Maharashtra from the early Jorwe period, after 1500 BC (Dhavalikar & Ansari 1988: 402), but are absent from the Southern Neolithic. Bread perhaps gains currency in South India with a later horizon of ceramic form and culinary infusion when round ceramic platters (*thalis*) occur in the later Iron Age, from *c*. 500 BC (Allchin 1959; cf. Wheeler 1948: Figures 10: C15-C17, 14: P13-P14, 17.1), suggesting culinary emulation of northern (Gangetic) food, which probably included flat breads, as well as rice, which begins to occur on peninsular sites at this time (Fuller 2002). The analysis of this later period of culinary diffusion is, however, beyond the scope of this present paper.

The likelihood that new cereals and new jars might be linked to the production of beers suggests possible links to social changes and suggests a reason for the lack of winter-pulse diffusion. As is well-documented ethnographically, and discussed in the context of several archaeological case studies, alcoholic beverages can play an important role in the emergence and maintenance of social inequality (Dietler 1990; Dietler & Herbich 2001; Edwards 1996, 2003; Joffe 1998). Beer often plays a role in mobilising labour and creating relationships of social debt (Dietler & Herbich 2001). In south India, the period that succeeds the Neolithic is marked by rich elite burials and burial monuments indicating emergent hierarchy (Moorti 1994; Brubaker 2001), and this must have its precursors in changes during the course of Neolithic. The long-term trend is from the more communal ritual activities that produced monumental ashmounds (cf. Fuller 2001; Johansen 2004) to the individually focused burial monuments of the megalithic period, and the development of practices that reinforced social differentiation must have occurred to bring this transition about. Changes in food and drink, like those outlined above, may be among them. An interest in wheat and barley

Table 2. Four modes in the evolution/diffusion of words in a given language in relation to foodstuffs. This shows four different ways in which things, such as crops, can be connected to their cultural labels (words)

Linguistic Model	English Example
A Name evolves from earlier linguistic roots	*Barley*, from earlier Indo-European cognates such as Old Germanic **barz-*.
B Name borrowed with food item	*Maize*, from Taino (Caribbean native) term *Mahiz*, where Columbus first encountered maize and brought it to Europe.
C Semantic shift: existing name re-applied to new species	*Corn* in American English, derived from traditional *corn* referring to wheat (and sometimes other grains)
D Compound name created from existing words	*Pineapple,* given to a New World fruit from existing words for a kind of fruit (*apple*) and the tree *pine,* perhaps because of resemblance to the latter's cones.

for beer also suggests why the winter pulses would not have spread to south Deccan since these cannot be made into beer.

Linguistic models for different modes of diffusion/evolution

In considering the correlations and contrasts between the adoption of different crop species and ceramic types, it is possible to frame a more general set of models for how the diffusion of culinary culture occurs. I will do this through an analogy with historical linguistic processes. Drawing inspiration for the ways in which historical linguists can categorise the origins of words, I would suggest four modes of diffusion/evolution (Table 2). To begin with, it is worth simply explaining these models based on their linguistic analogues. On the one hand, there is *in situ* evolution from existing tradition, which we can regard as the null hypothesis, and for which we can suggest two alternative scenarios. At its simplest there is simple evolution (Table 2: A), in which a lexical item persists within a tradition and undergoes some regular evolution, regular because other words show similar changes, i.e. the standard phonological changes that are the focus of historical linguistics' comparative method (Bynon 1977: 24-58; Crowley 1997: 87-109). To take lexical examples of foodstuff, we can point to words for food items that have their roots in ancestral languages (such as the English 'barley' from a reconstructed Germanic **barz-*). In this case it is obvious that the food item, barley, and associated cultural label were transmitted from ancestral populations. In the case of some of the South Indian crops discussed above, a proto-south/south-central Dravidian word can be reconstructed for the mungbean and horsegram (Southworth 1988), and it can be suggested that names for the millets of the Southern Neolithic as recorded by botanists can be related to an early food/millet term in Dravidian (Fuller 2003a).

A second scenario (Table 2: B) is that of simple borrowing (or 'lexical copying', Crowley 1997: 240; Bynon 1977: 217), in which both a new food item is adopted from another culture and its name is also borrowed from another culture. A classic example in English is maize, borrowed from the Spanish, who had brought it back from a native Caribbean language (Taino, *mahiz*) where the crop was also first encountered (Tannahill 1973). Another example, although slightly more convoluted, is that of potato, the name of which derived from the Taino word for sweet potato, confused with the superficially similar but botanically distinct potato in common parlance of seventeenth-century Europe (Haughton 1978: 304; Kiple & Ornelas 2000: 1879). In Dravidian languages there are numerous words, including those of some food items, which have been borrowed from early Indo-Aryan languages of India, and/or some other extinct language of the northern subcontinent (Southworth 1988; Masica 1979; Fuller 2003a).

In other cases, however, we encounter a semantic shift (Crowley 1997: 152), in which a new item is given a name of something that already exists in a language to which it shows some similarity (Table 2: C). This is liable to be the case when the newly adopted item becomes increasingly important or indeed replaces a pre-existing item. As an example we can cite the American English 'corn', used exclusively for maize, whereas the older, British English word was originally a generic term for cereals (especially wheat). Thus in America the semantic field of 'corn' shifted from wheat to maize. In Africa, one can find numerous languages in which the modern word for maize is clearly derived from an ancestral word for the sorghum established in Africa since prehistory (Bahuchet & Phillippson 1998; Blench *et al.* 1994). An interesting Dravidian example is discussed by Emeneau (1997) in which words related to *nelli*, the widespread name for the native Indian fruit Emblic myrobalan, have been applied to other species of similarly sour, but botanically unrelated, fruits in languages of the Niligiri hills, where Emblic myrobalan does not grow.

A fourth mode of lexical origin is the creation of a new compound word out of existing word elements (Table 2: D), that as a compound has some metaphorical relationship to the new lexical item (Thomason 2001: 80). As a ready English example we might cite the 'grape-fruit', a unique citrus fruit hybrid that probably evolved during the colonial period in the Caribbean (cf. Kiple & Ornelas 2000: 1780), which although completely unrelated to a grape presumably got this name on account of clusters of dangling fruits which look something like clusters of grapes. A slightly more curious example is the 'pine-apple', presumably based on the fruit's vague resemblance to pine cones (Kiple & Ornelas 2000: 1834). A possible ancient Indian example involves deriving the name for sorghum from a compound Sanskrit word meaning 'barley-shaped', although it may also derive from the word meaning western, referring to its overseas origin (Masica 1979: 77, 105), while the colonial era derivation of *sakarkand* for sweet potato comes from the Hindi words meaning 'sweet' and 'root' (Masica 1979: 110-111).

The four modes of the origin of food names can be taken as an analogy for the sources of cultural baggage, in particular culinary practices, connected to particular crop species. Thus methods of preparation and contexts of consumption may simply evolve from ancestral traditions (equivalent to A), or new means of preparation and consumption may be borrowed with a food item (equivalent to B). Alternatively, a new foodstuff can be adapted to existing processing methods, equivalent to linguistic semantic shift (C), or new hybrid methods can be devised from the existing cultural repertoire of kitchen techniques (D). Each of these modes implies different social processes, with different values placed on the new foodstuff, i.e. whether its adoption is integrally linked to how it is consumed, or whether it is a new addition to existing forms of consumption. In the case of adoption of foods as part of

Table 3. Four modes of diffusion/evolution of cuisine in terms of food items and associated cultural practices of preparation. These are suggested in analogy to the modes of linguistic diffusion outlined in Table 2. Each of the four cultural processes is shown with their expected archaeological correlates and south Indian examples from the data discussed in this paper

Cultural process	Archaeological expectation	South Indian examples
A Food item already used, evolution/elaboration of existing cooking practices	Crop already present in earlier period	Horsegram, mungbean, native small millets
B Food item(s) borrowed with practices of preparation	One or more food items introduced, together with introduced artefacts for preparation	Crops and ceramic forms from North Deccan, including wheat and barley, possibly milk use, and new jar forms
C New food item added to existing culinary practices	New food item appears without other associated changes	African crops, e.g. pearl millet and hyacinth bean, in the second millennium BC. These foods fit existing summer millet/pulse category. Also pigeonpea
D New food item with newly created culinary role	New food item associated with new, but not introduced, changes	?

a repertoire of practices, it is these forms of culinary consumption that are indicated as significant, suggesting social values placed on such cuisine or beverages. In other cases, the adoption of the food may be independent of its original cultural associations and thus more plausibly a substitute or addition to valued local products.

The evidence from South India (Table 3) indicates at least three groups of food crops in terms of their relation to culinary traditions and the implied social value attached to these crops at the time of their adoption. Existing South Indian native cultivars continued to be used throughout the Neolithic into the later period, and appear to remain staple foods. Other crops diffuse from the northern peninsula during the Neolithic, by *c*. 1900 BC. These include wheat and barley, which correlate with change in ceramic patterns that indicate cooking or serving practices also adopted from the north. By contrast, the winter pulses, that were so important on the northern Peninsula (and elsewhere where wheat and barley were major crops; see Fuller 2002, Fuller & Madella 2001) were not adopted, and thus serve to highlight the selective nature of this adoption. This implies selective uptake of these cereals as part of a culinary repertoire, for new foods or drinks. In addition, the South Dravidian names for wheat and barley are shared with Sanskrit and north Indian Indo-European languages, from which they have been borrowed directly or from a common source in an extinct language family (Fuller 2003a). The social motivations for the adoption of wheat and barley are further implied by the need to cultivate these crops intensively with irrigation. A countercurrent is seen with the Southern Neolithic crops (horsegram, mungbean, bristly foxtail and browntop millet) which moved northwards as did ceramic forms, like the spouted pots. This suggests that culinary and crop diffusion moved both ways on the peninsula during the later third and second millennia BC.

This mode of diffusion can be contrasted with the arrival of African crops. At the period of African crop adoption there is no material culture that points to Africa. Although it is conceivable that these crops move first from the northern Peninsula or Gujarat and then southwards, there are no artefacts of African derivation in these regions either. By contrast with the winter crops, the African millets and pulses fit readily into the seasonality and cultivation regimes of native species, as these species are naturally suited to summer, monsoon cultivation. Hyacinth bean, in particular, would have fitted into the existing cultivation systems of mungbean and horsegram, hence its large quantities at Sanganakallu (Fuller 2003b; Fuller *et al.* 2001, 2004). Pigeonpea, from the north-east, would also have fitted into this category. This might indicate that a few communities had the need to increase or diversify summer pulse production and thus took up these new crops as a way to do so. In general the African crops could have played a role in diversifying summer cultivation as risk-buffering. Differences in the processing (free-threshing), different colours and somewhat varied growth habit from native millets may have limited their popularity and thus account for the slow uptake of African millets. African crops in some cases, such as sorghum and finger millet, have names in Dravidian languages that clearly derive from semantic shift or the creation of compound words (Fuller 2003a), and thus the linguistic situation corresponds to the archaeological. Thus by contrast to the wheats and barley, the African summer crops can be seen as primarily adaptive diversification rather than socially motivated adoption.

Conclusion

I have suggested that some models drawn from linguistics provide us with a general framework for considering different modes of diffusion and evolution, contrasting cases in which new foodstuffs are accompanied by other cultural baggage, such as preparation and consumption practices, as opposed to cases where crops are simply added to existing systems as supplements. In peninsular India, African crops and crops from other parts of India, such as pigeonpea, appear to have been added to agricultural systems, for which they were inherently suited by shared seasonality. This occurred without any apparent adoption of preparation or consumption practices. We can suggest that these crops may have played a role in buffering risk through diversification. On the other hand, selected winter crops, such as wheat and barley, that were not suited to existing cultivation systems appear accompanied by material culture of new culinary practices, suggesting that socially motivated consumption of new foodstuffs (or beverages) is likely to have promoted the production of these species.

Increasingly, literature on Neolithisation (e.g. of Europe) leaves out discussion of the evidence of archaeobotany and agriculture (e.g. Price 2000), implying that it offers little in terms of considering the issues of cultural evolution or diffusion. But I would contend that archaeobotany's contribution to understanding culinary practices (cf. Palmer & Van Der Veen 2002), and a broader understanding of cultural history is crucial. This approach avoids the dichotomy between evolutionary innovation and diffusion, as the process of adopting any particular practice or foodstuff may in reality combine elements of both. An adopted foodstuff may fit into locally evolving culinary practices.

This analysis attempts to contribute to an understanding of the processes of *reticulate* cultural evolution, i.e. instances when changes in culture draw on more than one source rather than just through divergence from a common source. With increasing interest in tracing cultural phylogeny (e.g. Shennan 2002; O'Brien & Lyman 2000), there is a danger in emphasising cultural lineages that diverge and evolve in isolation, whereas the potential for the reticulation between cultural traditions is high. As increasingly recognised in historical linguistics, and studies of creolisation, the processes of borrowing and influence between different speech communities are numerous and dynamic (Croft 2000; Mufwene 2001; Chaudenson 2001; Thomason 2001), and we should expect a similar range of dynamics involved in the development and adoption of many aspects of cultural traditions. A question that is of potentially wider relevance is the extent to which different aspects of culture, such as language, music, cuisine or religion are more or less open, or resistant, to influence from other traditions, and thus under what circumstances is adoption more likely (for a preliminary assessment of this in the context of Indian Ocean creole cultures, see Chaudenson 2001). These cultural elements do not commingle at random but rather follow structured social processes. Ultimately, the empirical evidence of the long term provided by archaeology can provide important insights into the structure of cultural histories, and for this an approach that integrates data for subsistence production with evidence for consumption practices is necessary.

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