

Living in the Hinterland: Survey and Excavations at Masudpur 2018-2019

R.N. Singh*, C.A. Petrie**, ***, A. Alam*, J. Bates***, A. Ceccarelli**, S. Chakradhari*, S. K.Sing*, A. Chowdhary*, A.S. Green***, E. Lightfoot***, A.K. Pandey*, A. Ranjan*, D.I. Redhouse**, D.P. Singh*, U. Singh*, M.C. Ustunkaya***, and J.R. Walker***

*Department of AIHC and Archaeology, Banaras Hindu University, Varanasi-221005,
email:drravindransingh@gmail.com

**Department of Archaeology, University of Cambridge, Cambridge CB2 3DZ, UK

***McDonald Institute for Archaeological Research, University of Cambridge, Cambridge CB2
3DZ, UK

Introduction: Archaeological settlement sites that lie in the vicinity of the modern village of Masudpur, Hissar District, Haryana, were first recorded by D. Singh and C. Singh of the Department of Archaeology and Museums Haryana¹, and subsequently reported by Joshi et al.². The precise location of these sites is not known, however. A reconnaissance survey by the Land, Water and Settlement project (<http://www.arch.cam.ac.uk/rivers/>) in 2008 visited the site now known as Masudpur I, which is situated to the north-north-east of Masudpur village (Fig. 01 & 02 [A & B])³. This mound was selected for detailed surface survey and preliminary excavations in 2009⁴, and was revisited in 2009 and 2014 during the Rakhigarhi Hinterland Surveys⁵.

Again under the direction of R.N. Singh and C.A. Petrie, but this time under the auspices of the *Two Rains* project⁶, a collaborative team from Banaras Hindu University (BHU) and the University of Cambridge has now carried out further regional survey around Masudpur, and a second major season of horizontal excavation at the site of Masudpur I. This work was carried out with the permission and support of the Archaeological Survey of India (F.N^o1/26/2/2008-EE) and was conducted between January 19th and February 24th 2018. The following preliminary report presents an overview of the results of this season of survey and excavation.

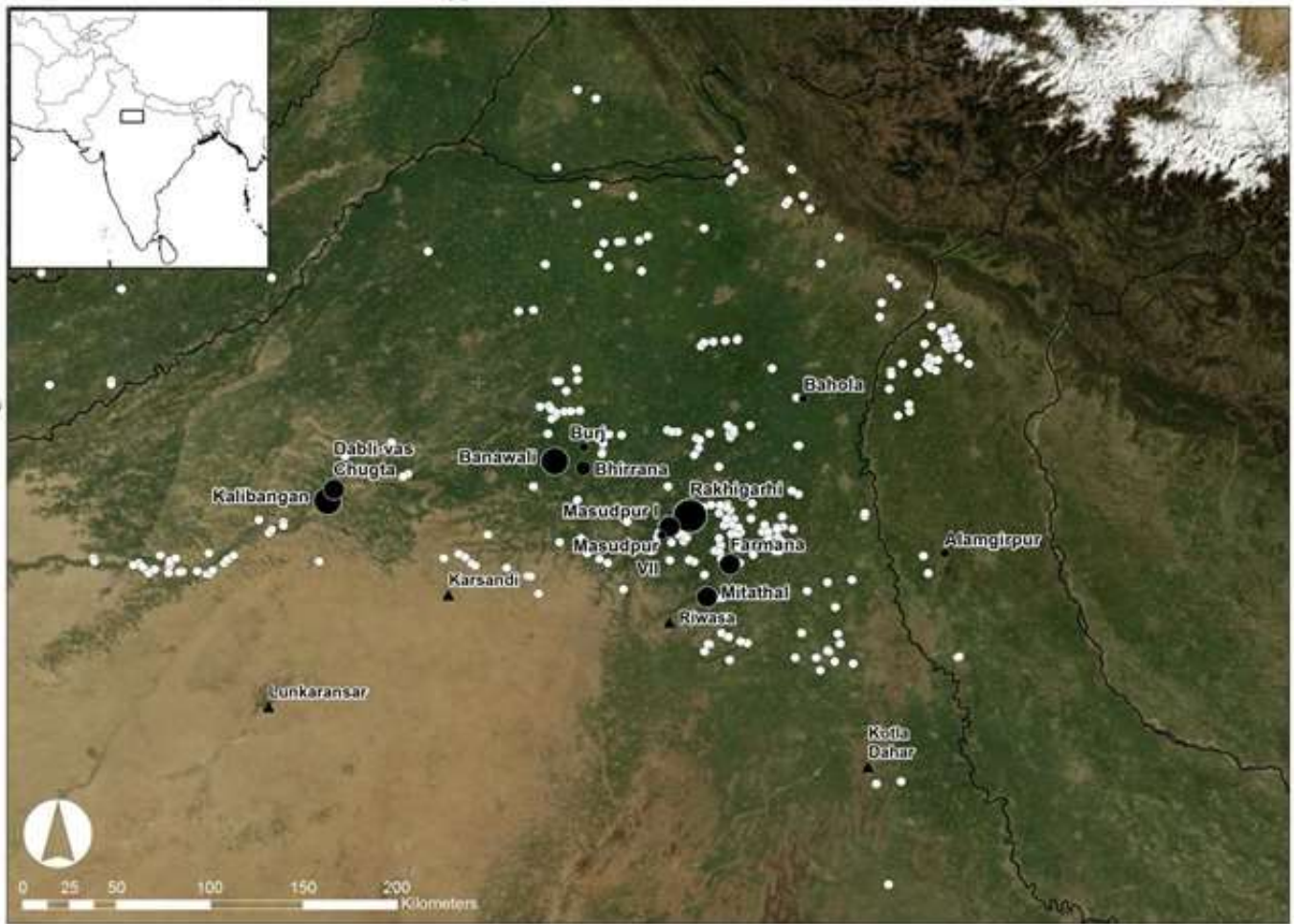


Fig. No. 1. Location of Masudpur I in relation to other major Indus sites in northwest India

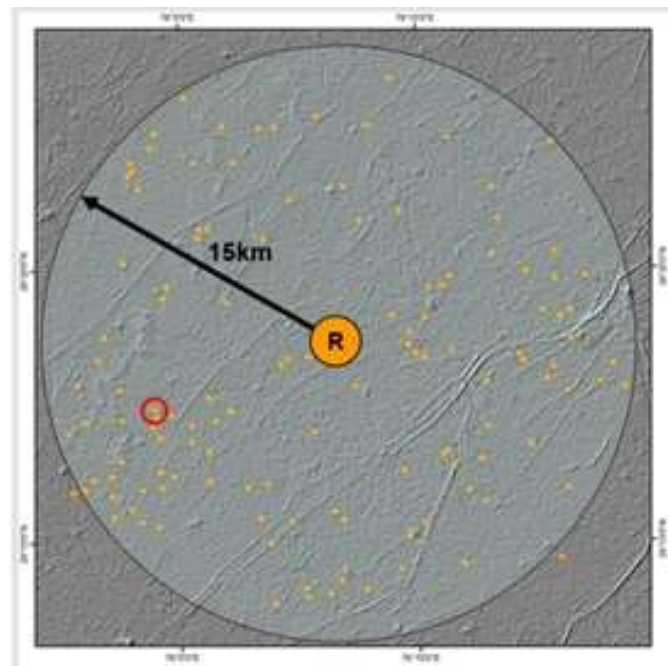


Fig. No. 2 (A): Location of Masudpur I (circled and in red at left, and in red at right) in relation to Rakhigarhi (R) and other settlements to the SW of the urban site

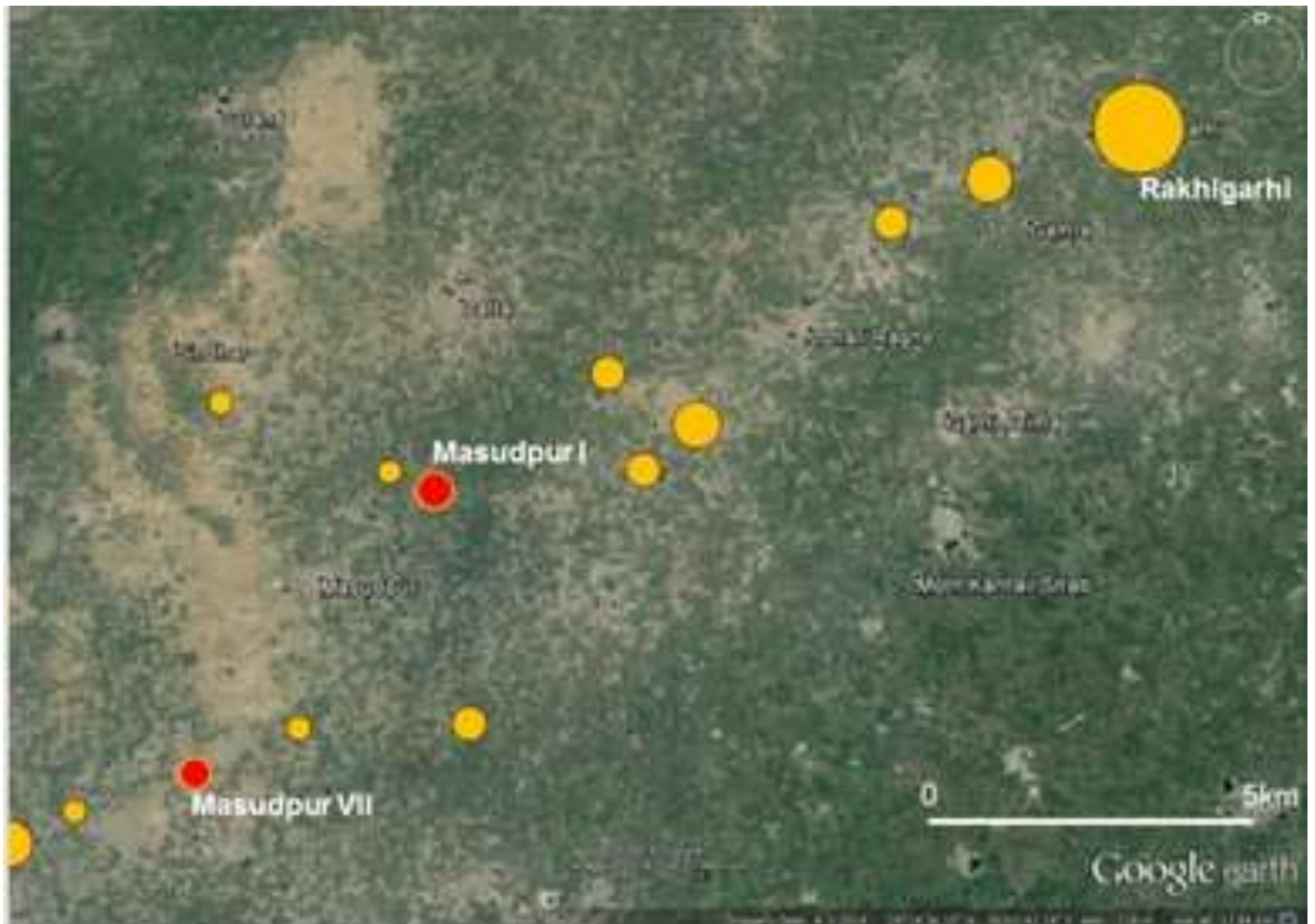


Fig. No. 2 (B): The location of Masudpur VII and modern villages are also indicated

Previous research at Masudpur I in 2009, and subsequent findings: The archaeological mound now referred to as Masudpur I is known locally as Sampolia Khera (Fig. 2), and was visited during the survey conducted by members of the Land, Water and Settlement Project in March/April 2008⁶. At that time it was selected for further investigation as the material recovered from the surface indicated that the site was occupied during the Mature and Late Harappan phases⁷. The Land, Water and Settlement project was a multidisciplinary endeavour co-directed by R.N. Singh from Banaras Hindu University (BHU) and C.A. Petrie from the University of Cambridge that also involved scholars from several other Indian and UK institutions, and investigated the relationships between archaeology, geography, landscape and climate in northwest India. The archaeological component of the Land, Water and Settlement project was primarily focused on establishing the relationship between archaeological sites and their geographical and landscape context in two primary zones: the area northeast and east of New Delhi in western UP; and the central Haryana Plains, between Hisar and Karnal. The preliminary survey around the village of Masudpur and the excavations at the mound sites of Masudpur I (Sampolia Khera) and Masudpur VII (Bhimwada Jodha), which will now be described briefly,

were designed to satisfy a range of project aims, most specifically to collect cultural material in association with archaeobotanical and archaeozoological material that would be suitable for a range of archaeological science based analyses.

Exploration of the hinterland of Masudpur I in 2009: The initial survey of the area around Masudpur village by Singh and Singh recorded the existence of four mounds, and these have typically been listed as Masudpur I, II, III and IV and given one geographic location⁸, although this location has varied in different reproductions of the site location data⁹ (E76° 00', N29° 14' - Ref- Joshi *et al.* 1984; or E75° 58' 12", N29° 12' 47"). The area around Masudpur village does not appear to have been revisited by archaeologists for the purpose of survey until the reconnaissance carried out by the *Land, Water and Settlement* project in 2008¹⁰. During the 2008 reconnaissance, an attempt was made to identify the four mound sites that had previously been visited, and this was followed up further during additional survey in 2009. The initial four mounds could not be clearly identified, but the 2009 survey identified a total of 13 mounds in the vicinity of Masudpur village, and many of these appear to have been occupied during the periods proposed for the previously identified mounds¹¹. It was thus impossible to be precise about which mounds corresponded to those that had been previously identified, so it was decided to re-number the mounds as MSD I–XIII and assign specific geographical co-ordinates to each mound. The one geographical location that was previously given for the Masudpur sites corresponds most closely with the location of a mound known as Mamanwala, which is referred to now as Masudpur V¹².

It is worth reiterating that the surveys undertaken by the *Land, Water and Settlement Project* in 2008, 2009, 2010 and 2014 showed that many of the unprotected Harappan period sites in Haryana have been flattened and/or destroyed by buildings and farming activities¹³. In particular, the 2009 reconnaissance around Masudpur village showed that agricultural/ploughing activities and road building have flattened most of the sites close by, and all mounds have been at least partially reshaped and truncated by ploughing¹⁴.

We noted in 2009 that all of the sites in the vicinity of Masudpur lie between 12 and 16 kms of the urban site of Rakhigarhi (E 76° 06.715', N 29° 17.365'), and are all thus likely to have been situated in its hinterland¹⁵. We also argued that it is highly likely that there lay within Rakhigarhi's socio-economic and political catchment during the Mature Harappan period, when it was occupied to its greatest extent¹⁶.

Surface survey and excavations in 2009: In addition to the 2009 survey that located the thirteen proto-historic and historic period mound sites, excavations were carried out at Masudpur I (Sampolia Khera) and Masudpur VII (Bhimwada Jodha). During the excavations in April-May 2009, members of the *Land, Water and Settlement* project carried out topographic mapping and

preliminary excavations at both sites (Fig. 3)¹⁷. The systematic surface mapping of Masudpur I demonstrated that most of the mound has been levelled for agriculture, and this form of disturbance produces what has now been described as a low terraced mound (Fig. 3).

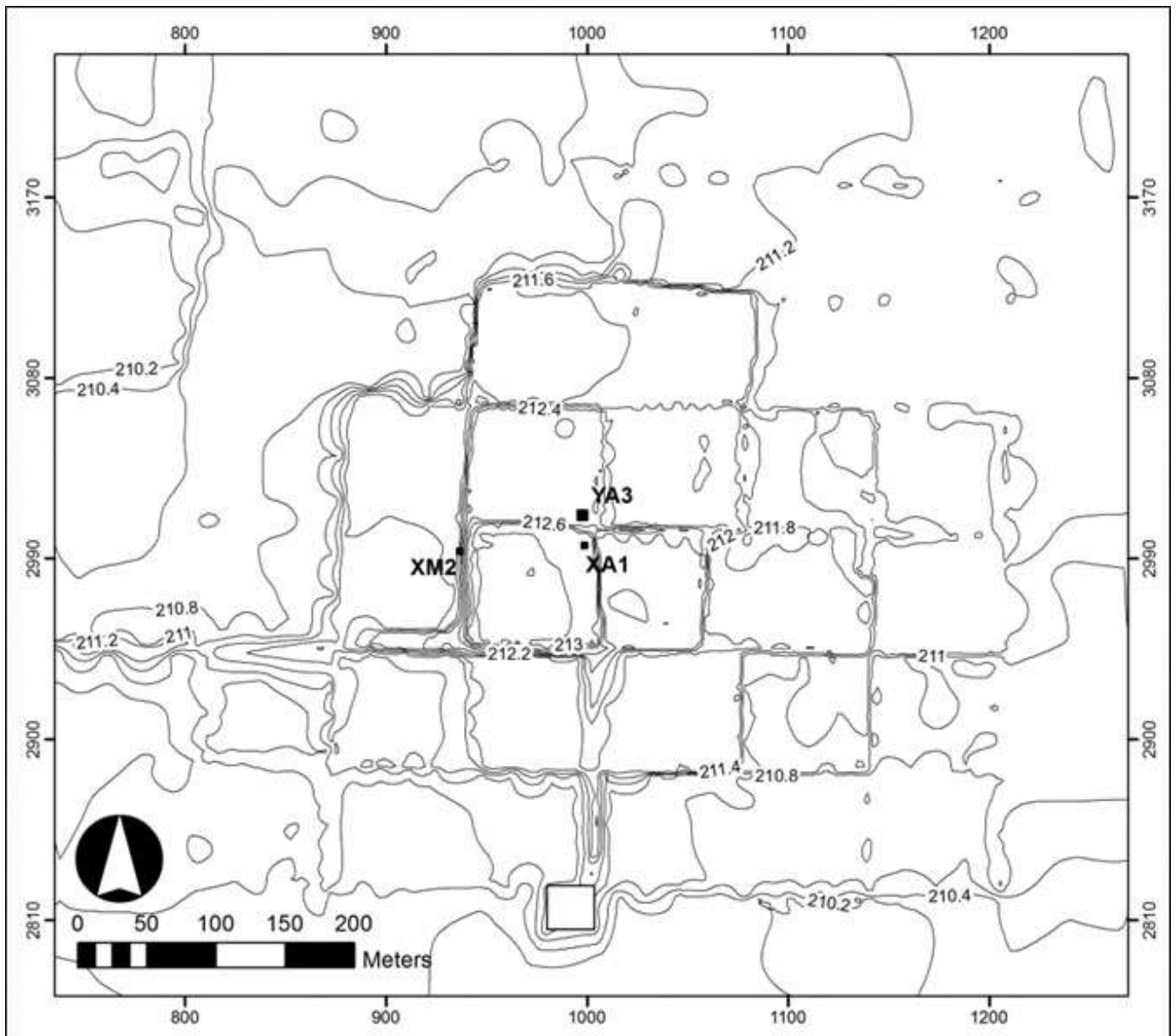


Fig. No. 03. Digital elevation model of Masudpur I based on surface mapping carried out in 2009. Location of Trench XK2 excavated in 2018 is also shown as a blue square (plan produced by C.A. Petrie)

The topographic survey showed that some areas of Masudpur I rise to a height of 3 m above the plain, and in total it covers an area of approximately 6 hectares, suggesting that it was a large village during the proto-historic period. However, as the entire mound has been levelled to some extent to produce fields, large areas that now appear to be ‘mound’ are the product of a range of cut and fill operations, which have increased the distribution of cultural artefacts beyond the extents of the original mound. During the detailed topographic survey of the site, trenches were

laid out in three areas, labeled XA1, YA3 and XM2 (Fig.3), and it will be useful to briefly reiterate the original findings¹⁸.

Trench MSD I/XA1: was sited to reveal a complete sequence of the occupation on the mound. A total of 38 separate stratified deposits were delineated, comprising what appears to be 9 individual stratified phases of occupation. The lower phases of the trench appear to be characterized by locally made *Early-Mature Harappan* ceramics. These are overlain by deposits containing *Mature Harappan* and then *Late Harappan* ceramics¹⁹.

Trench MSD I/YA3: was placed in the field adjacent to XA1, and total of 9 separate stratified deposits were delineated, comprising what appears to be 4 individual stratified phases of occupation. The lower phases of the trench were characterized by locally made *Mature Harappan* ceramics, overlain by a deposit containing a mix of *Mature* and *Late Harappan* material²⁰.

Trench MSD I/XM2: was placed in an area on the western side of the mound exposed by field levelling, where section cleaning had shown the remains of a mudbrick structure. A total of 24 separate stratified deposits were delineated, comprising up to 10 individual stratified phases of occupation. The lower phases of the trench appear to be characterized by *Mature Harappan* ceramics, which were overlain by deposits characterized by *Mature* and then *Late Harappan* ceramics²¹.

The absolute height of the natural sand at the base of each trench is variable, suggesting that the site was established on an irregular surface that was not entirely flat and that the site was either established on naturally raised ground, or that the area around the mound has been deliberately lowered in recent years.

Subsequent to the excavation fieldwork, a range of post-excavation analyses have been carried out on the material from Masudpur I, including detailed analysis of the geoarchaeology²², ceramic material²³, absolute dates²⁴, animal bones²⁵, archaeobotanical remains²⁶, and this has been complemented by stable isotope analysis of selected bones and seeds²⁷.

Geoarchaeological analysis has shown that the mound appears to have been situated on an area of raised land in a braided floodplain²⁸. It is notable that the absolute height of the natural sand at the base of is 0.75 m below the average height of the ground surface immediately around the mound. This either indicates that the ground surface around the mound has risen after the settlement was established, or the mound is substantially deflated²⁹. Ceramic analysis has shown that the pottery vessels used at the site are distinct from material known at larger Indus sites, and bear similarities to the so-called Sothi-Siswal ceramics identified at Mitathal³⁰, and also seen at Farmana³¹. The absolute dates obtained from a range of crop seeds including wheat, pulses, millet and rice demonstrate that the site was occupied during the *Mature* and *Late Harappan* periods,

but also that all of these economic species were being exploited during the Indus urban period at this site³². The dates for occupation at the site demonstrated that the site was also occupied before, during and after the dramatic weakening of the Indian Summer Monsoon at around 4.2-4.1 ka BP/2200-2100 BP, which has been documented in Lake Kotla Dahar³³. As such, Masudpur I was selected for further investigation by the Two Rains project, which is investigating the relationship between humans and their environment in the face of climate change – investigating the core question “Does climate change cause collapse?” in the Indus context.

Survey and Excavations in 2018

Open area excavations: The 2018 season of excavations was carried out in January and February and focussed on XK2 (Fig. 3), which was adjacent to the XM2 sounding that was excavated in 2009. As noted above, Trench XM2 had revealed evidence for well-preserved mud-brick architecture and associated occupation deposits dating to the final phases of the Indus urban period, and it was recognised that this period was ideal for investigating the research questions of the *TwoRains* project.

MSD XK2

Trench XK2 was laid out immediately adjacent to the track that runs north-south across the mound (Fig. 3). This area was under cultivation at the time of the excavations, but it was selected as the ideal location for open-area excavations, aimed at exposing household structures and working areas relating to the different periods of occupation at the settlement.

Excavations and documentation were carried out over five weeks between 19/01/2018 – 24/02/2018, and the excavations were conducted across an area of 10 x 10 m (Fig. 4). Single context recording methods were used throughout to document the deposits. A total of 126 distinct stratigraphic contexts were exposed, relating to at least four phases of occupation – which span both the *Mature Harappan* and *Late Harappan* periods. These exposures included a small sounding into the southeast corner of the trench (Figs 6-7). The deposits revealed include structural remains, a number of distinct activity areas including areas for storage and what appears to be food preparation (Figs 4-6). It is notable that a number of pit features were exposed, which appear to date to the *Mature Harappan* and *Late Harappan* phases, and typically contained an abundance of ceramic material and organic material, which should help with absolute dating.



Fig. No. 04: Photo showing excavated area of Trench XK2, looking east (photograph C.A. Petrie)



Fig. No. 05: Photo showing excavated area of Trench XK2, looking south (photograph C.A. Petrie)

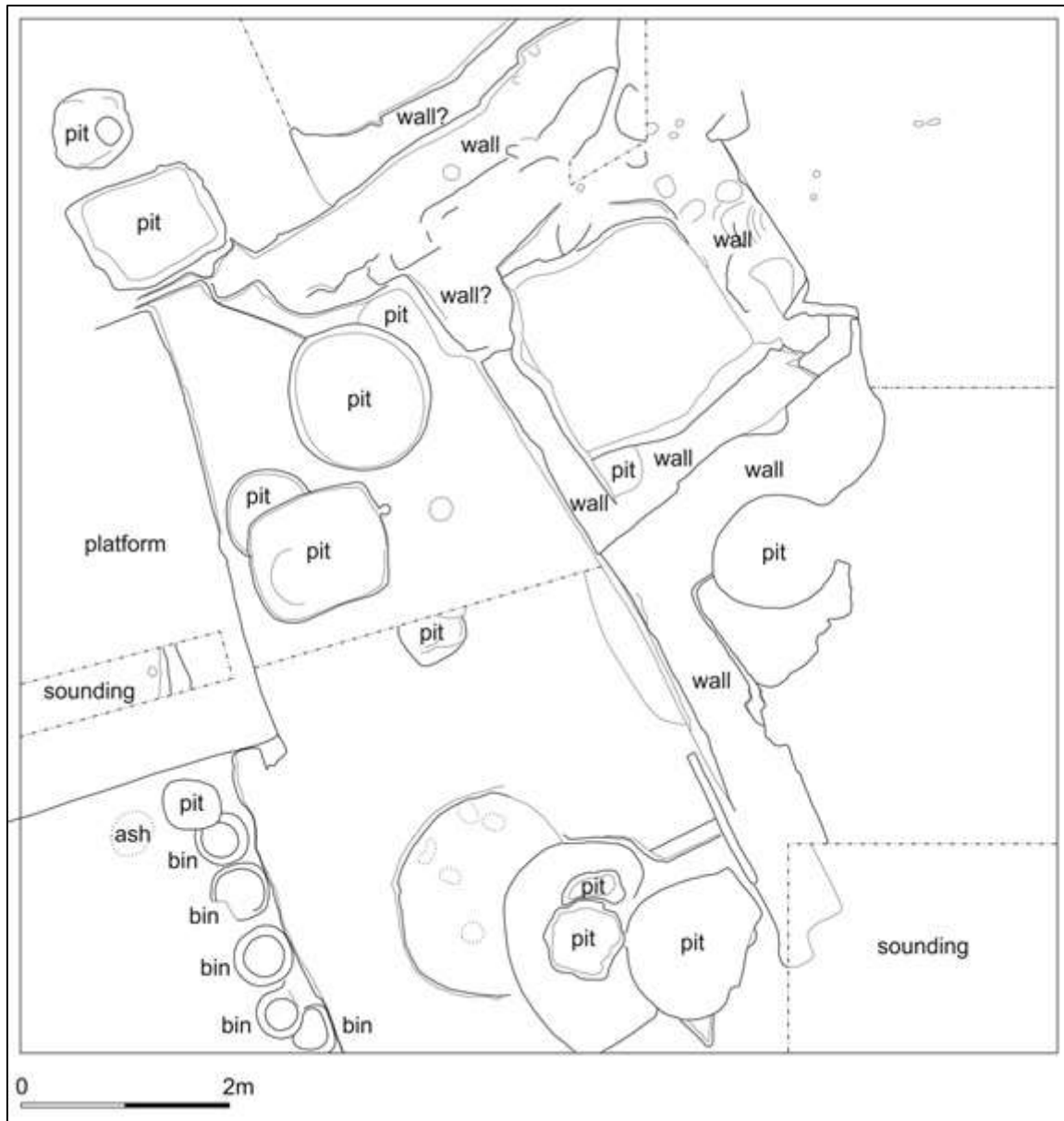


Fig. No. 06: Architecture exposed in Trench XK2 (plan C.A. Petrie)

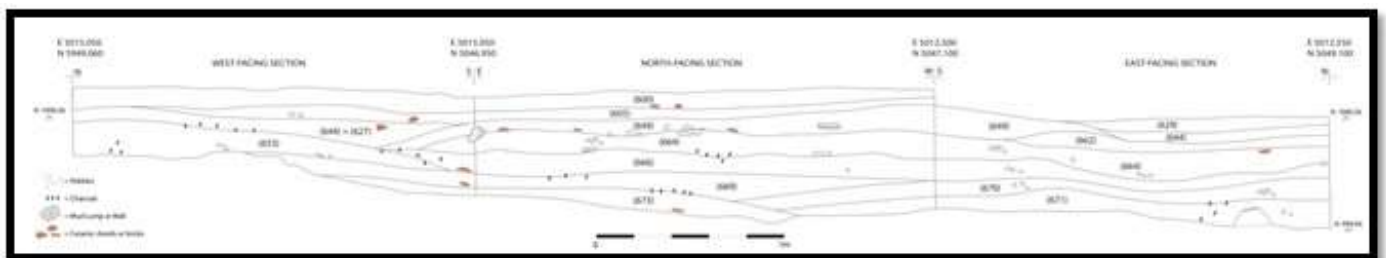


Fig. No. 07: Sections of the sounding excavated into the southeast corner of Trench XK2 (drawing A. Ceccarelli)

The excavated deposits were systematically sieved and/or hand-sorted, resulting in the recovery of 34,000+ pottery sherd fragments, weighing 653 kg, and 405 small find antiquities. The ceramic material was processed in the field, and registration and drawing was subsequently carried out at

Banaras Hindu University. Analysis of technological and compositional characteristics from selected samples is currently in process.

Animal bones and samples for flotation and phytolith analysis were systematically collected. Flotation was carried out using a recycled flotation system with a pump that prevented excessive water usage, and in general 100 litres were collected from every sampled deposit. Also, 100% of the soil collected from pits was floated, including pits ranging size from 20cm in diameter to over one meter, hence material collected ranged between 4 and 250l. A total of 72 samples, and ~7000 litres of soil was floated overall. Flotation samples were dried in a well-aired and shady area in order to prevent any shattering or degradation due to quick drying. Heavy residues were bagged and transported to BHU for storage and further analysis in order to see if there remains any wood charcoal that was not recovered by flotation process. Non-floating charcoals and seeds can be common in areas where mineral inclusion or waterlogging is high. Phytolith samples were collected from structural remains and several floor surfaces to investigate variation in the distribution of phytoliths in different features and areas. Animal bones will be analysed at BHU at a future date.

An additional sounding was excavated in January/February 2019 in order to check the extend of occupation and its preservation in a small area of the site adjacent to an access road (Fig. 8). This sounding identified occupation deposits similar to those identified in other areas of the mound.

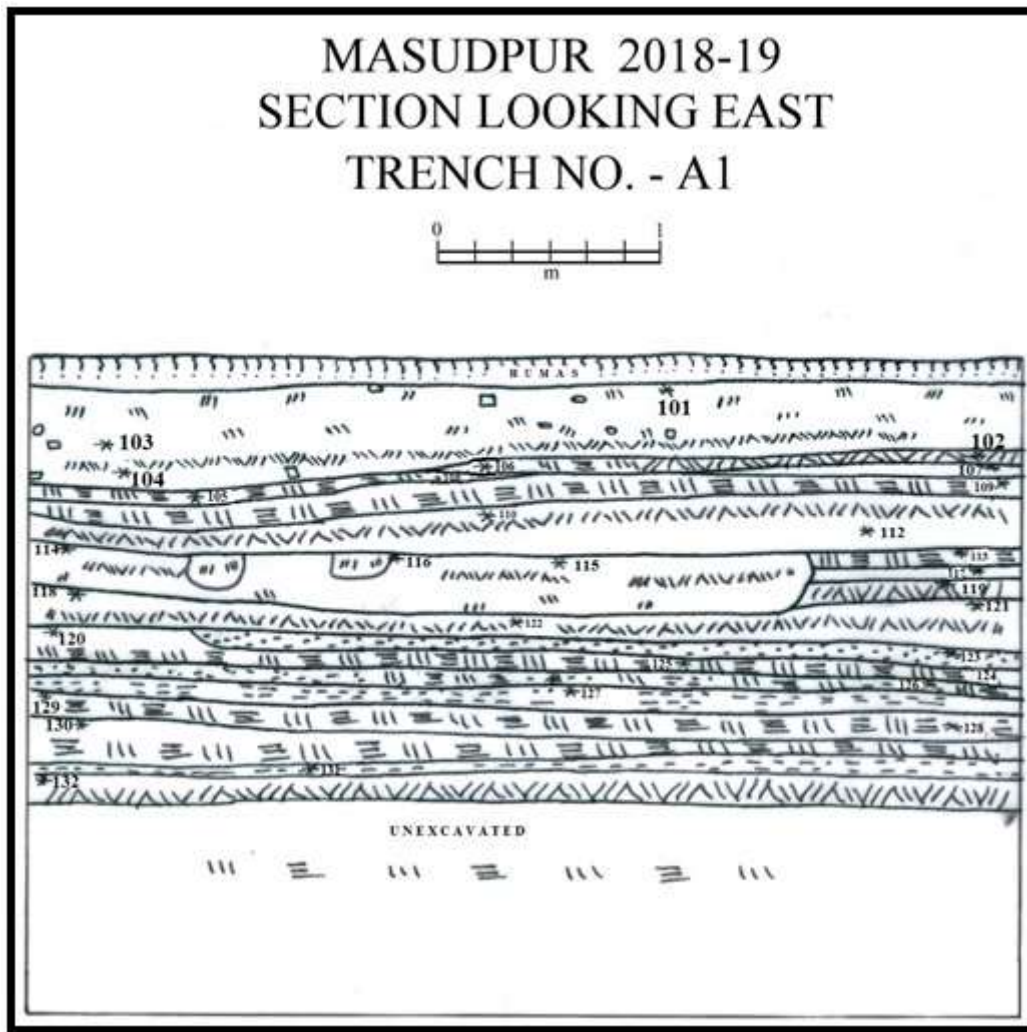


Fig. No. 08: Sections of the sounding excavated into the southeast corner of Trench XK2 (drawing A. K. Pandey)

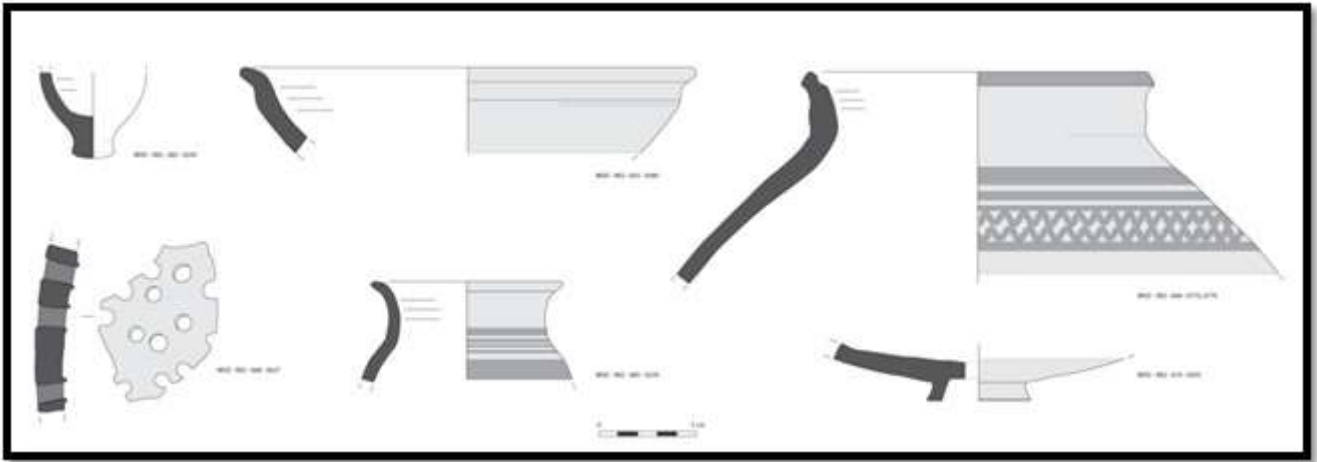
Work in the hinterland of Masudpur I: In addition to the work on-site, a coring survey was carried out around Masudpur I to identify sub-surface features. This involved the investigation of variation in the surrounding sub-surface landscape across a roughly 4km² area around the mound, which was cored with transects extending 750m-1km in each. Each core's sedimentological sequence was fully described with attention paid to the colour, composition, and humidity of units; any inclusions found within a unit; and, depth and nature of transitions between sedimentological units. The sampling strategy allowed for initial mapping of various sub-surface palaeo-environments, which was used for the identification of locations for high-resolution sampling and OSL dating. Specific areas for high-resolution sampling were identified and investigated in slot trenches excavated with a JCB. A significant number of flooded and ponded deposits, but there was no clear evidence for any sort of developed bank environments. A range of channel deposits, related to mid-Holocene and older channel beds that appear to have had varying intensity of water flow.

As with the 2017 season, more wide-ranging settlement survey was also carried out to ascertain and identify the correct locations for previously identified archaeological sites, establish whether features visible on historic maps and remote sensing imagery are actually archaeological sites, and ascertain the degree of archaeological site preservation in the greater region. This second phase of survey was carried out by assessing a database of thousands of previously reported or potential sites, and investigating locations within a regional grid of 100 square kilometer hexagons, which was projected over the project study region. The survey re-visited and re-documented previously recorded site locations in each of the sampled regional grid units, updating and confirming the location of at least 32 previously reported sites. A total of 511 locations were visited, but the previously reported archaeological sites were either not present, or the feature visible in the historic maps was not an archaeological site. However, 148 sites were visited, and up to 116 of these appear to have been previously unrecorded.

Cultural Material: A wide range of cultural material was recovered from the new excavations at Masudpur I, and although the analysis of this material is ongoing, in general it reinforces our knowledge from the initial season of excavation in 2009. As before, the most common material recovered was fragments of fired ceramic vessels, and the ceramic material has clear parallels with material from the previous excavations at Masudpur I (Mature and Late Harappan; Figs 8-9), and also Masudpur VII and Farmana.



Fig. No. 09: A



B

Fig. No. 09 (A & B): 'Local' style Mature Harappan pottery from Masudpur I (photograph A. Ceccarelli)

The small-find artefacts from the excavations included a range of material types, including large numbers of ceramic and faience bangle fragments (including segmented and painted examples), fragments of several different types of ceramic figurines and toy carts, beads of various types, including examples made from steatite and agate, as well as what appear to be fragments of vitrified slag and crucible fragments. The latter in particular suggest that metal working was being carried out at the site, which is a new finding.

Discussion: The new season of excavations at Masudpur I focused on recovering well stratified cultural material, carbonized organic remains for new radiocarbon assay, samples for phytolith and soil micromorphological analysis, and samples for flotation to collect macro-botanical remains. A multi strand analysis of this material is currently underway, and this will allow for a refined interpretation of site date range, use and function than is currently available. It will also be possible to carry out a focused spatial analysis of activities across several areas of the site, to identify different types of behaviour.

The survey of the sub-surface landscape around the site has revealed important new insights into landscape formation and change, and the expanded survey of sites in the area to the north and west of the site has produced important new insights into the nature of environmental and landscape variability in this part of Haryana.

Notes:

^A This collaborative project is funded by the European Research Council (ERC) and the UK India Education and Research Initiative (UKIERI) – Department of Science and Technology (DST) joint funding programme. The fieldwork undertaken by this project is possible thanks to the help and assistance of a large number of individuals, and the directors of the project would like to thank Dr Rakesh Tewari and Director General, Archaeological Survey of India, Government of India for granting us permission to carry out this field research. We have been given abundant support by the head of Department of AIHC and Archaeology, BHU.

References:

1. Indian Archaeology: A Review 1980-81. p. 16.
2. Joshi, J.P., Bala, M. and Ram, J. 1984. The Indus Civilisation: a reconsideration on the basis of distribution maps, in *Frontiers of the Indus Civilisation: Sir Mortimer Wheeler Commemoration Volume*, B.B. Lal and S.P. Gupta (eds), Books & Books, Delhi: 511-530; Possehl, G.L. 1999. *The Indus Age: The Beginnings*, University of Pennsylvania, Philadelphia.
3. Singh, R.N., Petrie, C.A., et al. 2008. Settlements in Context: Reconnaissance in western Uttar Pradesh and Haryana, April and May 2008, *Man and Environment* 33.2: pp. 71-87.
4. Singh, R.N., Petrie, C.A., Singh, A.K. and Singh, M. 2009. Excavations at Masudpur (Hissar District, Haryana) – 2009: a preliminary report, *Bhāratī* 33: 35-49; Singh, R.N., Petrie, C.A., et al. 2015a. Exploration and excavation around Masudpur, District Hissar, BHU and University of Cambridge Archaeological Project, *Indian Archaeology: A Review 2008-2009*: 55-57; Singh, R.N., Petrie, C.A., et al. 2015b. Excavations at Masudpur I (Sampolia Khera), District Hissar, BHU and University of Cambridge Archaeological Project, *Indian Archaeology: A Review 2008-2009*: 57-61; Singh, R.N., Petrie, C.A., et al. 2015c. Excavations at Masudpur VII (Bhimwada Jodha), District Hissar, BHU and University of Cambridge Archaeological Project, *Indian Archaeology: A Review 2008-2009*: 61-71; Petrie, C.A., Singh, R.N. and Singh, A.K. 2009. Investigating changing settlement dynamics on the plains: the 2009 survey and excavations at Masudpur (Hissar District, Haryana), *Puratattva* 39: 38-49; Petrie, C.A., Bates, J., Higham, T. and Singh, R.N. 2016. Feeding ancient cities in South Asia: dating the adoption of rice, millet and tropical pulses in the Indus Civilisation, *Antiquity* 90.354: 1489-1504 [doi: <https://doi.org/10.15184/aqy.2016.210>]; Joglekar, P.P., Singh, R.N. and Petrie, C.A. 2017. Faunal Remains from Sampolia Khera (Masudpur I), Haryana, *Indian Journal of Archaeology* 2.1: 25-60 [http://www.ijarch.org/Abstract.aspx?articleno=83].
5. Singh, R.N., Petrie, C.A., Pawar, V., Pandey, A.K., Neogi, S., Singh, M., Singh, A.K. Parikh, D. and Lancelotti, C. 2010. Changing patterns of settlement in the rise and fall of Harappan urbanism: preliminary report on the Rakhigarhi Hinterland Survey 2009, *Man and Environment* 35.1: pp. 37-53.
6. Singh, R.N. Petrie, C.A., et al. *Opcit.* 2008. pp. 71-87.
7. *Ibid.* p. 81.
8. I.A.R. *Opcit.* 1980-81. p. 16.
9. Possehl, G.L. 1999. *The Indus Age: The Beginnings*, University of Pennsylvania, Philadelphia; Kumar, M. 2009. Harappan Settlements in the Ghaggar-Yamuna Divide, *Linguistics, Archaeology and the Human Past* 7: pp. 1-75.
10. Singh, R.N. Petrie, C.A., et al. 2008. Settlements in Context: Reconnaissance in western Uttar Pradesh and Haryana, April and May 2008, *Man and Environment* 33.2: pp. 71-87.
11. Singh, R.N., Petrie, C.A., Singh, A.K. and Singh, M. 2009. Excavations at Masudpur (Hissar District, Haryana) – 2009: a preliminary report, *Bhāratī* 33: pp. 35-49.
12. Singh, R.N., Petrie, C.A., Singh, A.K. and Singh, M. 2009. Excavations at Masudpur (Hissar District, Haryana) – 2009: a preliminary report, *Bhāratī* 33: pp. 35-49; Petrie, C.A., Singh, R.N. and Singh, A.K. 2009. Investigating changing settlement dynamics on the plains: the 2009 survey and excavations at Masudpur (Hissar District, Haryana), *Puratattva* 39: 38-49.
13. Singh, R.N. Petrie, C.A., et al. *Opcit.* 2008. pp. 71-87; Singh, R.N., Petrie, C.A., Singh, A.K. and Singh, M. 2009. Excavations at Masudpur (Hissar District, Haryana) – 2009: a preliminary report, *Bhāratī* 33: pp. 35-49; Singh, R.N.,

- Petrie, C.A., Pawar, V., Pandey, A.K., Neogi, S., Singh, M., Singh, A.K. Parikh, D. and Lancelotti, C. 2010. Changing patterns of settlement in the rise and fall of Harappan urbanism: preliminary report on the Rakhigarhi Hinterland Survey 2009, *Man and Environment* 35.1: pp. 37-53; Singh, R.N., Petrie, C.A., Pawar, V., Pandey, A.K. and Parikh, D. 2011. New insights into settlement along the Ghaggar and its hinterland: a preliminary report on the Ghaggar Hinterland Survey 2010, *Man and Environment* 36.2: 89-106.
14. Singh, R.N., Petrie, C.A., Singh, A.K. and Singh, M. *Opcit.* 2009. pp. 35-49; Petrie, C.A., Singh, R.N. and Singh, A.K. *Opcit.* 2009. pp. 38-49.
 15. *Ibid.*
 16. *Ibid.*
 17. *Ibid.*
 18. *Ibid.*
 19. *Ibid.*
 20. *Ibid.*
 21. *Ibid.*
 22. Neogi, S. 2013. *Geoarchaeological investigations of Indus settlements in the plains of northwest India*. Unpublished PhD dissertation, University of Cambridge; Neogi, Sayantani, Charles A.I. French, Julie Durcan, Ravindra Nath Singh, and Cameron A. Petrie, 2020, Geoarchaeological insights into the location of Indus settlements on the plains of northwest India, December 2019, *Quaternary Research* , DOI: [10.1017/qua.2019.70](https://doi.org/10.1017/qua.2019.70).
 23. Parikh, D. and Petrie, C.A. 2016. Urban-rural dynamics and Indus ceramic production in northwest India: a preliminary analysis of the pottery from Masudpur I and Masudpur VII, in Lefèvre, V., Didier, A. and Mutin, B. (ed.), *South Asian Archaeology 2012: Man and Environment in Prehistoric and Protohistoric South Asia: New Perspectives*, Indicopeustoi, Brepols, Turnhout: pp. 221-241.
 24. Petrie, C.A., Bates, J., Higham, T. and Singh, R.N. *Opcit.* 2016. pp. 1489-1504.
 25. Joglekar, P.P., Singh, R.N. and Petrie, C.A. 2017. Faunal Remains from Sampolia Khera (Masudpur I), Haryana, *Indian Journal of Archaeology* 2.1: 25-60 [<http://www.ijarch.org/Abstract.aspx?articleno=83>].
 26. Bates, J. 2016. *Social organisation and change in Bronze Age South Asia: a multi-proxy approach to urbanisation, deurbanisation and village life through phytolith and macrobotanical analysis*. Unpublished PhD dissertation, University of Cambridge; Bates, J., Petrie, C.A., and Singh, R.N. 2017a. Approaching rice domestication in South Asia: new evidence from Indus settlements in northern India, *Journal of Archaeological Science* 78: 193-201 [doi: <http://dx.doi.org/10.1016/j.jas.2016.04.018>]; Bates, J., Petrie, C.A. and Singh, R.N. 2017b. Cereals, calories and change: exploring approaches to quantification in Indus archaeobotany, *Archaeological and Anthropological Sciences* [online first doi: <https://doi.org/10.1007/s12520-017-0489-2>]; Bates, J., Singh, R.N. and Petrie, C.A. 2017c. Exploring Indus crop processing: combining phytoliths and macrobotanical analysis to consider the organisation of agriculture in northwest India c.3200-1500BC, *Vegetation History and Archaeobotany* (special issue) 26:25–41 [published online 21 May 2016; doi: <http://dx.doi.org/10.1007/s00334-016-0576-9>]; Petrie, C.A. and Bates, J. 2017. 'Multi-cropping', intercropping and adaptation to variable environments in the Indus Civilisation, *Journal of World Prehistory* 30: 81-130 [doi: <https://doi.org/10.1007/s10963-017-9101-z>].
 27. Jones, P.J. 2017. *Climate change, water stress and agriculture in the Indus Civilisation, 3000-1500 BC*. Unpublished PhD dissertation, University of Cambridge.
 28. Neogi, S. 2013. *Geoarchaeological investigations of Indus settlements in the plains of northwest India*. Unpublished PhD dissertation, University of Cambridge; Neogi, Sayantani, Charles A.I. French, Julie Durcan, Ravindra Nath Singh, and Cameron A. Petrie, 2020, Geoarchaeological insights into the location of Indus settlements on the plains of northwest India, December 2019, *Quaternary Research* , DOI: [10.1017/qua.2019.70](https://doi.org/10.1017/qua.2019.70).
 29. Singh, R.N., Petrie, C.A., Singh, A.K. and Singh, M. *Opcit.* 2009. pp. 35-49; Petrie, C.A., Singh, R.N. and Singh, A.K. *Opcit.* 2009. pp. 38-49.

30. Suraj Bhan. 1975. *Excavation at Mitathal (1968) and Other Explorations in the Sutlej-Yamuna Divide*, Kurukshetra University Press, Kurukshetra.
31. Uesugi, A. 2011. Pottery from the settlement area. In V. Shinde, T. Osada, and M. Kumar, eds. *Excavations at Farmana: District Rohtak, Haryana, India 2006–2008*. Indus Project. Kyoto: Research Institute for Humanity and Nature: 168–328; Parikh, D. and Petrie, C.A. 2019. 'We are inheritors of a rural civilisation': rural complexity and the ceramic economy in the Indus Civilisation in northwest India, *Journal of World Archaeology*, Volume 51, 2019 - Issue 2: Rural Archaeologies, 252-272, <https://doi.org/10.1080/00438243.2019.1601463>.
32. Petrie, C.A., Bates, J., Higham, T. and Singh, R.N. 2016. Feeding ancient cities in South Asia: dating the adoption of rice, millet and tropical pulses in the Indus Civilisation, *Antiquity* 90.354: 1489-1504 [doi: <https://doi.org/10.15184/aqy.2016.210>].
33. Dixit, Y., Hodell, D.A. and Petrie, C.A. 2014. Abrupt weakening of the summer monsoon in northwest India ~4100 year ago, *Geology* 42: 339-342 [doi 10.1130/G35236.1].