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The spread of textile production and textile crops in India beyond the Harappan zone: an aspect of the emergence of craft specialization and systematic trade

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"*Clothes make the man. Naked people have little or no influence on society*"
- quotation attributed to Mark Twain, 19th century American novelist

ABSTRACT

This paper reviews the archaeological evidence for cotton and flax in South Asia. This is based primarily on archaeobotanical evidence from seeds. This evidence indicates that both crops were established in the Indus region by the Harappan civilization and spread elsewhere into India in post-Harappan/late Chalcolithic times. In addition some representative data from artefactual evidence in the form of spindle whorls are considered for the Middle Ganges and Peninsular Indian regions, which suggests an increase in spinning activities from the second half of the second millennium BC. This may indicate that spinning began slightly before the introduction of cotton and flax crops, or else in the earliest stages the presence of cotton and flax is still lacking due to taphonomic biases which have particularly affected evidence from early small scale production. In addition, a preliminary attempt to gather historical lingustic evidence for these crops and for weaving in South Asia is provided, including clear evidence that the advent of cotton and flax can be reconstructed for proto-South Dravidian associated with other terminologies for craft production and social hierarchy. Some materials from Sanskrit and Munda languages are collated as a basis for further linguistic enquiry. The spread of cotton beyond South Asia is briefly reviewed, including linguistic evidence from Southeast Asia and historical and archaeological data from Africa. The spread and development of textile industries in South Asia can be associated with the emergence of more complex societies in which specialized craft production and trade were of greater importance.

INTRODUCTION

Much effort by archaeologists and archaeobotanists focuses on the origins of agriculture, the domestication of plants and animals. Gordon Childe (1936) highlighted these as central issues in the study of the Neolithic revolution. In the South Asian context, recent years have witnessed an expansion of archaeobotanical research, much of it with a focus on agricultural origins (e.g. Kajale 1991; Saraswat 2004, 2005; Fuller 2002, 2006a). This has focused largely on the domestication of food plants, especially staple cereals and to a lesser degree pulses. Fibre crops have received less attention, despite their inclusion by Childe as part of his Neolithic revolution concept. In part this is a matter of archaeological preservation: cereals and pulses by far outnumber other categories of plants in the archaeobotanical record (cf. Weber 1992; Zohary and Hopf 2000; Fuller 2002). It is nevertheless important to consider these crops, which were aimed for raw materials of crafts, and what this tells us about the nature of early agriculture, and how economies changed.

In recent years Andrew Sherratt drew attention to the importance of seeing agriculture as about more than just subsistence (e.g. Sherratt 1995, 1999,

2007) [1]. In other words, cultivation was not just about getting enough to eat (for one community, for one year) but about getting excess, a storable, surplus which could both be transmitted across time, to provide food in lean periods, but also across space by being traded. Like Runnells and Van Andel (1988), Sherratt (1999) argues that the development of regional exchange systems that tied together communities was one of the factors that promoted the emergence of food production, and could be seen, for example in the early movement of lithic raw materials. But he also suggested that as food production systems became more widespread and intensified that there was a second major set of revolutions, which involved new uses of animals and new kinds of plants: animal secondary products and long-lived perennial crops, like trees. Tree fruits and nuts could be dried and traded or turned into trade-able products like wine, while milk products extended the cycles of productivity in animal herds and provided longer-shelf-life products like cheeses. Thus certain non-staple plant foods could increase as commodities for trade, just as the products of developing crafts. Some crops too may have undergone secondary transformations, such as flax (*Linum usitatisimum*), which was most likely first cultivated primarily for its edible oily seeds and later used as a source of bast fibres and ultimately bred for more fibre-productive varieties: which is indicated by the derivative phylogenetic position of fibre-selected flax cultivars (Allaby *et al*. 2005). Another important transition was the secondary products revolution amongst animals (see also Sherratt 1981), with the use of animal hairs, especially sheep wool, for fibre production and textile manufacture. As more wool-producing sheep breads evolved this meant that agriculturally marginal lands, such as the hilly margins of Mesopotamia could be productive for wool. Meanwhile wool offered a less labour-intensive source of fibres for weaving which could be supplied to emerging Bronze Age cities that were tied into widening hinterlands of raw materials and human demographic networks (McCorriston 1997). In other words, the transformations towards more fibrous crop-plants and then more fibrous animal breeds contributed to the economic transformations of smaller-scale Neolithic societies towards urbanism and increases in the scale of economic networks. Textile crops are thus an important aspect of "Bronze Age Economics" (*sensu* Earle 2003).

The production of textiles is an important part of craft production economies in two ways: first to do with craft and second, with agriculture. In terms of craft, textiles are labour-intensive and time-consuming to produce. They require labour in spinning, as well as weaving. In many traditional societies, textile production was carried out as a domestic activity, and women spent much 'surplus' time (i.e. when not engaged in basic subsistence and cooking activities) spinning (Barber 1991; McCorriston 1997). Weaving is a highly skilled craft which must be learned, and different regional traditions of weaving are often distinctive and recognizable (cf. Barber 1999; Tuck 2004). The production of textile crops, constitutes another important element of specialization, in as much as it is implies the use of land and agricultural labour resources for species that will not be eaten, and thus implies additional surplus production beyond what is required to feed families and communities. It is therefore necessarily production for trade, as fields of textile crops produce fibre far beyond what individual households are likely to use or have time, and perhaps skill, to process. Craft crops therefore constitute an important early "cash-crop" (*sensu* Sherratt 1999), along with such things as valued trade-able fruits.

Between cash crop production and craft work, there are additional labour costs in terms of processing. Even before spinning the creation of fibres requires a series of time-comsuming laborious operations. For flax this involves rippling and retting (soaking with partial fermentation of stems), followed by pounding

and combing to separate bast fibres (for a synopsis, see McCorriston 1997: 522-524). These can then be spun and weaved. With cotton it involves even more steps: dehusking, seed removal (ginning), cleaning and smoothing, bowing or carding to separate the fine fibres, which are then rolled and ready to be spun. Only then can weaving of the threads or yarn be done. Accounts of traditional cotton processing from different regions are similar, including those from ancient India (Schlingloff 1974), China (Goodrich 1943; Schlingloff 1974: 85) and Africa (Spring and Hudson 1995). In recent centuries much of this process has been aided by mechanical developments, but traditional ginning was done by a labour intensive method involving a rolling pin (often metal) and a wooden board which was used to force out seeds. Bowing is done with a bow-like instrument in which a vibrating cord helps to loosen to separate the fibres. The implication of all this is that cotton production requires both the expenditure of more labour in cultivation, beyond subsistence requirements, and more expenditure of labour in the household in processing, but with the result of a commodity by which wealth can be accumulated, and fairly easily transported, or sequestered by emerging elites.

Textile production may also play an important role as a technology of social differentiation. It is part of a wider category of technologies by which the natural body is transcended and socialized to represent and reinforce aspects of the social order (for archaeological case studies in other contexts, see, e.g. Traherne 1995; Hill 1997; Chapman 2000; with theoretical foundations in Douglas 1973, pp. 93ff.; Bourdieu 1984, pp. 175ff.; Shilling 1993, pp. 70ff.). Beads and textiles are very often intertwined as dress, which are potential indicators of social identity and status, that we expect to become increasing important as societies become more complex (for an ethnographic example, see Eicher 1998).

As a contribution to these issues, I will review the current archaeobotanical record for two major texilte crops in South Asia, cotton and flax. I will then situate these in their archaeological context by reference to the presence of spindle whorls, an artefactual indicator for textile production. This archaeological picture will then be compared to the historical linguistics of textiles in South Asia, as well as some related terms of craft production.

INDUS COTTON: ORIGINS TO HARAPPAN EVIDENCE

Today there are four cultivated cotton species, two of Latin American origin and two from the Old World (Wendel 1995). While the American cottons are perhaps the most important in modern production, the likely South Asian native was important in the early development of textile production in the Indus and South Asia, as well as in Indian Ocean trade in the Roman period. In the Old World there are two cotton species, both closely related diploids, *Gossypium herbaceum*, for which wild populations are identified for Southern Africa and tree cotton, *G. arboreum*. Unfortunately for the archaeobotanist, we have not yet developed methods for distinguishing the charred seeds of *herbaceum* versus *arboreum* cotton, and their seeds appear virtually identical even at an anatomical level.

Tree cotton, *Gossypium arboreum* L. is now considered most likely of South Asian origin. A weedy/wild form that is distributed in Southern Sindh, and reported from dry hills of the Central Deccan (Hutchinson and Ghose 1937; Santhanam and Hutchinson 1974). The modern distribution may not represent primary habitat as feral varieties may have spread together with the early cultivar (Wendel 1995; Zohary and Hopf 2000). Climatic change, through aridification since the mid-Holocene, and habitat loss due to agriculture, especially in the Greater Indus valley and its hinterland could have wiped out the wild progenitor. In this regard it is worth considering that during the wetter early to

mid-Holocene that wild cotton extended across the Southern Arabian peninsula which must have acted as a bridge at some point uniting the wild ancestors of *G. arboreum* and *G. herbaceum*. In this regard a mid-Holocene report of cotton fibres from the Arabian peninsula (Betts *et al.* 1994) is intriguing, but requires further documentation. If the dating of evidence reported from Egyptian Nubia for the late Fourth Millennium BC is accepted (for reservations on identification and archaeological dating, see Zohary and Hopf 2000; Fuller 2002; full details of the find in Chowdhury and Buth 1971, 2005), then wild cotton may have extended into what is today the Southern Sahara and formerly the Sahel, an environment comparable to the Arabian peninsula at that time. There is no evidence that these early finds in Arabia or Nubia relate to early cultivation, and evidence for cultivation in Africa only begins from the Early Historic horizon (broadly speaking, the Roman period) (cf. Rowley-Conwy 1989; Pelling 2005, 2007; Clapham and Rowley-Conway 2006, 2007, in press)

Tree cotton, as its name implies is naturally a woody shrubby plant (Figure 1A). As such it might initially have been grown as a perennial fruit crop, along the lines of grapes or tree fruits such as dates, which are also documented as cultivars in the Indus region from pre-Harappan times (Fuller and Madella 2001). Cotton requires a long growing season, of *ca.* 200 days

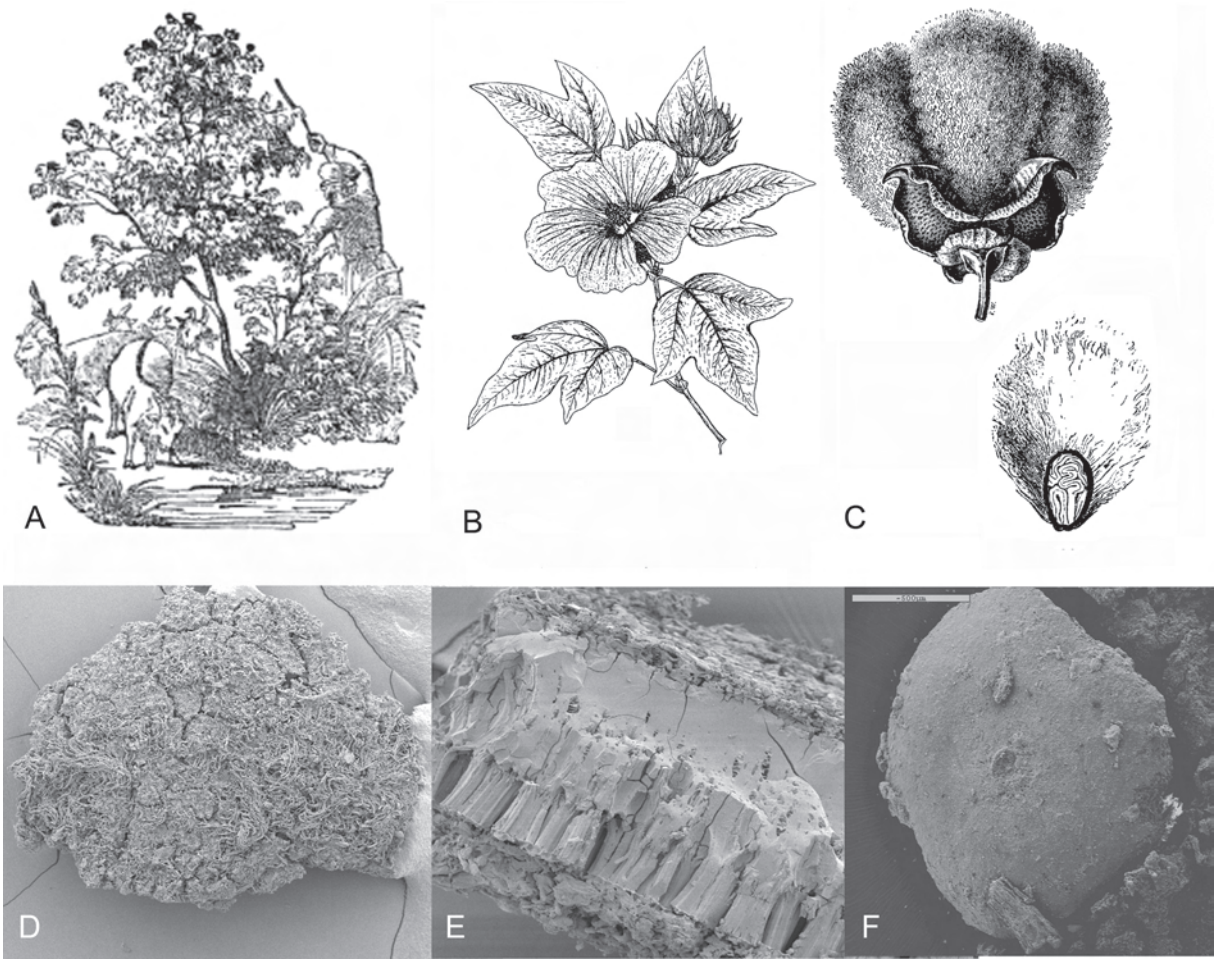

Figure 1 Pictures of cotton and archaeological cotton. A. An illustration of Indian tree cotton, towering over a goat (from Anonymous 1833). B. Leaves and flowers of a cotton, *Gossypium herbaceum* (after Sayre 1917). C. Drawing of cotton fruit and seed in cross-section (after Engler 1937). D. SEM of charred archaeological cotton seed with preserved hairs from Hallur, ca. 900 BC (after Fuller *et al.* 2004). E. SEM of cross section of seed coat from charred fragment from Hallur (by this author); F. "Cap-like" structure from interior of cotton seed, charred example from Early Historic Ufalda, Garhwal (by this author).

Table 1 Archaeobotanical and textile remains of cotton from South Asia

Site	Evidence	Period	Reference(s)
Mehrgarh, Baluchistan	Seeds (uncharred); mieneralized thread in copper bead	Ceramic Neolithic, 6000-4500 BC	Costantini 1983; Costantini & Biasini 1985: 24; Moulherat *et al*. 2002
Mohenjodaro	Cloth	Mature Harappan, 2600-2000 BC	Gulati and Turner 1929
Balakot, Sindh	Malavaceae pollen type, comparable to *Gossypium*	Mature Harappan, 2500-2000 BC	McKean 1983; also mentioned in Dales 1986
Harappa	Seed(s) [Weber]; earlier textile reports	Mature Harappan(?), 2600-1900 BC	Weber 1999: 818
Kunal	Seed(s)	Mature Harappan, ?2500-2000 BC, perhaps equivalent to Harappa 3C(?), 2200-1900 BC	Saraswat & Pokharia 2003
Banawali	Seed(s)	Mature Harappan (?=Harappa 3C), 2200-1900 BC	Saraswat 2002
Sanghol	Seed(s)	Late Harappan, 1900-1400 BC	Saraswat 1997
Hulas	Seed(s)	Late Harapan, 1800-1300 BC	Saraswat 1993
Kanmer, Kacchh	Seed(s)	Late Harappan, 2000-1700 BC	Pokharia 2007 (in Kharakwal *et al.* 2007)
Imlidhi Khurd, Gorakhpur, Uttar Pradesh	Seed(s)	Period II, 1300-800 BC	Saraswat 2005
Waina, Ballia, Uttar Pradesh	Seed(s)	Period I, 1600-800 BC	Saraswat 2005
Sringaverapura, Dist Allahabad, Uttar Pradesh	fibres	Late Ochre-Coloured Pottery, 1200-700 BC	Saraswat 1986
Hallur, Upper Tungabhadra, Karnataka	Seeds & fragments	Early Iron Age, AMS direct date: 950-900 BC	Fuller *et al.* 2004; for dating: Fuller *et al.* 2007
Sanghol, Ludhiana Dist., Indian Punjab	Seed(s)	Early Historic, Kushana, 200 BC- AD 300	Pokharia & Saraswat 1999
Charda	seeds	Period IIB, Early Historic, 200 BC- AD100	Chanchala 2002
Hund, Peshwar Dist., Pakistan	Seeds & fragments	Kushana through Mughal (all periods), 200 BC-AD 1600	Author's unpublished data; Cooke 2002
Kausambi	Seed(s)	NBPW horizon, 550-250 BC	Chanchala 1995
Hulaskhera	Reported indeterminate, appears to cotton seed "cap"	Iron Age/Early Historic, 600 BC- AD 250	Chanchala 1992, Plate 5, 24
Nevasa (1954-1956 season)	Seed(s)	Early Historic, 250 BC-AD 250	Anonymous, in Sankalia *et al.* 1960: 529-530
Kodumanal, Coimbatore Dist., Tamil Nadu	Seeds & fragments	Early Historic/Late Megalithic, 300 BC- AD 300	Cooke *et al.* 2005
Perur, Coimbatore Dist., Tamil Nadu	Seed fragments	Early Historic/Late Megalithic, 300 BC- AD 300	Cooke *et al.* 2005

Mangudi, Madurai Dist., Tamil Nadu	Seed fragments	Early Historic/Late Megalithic, 300 BC- AD 300	Cooke *et al.* 2005
Ufalda, Garhwal, Uttaranchal	Seeds & fragments	Early Historic(?), AD 0-600	Author's unpublished data
Singh Bhagwanpur, Rupnagar Dist., Indian Punjab	Seed(s)	Medieval, AD 800-1100	Vishnu-Mittre *et al.* 1984
Mangali Luduwala, Haryana	Seed(s)	Sub-recent, AD 1500-1900	Willcox 1992

(6.5 months) with abundant water early in the season (equivalent to at least 50cm rainfall) and dry rain-free conditions for the last two months when the fruit and seeds form so as not to damage the fibre from dampness and mould (Burkill 1997; Robbins 1931: 497; Langer and Hill 1982: 262). It generally needs a frost free environment, preferably with temperatures above 21°C (Langer and Hill 1982: 261; Burkill 1997). Cotton remains a major crop through much of India, except for the eastern part of the country, where rainfall continues too long (cf. Choudhary and Laroia 2001).

Archaeobotanical recognition of cotton relies mainly on the preservation of charred seeds or seed fragments. As the fibre grows out of the seed (Figure 1C), remnants of the fibre, which can often be preserved charred on seed surfaces are a give away (Figure 1D). In addition the layered cross section of the seed coat is distinctive (Figure 1E). In recent years we have come to recognize a small structure, which looks like a "cap" with a central circular pore ("belly button"), which comes from the inside of the cotton seed where it attaches to the vasculature of the capsule (Figure 1F; cf. Pelling 2007). This structure appears to survive charring better than the rest of the seed and on its own indicates the former presence of cotton seeds. In addition textile fibres of cotton can usually be identified in situations where textiles are preserved, although given the importance of textiles as a trade commodity they provide no indication of areas of textile production or cotton production. The seeds, by contrast, are expected to come from centres of cotton processing, where bolls are ginned before the cotton fibres are combed and spun. Thus the seeds indicate places of cotton processing for fibre. In general we expect these to be close to centres of cultivation, although it may sometimes be the case that raw cotton is transported from areas of cultivation to centres, such as cities, that have larger available labour populations.

THE EVIDENCE OF FLAX

The flax plant (*Linum usitatissimum* L.) is an important source for bast fibres for textile production (linen) as well as for an oily seed made edible with roasting. Once removed from the seed the oil goes quickly rancid and becomes inedible, and thus linseed oil is better known for craft and non-culinary uses in the modern West, but in the seed it is a storable product of considerable nutritional value (see, e.g. Seegler 1983). Use of the edible seed has probably been more important in India than the fibre, as numerous other fibre plants are available in this region, although fibre varieties are also cultivated (cf. Vavilov 1950 [1992]). While stands cultivated for fibre are often harvested before seed production, and thus finds of seeds are more likely to result from production for food (McCorriston 1997: 519), their presence nevertheless raises the possibility of flax fibre production in a region in prehistory, and so the South Asian archaeobotanical record will be reviewed in this paper. The evidence is summarized in Table 2.

The closest wild relative of flax is well established,

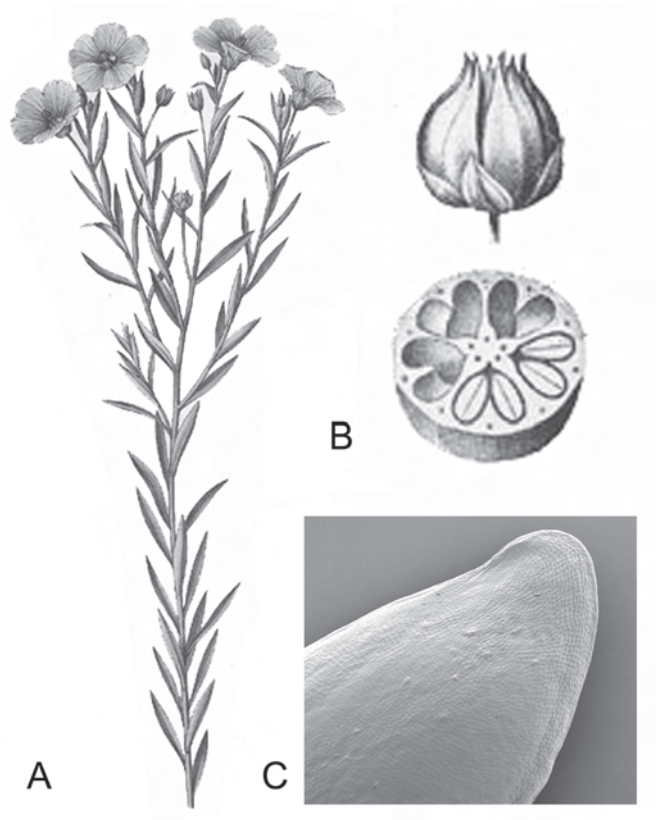

Figure 2 Illustrations of the flax plant, *Linum usitatissimum*. A. Drawing of the flax plant in flower (after Berg and Schmidt 1958-1863). B. drawing and cross-section of flax capsule, at approximately twice the scale of A (after Berg and Schmidt 1858-1863). C. SEM of the distinctive seed tip of flax (the author).

as *Linum bienne* Mill. It is distributed across Meditarranean and steppic habitats in Southwest Asia, Europe and North Africa (Vavilov 1950 [1992]; Zohary and Hopf 2000: 129). The wild distribution coupled with archaeobotanical evidence from Neolithic and pre-Neolithic sites in Southwest Asia indicates that this was a component of the earliest agricultural economies in Southwest Asia, along with wheat and barley (McCorriston 1997; Zohary and Hopf 2000). A small phylogenetic analysis of flax, suggests a single domestication, and that domestication was initially for oilseed types (Allaby *et al*. 2005). Fibre-adapted forms were developed later, but even so use of fibres had begun before the end of the Neolithic in Southwest Asia, i.e. by *ca*. 7000-6000 BC (Ryder 1965; McCorriston 1997: 519). It is clear that flax was a significant fibre crop in the early civilization of Egypt and Mesopotamia, and we can postulate that fibre-varieties had evolved by the end of the Fourth Millennium BC. It is possible that such varieties were available to the Indus civilization. The earliest finds in South Asia come from Harappan period sites, (Table 2; Figure 3), including Nausharo (Costantini 1990) and Miri Qalat (Tengberg 1999), and Balathal east of the Harappan orbit (Kajale 1996). From the post-Harappan horizon in the northwest, finds come from Pirak (Costantini 1979).

Flax or linseed is normally a winter crop in South Asia requiring moderately high rainfall (>75cm) or irrigation during this period (cf. Weber 1991: 81). In India this means either sowing immediately after the monsoons, in a region that have adequate rain levels and water-retentive clay-rich soils, or broadcasting into remnant standing water of harvested rice paddies (McCorriston 1997: 524). Cultivation and preparation is labour intensive (McCorriston 1997), requiring weeding, the pulling up of plants for fibre (if grown for seed they can be cut below the capsules), rippling to remove seeds and capsules and then retting (partial rotting in water for about 2 weeks) drying and

Table 2 Archaeobotanical finds of linseed/flax (*Linum usitatissimum*) in South Asia

Site	Evidence	Period	*Reference(s)*
Harappa	Seed(s)	Mature Harappan, 2600-1900 BC; and Late Harappan, 1900-1700 BC	Weber 1999, 2003; personal communication
Kunal	Seed(s)	Period 2, Early Harappan, 2800-2500/2300 BC [?]	Saraswat & Pokharia 2003
Miri Qalat, Makran	Seeds	Mature Harappan, 2500-2000 BC	Tengberg 1999
Nausharo, Baluchistan	Seeds	Mature Harappan, 2500-2000 BC	Costantini 1990
Balathal, Rajasthan	Seeds	Chalcolithic, 2500-2000 BC ?	Kajale 1996
Ojiyana, Bhilwara Dist., Rajasthan	Seed(s)	Ahar Culture, 2500-1500 BC	Pokharia & Saraswat 2004
Pirak, Baluchistan	Seeds	Late Harappan, 1950-1550 BC	Costantini 1979
Sanghol	Seeds	Late Harappan, 1900-1500 BC (?)	Saraswat 1997
Babar Kot, Saurashtra	Seeds	Late Harappan, 2000-1700 BC	Reddy 1994, 2003
Rojdi, Saurashtra	Seeds	Late Harappan, 2000-1700 BC	Weber 1991
Loebanr 3, Swat	Seed(s)	Late Chalcolithic, 1700-1400 BC	Costantini 1987
Imlidhi Khurd, Gorakhpur, Uttar Pradesh	Seed(s)	From Periods I & II, 2000(?)/1600-800 BC	Saraswat 2005
Narhan I, Gorakhpur Dist., Uttar Pradesh	Seed(s)	Period I, 1300-800 BC	Saraswat *et al.* 1994
Senuwar II, Rohtas District, Bihar	Seed(s)	Period II, Chalcolithic, 1300-600 BC	Saraswat 2004
Waina II, Ballia Dist., Uttar Pradesh	Seed(s)	Period II, 800-500 BC	Saraswat 2005
Raja-Nala-Ka-Tila II, Sonbhadra Dist., Uttar Pradesh	Seed(s)	Period II, 1300-700 BC	Saraswat 2005
Navdatoli, Maharashtra	Seed(s)	Jorwe Phase, 1500-1200 BC	Vishnu-Mittre 1961
Daimabad, Maharashtra	Seed(s)	Jorwe Phase, 1500-1200 BC	Kajale 1977
Hallur, Karnataka: Upper Tungbhadra	Seed (fragments)	Early Iron Age, 1000-900 BC. Two AMS dates from same context.	Fuller *et al.* 2004; dating: Fuller *et al.* 2007
Charda	seeds	Period I, 1000-600 BC; IIA, 600-200 BC IV, AD 500-1000	Chanchala 2002
Paithan, Godavari river, Maharashtra	Single seed	Period III, AD 300-700	Author's unpublished data
Hund, Peshawar Dist., Pakistan	Seeds	Mughal period, AD 1100-1600	Author's unpublished data; Cooke 2002

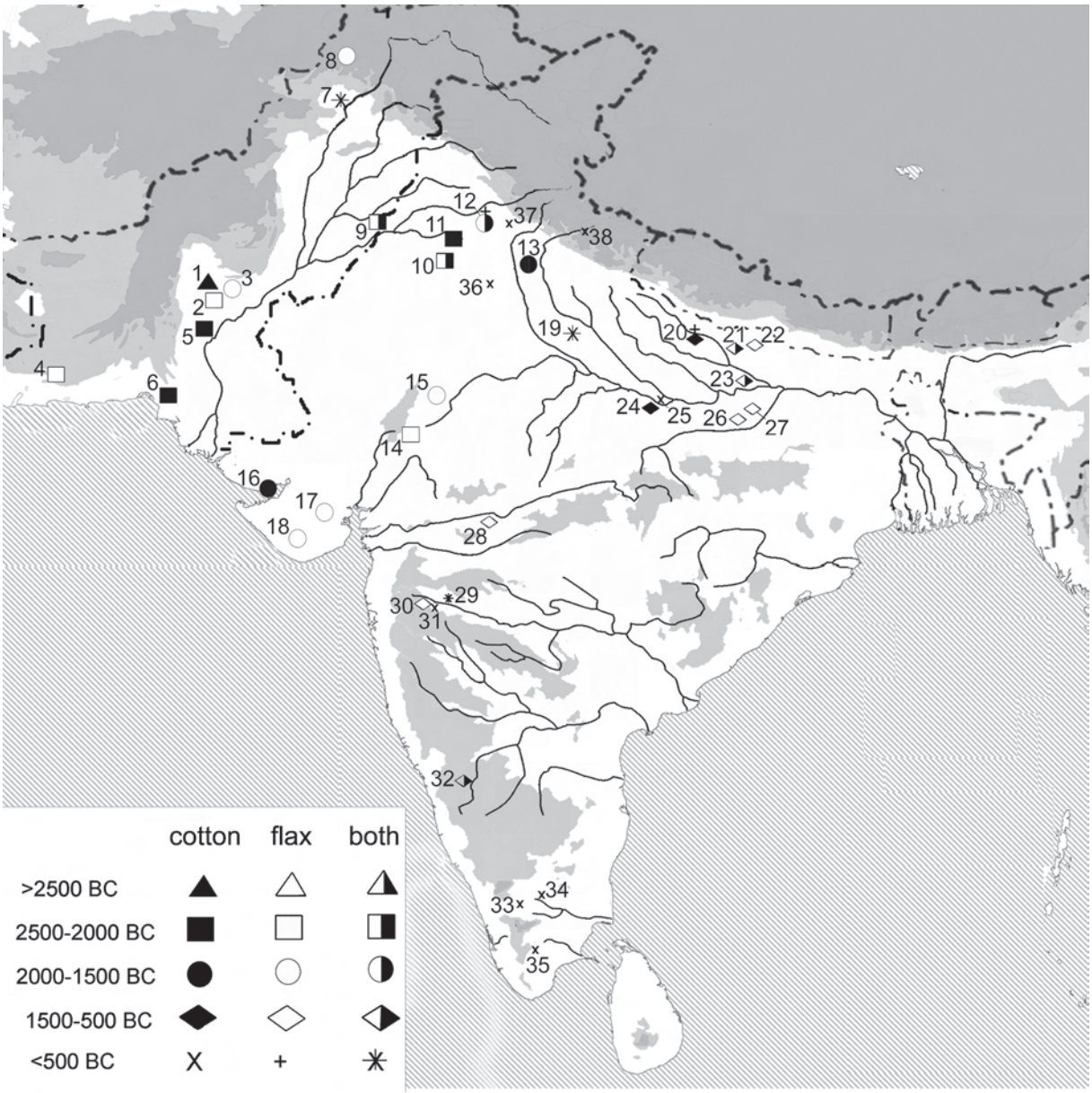

Figure 3 The distribution of archaeological finds of cotton and flax seed in South Asia, indicated by broad time horizons (for details of chronology and sources, see Tables 1 and 2). Sites numbered: 1. Mehrgarh; 2. Nausharo; 3. Pirak; 4. Miri Qalat; 5. Mohenjodaro; 6. Balakot; 7. Hund; 8. Loebanhr 3; 9. Harappa; 10. Kunal; 11. Banawali; 12. Sanghol (indicating Late Harappan and Early Historic evidence); 13. Hulas; 14. Balathal; 15. Ojiyana; 16. Kanmer ; 17. Babor Kot; 18. Rojdi; 19. Hulaskhera; 20. Charda; 21. Imlidh-Khurd; 22. Narhan; 23. Waina; 24. Sringaverapura; 25. Kausambi; 26. Senuwar; 27 Raja-Nala-Ka-Tila; 28. Navdatoli; 29. Paithan; 30. Daimabad;. 31. Nevasa; 32. Hallur; 33. Perur; 34. Kodumanal; 35. Mangudi; 36. Mangali/Luduwala; 37. Singh-Bhagwantpur; 38. Ufalda

beating (bracking and scotching to remove the fibres from the pith), and combing ("hackling") to clean away the pith fragments. After spinning and weaving extra efforts are required to get the fibre to take and hold dyes.

THE ARCHAEOBOTANICAL DATA FOR FLAX AND COTTON BEYOND THE INDUS VALLEY

The distribution of evidence for cotton beyond the Indus zone can be seen in Figure 3. As can be seen all the early finds are in the Indus region, and only

post-2000 BC finds are reported beyond this zone. Amongst those beyond the Indus valley it is those areas closest to the Indus that have evidence for the first part of the Second Millennium BC, including Saurashtra, Rajasthan and the upper Ganges region. Further afield on the peninsula and in the middle Ganges area finds are later, and all post-1500 BC. On north peninsular sites, Chalcolithic evidence is so far only available for *Linum*, with finds from the Jorwe horizon, 1200-1500 BC. In the middle Ganges both species are well represented in samples from the Chalcolithic, which in this region can be placed from *ca.* 1300-800 BC. The only direct AMS date is from Hallur, where both cotton and flax were found in the same rich sample of the early Iron Age, from which cotton produced a date of 900-950 BC and another seed from the same sample produced a date closer to 1000 BC (Fuller *et al.* 2007).

In the Harappan northwest the archaeobotanical evidence for flax is more limited than that of cotton. This may be due in part to less robust seeds, as well as cultivation of fibre varieties which are less often allowed to set seed. It may also be due to differing processing customs, as the time-consuming removal of cotton seeds (ginning) may have been regularly carried in settlement areas and domestic contexts whereas flax retting may have taken place off site in special locals where vats or pits were constructed for this process; as such flax might be less likely to come into contact with domestic fires, although waste from rippling flax before retting could be used as domestic fuel.

Given that there are strong preservational biases against both species, the archaeobotanical picture can only be taken to represent the very minimum period of entry to a region. It may well be that we should regard the archaeobotanical evidence as indicating the period during which cultivation became more widespread and use intensified rather than the initial introduction as such. There may be a matter of scale in which larger scale and more intensive use crosses a threshold after which it becomes more likely to recover these species archaeologically.

More limited evidence for some other fibre crops also comes from the same horizon in the Gangetic zone. This includes evidence for hemp (*Cannabis sativa*) on the basis of both seeds and wood charcoal from Chalcolithic Senuwar, 1300-600 BC (Saraswat 2004). In addition fibres of ramie (*Boehmeria* cf. *nivea*), are reported from Narhan from the same peiord (Saraswat *et al*. 1994: 287), This species may have been the first important fibre cultivar of the Lower Yangzte region in China, and is likely to be introduced to India (cf. Burkill 1966; Keng 1974).

SPINDLE WHORLS AND THE EMERGENCE OF CHALCOLITHIC CLOTH PRODUCTION

Artefactual evidence can also shed light on the history of textile production in India outside the Indus valley. Spindle whorls, used for making thread from fibres, are a common archaeological find, often being made of ceramic. While a comprehensive review of the archaeology of spindle whorls in South Asia is beyond the scope of the present contribution, some representative patterns can be noted here, by reference to published reports from some important excavations: Senuwar in the Ganges and Inamgaon in the Deccan. The evidence from the Southern Neolithic will also be considered.

In the middle Ganges region, I will use the data from the Senuwar excavations (Singh 2004). This site spans a well-dated sequence from a Neolithic phase that starts *ca.* 2500 BC, during which native rice agriculture was present prior to the introduction of non-native crops like wheat and barley (see Saraswat 2004). By the end of this phase wheat and barley had been introduced, so a date of *ca.* 2200 BC can be inferred for the first influence from the Harappan zone to the west, in this case in terms of staple crops. Indeed, more recent evidence from Lahuradewa-IB, including

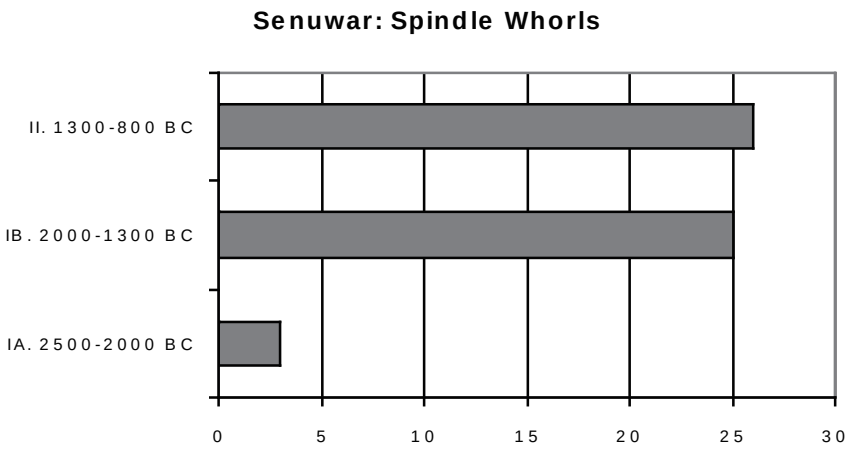

Figure 4 The evidence for spindles whorls in the three phases of Senuwar (data from Singh 2004). This shows clearly a minimal presence in the early Neolithic (before 2000 BC) and a massive increase in evidence for textile production during Period IB (before 1300 BC).

an AMS date on barley and another AMS date from a barley grain from Damdama confirm this diffusion (Saraswat 2005; Tewari *et al*. 2006). Dish-on-stand type vessels also first occur in this horizon and are reminiscent of forms from the Greater Indus region. During the late Neolithic at Senuwar (Seunwar-IB) introduced crops become more important and diverse, with the addition of pulses such as lentils (from the northwest?) and mungbean, which is small-grained (unlike Indus varieties at that time) and might thus derive from the peninsular region to the south (cf. Fuller and Harvey 2006). Finally the site has a Chalcolithic horizon characterized by metal finds and a still greater crop diversity, including flax. Finds of spindle whorls divided into these broad phases are shown in Figure 4, in which it can be seen that only a few perforated disc sherds are present in the lowest levels (Period IA). With such small counts intrusion from later periods must be considered. In the Late Neolithic (Period IB) there is a substantial quantity of spindle whorls. This certainly indicates the practice of spinning during this period. A comparable level continues through Period II. This suggests that spinning (and presumably weaving practices) began in the later Neolithic during the early to mid-Second Millennium BC. There is no hard evidence as to what fibres were involved, although cotton and flax seem likely candidates. Their absence from the archaeobotanical record until the Chalcolithic may reflect scale of use. If so, then by Chalcolithic times the threshold had been crossed that leads to recurrent archaeobotanical recovery, as several sites in the Middle Ganges region have evidence for flax and/or cotton only during this period and consistently not from the earlier levels in these sites, despite the presence of spindle whorls in those levels. Such an argument, that there is a misleading absence of evidence assumes that it is more likely that techniques and raw materials (crops) were adopted together. Alternatively we might consider the possibility that techniques developed first and created a demand for better raw materials. In other words, spinning was first developed on the basis of some other, perhaps wild fibre source, and once the techniques were established there was a context in which better fibres from the fibre crops became desirable.

The evidence from Inamgaon in Maharashtra, suggests a similar pattern of increasing importance of spinning in the late Second Millennium BC (Figure 5). The few spindle whorls from the early levels (Malwa Phase) are negligible, while quantities in the Jorwe period are significant, and increase further in the late

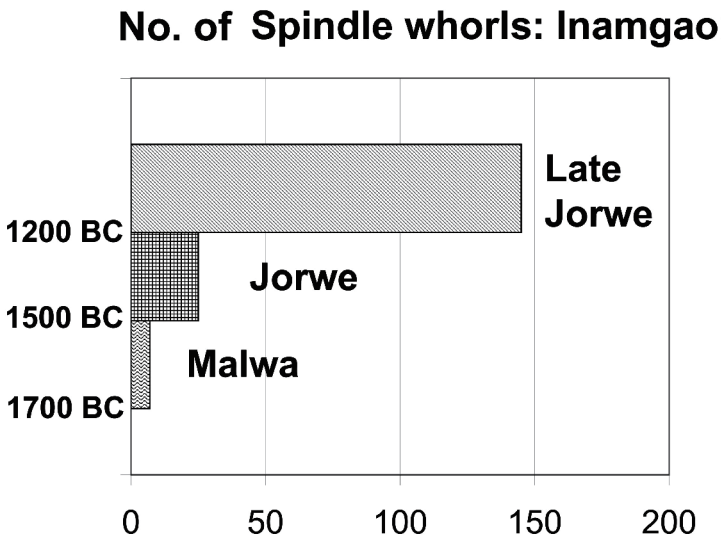

Figure 5 The evidence spindles whorls in the three phases of Inamgaon (data from Dhavalikar et al. 1988). This shows clearly a minimal presence in the earlier Chaclolithic Malwa phases and a massive increase during the Jorwe period after 1500 BC.

Table 3 Representative Spindle Whorls from the Southern Neolithic

Site	Count	Phase(s)	Comments	Reference
Budihal	2	Tr. 4, settlement, level 2(?).	Pre-1700 BC radiocarbon dates. Association uncertain	Paddayya 1993, 2001
Tekkalakota	12	Layers 2-4		Nagaraja Rao & Malhotra 1965
Brahmagiri	IB: 1; II: 2	IB= Late Neolithic; II- Megalithic	Probably Later Neolthic, phase III, 1500-1300 BC	Wheeler 1948
Hallur	? ?	Phase I, period 2 (Layers 8, 9) Later Neolthic phase III , 1500-1300 BC Phase II (layer 6); Early Iron Age, Ca. 1000 BC		Nagaraja Rao 1971
Sannarachamma (second excavations)	21 possible spindle whorls,	contexts not reported, post-ashmound 1700-1000 BC	More examples from recent work: only from post 1500 BC levels	Ansari & Nagaraja Rao 1969 (on recent work, cf. Boivin *et al.* 2005: 79)
Halakundi	1 perforated mica schist disk		Later Phase III(?) [Black and Red Ware present]	*Indian Archaeology - A Review 1959-1960*: 72

Jorwe. This figure may be somewhat skewed by the fact that a much greater site area and soil volume was excavated for the Jorwe and Late Jorwe, but this does not seem to account for the magnitude of difference. Although limited the evidence for flax begins in the Jorwe period, although only at some other sites in the region (see Table 2). It should also be noted, however, that the Jorwe and especially the late Jorwe see increasing proportions of sheep and goat amongst the faunal assemblage (Thomas 1988; Pawankar and Thomas 1997), so some use of animal fibres may also be involved, although wool is generally of little significance in Peninsular India, and South India today retains unimproved hairsheep breeds (Ryder

1984; Fuller 2006a: 26).

Further evidence for a late Second Millennium BC start to spinning comes from the Southern Neolithic (Table 3). Almost all spindle whorl finds come from Southern Neolithic Phase III, which dates from 1800-1300 BC (for phasing see Korisettar *et al*. 2001; Fuller *et al*. 2007). For several sites which have earlier levels, including Hallur, Sanganakallu and Brahmagiri, whorls are absent from earlier levels. Total spindle whorl numbers are low, and I would suggest that most of these actually come from the later half of this period, mainly after 1500 BC, although chronological resolution is inadequate for most of these published finds. The earliest possible spindle whorls in the region come from surface samples at Budihal (Paddayya 1993, 2001), a site that has Neolithic settlement occupation through *ca.* 1700 BC (see dating evidence summarized in Fuller *et al*. 2007), although some small scale, or intermittent later Neolithic use is possible, and the stratigraphic association of these finds can not be linked clearly to the dated occupation on the basis of evidence published so far. Although some possible cotton fragments are present at Sanganakallu from the end of Period III (*ca.* 1400 BC) [not included in Table 1 due to the uncertainty of identification], the only definitive evidence from this region is the 1000-900 BC cotton seeds from Hallur. Nevertheless it is worth noting the presence of *Rubia cordifolia*, an important traditional dye plant for cotton, at Sanganakallu from *ca.* 1400 BC (Boivin *et al*. 2005: 81), as this species would not have been locally available but rather suggests transport to the site from the Moist Deciduous woodland zones.

Thus the evidence from both Ganges and the Peninsula suggest that the very beginnings of fibre spinning can be placed in the first half of Second Millennium BC, and perhaps slightly earlier in the Ganges, but that there is a marked increase in spinning by the end of the Second Millennium BC. Hard archaeobotanical evidence for fibre crops a slightly later still, although a larger sample size is needed before we can conclude that this indicates that spinning techniques preceeded cultivation targeted at fibre production.

In terms of cultural context it should be noted that this horizon is the same one that sees other changes towards increased crop diversity, craft diversity and possible craft specialization. This is indicated in broadening crop and ceramic form repertoires, a process that definitely begins early in the Second Millennium BC (for the Peninsula, see Fuller 2005), and the addition of fruit tree-crops, indicated in particular in the wood charcoal record from the second half of the Second Millennium BC (see Asouti *et al*. 2005; discussion in Fuller 2006b). In addition this is the period that sees the spread of copper objects and probably copper-working in these zones (cf. Allchin and Allchin 1982).

THE HISTORICAL LINGUISTICS OF SOUTH ASIAN CLOTH PRODUCTION

The beginnings of textile production and the introduction of cotton and flax should be recognizable in historical linguistics, at least in a region in which these developments happened later than other linguistically-identifiable adoptions and where the species involved were not available wild. South India and evidence from the Dravidian languages meets these criteria. As shown above, the first textile production indicated in the artefactual record comes from the mid-Second Millennium BC (or perhaps slightly earlier) and cotton and flax were certainly cultivated by *ca.* 1000 BC. These developments post-date the beginnings of subsistence agriculture and pastoralism. Historical linguistic reconstructions for Dravidian suggests a Proto-Dravidian familiarity with domestic livestock (Fuller 2003; Southworth 2005) and with a number of indigenous wild trees of Peninsular India (Southworth 2005; Fuller 2006b, 2007). As a slightly later stage, of "Late Proto-

Table 4 Historical linguistic data relating to textiles in Proto-South Dravidian

Dravidian root (*Proto-form, if given, from Southworth 2005; entry no. from Burrow & Emeneau 1984).	**Suggested meaning**	**Attestations** (from Burrow & Emeneau 1984)
PSDr. *cāl- [DEDR 2475] Cf. Skt. *kōlika* [CDIAL 3535] "weaver, spider"	weaver caste name	Ta. *Cālikaṉ*, *cāliyaṉ* Ma. *cāliyan* Ka. *sāliga*, *sāliya* Tu. *tālye* 'weaver'; 'spider'; *sālye* caste of weavers Te. *sāle*; *sālī˜ḍu*, *sālevāḍu* 'a weaver' Ga. (S.2) *sāle* Kuwi (S.) *sāliesi*
PSDr. **cēntr-ir* [DEDR 2809]	Weaver	Ta. *cēṇṭiravar* Ka. *jāḍa*; *jēḍa* 'a weaver of the *Liṅgavanta* sect'; 'spider' Tu. *jāḍe*, *jāḍye* 'weaver'; 'spider'. Te. *jēṇḍra*, *dēṇḍra* 'a caste of weavers'
PSDr. **par-utti* [DEDR 3976]	Cotton	Ta. *Parutti*; *pāram* Ma. *parutti* To. *pašty* 'wick'. Ka. *parṭi*, *parti*, *patti* Koḍ. *parati* 'cotton cloth' Tu. *parti* Te. *p(r)atti* Go. (Ko.) *part* Kui *parti* Kuwi (Su.) *pratti* (Isr.) *parti*, (F.) *paṛti*
PSDr. **nūl-* [DEDR 3726]	cotton thread, or thread, or yarn (from an older terms for twisting/ spinning, cf. Kurux)	Ta. Nūl; *nūṟp-*, *nūṟṟ-* 'to spin, compose (as a poem), make a plot' Ma. *nūl*; *nūlkka* 'to spin'. Ko. *nu·l* thread; *nurb-* (*nurby-*) 'to twist', 'wring (neck)'. To. *nu·s*; *nu·sf-* (*nu·st-*) 'to join ends of thread by rolling'. Ka. *nūl*; *nūlt-* 'to spin'; *nūlige* 'spinning'; *nuli* 'to twist', 'curl (whiskers)', 'roll (as cotton) between the hands' Hal. *nugulu* 'thread' Koḍ. *nu·lï* 'thread' Tu. *Nūlu*; *nūloḍu* 'spindle'; *nūpuni* 'to spin, twist' Kor. (M.) *nuglu* Te. *nūlu*; *nulaka* 'a rough kind of rope or string'; *nuli* 'entanglement in a thread'; *nuliyu* 'to be twisted'; *nulincu*, *nul(u)cu*, *nul(u)pu*, *nulumu* 'to twist' Kol. *nuv*, Kin. *nūl* Pa. *nūl* Ga. (Oll.) *nūl* Go. (many dialects) *nūl* 'thread, string' Konḍa *nūlu*; *nuls-* 'to twist' Pe. *nūl*; *nōṇ-* (*nōṭ-*) 'to spin', 'twine' Manḍ. *nūl* Kui *nūḍu* (pl. *nūṭka*) 'cotton yarn, thread'; *nōlba* (*nōṭ-*) to twist strands together, spin thread; n. spinning. Kuwi (Su. Isr.) *lūlu*, (F.) *lūlū*, (S) *lōlu*. Kurux *nōēnā* 'to wind or twist anything flexible', 'twist grass or creeper into rope'.

3745 PSDr. *#nec* Weave, from older root, PDr. *#(n)ese*, plaiting(?)		Ta. *ney* to weave as clothes, string, link together; *neyvār* the caste of weavers; *neyvu* weaving; *necavu* weaving, act of weaving, texture, intertexture, web; Ma. *neyka* to weave, plait mats; *neyttu* weaving; *neyyal* weaving. Ko. *nec-* (*nec-*) to weave; *negc-* (*negc-*) to make close-woven. To. *nic-* (*nie&cangle;-*) to darn; *nes-* (*nesQ-*), *ni·Q-* (*ni·Q-*) to weave. Ka. *nēy̆*, *nēy̆i*, *neyyu*, *nē*, *nēyu* to weave, entwine; *neyi*, *nē*, *nēyu* weaving, a web; *nēy̆ige*, *nēy̆ge*, *nēge*, entwining or being entwined; *neysu*, *nēyisu* to cause to weave; *nēy̆ikāṟa*, *neygekāṟa*, *nēkāṟa* weaver. Koḍ. *ne·y-* (*ne·yuv-*, *nejj-*) to spin (thread); *neyv* braiding, weaving. Tu. *neyuni* to weave (as a spider); *neyipini*, *nēpini*, *nēyuni* to weave, plait, braid; *neyigė̀*, *nēgė̀* texture; *neyigāre* weaver. Te. *nēyu* to weave; *nēyincu* to cause to be woven, get woven; *nēta* weaving, texture; *nēṯakāḍu*, *nēṯari* weaver; *nēṯa-purugu* spider (see 4312). Go. (Koya Su.) *nēcc-* to weave. Konḍa *ney-* (*-t-*) to weave or thatch the roof with leaves Kui *nehpa* (*neht-*) to build a fence. Kuwi (S.) *neh'nai* to interweave. Kur. *essnā* (*issyas*) to weave, entwine into a fabric, furnish or adorn any article with net-work or plait-work. Malt. *ese* to plait, do mat-work.
[DEDR 765] PSDr (?)	To card cotton; older meaing suggested by C.Dr./S-C.Dr. cognates (Parji and Gondi) "to weed" or "pick stones from field"	*Ta*. eḵku (eḵki-) to pull with fingers (as cotton), to scrutinize; *Ma*. ekkuka to card cotton; ēkku carding cotton. *Ko*. ek- (eky-) to scratch (oneself) *To*. ök- (öky-) to scratch oneself. *Ka*. ekku, yakku to divide, separate, dress cotton, card wool; ekkike dressing cotton, etc. *Tu*. ekkuni to gin. *Te*. ēku to pick, beat, or clean (cotton); n. roll of cleaned cotton prepared for the spindle; ēkuḍu picking, beating, or cleaning cotton. *Pa*. ēk- to pick and throw away stones and weeds from field. *Go*. (A. Y.) eh-, (Tr.) ehtānā, (Ph.) ahtānā to weed *Pe*. ec- (-c-) to card cotton; *Kui* ēspa (ēst-) to unravel.
PSDr. **tuu-* [DEDR 3393] → Skt. *tūla-* [CDIAL 5904, 'cotton'] → Munda: Juang *tula* (Matson 1964), ≈? Kharia *turai* (Donegan and Stampe 2004b), or *tuday* (Biligiri 1965) → Proto-Monic **tɔ:[l]* Old Mon: *tol* Modern Mon: *tow* Nyakur: *tual.L* [differs from Proto-Palaung-Wa **da:i* (Peiros & Starostin 2003)	Feather, soft hair, sometimes derived meaning cotton (loaned to Indo-Aryan)	Ta. *tūval* 'feather'; *tuy* 'cotton' Ma. *tūval* 'feather', 'quill', 'painter's brush' *toppa* 'wool'; *toppal* 'feather' To. *tu·fy* 'feather, bird's tail'. Ka. *tippuṟ* 'bird's wing or feather'; *tuppuṟ* a 'soft plumage of birds', 'soft hair of rabbits'; *tuppaṟu* 'wool'; *tuppaṭa*, *tubaṭa* 'wool' Koḍ. *toppïṭa* 'feather' Tu. *tuyi*, *suyi* 'feather', 'quill' Kor. (M.) *cippuḍu* 'feather', 'quill' Te. *tūnī˜ga*, *tūnīga* 'dragon-fly'; *truppuḍu* 'feather', 'hair', 'down' Go. (Ma.) *tōṟ(i)* (pl. *tōhku*) 'large feather'; (Mu.) *tokenj*, (Ma.) *tokonji* 'feather' Manḍ. *tūku* 'feather'

[DEDR 1195] PSDr.(?) *#katir*	spinner's spindle	*Ta*. katir *Ma*. katir. *Ka*. kadir, kadaru, kaduru *Tu*. kadr; kaduring *Te*. kaduru *Ga*. kadur
PSDr.1 **ak-V-ce* [DEDR 3] ↔ Old Indo-Aryan *atasi-*	flax (or linseed) crop	Ka. *Agase* Tu. *agase-nār* Te. *agise*, *agisiya*, *avise*, *avisiya*
PSDr. **car-a-kk-* [DEDR 2353]	Commodity	Ta. *carakku* goods, articles of merchandise, gold, solid worth, curry-stuffs, spices, medicinal substances. Ma. *carakku* merchandise, cargo, different movables or valuable articles as cloths, jaggery, or drugs. Ko. *cark* spices for curry. Ka. *saraku*, *sarku* goods, things, commodities, merchandise, cargo; *saraku* esteem, regard, care. Tu. *Sarak*; articles, goods, commodity; *caraku* merchandise, articles, goods, cargo. Te. *saraku* an article, commodity, thing, ornament, jewel, trinket; care, heed, regard. Konḍa *sarku* materials. Kuwi (S.) *harku* thing, instrument, furniture, jewels; *hārka*, pl. *harkunga* things (F.) *harkū* jewelry, thing; (Isr.) *harku* implements.

Dravidian" (*sensu* Southworth 2006) or Proto-South-Central Dravidian (PDr-2) (*sensu* Southworth 1988; Fuller 2003) terms for several native subsistence crops can be reconstructed, and this can be suggested to have a pretty good fit with the Southern Neolithic in archaeological terms. At an even later stage, of Proto-South Dravidian, several non-native crop names can be reconstructed, including wheat and barley (introduced archaeologically by *ca.* 1900 BC) as well as cotton, flax and some fruit trees (see especially Fuller 2007). As I have noted before, it is also to this stage that a number of terms relating to emergent social hierarchy and craft specialization (including metallurgy) can be reconstructed (Fuller 2006b, 2007). Those terms relating to textiles and textile crops are collected in Table 4 (mainly following Southworth 2005, with reference to Burrow and Emeneau 1984), together with terms of equal antiquity that relate to craft specialization and trade with which we expect the development of South Indian textile industry to be connected. Connections with other languages, especially Indo-Aryan are indicated. And shared roots can be seen for flax and for one of the Sanskrit terms for cotton, which may originate in another Dravidian term for feathers.

The Indic languages contain another root word for cotton, which may ultimately derive from a term used by the Harappans. Hindi *kapās*, from a Prakrit *kappāsa*, from an earlier Sanskrit *karpā'sa* (Turner 1966: CDIAL 2877). The Persian term *karvās* also derived from this root. This is suggested to be a non-Indo-European substrate word (Mascia 1979; Fuller 2003: 205), and based on its *kar-* prefix is amongst a group of terms that Witzel (1999, 2005) has referred to as "Para-Munda" or *kubha-vipas*, which have broad Austroasiatic (or perhaps Austric?) structure (cf. Fuller 2007). This language is inferred to have been a major language of the Indus region during the Harappan civilization, which would accord with the great antiquity of cotton for this region.

The term for flax, *atasi*, which was also loaned to South Dravidian, also appears to be a substrate word (Mascia 1979; Fuller 2003: 205; Southworth 2005), but in this case it is amongst those which are

Table 5 Indic terms relating to cotton processing with some Munda comparisons

Sanskrit term and cognates	**Cotton processing stage/product**
Skt. **vangaputa*	Cotton pod (Turner 1966: CDIAL 11198) **Contrasts**: Munda: Pinnow 1959 #327 : Sora *ə'di:-n*; Kharia *si'diʔ*, (or sidij, Biligiri 1965)
Skt. *Parikarma*	Preparation of the cotton
Skt. *lothinī*, *lodhanī*	Gin (n.)
Skt. Root: *luñc*, *luth*	Root: to gin **Comparisons**: Sora *rid*, *rənid* "cotton gin" (Donegan and Stampe 2004b)
Skt. *vilup*	"to tear off" [an alternative to above]
Skt. *kanaka*	Cylindrical roller of gin
Sky. *oronī*	Flat board of gin
Skt. *rūta*	Rough fibre from the gin (also, Masica 1979)
H. *rūī*, <Pk. *rūa*	**Comparisons**: Remo *rua* "cotton", Gorum *ruj*, ≈? Kharia *tuRai* "cotton ready for spinning" (Donegan and Stampe 2004b),but *tuday* (Biligiri 1965); Bonda *rŭa* "cotton" (Bhattacharya 1968 #2280), but also *sūru* (#2683).
Skt. *piñjana*	Cotton bow (also, Southworth 2005: 226)
Skt. Root: *pij*	Root: "to bat"
Skt Root: *sphut*	"to strike" [an alternative to above]
Skt. *vihan*	"to beat" [an alternative to above]
H. *dhanukī*, *dhanuhī*, *dhunkī*	Cotton bow
Skt. *pramrd*	To smooth (or card)
H. *pīnnā*, *pīmjnā*	**Comparisons**: no relationship to PSDr. Term (Table 4), nor w/ Bonda *tiŋ-* "to card", also "to pierce, shoot with an arrow" (Bhattacharya 1968 # 1367); Bonda *jik* "to chard cotton with hands (ibid. #1071).
Skt. *vikrs*	"to pluck asunder" [used as an alternative to above]
Skt. *pūnikā*	Rolls of cleaned cotton
H. *pīnī*, *piunī*,	**Comparisons**: Munda *pid-pid* "sound produced with cotton bow" (Hoffman 1930-1938; Osada, pers. comm.); *pitlEd*, reported for "to clean cotton" in Mundari and Santali (Donegan and Stampe 2004a); Kharia *pinuri*, *pue~ri* "cotton lump prepared for spinning" (Donegan and Stampe 2004b); cf. PSDr. **par-utti* (Table 4 above)
Skt. *kartana*	Spinning
Skt. Root: *krt*	**Comparisons**: PSDr.# *katir* (Table 4, above) Bonda *gurak'-* "to spin"; *gunurak'* "spindle" (Bhattacharya 1968 #915, 893)
Skt. *sūtra*	Cotton thread
H. *sūtī*	**Comparisons**: Juang *sotorom* "thread", but also *goḷa* "thread" (Matson 1964); Bonda *sūru* (Bhattacharya 1968 #2683). Kharia *sugtrom* "thread" (Biligiri 1965)
Skt. *tántu* [CDIAL 5661]; H. *tātī* "weaver" [CDIAL 5666]	Thread, warp; *tántra* [CDIAL 5663] "loom" **Comparisons**: Juang *tonti* "weaver" (Matson 1964) Bonda *tāy-* "weave" (Bhattacharya 1968 #1358) Kharia *tañ* "weave" (Bligiri 1965; Pinnow 1959 #301); Santali *teñ*, Mundari *tɛŋ*, Ho/Birhor *teŋ*, Turi *teŋge*:, Sora *tañ*, Gutob *tai*, Palaun *te:ŋ*, *thă*, Wa *taiŋ*; E. Austro-Asiatic: Khasi *tha:in*, Nicobarese *təñə*, Bahnar/Boloven/Niahon/Alak *tañ*, Lave *tăñ*, Khmer *p ɔ nṭañ* (Pinnow 1959 #301)
Skt. *vāya* Skt. Root: *ve*, RV. *vayī* (Turner 1966: CDIAL 11298)	Weaving; weaver
H. *kaprā*	Cloth **Comparisons**: Juang *kote* (Matson 1964) Bonda *kɔdi* "clothe worn by men" (Bhattacharya 1968 #713), differs from *nɔʔri* "cloth worn by woman (#1622), *mp ɔʔ* "cloth" (#2210). Nahali *kupra* (Kuiper 1962 #323)

relegated to "Language X". While I have previously hypothesized that "Language X" might be associated with the Ganges Neolithic, the range of plant taxa found in this language suggests instead that it accords with some part of the Greater Harappan zone. It may well be that Harappan language was itself already a mixed language, combining Language X (of unknown affinity) and the "Austric-oid" *kubha-vipas*. As both this term and the preceding cotton term appears to be substrate loan words, it is not possible to use the linguistic evidence to suggest their antiquity, except that they appear to the South Asian, as they are absent from Iranian, and pre-Indo-Aryan. This fits with lost substrate language(s) in the northwestern subcontinent and with the known archaeological antiquity of both these crops as at least Harappan or older as cultivars in the Indus region.

In addition to terms for the fibre plants themselves, we are able to identify Sanskrit terms for some of the processes involved in processing them, especially for cotton, as well as some equivalent words in Munda and Dravidian languages. The Sanskrit terms are identified by Schlingloff (1974) on the basis of early Jain and Buddhist texts, as well as some modern (Hindi) terms. Consideration in terms of historical linguistics to track these as cognates or loans in various languages is needed, as is work on the equivalent terms in Dravidian or Munda languages, although a few terms are collected here. The table offered is therefore only a starting point for such research (Table 5). Further compilation of alternative or cognate terms in other languages, especially amongst Dravidian and Munda languages, and possible loans amongst Southeast Asian languages is needed. Of note are several terms that are shared between Indic and some Munda languages, as well as a few shared with Proto-South Dravidian. One widespread term for weaving/weaver (# *tan*) is perhaps originally Austric(oid), as it is widespread in Munda languages, Eastern-Austroasiatic, and appears related to the Sanskrit *tántu*, perhaps then an earlier substrate term. This term refers to the activity of weaving, which is one form or another is likely to be universal and Palaeolithic, rather than to any particular product, such as cotton or flax.

THE SPREAD OF COTTON BEYOND SOUTH ASIA

The eastward spread of cotton appears to be tracked by historical linguistic data. As indicated in Table 4, one set of Indic cotton terms derives from a South Dravidian term originally denoting "feathers", Proto-South Dravidian **tuu-* , Sanskrit *tūla-*. This appears to be the source of cotton terms in some Munda languages (e.g. Kharia *turai*), and some Southeast Asian languages, including Monic (Old Mon *tol*, Modern Mon *tow*, Nyakur *tual*. L (Peiros and Starostin 2003). This differs from another set of related terms, which are derived instead from the other Sanskrit term *karpā'sa* (Turner 1966: CDIAL 2877). Loans are found in some Munda languages (Karia and Juang *kapas*, Gorum and Remo *kapa*, Gta *kopa*, Mundari *ka'dsom*: from Donegan and Stampe 2004b) and in several Southeast Asian Austroasiatic branches: Old Khmer *krəpa:s*, Proto-Viet-Muong **k-pa:lh*, Proto-Katuic, Proto-Banharic and Proto-Pearic **kə-pa:jh* (Peiros and Starostin 2003; cf. Osada 2006: 163-164). This root is also borrowed into Austronesian languages such as Malayan and Batak (Osada 2006: 163). The distinct etyma borrowed into Mon and Khmer would suggest that cotton arrived in Southeast Asia after the divergence of the Mon-Khmer family, although the divergence of these is generally considered much earlier than the likely arrival of cotton (cf. Diffloth 2005), which is presumably during or after the Early Historic period of trade between India and Southeast Asia starting from the end of the First Millennium BC. To the north, the first cotton fabrics apparently reached China as "tribute" from Java in AD 430, while cotton fabrics from Gangetic India were sent as "tribute" to

the Chinese court at the start of the Sixth Century (Goodrich 1943). Nevertheless during the Tang Dynasty and until the 13th Century AD, cotton does not appear to have been a widely known product in China (Laufer 1919: 490-492; Goodrich 1943).

The westward diffusion of cotton is rather better tracked through archaeology, and is a process that takes place mainly in the Roman era (less than 2000 years ago). There is no evidence that cotton came to be grown in the Mediterranean region or Egypt in the Bronze Age or early Iron Age. Indeed, during the Roman period, cotton textiles were one of the desired products from Indian trade ports, as indicated in the *Periplus Maris Erythraei*, a First Century AD Roman mariner's travel guide, written in Greek probably in Egypt (see Casson 1989). Cotton is also indicated as an import in Papyrus Vinod (Casson 1990; Sidebotham 1991). It is suggested that Indian imported textiles had Z-spun thread, which dominate the archaeological textile record at the Roman era port of Berenike on the Red Sea coast (Wild and Wild 1998, 2001, 2005). Cotton is rarely attested in papyrological records from Roman Egypt (Bagnall 1993: 33, n. 123). but is first recorded as a local cultivar in the Second Century AD in the Khargeh Oasis, and a Fourth Century AD cultivar in the Dakhleh Oasis (Winter and Youtie 1944; Bagnall 1993). Already in the First Century AD, Pliny in his *Naturalis Historia* described the cotton crop and indicated cultivation in Nubia and parts of upper Egypt (see Clapham and Rowley-Conwy in press). Archaeological finds suggest that cotton cultivation and fibre-processing was established in the Meroitic Kingdom of Nubia, as indicated by finds of desiccated seeds and capsules from Qasr Ibrim (Rowley-Conwy 1989; Clapham and Rowley-Conwy 2006, 2007, in press), as well as quantities of textiles from Lower Nubia (Crowfoot and Griffiths 1934; Bergman 1975; Crowfoot *et al*. 1977: 46; Crowfoot 1979; Mayer-Thurman and Williams 1979; Adams 1986: 507; Wild *et al*. 2007). This must be seen as part of wider process of establishment of cotton cultivation across the southern frontiers of the Roman world, indicated by finds of seeds in the Southern Egyptian Oases (Dakleh: Thanheiser 1999; Khargeh: A.J. Clapham, unpublished; cf. Pelling 2005: 406; Clapham and Rowley-Conwy, in press), and in Southern Libya, the kingdom of the Garamantes (Pelling 2005), as well as in Nubia (Clapham and Rowley-Conwy, in press). It is tempting to link this new region of cotton cultivation to the spread of *Gossypium herbaceum* originating in sub-Saharan Africa, which was tentatively identified from desiccated capsule remains at Qasr Ibrim (Rowley-Conwy 1989; cf. Clapham and Rowley-Conwy, in press; Wild *et al*. 2007), but it is also possible that this represents the introduction of tree cotton from India. In the latter connection, one wonders whether the Nubian term (Nobiin) *koshmaag* (cf. Fuller and Edwards 2001) might also be derived ultimately from the Sanskrit *karpā'sa* ?

CONCLUSION

The evidence reviewed in this paper allows us to assess the role of textile production in the "Neolithic revolution" in the South Asian context. When defining the "Neolithic Revolution", Childe (1936) considered textile production, together with ceramics, as one of the technological hallmarks of the Neolithic. A "self-sufficing economy", i.e. food-production, based on domesticated plants and animals was his main focus, but he suggested that the breeding of woolly animals and cultivation of fibrous plants would have also made textiles part of this transition. It is clear that in South Asia, and I suspect elsewhere, this was not the case, in terms of a strict sense of Neolithic beginnings. However, neither is pottery, as pre-ceramic food production is clearly in evidence in Southwest Asia, Pakistan, and parts of the Americas (e.g. Bar-Yosef and Meadow 1995; Crown and Wills 1995; Smith 1992; Burger 1992; Jarrige *et al*. 2006; see discussion in Fuller 2006a: 60). Pottery, however,

remains an important development in the technology of food processing (grinding and pulverizing tools could be cited as another important technology). It is clear that together with food production, changes in processing which allowed the more intensive extraction of nutrients and the more complex cultural transformation and combination of raw foods, was an important and recurrent feature of the changes that occurred between the pure foraging of the Palaeolithic and the development of economies that supported hierarchical, complex societies and "civilization". If the Neolithic is re-conceived as an extended period of directional transformations in human economy and social organization, which provided the necessary basis for the development of "complexity", then textile production should indeed be included in this. Rather than being formative of the Neolithic, textiles appear to have been transformative, in that the development of, and increasing scale of, textile production and the growing of textile crops, was part of a wider process of craft specialization and commodification that was necessary to the development of larger polities, states and cities. It is clear that in South Asia textile production was earliest in the northwest and was well-established for the development of Harappan urbanism. Elsewhere, textile production is later. Rather than seeing this as "fall out" from the Harappan civilization, however, I would suggest that this indicates the internal drives in early village (Neolithic) societies in various parts of India as they developed more complex economic interdependencies, internal hierarchical social competition, and moved towards "Bronze Age" economies (which in many parts of India are rather associated with the Iron Age). Thus by combining Childe and Twain: man[2)] makes and remakes himself through the technological developments of the past, but clothes too re-make the man, and documenting the beginnings and intensification of textile production may be as important to tracking the early transformations of society as the origins of food production.

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Notes

1) See also Sherratt's on-line ArchAtlas: http://www.archatlas.dept.shef.ac.uk/OriginsFarming/Farming.php

2) Or Woman.

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