



Contents lists available at ScienceDirect

Journal of Archaeological Science

journal homepage: <http://www.elsevier.com/locate/jas>

Approaching rice domestication in South Asia: New evidence from Indus settlements in northern India

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ARTICLE INFO

Article history:

Received 17 February 2015

Received in revised form

11 March 2016

Accepted 15 April 2016

Available online xxx

Keywords:

Rice (*Oryza sativa*)

Indus Civilisation

South Asia

Macrobotanical analysis

Cultivation systems

ABSTRACT

The nature and timing of rice domestication and the development of rice cultivation in South Asia is much debated. In northern South Asia there is presently a significant gap (c.4200 years) between earliest evidence for the exploitation of wild rice (Lahuradewa c.6000 BCE) and earliest dated evidence for the utilisation of fully domesticated rice (Mahagara c.1800 BCE). The Indus Civilisation (c.3000–1500 BCE) developed and declined during the intervening period, and there has been debate about whether rice was adopted and exploited by Indus populations during this ‘gap’. This paper presents new analysis of spikelet bases and weeds collected from three Indus Civilisation settlements in north-west India, which provide insight into the way that rice was exploited. This analysis suggests that starting in the period before the Indus urban phase (Early Harappan) and continuing through the urban (Mature Harappan/Harappan), post-urban (Late Harappan) and on into the post-Indus Painted Grey Ware (PGW) period, there was a progressive increase in the proportion of domesticated-type spikelet bases and a decrease in wild-types. This pattern fits with a model of the slow development of rice exploitation from wild foraging to agriculture involving full cultivation. Importantly, the accompanying weeds show no increased proportions of wetland species during this period. Instead a mix of wetland and dryland species was identified, and although these data are preliminary, they suggest that the development of an independent rice tradition may have been intertwined with the practices of the eastern most Indus peoples. These data also suggest that when fully domesticated *Oryza sativa* ssp. *japonica* was introduced around 2000 BCE, it arrived in an area that was already familiar with domesticated rice cultivation and a range of cultivation techniques.

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1. Introduction

Since the rediscovery of South Asia’s Indus Civilisation (c.3000–1500 BCE) (Fig. 1, Table 1) in the early 1900s, the nature of the agricultural practices used by Indus populations has been a source of speculation (e.g. Marshall, 1931; Wheeler, 1953; Fairservis, 1961, 1967). In particular, the role of rice in Indus agriculture has been a continuing source of debate, which is at least partly due to its long and complex history of exploitation in the subcontinent (see Fuller et al., 2010). This paper contributes new evidence to the Indus rice debate by presenting an analysis of archaeobotanical data collected from three settlement sites in the

most easterly part of the area occupied by Indus populations. First it will outline the history of rice in South Asia, and it will then review how the Indus Civilisation fits into this debate, before presenting the new evidence and then assessing its significance.

2. Background

2.1. Rice domestication and South Asia

Modern domesticated rice, *Oryza sativa*, has a complex history as it is the product of repeated instances of hybridization. Current genetic evidence suggests that it developed from the hybridization of two other domesticated forms: *O. sativa* ssp. *japonica*, which is a Chinese rice domesticated from wild *O. rufipogon* around 4000 BCE (Fuller and Weisskopf, 2011), and *O. sativa* ssp. *indica*, which is a domesticated version of the South Asian *O. sativa* ssp. *nivara* (Fuller et al., 2010). Based on this evidence, Fuller (2005, 2006, 2011) has

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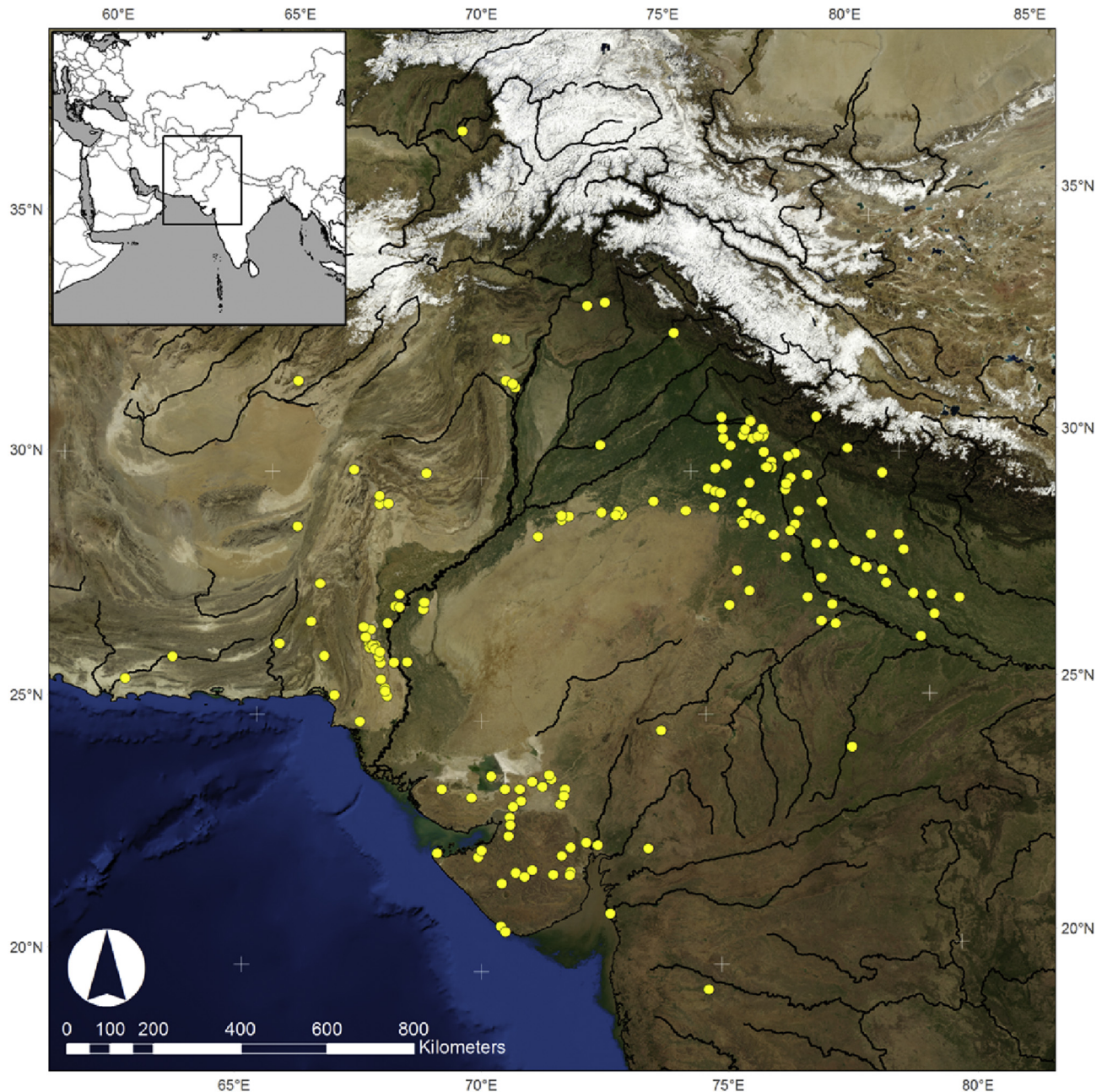


Fig. 1. Map showing the distribution of excavated sites belonging to the Indus Civilisation and Painted Grey Ware periods, based on published data as of date of paper submission. Data obtained from in Indian Archaeology, a Review and Possehl (1999).

Table 1
Periodisation of the Indus Civilisation (after Possehl, 2002:29).

Stage	Dates
Early Harappan	3200–2600 BCE
Early-Mature Harappan Transition	2600–2500 BCE
Mature Harappan	2500–1900 BCE
Late Harappan	1900–1300 BCE
Painted Grey Ware (PGW) (early Iron Age)	1300–500 BCE

suggested that *O. sativa* ssp. *indica* may have been domesticated many times, including during what he has referred to as a 'proto-indica' phase of cultivation (Fuller, 2011). Using a combination of genetics, the modern distribution of wild rice species, and

archaeological evidence, Fuller (2002, 2005, 2006, 2011; Fuller and Weisskopf, 2011) has also suggested that one of these domestication events may potentially have taken place in the Ganges region of India.

Fuller and Madella (2002) have, however, long argued that the archaeological evidence for rice exploitation in South Asia is patchy and often inconclusive. Based on what is available, Fuller (2011: 82) has proposed that the "independent rice tradition in north India [...] never [...] proceeded on its own to full domestication" until the arrival of *O. sativa* ssp. *japonica* c.2000 BCE. The earliest evidence for rice cultivation in South Asia comes from the site of Lahuradewa, which is situated in the Middle Ganges plains in north India. Tewari et al. (2008) have recovered charred rice grains from the site that have been radio-carbon dated to 6409 BCE (8359 cal BP) (Tewari

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