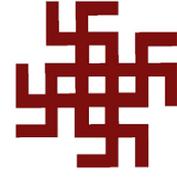




भारतीय प्रौद्योगिकी
संस्थान गांधीनगर
IIT GANDHINAGAR



सत्यमेव जयते
संस्कृति मंत्रालय
MINISTRY OF
CULTURE



इंदिरा गांधी राष्ट्रीय कला केंद्र
INDIRA GANDHI NATIONAL
CENTRE FOR THE ARTS

Emerging Perspectives of the Harappan Civilization

BOOK OF ABSTRACTS

An International Colloquium on the
**Genesis, Material Culture, Climatic
Scenario and Theoretical Perspectives**
on the Harappan Civilization.

February 10-12, 2023

ARCHAEOLOGICAL SCIENCES CENTRE
IIT GANDHINAGAR



ASC: Archaeological Sciences Centre
AB: Academic Block

Table of Contents

SESSION ONE:

THE GENESIS OF THE HARAPPAN / INDUS / INDUS-SARASVATI CIVILIZATION, TERMINOLOGIES 10

SESSION TWO:

THE GENESIS OF THE HARAPPAN / INDUS / INDUS-SARASVATI CIVILIZATION, TERMINOLOGIES 14

SESSION THREE:

BIOARCHAEOLOGICAL PERSPECTIVES (FLORAL, FAUNAL, AND OTHER RELATED STUDIES) 17

SESSION FOUR:

TRADE CONTACTS WITH OTHER REGIONS 24

SESSION FIVE:

CLIMATE AND ENVIRONMENT 29

SESSION SIX:

TECHNOLOGY DURING THE HARAPPAN CIVILIZATION 34

SESSION SEVEN:

TECHNOLOGY DURING THE HARAPPAN CIVILIZATION 38

SESSION EIGHT:

GENETIC STUDIES OF ANCIENT SOUTH ASIAN POPULATIONS 43

SESSION NINE:

THE INDUS SCRIPT: INPUTS FROM ARCHAEOLOGY AND STATISTICAL STUDIES 45

SESSION TEN:

HARAPPAN CIVILIZATION VS. VEDIC CULTURE: POSSIBLE POINTS OF CONTACT / TRANSMISSION 51

EMERGING PERSPECTIVES OF THE HARAPPAN CIVILIZATION CONFERENCE

An International Colloquium on the Genesis, Material Culture, Climatic Scenario and Theoretical Perspectives on the Harappan Civilization

Concept Note

The Harappan Civilization (also known as the Indus Civilization, Indus Valley Civilization, Indus-Sarasvati Civilization) is a Bronze Age complex state-level society which flourished from c. 2600-1900 BCE in the Greater Indus Region (Indus and its tributaries, Sarasvati-Drishadvati, Gujarat and Balochistan). It was contemporary with other state-level societies like the Mesopotamian and Egyptian civilizations. The Harappans also co-existed with different regional Chalcolithic cultures like Ahar-Banas, Ganeshwar-Jodhpura (in its immediate vicinity towards the east), Sorath Harappan (in Saurashtra, Gujarat) and Kulli complex (Balochistan).

Ever since its discovery and announcement in 1924 by the Archaeological Survey of India (ASI), field investigations by research institutions in India and Pakistan have led to the discovery of over 1500 sites of this civilization. The excavations at Mehrgarh (Balochistan) have helped to understand the antecedent phases of this civilization, with well-defined cultural developments right from the Early Food Producing Era (Neolithic) through Regionalization Era (Regional Chalcolithic and Early Harappan cultures), Integration Era (Urban phase of Harappan civilization) and Localization Era (Late and Post-Urban Harappan cultures). We are now in a position to identify various technological stages and their evolution in the context of the urbanization process of the Harappan civilization. Investigations at significant sites like Mehrgarh, Sohr-Damb (Nal), Shahi Tump, Miri Qalat, Harappa (all in Pakistan) and Dholavira, Rakhigarhi, Kalibangan, Farmana, Lothal, Sanauli (all in India) have indeed helped redefine this earliest urbanization of India.

The domestication of plants and animals in the emergence of earliest settled human life, particularly in the piedmont zones, is now well understood. Similarly, the various technologies, such as pyrotechnology, led to the production of white steatite (the form of steatite preferred by the Harappans later), ceramics, copper, and lithics, which have been well documented. Recent studies on various aspects of this civilization, like technology, raw material acquisition & redistribution, climatic studies, DNA profiling, stable isotope studies, and palaeo-diet, have thrown ample light on the overall setup. The Greater Indus plains are devoid of raw material resources, only enriched with fertile alluvium, which took care of agricultural produce. The surrounding hilly areas possessed numerous sources of raw materials like quartzite and sandstone (for grinding stones), agate-carnelian and various siliceous rocks (for jewelery, weights, figurines), metals like copper, silver, lead and gold, and shell resources. The Harappans exploited the raw material resources through well-managed mechanisms facilitated by the integration of regional Chalcolithic cultures.

The climatic profiles from palaeo-lakes, cave stalagmites and deep-sea cores indicate a change in the climatic regime towards the end of the second millennium BCE, which might have accelerated the deurbanization. Investigations of other contemporary cultures in countries like Oman, Bahrain, Iran, Turkmenistan and Afghanistan have also helped understand the nature of interaction zones and

long-distance trade networks, in which the Harappans were extensively participating. As per cuneiform records of the Mesopotamians from around 2500 BCE, the Harappan trade exports to those regions, which included exotic finished products of agate-carnelian, shell, timber, gold and pearl, extended over at least 600 years.

Even though field investigations for well over a century have contributed enormously to a better understanding of the civilization, several facets require further research with coordination between research institutions and government organizations. These include the nature of the state and political organization, the climatic profile of each region, the authors of the Harappan civilization, the factors that contributed to its decline, its technological and cultural legacy, its possible connections to Vedic and other cultures of India, and the decipherment of the Harappan / Indus script, to name a few. For this, it is necessary to hold coordinated deliberations on the results obtained so far, on further prospects of intensive field research, followed by science-based analytical research.

The proposed international conference thus aims at (i) bringing together the scholarly community engaged in those themes, (ii) deliberating on the various facets and unresolved issues of this civilization, (iii) arriving at a consensus on terminologies used in this context, (iv) fostering future collaborations in fieldwork and research, (v) proposing a national centre for Harappan studies, (vi) bringing together various state governments and research institutions to evolve a mechanism for the protection, preservation of this rich cultural heritage with the help of Government of India.



ABSTRACTS OF INVITED TALKS

KEYNOTE ADDRESS

ROOTS OF THE HARAPPAN CIVILIZATION

SPEAKER: RS BISHT

EMAIL: rsbishtarch@gmail.com

The earliest urbanization of South Asia, variously known as Harappan / Indus / Indus Valley / Sindhu-Sarasvati civilization, is due to the culmination of long-drawn processes of cultural evolution, which started roughly around the eighth millennium BCE. The roots of the Harappan culture can be traced back to the incipient agro-pastoral communities of Mehrgarh and its adjoining region. The evidence indicates a gradual evolution from a hunter-gatherer economy to a food-producing economy with substantial support from pastoralism. Several technologies emerged during the course of this cultural evolution, which lasted for nearly 5000 years before the advent of urbanism. The mastery of pyrotechnology at Mehrgarh enabled the production of sophisticated ceramics and copper metallurgy, modifying the chemistry of certain materials like steatite. Several of these technologies catered to the needs of a growing elite, who might have contributed to the pooling of resources from distant sources, procuring, and redistributing them to the needs of the society.

Some technologies persisted and continued into the Harappan period, albeit with certain modifications. The continuities could be seen in the modification of steatite through heating, which became the hallmark Harappan craft activity and administrative tool. The steatite heating increased its hardness; thus, the seals could withstand several rounds of authorization. Similarly, the bead drilling technology that originated at Mehrgarh developed unprecedentedly during the Harappan period, another hallmark item in international trade with Mesopotamia. Several millennia of experience and handling such technologies provided the much-needed expertise of the Harappans.

This paper will illustrate the roots of the Harappans through several archaeological discoveries of the recent past and also review the research of several national and international scholars.



SPEAKER'S PROFILE

RS Bisht was born on 2nd January, 1944 to Lt. LS Singh in Uttar Pradesh, India. He passed the degrees of *Visharad* and *Sahityaratna* in 1958 and 1960 respectively, before getting his Master's degree in Ancient Indian History and Culture from Lucknow University in 1965. He passed the Diploma in Archaeology from the School of Archaeology, run by the Archaeological Survey of India in 1967, and in 2002 was awarded Ph.D. degree for his thesis on "Emerging Perspectives of the Harappan Civilizations in the Light of Recent Excavations at Banawali and Dholavira from Kumaon University".

His career started by joining the Department of Archaeology, Government of Punjab as the Senior Technical Assistant in 1968. Later, he joined the Government of Haryana as an Assistant Archaeological Officer (1972-1974) and later rose to the position of Deputy Director (1974-1977). He presented a Vision Plan for the Department of Archaeology, which led to the creation of several Technical posts in Archaeology and Conservation. He joined ASI as Superintending Archaeologist in 1977 and served at Patna and Srinagar Circles, before joining Excavation Branch, Vadodara in 1984.

Having a strong inclination towards field archaeology and excavation, he excavated Sanghol,

Banawali, Sarai Mound, Nalanda, Chechar, and Semthan, before embarking on the most significant excavation of his career at Dholavira (1989-2005). He started the surface investigations at Dholavira from 1985 onwards, and made a presentation in 1987 in Paris, before starting the excavations. The surface observations were so minute and detailed, that the later excavations proved most of his interpretations. The remarkable discoveries he made at Dholavira enabled the ASI to nominate it successfully to the World Heritage List.

An erudite scholar with a deep understanding of ancient literature, he has contributed over 50 Research Articles, popular articles, and book chapters. He was conferred with the Padma Shri award by the Hon'ble President of India in 2013 for his enormous contributions to the field of archaeology.

SESSION ONE: **THE GENESIS OF THE HARAPPAN / INDUS / INDUS-SARASVATI CIVILIZATION, TERMINOLOGIES**

SOHR DAMB / NAL: PERSPECTIVES ON CULTURAL DEVELOPMENT AND CHANGE IN THE CENTRAL INDO-IRANIAN BORDERLAND FROM THE 4TH THROUGH THE MID-3RD MILL. BCE

SPEAKER: UTE FRANKE

EMAIL: ute_franke@yahoo.de

Pioneering archaeological research in the early 20th century revealed that Pakistani Baluchistan is not a periphery, but a key region for assessing cultural development and trans-regional interaction in the Indo-Iranian Borderlands and beyond. Yet, accessibility became restricted in the 1950s, and again in 2007, and large parts of this vast terrain remain unexplored. Nevertheless, decades of research by French Archaeological Missions in the Kacchi Plain, with Mehrgarh, Nausharo and other sites, and in the western regions of Makran pushed back human settlement to the Neolithic era and provided crucial information in its further development until the late 3rd mill. BCE. This work was supplemented by the Joint German-Pakistan Mission to Kalat, who revived fieldwork in Central Baluchistan in 1996, providing a link between these distant regions. This work produced substantial information on settlement expansion, environment, human economy, and patterns of life and death. A vast body of material culture provides insights into technological know-how, stylistic preferences and choices, and facilitates new approaches to interaction, continuity, and change within this patterned cultural landscape. The presentation summarizes the results of the German-Pakistani excavations at Sohr Damb / Nal in the frame of the wider regional context.



SPEAKER'S PROFILE

Ute Franke-Vogt is a Professor at Freie Universität Berlin. She studied Near Eastern Archaeology, Iranian Studies, and Cultural Anthropology in Goettingen, Munich, and Berlin, Germany. Her Ph.D. thesis was devoted to the inscribed objects from Mohenjo-daro. She actively worked with the German Research team in Mohenjo-daro due to her interest in the trade relation between Mesopotamia and the Indus. She visited the Gulf countries widely and worked on the prehistoric and Islamic sites in the United Arab Emirates.

RECENT DISCOVERY OF SHELL MIDDENS OF THE SEVENTH MILLENNIUM BP FROM KHADIR ISLAND AND ITS IMPLICATIONS

SPEAKER: VN PRABHAKAR

CO-AUTHORS: SHIKHA RAI, VIKRANT JAIN, AND JS RAY

EMAIL: vnprabhu@iitgn.ac.in

The human occupation from early Harappan times onwards on Khadir Island, Great Rann of Kachchh, is well-known from the excavations at Dholavira. The possible presence of other early Harappan settlements on this island is also recently indicated by researchers. The entire cultural dynamics of the Harappans and the related trade activities are well-attested by Dholavira. The well-planned settlements at a vantage location on the island would not have been possible without the proper understanding of the topography and surface run-off during the monsoon season. However, the sudden appearance of an early Harappan settlement between the streams of Mansar and Manhar poses pertinent questions about human occupation during prehistoric times. The possibility of prehistoric sites on Khadir Island is strengthened by the discoveries in the similar geographical location of Las Bela region of Pakistan, wherein hunter-gatherer presence has been attested from over 29 locations.

The chance findings from a channel cutting on a hillock near Bambhanka exposed a compact shell-midden horizon of roughly 30-40 cm thickness. Most of the shell remains are broken at the central part to extract the maximum meat from it. The evidence also corroborates similar findings from the Las Bela region of Pakistan, which are placed between the seventh and fifth millennium BP. The possibility of hunter-gatherer communities depending upon the shell remains participating in long-distance trade with inland sites like Mehrgarh cannot be ruled out. Following the discovery of shell-midden sites at Bambhanka, similar evidences were also found at three more locations on the Khadir island. This paper discusses in detail the discovery of shell-midden sites on Khadir Island.



SPEAKER'S PROFILE

VN Prabhakar is an Associate Professor (Archaeology) at the Indian Institute of Technology, Gandhinagar, since September 2020. He was formerly the Director (Exploration and Excavation and Institute of Archaeology) at the Archaeological Survey of India between August 2018 and September 2020. He coordinated the exploration and excavation activities throughout the country and headed the Institute of Archaeology, an academic wing of the ASI imparting education in Archaeology, Heritage Management, and Museology. He has also conducted excavations at Rupnagar (Punjab) and Karanpura (Rajasthan), both of Harappa culture, between 2011 and 2014. From 2009 to 2011, he was responsible

for the exploration and excavation, conservation, and preservation of 166 nationally essential heritage structures, including the World Heritage Properties of Ajanta and Ellora Caves. He obtained his Ph.D. (2013) from the Kurukshetra University, India, on the "Burial Practices of the Harappans with Special Reference to Sanauli Excavation". He has published around 40 research articles in journals, edited books, and conference proceedings.

Shikha Rai is from Centre for Indic Studies, Indus University.

Vikrant Jain is Professor in the Discipline of Earth Science at IIT Gandhinagar.

JS Ray is the Director at National Centre for Earth Science Studies, Earth System Science Organization, Ministry of Earth Sciences, Government of India.

NEW INSIGHTS FROM THE PRE-URBAN HARAPPAN CEMETERY AT JUNA KHATIYA

SPEAKER: RAJESH SV

CO-AUTHORS: ABHAYAN GS, FRANCESCO C CONESA, JUAN JOSE GARCIA-GRANERO, SUBHASH BHANDAR, AND ANIL CHAVAN

EMAIL: rajeshkeralian1981@gmail.com

Our understanding of the Pre-Urban Harappan burials in Gujarat was minimal till the recent excavations at Juna Khatiya and Dhaneti in Kachchh. The site of Juna Khatiya discovered in 2016 by archaeologists from the University of Kerala, located in Lakhpatt taluka of Kachchh district, measures approximately 300 x 300m, and it probably accommodates more than 500 pre-Urban Harappan burials. The excavation in three seasons at the site revealed around 125 burials. Most burials were found in stone-made burial structures of various sizes and shapes. The preservation conditions of the bones were bad due to the acidic nature of the soil. Animal remains were also unearthed from a few burials. Although the human and animal skeletons are fragmentary, the burial structures yielded various burial goods such as pottery, stone tools, lithic debitage, stone beads, terracotta beads, shell beads, and shell bangles. The vessels are generally placed near the legs and showed similarities to the ceramics from Kot Diji, Amri, and Nal in Pakistan, Nagwada, Santhli, Moti Pipli, Vaharvo Timbo, Dhaneti, and Surkotada in Gujarat. The burials also yielded exciting insights regarding the burial architecture, orientation of skeletons, position of burial goods, and modes of burials. Some interesting evidence regarding the shell bangle and pottery production was also noticed at the site. Finding the habitation site(s) associated with these burials is a significant challenge. This paper presents the preliminary results of the recent excavations at Juna Khatiya and explorations in nearby areas.

SPEAKER'S PROFILE



Rajesh SV is an Assistant Professor in the Department of Archaeology, University of Kerala. He received his doctoral degree from the Maharaja Sayajirao University of Baroda, Gujarat on the topic of "A Comprehensive Study of the Regional Chalcolithic Cultures of Gujarat". His fields of research interests include Indus Civilization, field archaeology, artefact analysis, ancient technology, thanatology, origin, and development of urbanism in South Asia, and Megalithic/Iron Age archaeology. He is serving as the co-editor of the journal "Heritage: Journal of Multidisciplinary Studies in Archaeology". He has published more than 85 research articles in journals, edited books, and co-edited four books. He has

participated in several excavations and explorations in India and abroad. He is currently directing a multidisciplinary archaeological research project entitled "Archaeological Excavations at Juna Khatiya and Explorations in Gujarat".

Abhayan GS is working in the Department of Archaeology, University of Kerala, Kariavattom Campus, Thiruvananthapuram, Kerala.

Francesc C Conesa is from the Landscape Archaeology Research Group, Catalan Institute of Classical Archaeology, Plaça d'en Rovellat, Tarragona, Spain.

Juan Jose Garcia-Granero is from Archaeology and Human Ecology Research Group, Milà i Fontanals Institution, Spanish National Research Council, C / Egipcíacues, Spain.

Subhash Bhandar is working in the Department of Earth and Environmental Science, K.S.K.V. Kachchh, Bhuj, Gujarat, India.

Anil Chavan is from the Planetary Science Division, Physical Research Laboratory, Ahmedabad, Gujarat, India.

EXTENSIVENESS, DIVERSITY, AND INTEGRATION OF THE INDUS URBAN SOCIETY

SPEAKER: AKINORI UESUGI

EMAIL: southasia.ua@gmail.com

The Indus Civilization is known for its extensiveness of the area of approximately 1800 km from north to south and 1800 km from east to west. This vast area of the civilization was apparently sustained by the large-scale network of urban centers connecting different parts of the northwestern part of South Asia. While the extensiveness and cultural homogeneity were stressed by scholars, recent research has been revealing the diversity of physical settings, subsistence economy, and material culture. Based on this recent recognition of the diversity in various traits of the civilization, it is needed to ask a question about how such a vast area with physical and cultural diversity was incorporated into one urban system during the Urban period (c. 2600–1900 BCE). This question leads to a better understanding of the dynamism of the urban society.

This paper explores the cultural diversity and homogeneity of the Indus Civilization to set questions about how we can better understand the nature and the dynamism of this early civilization in South Asia, focusing on the production and distribution of different types of crafts, which exhibit stylistic diversity and coherence.



SPEAKER'S PROFILE

Akinori Uesugi is an Associate Professor at the Institute for the Study of Ancient Civilizations and Cultural Resources, Kanazawa. He received his Ph.D. from Kansai University in Osaka, Japan, in 2003. His area of interest nestles around the archaeology of South Asia, the Middle- East and Japan. He has excavated at Sravasti (Maheth) in Uttar Pradesh, the Jomon site in Japan, and the Buddhist cave temples in Maharashtra. He has published his research in numerous reputed peer-reviewed journals.

SESSION TWO: THE GENESIS OF THE HARAPPAN / INDUS / INDUS- SARASVATI CIVILIZATION, TERMINOLOGIES

TWO GRAND CHALLENGES FOR INDUS ARCHAEOLOGY

SPEAKER: ADAM S GREEN

EMAIL: ag952@cam.ac.uk

Over the last century, archaeologists have revealed evidence that provides critical insights into the urbanization and de-urbanization of the Indus civilization, home to some of the world's first cities. In this paper, I argue that as archaeologists have amassed substantial evidence from ancient South Asian landscapes, we now face two grand challenges. The first challenge is the pressing need to incorporate evidence from the Indus into comparative archaeologies of ecological change and urbanization. Even though the Indus was among the most sophisticated and prosperous Bronze Age societies known to archaeology, evidence from South Asia is too often omitted from global debates about early urbanism. This exclusion may be related to the fact that the Indus civilization was conspicuously egalitarian, defying the expectations of traditional neo-evolutionary archaeological theory. It is essential that Indus archaeology fills this lacuna, because despite (or perhaps thanks to) the absence of stratification in the Indus, its landscapes supported a prosperous and long-lived Bronze Age economy that yielded unprecedented technological discovery, innovation, exchange, engineering and governance. The second (and perhaps more challenging) challenge is to incorporate insights from South Asia's deep history into contemporary programmes designed to make present-day social-ecologies more sustainable and resilient. Recent landscape studies carried out by multiple teams throughout the Indus civilization's diverse regions have revealed that the prevailing characteristics of the Indus economy was its flexible and adaptive social-ecology that allowed diverse communities to flourish in contrasting environments. Insights from these past social-ecologies can inform agricultural and development strategies today. There is potential to develop insights from Indus archaeology into experiments with cropping regimes, land use, water management, and balanced forms of economic interaction. Indus archaeologists are ideally situated to shape these conversations, and help create contemporary social-ecologies that are fairer and more sustainable. As such, in addition to engaging comparative international archaeology, the next challenge for the Indus civilization is to help reshape critical social-ecological debates about the present.



SPEAKER'S PROFILE

Adam S Green is a Lecturer in Sustainability in the Department of Archaeology and the Department of Environment and Geography at the University of York (UK). He holds a Ph.D. in anthropology from New York University (USA). His research highlights the surprising prevalence of egalitarianism in the archaeological record, and his interest in inequality in the past is tied to a strong desire to reduce inequalities in the present. That is why he works closely with farmers, economists, agronomists, and other stakeholder communities to identify ways archaeological data and insights can help make the world fairer and more sustainable.

Adam began working in India in 2009 as a Fulbright scholar affiliated with the National Museum of India in Delhi and a research scholar affiliated with the Deccan College Post-graduate Institute for Archaeology in Pune, contributing to archaeological fieldwork at Farmana, Karsola, and Rakhigarhi.

Prior to joining the University of York, he was a Postdoctoral Researcher at the University of Cambridge, where he conducted collaborative landscape archaeology in northwest India as part of the European Research Council-funded *TwoRains* project. In 2018, he joined the Global Challenges Research Funded TIGR2ESS Project, an interdisciplinary research project that worked across institutions in the United Kingdom and India to help improve the sustainability of Indian agriculture.

PERCEIVING THE INDUS CIVILIZATION CERAMIC TRADITIONS DIFFERENTLY

SPEAKER: K KRISHNAN

EMAIL: krishnan.msu@gmail.com

The complexities of the Indus Civilization is due to a combined effect of many cultural components, especially a combination of its regional traditions with the overall Indus tradition. The visibility of these traditions within the tangible components of the Indus tradition is fairly well understood. Whilst making an attempt to compare the similarities and differences between the artefact types, especially ceramics, this paper tries to see how its microstructural variations can be defined and differentiated to appreciate variations. Ceramics is chosen as an example as it is the most abundant artefact type with easily visible differential parameters. The methods adopted for study include morphological analysis followed by thin-section studies.



SPEAKER'S PROFILE

K Krishnan's doctoral research presented the chemical and petrological examination of the Harappan Ceramics from three regions in Gujarat. This study demonstrated the wider applications of several scientific methods in examining the ceramics and also its cultural implications. After completion of his doctoral research, he continued his research on proto-historic and Early Historic ceramics by incorporating several methods such as traditional archaeological, ethnographic, and scientific. These studies have enabled to work towards understanding craft specialization, development of technology, and its impact on ancient South Asian

Society. These studies have inspired several students from South Asia to conduct research on South Asian Ceramics. In addition to this, his work towards appreciating and reconstructing palaeo-climate in central and western India. He has completed several research projects dealing with ancient technology and palaeo-climatology, and currently he is a part of four projects (two in Nepal and two in Sri Lanka). He also coordinated a project which established a museum at Siddhpur, a center of pilgrimage for the Department of Tourism, Government of Gujarat.

THE AHARIANS IN THE HINTERLAND

SPEAKER: JS KHARAKWAL

EMAIL: jskharakwal66@gmail.com

The Ahar culture flourished in South Eastern Rajasthan between late fourth and second millennium BCE. Over 100 sites of this rural culture have been recorded, the concentration of which has been found in the valleys of Berach and Banas in the districts of Udaipur and Chittorgarh. The Aharians had learnt making defence structures, variety of craftsmanship, and long distance contacts. The presence of Aharian is visible in Central India, North Gujarat, and so on. In the Ahar complex double mounds at certain sites, defence structures, planning of structures, certain crafts, a variety of pottery types such as Tan Ware, buff ware, and perforated pottery, force us to think about the interaction with the neighboring Harappans. This paper is an attempt to discuss the possible role of the Aharians in the urbanization process of the Harappans in Gujarat.



SPEAKER'S PROFILE

JS Kharakwal did his Master's from Kumaun University, Nainital and Ph.D from Deccan College, Pune under the guidance of celebrated Prehistorian Prof. VN Misra in the year 1994, on the *Archaeology of Central Himalayan Region*. He was trained in field archaeology in a number of archaeological excavations ranging from Stone Age to Iron Age in Karnataka, Maharashtra, MP, Gujarat and Uttarakhand. He spearheaded a multidisciplinary Indo-Japanese archaeological research project at Kanmer, a Harappan site in Kachchh, Gujarat 2005 to 2016. Besides, he carried out excavation of Chandravati, near Abu Road, in the Aravallis (2013-16). He has carried out

archaeological and archaeometallurgical explorations in Central Himalaya, Rajasthan, and Gujarat.

He has published widely on Uttarakhand, Rajasthan and Gujarat which include 6 books, 3 monographs and 60 research papers in various international journals like *Antiquity*, *Archaeological Science*, *Radiocarbon*, *Man and Environment*, *Puratattva*, *Sodh Patrika*, *Pahar*, and others. He was awarded a post doctoral fellowship of *Japan Society for Promotion of Science (JSPS)* at the International Research Center for Japanese Studies, Kyoto, Japan for 15 months (2001-2002) and subsequently he was invited as a Visiting Professor at the Research Institute for Humanity and Nature, Kyoto, Japan for one year (2004-2005). He is a member of various academic societies such as Indian Society for Prehistoric and Quaternary Studies, Pune, Indian Archaeological Society, Delhi, PAHAR, Nainital, Rock Art Society of India, Agra, European Association of South Asian Archaeology, Indo-Pacific Prehistory Association, Australia, Alumni of Japan Society of Promotion of Science, Kyoto, and others. He has participated in various national and international seminars in several countries, such as France, Japan, Italy, Austria, Turkmenistan, China, Vietnam, and Iran. He has organized national and international seminars, symposia and workshops. Currently he is working as Director of Sahitya Sansthan, JRN Rajasthan Vidyapeeth, (Deemed University), Udaipur, Rajasthan.

SESSION THREE: BIOARCHAEOLOGICAL PERSPECTIVES (FLORAL, FAUNAL, AND OTHER RELATED STUDIES)

PHYSICAL ANTHROPOLOGY OF THE HARAPPANS: STATUS OF RESEARCH AND PROSPECTS

SPEAKER: SUBHASH R WALIMBE
EMAIL: subhashwalimbe@gmail.com

The Harappan phase has an extensive human skeletal series. This presentation summarizes and critically examines the anthropological information available on these collections and suggests potential areas of research that need to be attempted. Earlier anthropological studies on this skeletal series were primarily focussed to answer two questions, problems of 'ethnic' identity, and the enigmatic decline of the culture. Mostly cranial metric features were used to establish the 'racial' composition of these urban dwellers. Recent interpretations of craniometric data, along with the studies on non-metric skeletal and dental features clearly show that the skeletons belong to a single morphologically homogeneous series, contrary to their previous classification into morphological 'races' and 'sub-races'.

The anthropological data generated during the last two decades very clearly concludes that the Indus communities share similarities with Indian Mesolithic hunter-gatherers. According to this study, the inhabitants of the Indus Civilization appear most likely to have been descendants of the indigenous hunter-gather populations of South Asia, rather than intrusive (and genetically distinct) populations from the West. In other words, this inference implies genetic continuity in the sub-continent at least during the last 10,000 years.

Conclusions regarding the traumatic end of the inhabitants of Mohenjo-daro were drawn on the basis of disorderly disposal of the skeletons. It was suggested that these individuals had been slain by raiders while attempting to escape from the city during a military attack of "Aryan". Restudy of presumed 'cut-marks' on the Mohenjo-daro cranial collection clearly ascribes the changes as post-mortem effect and refutes the role of "Aryan" in the so called 'massacre theory'.

Recent studies dealing with the palaeopathological aspects of the Harappan skeletal collection have brought forward the evidences of several infectious lesions like tuberculosis and leprosy. One widely debated and controversial study undertaken recently questions the image of a "peaceful realm" among the Harappans. This research, however, needs to be reevaluated and reconfirmed in the background of the archaeological and literary data.

Genetic data for extinct and extant populations is being generated in recent years. Largely the results corroborate with the physical anthropological inferences, concluding that there is no material evidence for any large-scale migrations into India over the period of 4500 to 800 BCE, but frequent small-scale bilateral movements were probable. Process of peopling of the Indian continent may not be fully understood by using only the conventional anthropological parameters and therefore the intervention of molecular technology needs to be welcomed. Yet the results, esp. the hypotheses on 'Ancestral North Indians' and 'Ancestral South Indians', and the notion of 'racial purity' of the Indians, will remain debatable unless supported by high quality ancientDNA data of Indian protohistoric populations, and unfortunately success rate of these studies is still very poor.

The knowledge of biological anthropology of the Harappans is still incomplete. The collection needs to be relooked using recent methodological protocols to understand issues of population continuity during the Mature and Late Harappan cultural succession, and to understand adaptive strategies of these groups to urban settings.



SPEAKER'S PROFILE

Subhash R Walimbe, though formally retired as Professor and Chair of the Anthropology Department of Pune University, is better known for his long association with Deccan College Post-Graduate and Research Institute (DCPGRI, Deemed University). After receiving his Master's (1972) and Ph.D. (1978) degrees from the Pune University, he joined the archaeology club in 1980. He is credited for establishing a fully equipped laboratory solely devoted for archaeological human skeletal research in DCPGRI. This being the only facility on the subject in India, over the last 35 years, Walimbe and his team had an opportunity to examine human remains

from over 75 archaeological sites (dated between 8000 BCE to 800 CE) collected by various Indian Universities. He is also instrumental in creating a national level facility of ancient-DNA laboratory in India. He is an executive member of several professional bodies and recipient of research funding from reputed national and international agencies. Major emphasis of his career research is on examining the relative quality of hunter-gatherers' and farmers' health and nutrition. His current research uses ethnographic data to model cultural frontiers of health for archaeological populations. He is the author of "A Companion to South Asia in the Past (Wiley Blackwell Companions to Anthropology)", seven monographs / skeletal reports, and over 80 articles in peer-reviewed journals.

ANTHROPOLOGICAL ANALYSIS ON HUMAN SKELETAL REMAINS FROM RAKHIGARHI (1999-2000)

SPEAKER: VEENA MUSHRIF-TRIPATHY

EMAIL: veena.mushrif@dcpune.ac.in

The excavations (1999-2000) at Rakhigarhi (29° 17' 30" N and 76° 06' 50" E) have reported skeletal series of the Harappans both from cemetery and habitation area. It is spread over an area of a 3 km radius (300 ha) encompassing a set of seven mounds of which 1 to 5 are integrated while a couple are removed from each other.

The excavation yielded skeletal remains of 17 individuals. Out of those remains 11 individuals were sent to the anthropology laboratory at Deccan College Post Graduate and Research Institute. Out of eleven, nine individuals are from RGR 7 and the other two are from RGR 2. The material excavated from RGR 1 was either not collected or sent to the laboratory. From RGR 7, one individual (SK7) is in the National Museum and SK 5 was not lifted from excavation. The preservation for SK 9 and SK 10 is very fragmentary.

The individuals from RGR 7 belong to the middle age to old age category and from RGR 2 one is a child aged 8 years and the other individual is of old age. There are 4 females and 5 males. The sex determination for RGR 7, SK 10 is not possible, and RGR 2 SK 1 is child.

Palaeopathological observations include nutritional deficiency, infection diseases, joint problems, and stress markers. The dental anomalies other than attrition are enamel hypoplasia, caries, antemortem tooth loss, dental crowding, and dental calculus. The craniometry and odontometry were conducted using standard methodology and they were compared with measurements from other Harappan sites.



SPEAKER'S PROFILE

Veena Mushrif-Tripathy is working in the field of Bioarchaeology, specializing in the study of human skeletal remains from archaeological excavations. She has worked on more than 30 sites belonging to various cultural phases from different parts of India. Some of the sites are Nevasa, Kodumanal, Sanjan, Balupur, Jotsoma, Farmana, Rakhigarhi, etc. She is part of national and international projects. She has completed seven major research projects and currently she is engaged in two major projects, one funded by National Geographic society and another by Australia National University. She has been publishing her research work in

both national and international journals. She has presented her work in the national and international conferences. She has excavated a cave site in District Kargil, Ladakh. She has published six monographs.

BIOARCHAEOLOGICAL PERSPECTIVE OF HARAPPAN ARCHAEO-FAUNAL RECORD

SPEAKER: PP JOGLEKAR

EMAIL: pramjog@gmail.com

The first hint of the role of animals in the Harappan subsistence economy was obtained nearly eight decades ago when a few bones from Mohenjo-daro and Harappa were examined by Sewell and Guha (1931) and Prashad (1934), respectively. Since then, several scholars have paid attention to the study of animals in Harappan culture. These studies have been reviewed by several scholars, e.g., Sahu (1988), Possehl (1999), Thomas and Joglekar (1994), Thomas (2002), Chattopadhyaya (2002), Meadow and Patel (2002), Joglekar (2006), Joglekar and Goyal (2012), and Joglekar (2013). All of these reviews correctly recognized the significance of archaeofaunal studies in reconstructing past human-animal interactions on the environment, especially at Harappan sites.

With the exception of Alamgirpur in Uttar Pradesh, most of the sites from which faunal material has been studied are in Punjab, Rajasthan, Haryana, and Gujarat. For a long period of time, the archaeofaunal record from Harappan sites was scanty for various reasons. The main reason was that very few sites were excavated and / or very little attention was paid to the faunal material from these sites. However, in recent years, several sites, such as Farmana, Girawad, Mitathal, Karsola, Masudpur, Burj, Bahola, Rupnagar, Karanpura, Dabli-vas-Chugta, Lohat, Lohari-Ragho, Rakhigarhi, Kunal, Khirsara, and Kanmer were excavated. Moreover, faunal materials from all of these sites have been made available for faunal studies. These studies have shown the nature of human-animal interactions in the Harappan cultural context. This presentation briefly reviews the newly studied faunal material from such sites and presents a summary of findings, particularly those related to faunal diversity and animal-based subsistence. Also, it discusses various methodological concerns related to our understanding of animal-environment interactions during the Harappan times. The gaps in research that need to be identified would also be touched in brief.



SPEAKER'S PROFILE

PP Joglekar is presently the Director (Academic Development Programme) at the Bhandarkar Oriental Research Institute, Pune and a Guest Professor, Humanities and Social Sciences at the Indian Institute of Technology, Gandhinagar, Gujarat. He was also a former Professor and Head of the Department of Ancient

Indian History Culture and Archaeology at the Deccan College, Pune. Prof. Joglekar holds an M.Sc. in Zoology (1982) and a Ph.D. in Archaeology (1991). He has a research experience of 40 years with specialization and interests in Bioarchaeology, Environmental History, Archaeological Sciences, Pre and Protohistory, History of Science and Technology, Indology, and Biolinguistics Research Methodology. He has published 11 academic books, 39 fiction and other books, two edited volumes, 232 research papers, and 27 Popular articles.

ORGANIC RESIDUES IN POTTERY FROM THE INDUS CIVILISATION: OPPORTUNITIES, CHALLENGES, AND QUESTIONS

SPEAKER: AKSHYETA SURYANARAYAN

EMAIL: akshyeta@gmail.com

Techniques in archaeological science are increasingly revealing insights into the ancient cropping, pastoral, and land use practices of settlements of the Indus Civilisation. Knowledge about agricultural strategies and animal exploitation at different Indus settlements has greatly increased our understanding of the diversity of subsistence practices before, during, and after the urban period. But how were resources coming together to produce the food people were eating? How were different Indus vessels used in the past, beyond speculation based on the shape or size of vessels? Recently, the application of ceramic lipid residue analysis has enabled the direct detection of organic products absorbed within ancient vessels, allowing the characterization of animal and plant products that were a part of everyday food practice. This talk will present the cumulative results of the study of organic residues in pottery dating primarily to the urban period (c. 2600 / 2500-1900 BCE) from sites in northwest India, northern Gujarat, and Sindh, as well as Indus Black-Slipped Jars found in SE Arabia, providing an overview of the types of products detected in vessels from different regions of the Indus Civilisation and beyond. These results open up a new means by which to investigate and imagine Indus foodways and vessel usage at both urban and rural settlements in different regions. However, due to small sample sizes and methodological challenges, the results also present new questions about the evidence, and absence of evidence, of different foodstuffs used by the Indus populations.



SPEAKER'S PROFILE

Akshyeta Suryanarayan's research focuses on exploring foodways and vessel usage practices of ancient populations of the Indus Civilisation and Bronze Age south-east Arabia. She applies biomolecular techniques, such as ceramic lipid residue analysis, to understand ancient subsistence practices and human-environment interactions. Akshyeta obtained her first degree in Classical and Near Eastern Archaeology and Anthropology from Bryn Mawr College (USA) in 2013. She completed her M.Phil. (2015) and Ph.D. (2020) in Archaeology from the University of Cambridge (UK). Her Ph.D. thesis conducted an investigation of lipid residues from

pottery from rural and urban sites of the Indus Civilisation located in NW India (Haryana and Uttar Pradesh) to characterize rural and urban food practices and how they changed in the face of cultural and climatic change. She was awarded a Fyseen Foundation fellowship in 2020 to conduct independent postdoctoral research on lipid residues in imported and locally-produced pottery from the Neolithic and Bronze Age in SE Arabia at CEPAM, UMR 7264 CNRS, Université Côte d'Azur in Nice (France) to understand the movement, exchange, and use of organic products in pottery in the Arabian Peninsula. She is currently a Marie Skłodowska-Curie EUTOPIA-SIF fellow (2021-2023) at CaSEs, University of Pompeu Fabra, Barcelona, where she is using proteomic and lipid analysis to investigate foodstuffs in pottery from the Indus Civilisation sites in Sindh, Pakistan.

ICHTHYOARCHAEOLOGICAL PERSPECTIVES ON THE ROLE OF FISH IN INDUS CIVILIZATION IN GUJARAT, INDIA

SPEAKER: ABHAYAN GS

CO-AUTHORS: PP JOGLEKAR, AJITHPRASAD P, RAJESH SV, AND JS KHARAKWAL

EMAIL: abhayangs@gmail.com

The roles of animals in the Indus Civilization have been estimated through the substantial efforts of zooarchaeologists who worked on the faunal remains. However, most understandings about the animals surround the mammalian category of fauna, while meagre studies have been conducted with taxa-specific approaches using the remains like fish, shells, and birds. Among them, fish remains occur in significant quantities from the many excavated Indus Civilization sites, but from most of these sites, they have not been collected meticulously nor studied with due attention. The lack of adequate comparative reference collections of fish and specialization in ichthyoarchaeology are two main reasons for this. A newly developed comparative reference collection of fish at the Ichthyoarchaeology Laboratory of the University of Kerala opened up the possibilities of identifying and studying fish bones. The fishbone assemblages recovered from the excavated Indus Civilization sites, such as Bagasra, Kanmer, Shikarpur, and Navinal in Gujarat were analyzed. The analysis revealed 21 species of fish belonging to 13 families, such as Ariidae, Bagridae, Carangidae, Carcharhinidae / Dasyatidae, Cyprinidae, Haemulidae, Latidae, Platycephalidae, Polynemidae, Sciaenidae, Serranidae, Siluridae, and Sparidae. Bone modifications like cut marks, charring and chewing were recorded, and from these, many anthropogenic activities related to fish consumption were inferred. This presentation talks about aspects of fish utilization, such as the diversity of fish species used, cultural phase-wise changes in fish consumption, the spatial distribution of fish within the sites, and fish processing patterns. The integration of the fish faunal data with the rest of the non-fish faunal data reveals some interesting patterns with respect to cultural changes. Compared to the mammalian fauna, fish formed a supplementary but inevitable part of the diet during the Indus Civilization, and rather than an arbitrary way of food gathering, fishing seems to be a planned activity for meeting specific needs.



SPEAKER'S PROFILE

Abhayan GS is an Assistant Professor in the Department of Archaeology, University of Kerala. His doctoral research from Deccan College, Pune, specialized in zooarchaeology, specifically ichthyoarchaeology (studies on fish bones) of Harappan contexts in Gujarat. He has played a vital role in the establishment of the Zooarchaeology Laboratory at University of Kerala. He has conducted faunal analyses of several excavated sites representing various periods across the country. He has keen interest in the Megalithic-Iron Age archaeology of Kerala. He has been part of various research projects on Indus and Iron Age archaeology. He has

been part of the excavations of archaeological sites in Kerala, such as Pattanam, Marayur, Vizhinjam, Arikkadi fort, Kuttikol, Nannangadikkunnu and Enadimangalam; and elsewhere in the country such as Adichanallur (Tamil Nadu), Chaturbhuja Nath Nallah (Madhya Pradesh), Juaffardi (Bihar), Karsola, Lohat (Haryana), Navinal, Madi, and Juna Khatiya (Gujarat). He is also serving as the co-editor of the journal "Heritage: Journal of Multidisciplinary Studies in Archaeology". He has published 35 research papers in journals, 26 articles in edited books and co-edited four books.

PP Joglekar is presently the Director (Academic Development Programme) at the Bhandarkar Oriental

Research Institute, Pune and a Guest Professor, Humanities and Social Sciences at the Indian Institute of Technology, Gandhinagar, Gujarat.

Ajithprasad P is affiliated to the Department of Ancient History and Archaeology, The Maharaja Sayajirao University of Baroda, Vadodara, India.

Rajesh SV is an Assistant Professor in the Department of Archaeology, University of Kerala.

J Kharakwal is from the Institute of Rajasthan Studies, JRN Rajasthan Vidyapeeth, Udaipur, India.

ARCHAEOMALCOLOGICAL INVESTIGATIONS AT DHOLAVIRA, AN URBAN METROPOLIS OF THE INDUS VALLEY CIVILIZATION

SPEAKER: ARATI DESHPANDE-MUKHERJEE

CO-AUTHORS: ANINDYA SARKAR, TORSIA SENGUPTA, RAVI BHUSHAN, AND RS BISHT

EMAIL: arati.mukherjee@dcpune.ac.in

Dholavira, one of the five major urban centres of the Indus Valley Civilization (IVC), is enigmatic due to its location in the presently inhospitable salt waste terrain of the Great Rann of Kachchh, Gujarat. While excavations have exposed a fortified metropolis with systematic town planning and a rich material culture, the large-scale recovery of mainly marine molluscan remains at this advanced settlement located so far inland is most intriguing. A recent analysis of this rich archaeomalacological data supplemented with stable isotope analysis and radiocarbon dates has revealed that a long span of shell-working activities and dietary use, led to molluscan resource intensification between the late fourth to the middle of the second millennium BCE. While specific marine molluscs were sourced from the coastal Arabian sea water (Gulf of Kutch probably gulf mouth) whereas the others carry signatures of either estuarine or riverine water suggesting a paleogeography comprising tidal mudflats with mangroves supported by an active fluvial system, quite different from the present one at Dholavira.

SPEAKER'S PROFILE



Arati Deshpande-Mukherjee is an established archaeozoologist with 25 years of research experience studying animal remains from Indian protohistoric and historic through collaborations with the ASI, state archaeology departments, University departments, Museums, etc. These include sites, such as Kuntasi, Agiabir, Mahurjhari, Bhon, Juni Kuran, Somnath, Hathab, Bhirrana, Gotiprolu, etc. Her research interests are South Asian protohistory, environmental archaeology, coastal archaeology, and ethnoarchaeology. While her main focus is reconstructing human-animal interactions from early to complex urban societies in South Asia, she is also exploring the potential of archaeofauna as proxies in

paleoenvironmental reconstruction. With a specialization in archaeomalacology, she has studied shell material from Inamgaon, Nevasa, Junnar, Padri, Kuntasi, Shikarpur, Khirsara, Rakhigarhi, Dholavira, and Vadanagar.

Deshpande-Mukherjee has served as the principal investigator in major projects of the UGC, ICHR, and currently the SERB-DST project for studying climate change during the Indus Valley Civilization using stable isotope analysis on archaeological shells. She has more than 75 publications to her credit. From 2014 to 2022, she was twice elected as the International committee member of the ICAZ (International Council for Archaeozoology).

Anindya Sarkar is from the Department of Geology and Geophysics, Coordinator, National Stable Isotope Facility, Indian Institute of Technology, Kharagpur.

Torsa Sengupta is from the Department of Geology and Geophysics Indian Institute of Technology, Kharagpur.

RS Bisht is affiliated to the Archaeological Sciences Centre, Indian Institute of Technology Gandhinagar, Gujarat, India.

SESSION FOUR: TRADE CONTACTS WITH OTHER REGIONS

VISUAL LANGUAGE IN THE MINIATURE ARTS OF THE HARAPPAN WORLD

SPEAKER: MARTA AMERI

EMAIL:marta.ameri@gmail.com

The inscriptions on the seals, sealings, and tablets found in the excavations of Indus sites remain undeciphered to this day. Yet these miniature works, which include highly naturalistic representations of the fauna of South Asia, wildly imaginative depictions of fantastic creatures, and enigmatic scenes of interaction between figures, are often considered the height of artistic production of the Indus Civilization. Art historical analysis can offer a fresh translation of these tiny objects: not of their textual inscriptions, but of the extensive and extraordinary imagery they bear and of the long-ignored visual language that this imagery embodies. This paper presents an exploration of how art historical methodologies can be used to interpret the visual and practical aspects of seal production and its use in prehistoric South Asia.

As reproductive technologies, the seals, sealings, and tablets of the Indus allowed for the propagation of a set of motifs or symbols that could be used to reinforce belief systems and / or social hierarchies. The imagery on the miniature arts of the Indus, accessed and reproduced elements of a graphic language that would have been easily understood by people well-versed in its visual shorthand and served to bind together the population living over an extensive area of South Asia in the third millennium BCE. Investigating the visual vocabulary embedded in these artistic forms from within gives us a powerful set of tools to conceptualize the greater functioning of the Indus society on both a political and cultural level. Beyond the Indus, the approaches modeled in this paper seek to broaden the menu of approaches available to scholars investigating the arts of non-literate, pre-literate, and otherwise undeciphered cultures.



SPEAKER'S PROFILE

Marta Ameri earned her M.A. and Ph.D. in Art History and Archaeology at the Institute of Fine Arts at New York University and her B.A. in Classical and Near Eastern Archaeology at Bryn Mawr College. She works at the intersection of visual studies and archaeology. She is an interdisciplinary scholar who studies engraved seals from South and Central Asia and the Persian Gulf region from the third millennium BCE. Her work analyzes and interprets the stylistic and functional significance of seals and seal impressions in these prehistoric cultures. Her publications include a co-edited volume, *Seals and Sealing in the Ancient World: Case*

Studies from the Ancient Near East, Egypt, the Aegean, and South Asia, and many articles in leading journals and peer-reviewed essay collections.

HARAPPAN STEATITE BEADS: A NEW METHODOLOGY AND PRELIMINARY RESULTS PROVIDE FRESH INSIGHTS INTO THE CREATION AND CIRCULATION OF VALUE IN THE INDUS CIVILIZATION

SPEAKER: BRAD CHASE

CO-AUTHORS: RANDALL LAW, AJITHPRASAD P, PRABODH SHIRVALKAR, AND YS RAWAT

EMAIL: bchase@albion.edu

White steatite beads (WSB) have been recognized as a technologically and stylistically distinctive type of ornament unique to the Indus Civilization (2600-1900 BC) since the first excavations at Harappa 100 years ago. Traditionally, the ubiquity and relative uniformity of these objects along with the widespread availability of steatite in hilly areas surrounding the Indus alluvium, has led to their being interpreted as low-value objects. Building upon Law's earlier work identifying geological sources of unfired steatite production debris from Indus contexts, we present a new methodology for inferring the geological source of individual or (small groups of homogenous) WSB using X-ray diffraction (XRD) and instrumental neutron activation analysis (INAA). We apply this methodology to a small set of WSB from Indus archaeological sites in Gujarat as a proof-of-concept. Our findings demonstrate that most of these WSB were derived only from geological sources located in northern Pakistan and were therefore imported into Gujarat from an extreme distance. From these results, we infer that these were not low-value objects but were among the most materially valuable and widely circulated of all Harappan ornaments. Historically ornaments with similar physical characteristics have functioned as currencies, suggesting new directions in the study of the economic organization of the Indus Civilization. During our pilot study, we also identified one bead from the Sorath site of Kotada Bhadli that was likely produced from steatite originating in Rajasthan, a source area that was rarely used by Harappan craftspeople. Along with this bead, several other beads from Kotada Bhadli that visually appeared indistinguishable from WSB were found to have been crafted not from steatite but rather from a locally occurring claystone—the first identification of imitation steatite in the Indus context. These findings suggest the hypothesis that while the residents of this and perhaps other Sorath settlements valued these objects, they may not have participated in the social networks through which true steatite beads circulated. This hypothesis will be evaluated when we are able to subject many more putative WSB of different shapes and sizes from Indus archaeological sites in different regions to instrumental analyses.



SPEAKER'S PROFILE

Brad Chase received his B.A. in Anthropology from Northwestern University, his Ph.D. in anthropology from the University of Wisconsin-Madison in 2007, and has been at Albion since 2008. He is an anthropological archaeologist who has participated in fieldwork in the American Midwest and Southwest, Turkey, Pakistan, and currently India, where he has been conducting research for over a decade. His teaching and research interests include the organizational dynamics of early urban societies in comparative perspective, the relationship between humans and their environments during periods of social change, and the role

of material culture in the creation and maintenance of identities in the past and present. His ongoing research explores these issues in the context of the Indus Civilization in Gujarat, India, specifically focusing on changes in land-use practices and social organization with the emergence and decline of South Asia's first urban civilization.

Randall Law is from the Department of Anthropology, University of Wisconsin-Madison, Madison, USA.

Ajithprasad P is from the Department of Archaeology and Ancient History, Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India.

Prabodh Shirvalkar is from Deccan College Post Graduate and Research Institute, Pune, Maharashtra, India.

YS Rawat is the Director (Rtd.), Gujarat State Department of Archaeology, Gandhinagar, Gujarat, India.

WEIGHING SYSTEM OF THE DHOLAVIRA HARAPPANS: NEW INSIGHTS

SPEAKER: RS BISHT

EMAIL: rsbishtarch@gmail.com

The initial days of the discovery of the Harappan Civilization highlighted one of the sophisticated yet simple standardization of weights. The analysis of chert cubical weights from Harappa, Mohenjo-daro and Chanhudaro by Hemmy highlighted the remarkable sophistication of this system of weights. The chert cubical and agate-carnelian truncated spherical weights, along with a few curious shapes like the triangular ones, existed side by side. However, they all adhere to the binary ratio mode, with the average 16th ratio of 13.632 gm. The weight progresses in 1:2:4:8:16 up to the 64th ratio and then goes in multiples of tens. Scholars have also demonstrated the close connection between the Harappan weight pattern and *gunja / ratti* seeds. The combined weight of eight such seeds is equivalent to 1 gm, one of the smallest weights of the Harappans. The earlier excavation at Mohenjo-daro and Harappan could have neglected weights from different materials, as only the chert weights are mainly reported.

The excavations at Dholavira for nearly thirteen field seasons brought to light a plethora of artefacts, the prominent among them is the wide variety of weights of different raw materials in myriad forms and shapes. Even terracotta and shell were used to manufacture the weights apart from the typical chert cubical and agate-carnelian truncated spherical weights. The most negligible weight is around 0.3 gm, while the largest is about 13.5 kg, indicating various items that could have been weighed. This paper will discuss the system of weights at Dholavira.



SPEAKER'S PROFILE

RS Bisht was born on 2nd January, 1944 to Lt. LS Singh in Uttar Pradesh, India. He passed the degrees of Visharad and Sahityaratna in 1958 and 1960 respectively, before getting his Master's degree in Ancient Indian History and Culture from Lucknow University in 1965. He passed the Diploma in Archaeology from the School of Archaeology, run by the Archaeological Survey of India in 1967, and in 2002 was awarded Ph.D. degree for his thesis on "Emerging Perspectives of the Harappan Civilizations in the Light of Recent Excavations at Banawali and Dholavira from Kumaon University".

His career started by joining the Department of Archaeology, Government of Punjab as the Senior Technical Assistant in 1968. Later, he joined the Government of Haryana as an Assistant Archaeological Officer (1972-1974) and later rose to the position of Deputy Director (1974-1977). He presented a Vision Plan for the Department of Archaeology, which led to the creation of several Technical posts in Archaeology and Conservation. He joined ASI as Superintending Archaeologist in 1977 and served at Patna and Srinagar Circles, before joining Excavation Branch, Vadodara in 1984. Having a strong inclination towards field archaeology and excavation, he excavated Sanghol, Banawali, Sarai Mound, Nalanda, Chechar, and Semthan, before embarking on the most significant excavation of his career at Dholavira (1989-2005). He started the surface investigations

at Dholavira from 1985 onwards, and made a presentation in 1987 in Paris, before starting the excavations. The surface observations were so minute and detailed, that the later excavations proved most of his interpretations. The remarkable discoveries he made at Dholavira enabled the ASI to nominate it successfully to the World Heritage List. An erudite scholar with a deep understanding of ancient literature, he has contributed over 50 Research Articles, popular articles, and book chapters. He was conferred with the Padma Shri award by the Hon'ble President of India in 2013 for his enormous contributions to the field of archaeology.

ROLE OF SMALL SITE IN THE LARGER COMPLEX HARAPPAN ECONOMY

SPEAKER: PRABODH SHIRVALKAR

EMAIL: prabodh.shirvalkar@dcpune.ac.in

The site of Kotada Bhadli, Nakhatrana Taluka, Kachchh District, Gujarat was jointly excavated by the Department of AIHC and Archaeology, Deccan College PG RI, Pune, and State Department of Archaeology Gujarat, Gandhinagar from 2010-2013. The excavations at the site produced evidence of a structural complex and southern fortification wall, along with bastions and an entrance on the south-eastern side of the settlement. The dates obtained from the site are bracketed within 2200 to 2000 BCE. A major feature of the Harappan civilization in the region of Kachchh is the presence of fortifications similar to those identified at Kotada Bhadli. Such sites have been interpreted as trading centres or emporiums due to the high abundance of exotic goods denoting trade contacts and the prosperity of such sites. However, the excavations at Kotada Bhadli did not produce any evidence of craft manufacturing or luxurious items. To try and understand Kotada Bhadli in greater detail, various scientific studies have been carried out over the past 9 years on the various artefacts and ecofacts recovered during excavation. This has included ceramic lipid analysis, provenance studies of copper and steatite, shell and stone tool studies, archaeo-zoological analyses, isotope studies of animal bones, chemical and phytolith analysis of ash, etc. This paper will discuss the nature of the Kotada Bhadli settlement with a focus on its geographic location, and the relationship of the settlement with broader Harappan trade networks that resulted in the material attributes observed at the site. The probable function of the site will be addressed based on dates from other Harappan sites in Gujarat.



SPEAKER'S PROFILE

Prabodh Shirvalkar is an Assistant Professor in Department of AIHC and Archaeology, Deccan College, Pune. He specializes in Harappan civilization, Chalcolithic cultures, field archaeology, and ceramics studies. He was the Director of excavation at Kotada Bhadli in Gujarat (Harappan Civilization) and Chirand in Bihar (Neolithic, Chalcolithic, Kushan, Gupta, and Parmara periods). He was co-director of excavations at Pachamata (Ahar chalcolithic), Chatrikhera (Ahar chalcolithic, Early Historic and Medieval period) and Jawasiya (Microlithic) in Rajasthan. Under his guidance 4 Ph.D., 4 M.Phil., and 20 M.A. dissertations have been completed.

He has delivered 75 special lectures. He is a chairman and member of various committees and bodies of Deccan College, Symbiosis College of Arts and Commerce, and Satheya College, Mumbai. He has presented research papers in various conferences and has authored 2 books. He has published 55 articles in National and International journals and edited volumes. He is working as a ceramic specialist for the sites of 4MSR (Binjor), GB68, GB(43), Sanauli, and Rakhigarhi excavated by Archaeological Survey of India, New Delhi.

THE INDUS CIVILIZATION EXTERNAL TRADE: A COORDINATED SUPRA-REGIONAL MARKETING STRATEGY?

SPEAKER: DENNYS FRENEZ

EMAIL: dennys.frenez@gmail.com

This paper presents a paradigmatic change in defining the production and marketing strategies implemented by the Indus social-economic entities involved in external trade. Particular focus will be paid to describing the methodological advancements in the documentation and analysis of Indus-related artefacts and raw materials that allowed applying novel theoretical frameworks. A century of archaeological research across Middle Asia, from Southern Arabia to Central Asia and from the Levant to South Asia, has revealed the extraordinary occurrence of Indus-style trade tools and items. However, the socio-economic and cultural mechanisms underlying this phenomenon are yet to be fully decoded. Recent studies have applied an innovative recording and analytical approach to selected Indus-related artefacts, revealing that multicultural interactions in Bronze Age Middle Asia went beyond mere trade exchanges. Specialists trained in diverse the Indus technologies were found to have been active across the region in manufacturing prized Indus-style objects using local raw materials or applying their distinctive technical skills to redesign indigenous productions. Their activities were often linked to small Indus groups settled outside their native cultural sphere to negotiate with the local social-economic and political entities that controlled access to strategic raw materials and strategic trade routes. At the present research stage, it is possible to propose that the Indus social-economic entities involved in external trade implemented a coordinated supraregional marketing strategy adapting universalizing production modes to particularizing marketing tendencies to improve their commercial success.



SPEAKER'S PROFILE

Dennys Frenez obtained his Ph.D. in archaeology on Indus Civilization external trade from the University of Bologna (Italy) in 2011. He is currently investigating long-range trade and cross-cultural interactions between urban-level societies in South and Middle Asia during the Bronze Age, with a specific focus on the Indus Valley and Oman. His research involves a wide range of theoretical and methodological approaches, including ancient administrative and writing systems, traditional technologies and crafts, iconography and art styles, and social-economic and political organization. He directed archaeological excavations in

India and Oman and worked on archaeological collections with several museums and archaeological expeditions in India, Pakistan, Oman, UAE, Tajikistan, and Turkmenistan, establishing an extensive network of academic and research partnerships. He organized international conferences and exhibitions, published several edited volumes, and is a member of scientific and review committees of scholarly journals. He is presently the adviser for archaeology and heritage to the Ministry of Heritage and Tourism of the Sultanate of Oman.

SESSION FIVE: CLIMATE AND ENVIRONMENT

DOES A SINGLE MODEL FIT ALL? EVALUATING THE ENVIRONMENTAL ADAPTATIONAL MODEL TO EXPLAIN THE DECLINE OF THE HARAPPAN CIVILIZATION

SPEAKER: KALYAN SEKHAR CHAKRABORTY

EMAIL: kalyan2287@gmail.com

The evolutionary adaptational model has been extensively used around the globe to explain culture change, and the Harappan Civilization is no different. The evolutionary adaptational model explains culture change as a response to external factors, such as the environment, while negating the possibilities of internal factors as mechanisms that influence cultural change internally or work as an internal resistance to change influenced by external factors. Despite its shortcomings in explaining human interaction and perception of its surrounding environment, it also has its own strength.

In this paper, we will discuss whether a change in rainfall and a shift in the hydrological system is enough to explain the decline of the Harappan civilization that occupied varied geographical regions and different environmental niches or we focus on bottom-up regional analysis to provide better humanistic interpretation to the decline of this civilization. In this paper, we will re-evaluate the radiocarbon dates from the region of Gujarat using a suite of bayesian statistical models in combination with freshly acquired AMS dates from the site of Kotada Bhadli. I will compare these dates with the 4.2 ka global aridification event as well as other cultural changes that were happening in different regions within this civilization in order to understand if such global climatic events were responsible for the culture change that we observed in Gujarat or were there internal humanistic mechanisms that determined how this region functioned during the period of global acidification.



SPEAKER'S PROFILE

Kalyan Sekhar Chakraborty is an assistant professor at Ashoka University, Haryana, specializing in biomolecular archaeology and archaeological geochemistry. He is interested in reconstructing ancient animal herding practices and the utilization of animals and animal products to understand the role of domesticated animals and the inter-relationship between humans-animals-environment in the development and dispersal of complex societies in South Asia, especially in India. Dr. Chakraborty completed his M.A. in Archaeology from the Deccan College Postgraduate and Research Institute, Pune, India, in 2010 and his Ph.D. in Anthropological

Archaeology from the Department of Anthropology, University of Toronto, Canada, in 2019. He has held postdoctoral and research positions at the University of Toronto and McMaster University. Along with his teaching at Ashoka, he is also pursuing Postdoctoral research at the Max-Planck Institute for the Science of Human History as an Alexander von Humboldt Postdoctoral Fellow.

PALAEOHYDROLOGY TO ASSESS THE ROLE OF EPHEMERAL RIVERS IN SUSTENANCE OF THE HARAPPAN CIVILIZATION: MARKANDA RIVER, NW HIMALAYA

SPEAKER: AJIT SINGH

EMAIL: ajit268@gmail.com

Major civilizations of the Bronze age (third millennium BCE) include Mesopotamian along the Tigris River, Egyptian along the Nile River, and Harappan along the Ghaggar-Hakra River. A general notion is that the availability of surface water resources provided by large river systems helped foster the river valley civilizations. However, the rivers, associated with various civilizations across the world, are hydrologically different. In particular, the human-river interaction becomes complex in the case of the Harappan civilization as evidenced by the distribution of its sites along both large and small rivers. Therefore, in order to understand the relationship of human and river-landscape, it is important to reconstruct palaeohydrology of the Ghaggar-Hakra river system to assess the availability of surface water during the time of the past civilization.

Markanda River in northwest Himalaya, an ephemeral river of the Ghaggar-Hakra catchment, is chosen for the study as (1) geomorphic mapping shows that Markanda valley has several levels of fluvial terraces and (2) sedimentological investigation show layers of palaeoflood deposits conserved in the fluvial terraces.

Using available records of modern-day discharge, the SWAT (Soil and Water Analysis Tool) model was calibrated to obtain simulated data of daily discharge of the Markanda valley. Log-Pearson type III distribution was applied to the simulated data to estimate discharge for a range of return-period flooding. The estimated discharge ($\approx 300 \text{ m}^3/\text{s}$) for a 100-year return period flood was found to be nearly 13 times the modern monthly discharge ($22 \text{ m}^3/\text{s}$). DGPS survey of Markanda valley cross sections was done to measure elevation profile of the palaeoflood deposits. The ChanGe tool was designed in the MATLAB program that uses DGPS data to calculate channel cross-section area (A). The tool utilizes Manning's equation to calculate flow velocity (v) and flood discharge ($Q_{pf} = vA$). The peak discharge estimates for the palaeoflood deposits (4.6 to $36 \times 10^4 \text{ m}^3/\text{s}$) are several orders of magnitude higher than the modern-day average monthly discharge ($22 \text{ m}^3/\text{s}$), as well as the 100-year return period peak discharge ($\approx 300 \text{ m}^3/\text{s}$) of the Markanda River. Optically stimulated luminescence dating of palaeoflood deposits yield dates (3.8 ± 0.3 and $3.9 \pm 0.2 \text{ ka}$) that coincide with the timing of the mature and late Harappan civilization.

The study shows that the palaeoflood deposits represent a stronger hydrological regime in the catchment region of ephemeral rivers that provided sufficient flows downstream in the Ghaggar-Hakra region during the Harappan civilization.



SPEAKER'S PROFILE

Ajit Singh is Hydrogeologist in Jal Jeevan Mission (Gol project) at Public Health Engineering Department, Haryana. His current research focuses on the sustainable development of groundwater / surface water resources to ensure the availability of drinking water (SDG-6 of UNDP) in terms of both quantity (55 LPCD) and quality (BIS: 10500). Prior to joining PHED Haryana, he was Post-doctoral Fellow at IIT Gandhinagar (2017-2020) and at Imperial College London (2014-2016). Ajit completed his Ph.D. in 2014 from IIT Kanpur. He worked as Junior Research Fellow at Wadia Institute

of Himalayan Geology, Dehradun (2006-2008). He obtained his Master's and Bachelor's degree in Geology from Government Dungar College, Bikaner (Rajasthan). He has wide research experience that involves the application of sediment geochemistry and geochronology to understand tectonic and climatic controls on fluvial forms and processes in the NW Himalaya and its adjacent alluvial plains.

THE OPPORTUNITIES AND CHALLENGES AFFORDED BY A DIVERSE ECOLOGY, ECONOMY, AND SOCIETY: THE INDUS AS A UNIQUE REGION FOR AGRICULTURAL EXPERIMENTATION

SPEAKER: JENNIFER BATES

EMAIL: jbates01@snu.ac.kr

Once described as “dull homogenous and lacking” by the colonial archaeologist Wheeler, it is now recognized that this “reconstruction” failed to truly grasp the sheer complexity and vibrancy of the Indus Civilization (c. 3200-1500 BCE). Not only was the Indus vast in scale for an Old World Bronze Age civilization, resulting in encompassing a uniquely diverse range of environmental conditions, it provides a hitherto unseen set of social systems that we are still working to understand. And within this, it is perhaps no surprise that economically it was also highly complex and nuanced. The combination of a range of environments and social and economic structures provided opportunities for farmers, the food-producing powerhouses of the Indus, to explore numerous possible systems of food production that have implications for the development of the Indus and are entangled with the end of it. In this paper, the opportunities afforded by this singular set of circumstances are unpacked, how environment / economy / society came together in different places within the Indus, and how tensions within the system(s) also arose as a result of changing circumstances. The concept of “demand” is the focus. The interconnecting forces of economic, social, and environmental demands, through equations of multicropping / monocropping, low / high yield, and supply / flexibility are explored with regards to how farmers' choices may have differed regionally, and how these choices may have had widespread impacts during the Late Harappan deurbanization process.



SPEAKER'S PROFILE

Jennifer Bates is the Assistant Professor of Archaeological Science at Seoul National University (SNU) and PI of the Archaeobotany and Wet Chemistry labs at SNU. She gained her Ph.D. at the University of Cambridge and went on to do post-docs at Cambridge, Brown, and UPenn before joining SNU in 2021. Her research foci include the prehistory of South Asia, with interests in how people engage with their environments, food resources, and economic, social, and climatic surroundings. To do this, she works with plant remains, both macrobotanical (charred seeds primarily) and microbotanical (mainly phytolith) remains. She has published numerous works on

the subject of Indus Civilization foodways, agriculture and climatic change, Southern Indian Neolithic to Iron Age cooking, and Mesolithic Ganges rice domestication. Her published work can be found on her ResearchGate profile: <https://bit.ly/3AFqNcd> and Academia.edu profile: <https://bit.ly/3CN44xH>, and she regularly posts on Twitter under the handle @drjenniferbates. She is currently running the Ashmounds, KWG LC6k, and Indica Projects, more information on which can be found at <https://snuarchsci.com/>

RECONSTRUCTING CLIMATES OF THE HARAPPAN PERIOD: INSIGHTS FROM LAKES IN NW INDIA

SPEAKER: YAMA DIXIT

EMAIL: ydixit@iitd.ac.in

Past climate changes, both abrupt and gradual, have played an important role in shaping the fate of societies during the last 10,000 years, the Holocene period. Paleoclimate records indicate that a widespread aridification event occurred ~4.2 kiloyear before the present (ka), an event that has been linked with the collapse and transformation of the Indus civilization in modern day India and Pakistan, Old Kingdom in Egypt, the Early Bronze Age civilizations of Greece and Crete, and the Akkadian Empire in Mesopotamia. This talk will focus on climate reconstructions from lakes in close vicinity of Indus sites in northwest India. Apart from the 4.2 ka event, evolution of climate in the Harappan occupied NW India during the mid-late Holocene will be presented. One of the major issues while understanding the impact of climate change on ancient societies is that there exists significant heterogeneity within the climate records from various archives both temporally and spatially. This talk will attempt to collate the existing climate records and, in the process, also discuss the suitability of archive / proxy in the context of Indus cultural transformation. Since the Indus settlements spanned a diverse range of environmental and ecological zones, future directions in paleoclimate research to give perspectives for improved understanding of Indus cultural transformation will be presented.



SPEAKER'S PROFILE

Yama Dixit received her B.Sc. (Hons.) in Chemistry from Hansraj College, Delhi University and M.Sc. and M.Phil. degrees in Environmental Sciences from Jawaharlal Nehru University, New Delhi. She received a Ph.D. degree from University of Cambridge, UK as a Gates Cambridge Scholar, following which she was an Institute Postdoctoral fellow at IIT Kanpur briefly before joining IFREMER, France as a Marie Curie Postdoctoral fellow (2015-2017). After which, she was a Research Fellow at the Earth Observatory of Singapore (2018-2021). She joined CAS, IIT Delhi in October 2021.

Her broad area of research focuses on proxy reconstructions and paleoclimate dynamics, changes in hydrology, abrupt climate change and impacts on ancient societies. Her research interests aim to understand the patterns and mechanisms of climate change by using the “natural climate experiments of the past” archived in lake and ocean sediments. To decipher past changes in climate, she uses the stable isotope and geochemical composition of biogenic carbonates and sediments.

LIVING IN A HEARTLAND OF VILLAGES: CLIMATIC AND LANDSCAPE PERSPECTIVES ON THE DYNAMIC FLUVIAL LANDSCAPES AND SETTLEMENT SYSTEMS OF THE INDUS CIVILISATION

SPEAKER: CAMERON A PETRIE

EMAIL: cap59@cam.ac.uk

The populations of the Indus Civilisation were interacting with complex climatic parameters that includes both winter and summer rainfall regimes and used diverse approaches to urbanism and settlement networks. This talk will take perspectives from the sky down and the ground up to introduce new insights into the Indus Civilisation. It will review the ways that Indus populations were adapted to an unpredictable environmental context and able to respond to climate change. It will also explore the ramifications of the fact that Indus cities were considerable distances apart and situated in diverse ecological zones within the greater region occupied by Indus populations, the majority of which appear to have lived in medium- and small-sized rural settlements. Lastly, it will explore the ways that Indus populations were adapted to an unpredictable environmental context and able to respond to climate change.



SPEAKER'S PROFILE

Cameron A Petrie completed his undergraduate and Ph.D. degrees at the University of Sydney (1993-2002). He was then the Katherine and Leonard Woolley Junior Research Fellow at Somerville College Oxford (2003-2006), and the Research Councils UK Fellow in South Asian and Iranian Archaeology in the Department of Archaeology at the University of Cambridge (2005-2010). He was appointed as a lecturer in 2010, senior lecturer in 2014, reader in 2016, and professor in 2022. He conducts research on the archaeology of India, Pakistan, and Iran and has conducted fieldwork in all three countries. He is currently the PI of the Mapping Archaeology in

South Asia project, which is a collaborative endeavor attempting to document the archaeological heritage of Pakistan and western India.

SESSION SIX: TECHNOLOGY DURING THE HARAPPAN CIVILIZATION

CONTINUITY AND CHANGE IN DIAGNOSTIC INDUS TECHNOLOGIES: EVIDENCE FROM HARAPPA, PAKISTAN

SPEAKER: JONATHAN MARK KENOYER

EMAIL: jkenoyer@wisc.edu

Diagnostic technologies associated with the Indus Tradition will be reviewed on the basis of the stratigraphic excavations at the site of Harappa, Pakistan. The origin and development of major technologies that are characteristic of Indus rural and urban settlements involve architectural features, utilitarian tools, and containers as well as symbolic and ornamental objects. Specific technologies that will be covered in this presentation include the manufacture of unfired and later fired bricks of standardized sizes, drainage technology, and wells, steatite working and firing, faience production, stone bead making, metallurgy, and textile production. While all major civilizations have similar technologies, the detailed recording and stratigraphic excavations at the site of Harappa by the Harappa Archaeological Research Project make it possible to document continuities and changes in these technologies throughout the course of the Indus Tradition. The changing role of these technologies from the initial settlement of the site during the Early Harappan Phase (>3700-2600 BCE), through the height of urban expansion (2600-1900 BCE), and during the Late Harappa Phase (1900-1300 BCE) will be examined.



SPEAKER'S PROFILE

Jonathan Mark Kenoyer is the George F Dales Jr. and Barbara A Dales Professor of Anthropology, at the Department of Anthropology, University of Wisconsin, Madison. He obtained his Ph.D. in 1983 at the University of California Berkeley and has been teaching archaeology and ancient technology at the University of Wisconsin, Madison since 1985. He has served as Field Director and Co-Director of the Harappa Archaeological Research Project since 1986. He has worked on excavations and ethnoarchaeological studies in both Pakistan and India, and more recently in Oman. He has a special interest in ancient technologies and crafts, including

textiles and textile production, socio-economic and political organization, as well as religion. These interests have led him to study a broad range of cultural periods in South Asia as well as other regions of the world, including China, Japan, Korea, Oman, and West Asia in general. His work has been featured in the National Geographic Magazine and Scientific American and on the website www.harappa.com.

He is the author of numerous books and edited volumes on the archaeology of South Asia and the Indus civilization. He has published 4 monographs, two edited volumes with more in process, over 81 influential journal articles, has over 88 articles appear in edited volumes, 12 encyclopedia entries, and 22 book reviews on works relating to South Asian topics. He has helped curate major exhibitions on the Indus Civilization as well as textiles and experimental archaeological exhibits. *Great Cities, Small Treasures: The Ancient World of the Indus Valley*, in 1998-1999, at the Asia Society, in New York, and two other venues. He was also a consultant for the exhibit, *Art of the First Cities: The Third Millennium B.C. from the Mediterranean to the Indus* exhibition curated by Joan Aruz at the Metropolitan Museum of Art, New York, May, 2003.

ARCHAEOLOGICAL STUDY FROM KHANAK: HARAPPAN CIVILIZATION SITE IN BHIWANI, HARYANA, INDIA

SPEAKER: RAVINDRA N SINGH

CO-AUTHOR: CAMERON A PETRIE

EMAIL: drravindrasingh@gmail.com

The Harappan settlement of Khanak is located in Bhiwani, India. Khanak has been excavated by the first author in collaboration with Cameron Petrie, University of Cambridge. From amongst the cultural materials recovered from two seasons of fieldwork at Khanak several samples related to metal production were selected for scientific studies. This included five fragments of crucible, four slag, two samples of copper celt, and one sample of melt adhering to a potsherd. These were examined using SEM-EDS, EDAX and petrological techniques. Thin-section petrography technique has played a crucial role in the provenance studies of the ancient ceramics and slag. First, when the non-plastic inclusions derive from distinctive igneous and metamorphic rocks, thin-section petrography of slag provides a predictive method for identifying the source of the raw materials used in metallurgy. Very occasionally, a particular “key” inclusion allows one to identify the precise source of the raw materials, ores, and minerals. Electron microscopy was used to study the surface and internal structure of the slag samples. The information acquired provides more detailed information than that obtained from the petrological analysis. The data that has emerged so far from the present and earlier analysis will be presented.



SPEAKER'S PROFILE

Ravindranath Singh retired from the Professor and Deputy Coordinator position at the Centre of Advanced Studies, Department of AIHC and Archaeology at Banaras Hindu University. He has nearly thirty years of experience in research and teaching. His area of interest is grounded in the implication of scientific techniques in Archaeology, especially by SEM, EPMA, X-Ray, and Metallography. He has published his research in numerous reputed peer-reviewed journals.

Cameron A Petrie is a Professor at the Department of Archaeology, University of Cambridge, Cambridge, Downing Street, Cambridge, United Kingdom.

TECHNOLOGY OF HARAPPAN / CHALCOLITHIC COPPER FROM GUJARAT: REFLECTIONS ON COMPOSITION AND CONSERVATION

SPEAKER: AMBIKA PATEL

EMAIL: ambika.patel-museology@msubaroda.ac.in

Gujarat, the southern regional extension of the Indus civilization has many Harappan/Chalcolithic sites with abundant material assemblages. Copper artefacts in the material assemblage of the Harappan / Chalcolithic realm reflects the technological achievements of the cultural period. These copper artifacts carry stories of their creation in the form of signature patterns indicating the stages of fabrication and the technological dimensions. Outcome of the research done to trace the composition of the copper artifact assemblage from the Harappan / Chalcolithic sites of Gujarat, namely Bagasra, Shikarpur, Motipipli, Jaidak, Nagwada, Navinal, and Kanmer to see the trace element pattern and the composition of them will be shared in the presentation. Majority of the copper artifacts being heavily corroded leaving no core in it paused difficulty in composition study for few sites. The compositional analysis enabled tracing the alloy patterns to generate a preliminary set of data to take up the compositional comparative studies further. The presentation will also include the preventive and professional conservation measures undertaken for the copper artifacts of few of the sites.



SPEAKER'S PROFILE

Ambika Bipin Patel is the Head of the Department of Museology, and also holds the position of Dean of Students at the Maharaja Sayajirao University of Baroda, Gujarat, India. Moreover, she is the President of ICOM, India. Dr. Patel was also a member of the University Granth Nirman Board (Government of Gujarat) from 2014-2018 and served as an advisor (museum project) in the Statue of Unity. She has received the KN Dikshit Visiting Lectureship award at the University of Wisconsin, along with Andrew Mellon Conservation Fellowship 2015-Metropolitan Museum of Art, New York, USA, Indo-French Social Scientist Education Exchange Fellowship

2013-Foundation Maison des Sciences del'homme (FMSH) and UGC at CREOPS, Sorbonne IV, Paris, FRANCE, UK Visiting Fellowship 2013-14 - NTCIVA and Charles Wallace India Trust at V&A, London, UK and Cultural Heritage Institute South Asia Fellowship 2007-Council of American Overseas Research Center at Smithsonian Museums, Washington DC, USA. Her pertinent contribution to museum-related endeavors encompasses coordination of the museum collections and the development of the database for the Department of Archaeology and Ancient History from 2005-2013. Dr. Patel has published two books and has received 6 international travel grants, including research in Oman, Nepal, and Sri Lanka. She was also a recipient of the H. D. Sankalia Young Archaeologist Award (2002).

DIACHRONIC PERSPECTIVES ON SEAL PRODUCTION TECHNOLOGIES OF THE INDUS TRADITION: NEW INSIGHTS INTO ORGANIZATION, INTEGRATION, AND VARIATION

SPEAKER: GREGG JAMISON

CO-AUTHOR: AKINORI UESUGI

EMAIL: gregg.jamison@gmail.com

Engraved seals are among the most well-known and studied forms of material culture from the Indus Tradition of ancient South Asia. They were made and used for at least 2000 years and are diagnostic of multiple cultures from the Regionalization (5500-2600 BCE), Integration (2600-1900 BCE), and Localization Eras (1900-1300 BCE). Comparative studies of seal production technologies provide insights into craft production and its relationship to broader economic, social, political, and ideological systems. This paper highlights the results of our ongoing research of seal production technologies of the Indus Tradition. Using complementary methods including classification, distribution patterns, ethnoarchaeological, experimental, microscopic, and formal analyses, we investigate the long history of seal production and use in ancient South Asia. Though many examples of similarities and continuities in production strategies and iconography can be observed within and among different eras of the Indus Tradition, there is clear evidence of variation. Some of this is patterned and can be correlated with multiple sources. Taken together, the results of our study provide new insights into the significant role that seals played in the organization and integration of the people and places that made the Indus, and how they varied and changed over time and space.



SPEAKER'S PROFILE

Gregg Jamison is an Associate Professor of Anthropology at the University of Wisconsin-Milwaukee at Waukesha. He teaches a variety of introductory and upper-level anthropology courses and received his Ph.D. in Anthropology (Archaeology Section) from the University of Wisconsin-Madison. Professor Jamison is an anthropological archaeologist whose primary research interests include the Indus Civilization (2600-1900 BCE) of ancient South Asia, engraved seal production and use, prehistoric craft production, experimental and ethnoarchaeology, and the origins of cities and states. Since 2018, he has also served as the Lead Archaeologist

for the UW MIA Recovery and Identification Project, which aims to recover and repatriate the remains of missing American Armed Services Personnel from World War II. He has conducted archaeological fieldwork in India, Pakistan, Oman, Bahrain, France, Belgium, Poland, and throughout the midwestern United States.

Akinori Uesugi is an Associate Professor at the Institute for the Study of Ancient Civilizations and Cultural Resources, Kanazawa.

SESSION SEVEN: TECHNOLOGY DURING THE HARAPPAN CIVILIZATION

HARAPPAN SHELL PRODUCTION IN GUJARAT, WESTERN INDIA: RAW MATERIAL, STOCKPILING, ACTIVITY AREAS, AND WORKSHOPS

SPEAKER: KULDEEP KUMAR BHAN

EMAIL: bhankuldeep07@gmail.com

After stone and terracotta, the shell is one of the most durable materials in the archeological context, and most of the Harappan sites have significant shell artifacts because of its use as a raw material to produce a variety of utilitarian and ornamental objects. The study of shell working is a growing field of investigation in the archaeology of South Asia since the pioneering work on Harappan shell-working by Jonathan Mark Kenoyer in the early 1980s, though some archaeologists unfortunately still prefer to refer artefacts manufactured from shells as “miscellaneous small finds”. However, most scholars agree that it provides a unique perspective on ancient trade, networks, technological and economic organization, wealth and social hierarchy, ritual symbols, as well as chronological changes. In recent years, new research on the Harappan Civilization is aimed at a better understanding of the protohistoric urban centers as well as rural towns and villages. With the accumulation of new data, varied types of misconceptions regarding the rigid social structure and unimaginative material culture are being replaced by a new appreciation of the complex and varied nature of this civilization.

With the adoption of rigorous excavations and recovery methods, a wide range of shell objects from well-dated contexts, along with the evidence of manufacturing processes, activity areas, stockpiling areas, and workshops have been forthcoming from many recently excavated archaeological sites of Gujarat. During the last four decades, ethnoarchaeological research on shell production had made significant advances, especially in the context of Harappan Studies. A discussion on shell in this paper will demonstrate how ethnoarchaeological studies in combination with analytical studies have contributed to more reliable interpretations of raw material resource areas and craft activity areas and demonstrates how it helps in developing more meaningful research questions of urbanism and the character of the Indus socio-religious and political systems.

In this paper, I will discuss the current research on shell-working in the region of Gujarat, Western India. The detailed study of the Harappan shell-working and on the basis of analogy with contemporary agate working of Khambhat and shell-working of Bengal, the shell-working reflects the following hierarchy among the shell cutters:

- 1) *Shell cutters families controlling the large shell workshops*
- 2) *Small – scale entrepreneurial workshops*
- 3) *Shell cutters recycling the shell manufacturing waste to produce smaller or lower quality objects and*
- 4) *The itinerant crafts persons processing shells to sell their ware to smaller outlying villages.*

Stratification in the trade of raw materials and the movement of finished goods is also reflected in the shell industry. Different types of shell-working techniques were necessary to produce various objects, and at each site, the role of this industry is slightly different. Nonetheless, an overall pattern can be seen in the industry at the major urban centers, such as Mohenjo-daro, Chanhu Daro, Harappa, and Lothal etc. At these sites, we see a wide variety of objects being produced primarily for markets within the city or at the most for nearby rural sites. Smaller rural or coastal sites like Allahdino, Balakot, Nageshwar, and Gola Dhoro produced only a limited range of artifacts. At Balakot the intensive production of Tivela

bangles appears to have been gauged towards a limited regional market along the Western coast. Nageshwar and Gola Dhoro however, seem to have specialized in the production of bangles and ladles primarily for trade to regional and extra-regional markets.



SPEAKER'S PROFILE

Kuldeep Kumar Bhan, formerly Chair of the Department of Archaeology and Ancient History, Maharaja Sayajirao University of Baroda. Gujarat, India. He was also Director and the Curator of the Archaeological Museum of the Maharaja Sayajirao University of Baroda.

He was born in and raised in Srinagar (Kashmir) and completed his early schooling and Bachelor's of Science from Kashmir University. He obtained his Master's, completed his Ph.D. and Post Graduate Diploma in Museology from the Maharaja Sayajirao

University of Baroda. Over the past 25 years, Dr. Bhan has collaborated in major excavations at several important settlements of the Indus Civilization in Gujarat. Though these settlements are small, they were flourishing trade and craft production centers of the Indus Civilization. He has also excavated numerous other settlements that belong to periods both preceding and following the Harappan cities. He co-directed the Khambhat Bead Project with Professor JM Kenoyer, and Prof. Massimo Vidale

His special expertise lies in ancient technologies and crafts, which has led him to study a broad range of cultural periods. He taught South Asian Archeology and ancient technology in the department of Archaeology and Ancient History at the M S University of Baroda. As director and curator of the Archaeological Museum of the Maharaja Sayajirao University of Baroda, he has planned many exhibitions that have toured various places in India and abroad. He has successfully collaborated with many Indian and Foreign research projects.

PRELIMINARY INFORMATION ON AN UNREPORTED HOARD OF COPPER AND SEMIPRECIOUS STONES OBJECTS FROM MOHENJO-DARO

SPEAKER: MASSIMO VIDALE
EMAIL: mass.vidale@gmail.com

In 1984, Maurizio Tosi spotted the fragments of a copper vessel eroded in situ on the surface of Mohenjo-daro. In the following weeks, together with other colleagues, he micro-excavated the find in the laboratory unearthing a set of two blades, two axes, a group of copper bangles, and 106 beads of different materials. The position of each single object and its micro-stratigraphic and depositional setting were carefully recorded. After the end of the field activities of the German-Italian project at Mohenjo-daro that Tosi co-directed with Michael Jansen, the hoard was not published, and the records remained in a distant, scarcely accessible archive. The closure of ISMEO in 2012 and Tosi's death in 2017, and the closure of the Museo Nazionale d'Arte Orientale, Rome, in the same year, were additional problems. While we are presently locating the original photographic documentation (all our archives now having been moved to the new Museo delle Civiltà, Rome) the excavation report, with maps and sections, was finally found. I will very briefly and preliminarily present what so far has been recovered, and some possible implications and potentials of this important, so far "forgotten" discovery.

SPEAKER'S PROFILE

Massimo Vidale was born in Bassano del Grappa (Vicenza, Italy) on April 10, 1956. He is an Associate Professor at the University of Padova (Methodology of Archaeological Research and Bronze age



Archaeology of Central Asia, Iran and the Indus Valley). He has taught ancient technology at the Central Institute for Restoration (ICR, Rome) from 1990 to 2003. He has been for a long time Visiting Professor at the Universities of Genoa and Rome “La Sapienza” (Taphonomy and Funerary Archaeology). In these contexts, he carried out micro-stratigraphic excavations of urns with cremated remains for the detailed reconstruction of cremation processes and subsequent secondary burials. In addition to collaborations on advanced studies of dentition in prehistory, he specializes in studying ancient and traditional contemporary craft technologies from an ethnoarchaeological perspective; and in micro-stratigraphy

for the reconstruction of funerary behavior. Between 1987 and 1988, he was a Fellow in Materials Analysis at the Conservation Analytical Laboratory of the Smithsonian Institution (Washington DC, USA). Later (1987-1988), with a NATO postdoctoral fellowship, he continued his collaboration with SI and the University of Wisconsin, Madison (USA) continuing his studies on ancient ceramic technologies and craft industries of the Indus civilization.

Between 1987 and 1988 he studied at the Italian Archaeological School of Athens, where he obtained a postgraduate degree in Greek and Roman Archaeology. Since 1976, he has an unbroken record of field experience in Italy, Central, Middle, and South Asia, and North Africa. He has carried out archaeological and ethnoarchaeological projects in Italy, Iran, Iraq, Kuwait, Pakistan, Turkmenistan, India, Nepal, Indonesia, Tunisia, and Eritrea. He is the author of more than 300 specialized articles on the results of his research, of many articles addressed to a more general audience, of 15 monographic volumes, and two co-edited volumes.

AN OVERVIEW OF THE INDUS CIVILIZATION STEATITE ACQUISITION AND PRODUCTION

SPEAKER: RANDALL LAW

EMAIL: rwlaw2@gmail.com

Steatite is a rock composed primarily of the mineral *talc* and was undoubtedly a material of tremendous importance to the Harappans of the Indus Civilization (ca. 2600-1900 BCE). This soft, easily carved stone was not only used for the mass-production of common items, most notably the ubiquitous white steatite bead, but also for the closely controlled creation of objects with significant political and / or economic value, such as stamp seals and inscribed tablets. Steatite artifacts of one kind or another have been reported from practically every Indus Civilization site. Massimo Vidale observed (1989) that the aforementioned beads are so common that their presence alone could almost be considered a marker of a settlement’s “Harappan” character. The renowned scholar Horace Beck (1940: 141) even went as far as to characterize the Indus society as a “steatite civilization”.

In a study originally published in 2011, 141 unheated talc artifacts (mostly manufacturing debris fragments) from the Indus city of Harappa were compared, using instrumental neutron activation analysis (INAA), to geologic samples collected from over three dozen deposits of this stone located across Pakistan and India. Although the results indicated that craftspeople at the site utilized steatite acquired from sources in multiple regions of northwestern South Asia, deposits located in northern Pakistan’s Khyber-Pakhtunkhwa Province were found to be by far the most heavily utilized.

Over a decade has passed to that study and, in that time, the scope of this steatite source provenience study has been significantly expanded. Talc manufacturing debris has now been analyzed from several

other Indus cities (Mohenjo-daro, Dholavira, and Rakhigarhi) as well as from many smaller Harappan and / or Early Harappan settlements. The geologic database has been bolstered with the samples from additional sources. Steatite artifacts from contemporaneous sites in Oman – a region in which there is a well-documented Harappan presence – have also been analyzed. All of this new data, which will be summarized in this paper, has enabled the development of a picture of Harappan talc acquisition and production that is simultaneously more intricate and wide-ranging.



SPEAKER'S PROFILE

Randall Law is an archaeologist specializing in geologic provenience analysis of stone and metal artifacts. He received his Ph.D. in 2008 from the University of Wisconsin-Madison under the direction of Prof. J Mark Kenoyer. His research focuses on reconstructing the trade and communication networks of the Indus Civilization of South Asia. He has participated in excavations and has conducted extensive field studies in India, Pakistan, and Oman.

ECONOMIC PRODUCTION, CULTURAL, AND FOOD CONSUMPTION PRACTICES OF THE HARAPPANS: VIEWS FROM SHIKARPUR, GUJARAT

SPEAKER: AJITHPRASAD P

EMAIL: ajit.karolil@gmail.com

Customs and manners associated with food consumption are bound by cultural practices influenced by modes of economic production. Generally, cooking and serving vessels reflect culturally ordained culinary habits far better than other vessels. The Harappan ceramic assemblage includes several vessel forms specially used for cooking and curating cooked food and bowls and dishes used for serving. The most easily identifiable vessels of this category are the wide-mouthed, somewhat squat, medium-sized cooking pots with a ledge and the open-mouthed conical bowls with a flat base. While the cooking vessels and their standard features are investigated in somewhat more detail, few studies are carried out on the specific features of the serving vessels. The open mouthed conical bowls are one of the serving vessels reported in sizable numbers in the Urban Harappan context. A study of these bowls excavated from Shikarpur revealed their typo-technological features and stratigraphic context.

Although made on a fast wheel, they exhibit a casualness in their overall appearance. The size and the conical form of these bowls are more or less standard but sometimes vary within a limited range. Spatial distribution of these bowls at the site indicates the context of their use and their link with economic production-related activities. These observations were compared with data from other Urban Harappan sites in Gujarat and the Indus valley. The specific morphological features and unusual abundance of the bowls from Shikarpur would suggest they were produced as one-time-use vessels, which could be discarded after use. This practice is prevalent even today in many parts of India, which is linked to the idea and practice of pollution through contact or food sharing. While the abundance of conical bowls at Shikarpur may indicate the Harappan practice of “use and discard”, it is debatable and difficult to confirm if it reflects the idea of food pollution. More important, however, is the association of these vessels in the areas or contexts related to economic activities at Shikarpur, which reflects additional dimensions of social and food consumption practices.



SPEAKER'S PROFILE

Ajithprasad P joined the Maharaja Sayajirao University of Baroda, at the Department of Archaeology and Ancient History as a faculty member in 1990 and retired as Professor in June 2021. He taught prehistory and bioanthropology for over three decades and currently is a Visiting Faculty at the IIT Gandhinagar. His research interest spans from Stone Age prehistory to Harappan archaeology. He has worked on the Harappan archaeology from the 1980's onwards and has been a part of the M S University excavations of the Harappan sites in North Gujarat, Kachchh, and Saurashtra. Many of these excavations have investigated issues of hunter-gatherer transition

and the beginning of agro-pastoral life in the context of Early Harappan settlements in North Gujarat. He is currently involved in the Palaeolithic investigation in Kachchh along with the study of Early Harappan and Harappan cultural development in Gujarat.

SESSION EIGHT: GENETIC STUDIES OF ANCIENT SOUTH ASIAN POPULATIONS

ORIGIN OF ANCIENT AND CONTEMPORARY INDIANS: GENOMIC PERSPECTIVES

SPEAKER: K THANGARAJ
EMAIL: thangs@ccmb.res.in

Modern India is a region of remarkable cultural, linguistic, and genetic diversity with over 4,500 anthropologically well-defined groups. Our genetic studies provided evidence that the enigmatic tribal populations of Andaman and Nicobar islands are the first modern humans, who migrated out of Africa and reached the islands about 65,000 years back. Further, we demonstrated that the contemporary Indian populations have descended from two divergent groups: (1) Ancestral South Indians (ASI) and (2) Ancestral North Indians (ANI). Unfortunately, we do not have enough ancient biological materials in India to understand the genetics of ancient Indians. The only complete ancient genome we sequenced from the Indus Valley Civilization (IVC) fits as a mixture of people related to ancient Iranians (the largest component) and Southeast Asian hunter-gatherers, a unique profile that matches ancient DNA from 11 genetic outliers from sites in Iran and Turkmenistan in cultural communication with the IVC. These individuals had little if any Steppe pastoralist-derived ancestry, showing that it was not ubiquitous in northwest South Asia during the IVC as it is today. Another study, where we have sequenced 523 ancient humans from Central and South Asia, revealed that the primary source of ancestry in modern South Asians is a prehistoric genetic gradient between people related to early hunter-gatherers of Iran and Southeast Asia. After the Indus Valley Civilization's decline, its people mixed with individuals in the southeast to form one of the two main ancestral populations of South Asia, whose direct descendants live in southern India.



SPEAKER'S PROFILE

K Thangaraj is presently the Director of the Centre for DNA Fingerprinting and Diagnostics (CDFD) at Hyderabad. Prior to this, he was Chief Scientist and Group Leader at the Centre for Cellular and Molecular Biology (CCMB), Hyderabad. His main research interests are; the origin of modern human, cardiovascular diseases, mitochondrial disorders, and male infertility. He has published more than 280 research articles, some of which are in *Cell*, *Lancet*, *Science*, *Nature*, *Nature Genetics*, etc. He is an elected Fellow of - the Indian National Science Academy, Indian Academy of Sciences, and the National Academy of Sciences. He is a recipient of several

awards, including JC Bose Fellowship, Sun Pharma Research Award in Medical Sciences, Raman Research Fellowship, Lifetime Achievement Award, Excellence in Science Award, Distinguished Scientist Award, Sir CV Raman Memorial Lecture Award, Sir Dr. UN Brahmachari Award, and delivered several orations. He is a Board Editor of *Mitochondrion*; Associate Editor of *BMC Medical Genetics*; *BMC Genetics*; *Tropical Medicine and International Health*, and a member of the Editorial Board of the journals – *Scientific Reports*, *Human Genetics*, and *Clinical Genetics*. He was the President of the Indian Society of Human Genetics (2011 – 2015) and the founder of the Society for Mitochondrial Research and Medicine.

WHICH LANGUAGE GROUP IS THE FIRST SETTLER OF INDIA?

SPEAKER: GYANESHWER CHAUBEY

EMAIL: gyaneshwer.chaubey@bhu.ac.in

India has four primary language families, predominantly distributed over non-overlapping geographic regions. Among these language families, the Indo-European family is the largest, followed by Dravidian, Austroasiatic, and Trans-Himalaya (Sino-Tibetan). The early ethnographic, Indological, and linguistic scholarship during British Raj suggested Austroasiatic as the oldest language family. Further work bolstered this view based on the classical genetic markers. Overall, the view that the first Indians were Austroasiatics, who were further pushed by the agriculturist (Dravidian) coming from West Asia nearly 3000 BCE and the arrival of Aryans during 1500 BCE have settled the present geography of language groups. This most widely accepted view has also gained support from several genetic studies. We have revisited this 150 year old question with high-resolution genetic data and a large number of samples. We outlined several shortcomings of the previous theory and suggested rewriting the age-old colonial theory.



SPEAKER'S PROFILE

Gyaneshwer Chaubey is presently a full Professor in the Department of Zoology at Banaras Hindu University, Varanasi, India. His research is focused on the pre-historic early peopling of South and Southeast Asia and their admixture, drift, and selection. He is also applying his expertise in predicting the pre-disposition of the population to complex trait diseases and emerging infectious diseases and their applications in medical genetics and associated DNA technologies. He developed his expertise at the Estonian Biocentre and the University of Tartu, Estonia, as a Ph.D. student and thereafter in scientist and senior scientist positions. He was

also a visiting scientist at the Sanger Centre, United Kingdom. He realized his interest and developed fundamental skills in his early days at the Centre for Cellular and Molecular Biology, Hyderabad. He has contributed to a milestone number of discoveries in this field. He is an emerging authority on the understanding and elucidation of the genetic structure of South Asia with a high impact on the human genomics of population and its applications in complex trait diseases and emerging pathological diseases, and forensic genomics.

SESSION NINE: THE INDUS SCRIPT: INPUTS FROM ARCHAEOLOGY AND STATISTICAL STUDIES

A DIGITAL CORPUS AND EPIGRAPHICAL DATABASE FOR INDUS SCRIPT RESEARCH

SPEAKER: ANDREAS FULS

EMAIL: andreas.fuls@tu-berlin.de

The Indus culture (2600-1700 BCE) is found in Pakistan and NW India, and is one of the earliest ancient civilizations, along with the civilizations of Egypt, Mesopotamia, and China. This Bronze Age culture is most famous for its short inscriptions found on different artefacts such as seals, tablets, pots, bangles, and sealings. Since the Indus writing system has for the most part remained undeciphered, our knowledge of the Indus culture is based solely on the interpretation of archaeological data. Any decipherment, even a partial one, would provide important information about the Indus people, their social structure, trade, and religion.

The basis of successful decipherment is an up-to-date corpus of Indus inscriptions and a comprehensive sign list, which makes it possible to analyse sign patterns and to identify the Indus root language(s). This is the reason why the Interactive Corpus of Indus Texts (ICIT) has been compiled. At present it contains 4665 inscribed objects with 5650 texts and 17966 legible sign occurrences. It is complemented with 16015 images of photos and drawings of the artefacts. Analytical methods have been developed to analyse Indus inscriptions such as Normalized Weighed Sign Position Histograms, Multivariate Segmentation Trees, and a classification method to determine the type of the Indus language.

A special issue that will be discussed is the heterogeneity of Indus inscriptions and the spatial and temporal distribution of inscribed artefacts. Because of the varying number of excavated Indus artefacts at each site, a modified Chi-square test shows the comparison of frequencies with expected frequencies of homogenous distribution. This is especially important because of the many low frequencies of excavated artefacts and published data of Indus archaeology. One of the main implications we can already draw from the spatial distribution and statistical tools is that inscribed Indus artefacts are not homogeneously distributed. The archaeological context indicates that inscribed artefacts were used for various purposes and should not be considered as one homogeneous set of data.

The goal of the database project is to make all Indus inscriptions accessible to scholars worldwide and to stimulate further research on Indus writing and the Indus culture in general. The database is accessible through a web-based online user interface and will be constantly updated in the future after the publication of new excavated inscriptions of the Indus culture.



SPEAKER'S PROFILE

Andreas Fuls is a geodesist specialized in mapping and surveying. He has been working at the Technical University of Berlin in the Institute of Geodesy and Geoinformation Science since 1988. He holds a Ph.D. in the field of History of Mathematics, Natural Sciences, and Techniques from the University of Hamburg. His publications

deal with archaeoastronomy as well as epigraphy of the Maya, Indus, and Minoan cultures. Since 2007, he has been developing and managing an online database for Indus inscriptions in cooperation with Dr. Bryan Wells, the Interactive Corpus of Indus Texts (ICIT).

DIRECTIONS FOR THE DIRECTION: USING STATISTICS TO COMPUTATIONALLY INFER SEQUENCE ORIENTATION IN UNDECIPHERED INSCRIPTIONS

SPEAKER: MD IZHAR ASHRAF

EMAIL: ashraf.bioinfo@gmail.com

In this talk, using large written corpora for many different languages and scripts, we show that the occurrence probability distributions of signs at the left and right ends of words have a distinct heterogeneous nature. Characterizing this asymmetry using quantitative inequality measures, viz. information entropy, and the Gini index, we show that the beginning of a word is less restrictive in sign usage than the end. We use the existence of this asymmetry to infer the direction of writing in undeciphered inscriptions of the Indus Valley Civilization that agrees with the archaeological evidence.



SPEAKER'S PROFILE

Md. Izhar Ashraf is a Research Associate in the Computational Epigraphy Lab (CEL) at the Institute of Mathematical Sciences (IMSc), Chennai. He did his Ph.D. at the BSACIST, Chennai, under the supervision of Prof. Sitabhra Sinha, IMSc, Chennai. His research focuses on developing computational tools that can aid in the eventual decipherment of Indus Valley inscriptions by identifying statistically significant regularities and inferring the underlying syntactic structure of the inscriptions.

OF GOODS AND PEOPLE: THE INDUS-RELATED SEALS BEYOND THE HARAPPAN WORLD

SPEAKER: DENNYS FRENEZ AND MASSIMO VIDALE

EMAIL: dennys.frenez@gmail.com; mass.vidale@gmail.com

This presentation discusses how the stylistic features and operational uses of Indus-related seals were adapted to the different socio-economic and cultural contexts in which they were found beyond the Greater Indus Valley. Standard Indus-type seals with a short string of writing signs above the image of a male animal or a narrative scene suddenly appeared in the Indus Valley during the second quarter of the third millennium BCE, in connection with the emergence of a highly structured production and exchange system regulated by common standards and procedures. Seals of the Indus standard type or with characteristics linked to the Indus glyptic tradition were later found in all regions of Western and Central Asia, from the Indus Valley to eastern Syria and from southern Arabia to northern Afghanistan, in contexts spanning the second half of the third millennium BCE. Such Indus-inspired seals were often produced by conforming their morphology and/or the stylistic rendering and composition of the Indus-derived iconographies to the autochthonous seal traditions and art styles. In some exceptional cases, they were also inscribed in the local scripts and languages. The possibility of deconstructing the various Indus features embedded in the different receiving administrative systems not only contributes to reconstruct the organisation of Indus external trade but also to infer their original function and significance in the Indus standard seals.



SPEAKER'S PROFILE

Dennys Frenez obtained his Ph.D. in archaeology on Indus Civilization external trade from the University of Bologna (Italy) in 2011. He is currently investigating long-range trade and cross-cultural interactions between urban-level societies in South and Middle Asia during the Bronze Age, with a specific focus on the Indus Valley and Oman. His research involves a wide range of theoretical and methodological approaches, including ancient administrative and writing systems, traditional technologies and crafts, iconography and art styles, and social-economic and political organization. He directed archaeological excavations in

India and Oman and worked on archaeological collections with several museums and archaeological expeditions in India, Pakistan, Oman, UAE, Tajikistan, and Turkmenistan, establishing an extensive network of academic and research partnerships. He organized international conferences and exhibitions, published several edited volumes, and is a member of scientific and review committees of scholarly journals. He is presently the adviser for archaeology and heritage to the Ministry of Heritage and Tourism of the Sultanate of Oman.

Massimo Vidale is an Associate Professor at the University of Padova (Methodology of Archaeological Research and Bronze age Archaeology of Central Asia, Iran and the Indus Valley).

COMPUTATIONAL STUDIES OF THE HARAPPAN SCRIPT

SPEAKER: NISHA YADAV

EMAIL: y_nisha@tifr.res.in

Harappan script has defied decipherment. Several attempts have been made in the past to decipher the script but there is no consensus about its content. The lack of definite knowledge about its structure makes it difficult to objectively evaluate any claim of decipherment. We have tried to fill this lacuna by analyzing the structure of the Harappan script using various computational techniques. The focus of our study is to identify patterns in the Harappan writing and explore its underlying logic without making any assumptions about its content. In the present talk, I will provide an overview of our computational studies of the Harappan script.



SPEAKER'S PROFILE

Nisha Yadav is working at the Tata Institute of Fundamental Research, Mumbai. Her research aims at elucidating the structure of the Harappan script using computational methods and investigating its connection to other aspects of the Harappan culture. She has published several papers on Harappan script in leading international and Indian academic journals. Her work has also been a subject of articles in press, journals, and documentaries. She was awarded the INSA Young Historian of Science Award (2017) for her work on the Harappan script.

COMPUTERS, STATISTICS, AND INSCRIPTIONS: THE DIGITAL EPIGRAPHY OF INDUS "WRITING"

SPEAKER: SITABHRA SINHA

EMAIL: sitabhra@imsc.res.in

The talk will focus on the development of unsupervised computational techniques at the IMSc Computational Epigraphy Lab (iCEL) to infer characteristic properties underlying syntactic organization of sequences, including yet-to-be-deciphered inscriptions. Applying techniques based on graph theory and statistics to various different corpora of linguistic sequences and on a database of inscriptions from the Indus Valley Civilization (IVC), we report a number of possibly universal structural patterns that may aid in deciphering IVC inscriptions.



SPEAKER'S PROFILE

Sitabhra Sinha is Professor of Theoretical Physics and Dean of the Computational Biology Graduate Program at the Institute of Mathematical Sciences (IMSc), Chennai, and was earlier also an adjunct faculty of the National Institute of Advanced Studies (NIAS), Bangalore and the Department of Computer Science, Indian Institute of Technology, Kharagpur. He did his Ph.D. at the Indian Statistical Institute, Kolkata and postdoctoral research at the Indian Institute of Science, Bangalore and the Weill Medical College of Cornell University, New York City, joining the faculty of IMSc in 2002. His research falls broadly under complex systems, nonlinear

dynamics, and statistical physics with applications to systems biology, economic and social sciences, and computational linguistics.

THE INDUS SCRIPT: INPUTS FROM ARCHAEOLOGY

SPEAKER: PALLAVEE GOKHALE

EMAIL: pallavee.g@gmail.com

Harappan script scholarship is an archaeological discourse debating on the linguistic nature of the undeciphered signs, also known as the Indus script. Despite being an invaluable archaeological material, the artefacts popularly identified as seals, sealings, and tablets, which carry these signs, have merely performed a sign / script bearer role. Since the 1930s, there are more than 10 different sign lists (ranging from ~20 to 700 signs) and more than 100 decipherment claims by multiple scholars. However there is no consensus yet. Majority of the scholarship can be seen as influenced by linguistic hegemony and passing through phases of research. This phenomenon can be explained based on combined effects of multiple parallel developments in the socio-political atmosphere, archaeological theory, technological innovations, and changing mindsets. The post-independence motion of imbibing "scientific" approach in all academic faculties is manifested in the form of Harappan script decipherment studies based on advanced statistical analysis of sign concordances. These are rooted in the ideas of language and nation relationship, notional needs of developed past, and script considered as an "essential feature" of civilization. The problem with various decipherments and encodings is that there is no element of falsifiability. Their claims are constrained in their own systemic framework.

The consequence of this linguistic scholarship has resulted in latency in typology studies of the artefacts which generally forms the basis for material interpretation epistemologies in archaeology. The class of artefacts under discussion is seen in numerous shapes, sizes, materials, and forms,

almost all bearing sign sequences from the sign corpora described above. The most common forms are square steatite intaglio seals depicting single-horned animal with perforated boss at the back, rectangular ones without iconography, copper incised tablets with signs and icons on multiple sides, clay or terracotta tablets with signs and icons in relief - either moulded or impressed. Despite diversity in its form, material, and detailing, there aren't other alternate interpretations to trade.

The recent advances in technology, accompanied by postmodern thought elaborate on the materiality, contextuality, and typology to some extent. The new scholarship has raised questions about the monolingual presumption about the vast geographical area. Because of the lack of consensus on linguistic outputs and inability to validate the claims, scholars insist on searching for bilingual texts through new excavations as a solution. The hegemonic position assumed by the linguistics can be seen posing serious constraints in this scholarship. With the new excavation, should we find more diverse artefacts in their forms, the interest is still limited to "reading" the signs rather than "interpreting" the artefacts for their "purpose" and "place" in the past society.

This presentation provides a birds eye view of this scholarship with emphasis on inputs from the archaeological domain and hence the additions to our understanding.



SPEAKER'S PROFILE

Pallavee Gokhale is a doctoral research fellow at the Humanities and social sciences department at IISER Pune. She is an associate at Tejaswini Aphale Associates, Pune and a research collaborator at LIAVH, Pratt Institute, New York. She is director at Citizen Archaeology Foundation - CAF, supported by Tata Trust and established in partnership with the Archaeological Survey of India. She holds Master's in GIS and Remote Sensing from University of Greenwich, UK; in archaeology from Deccan College, Pune (H D Sankalia Gold Medal); and in Indology from TMV, Pune. With professional experience in the domains of Geospatial data and

software quality engineering for 12 years, she has interdisciplinary interests in archaeology involving spatial analysis, artefact typologies, and cultural interpretation. She has been a resource person at IISER Pune, CEPT (Ahmedabad), Deccan College (Pune), UCC (Meghalaya), and ASI for geospatial data and its significance in different domains. Her work on 18th century Maratha period water supply system in Pune has reached wider public through multiple forums, such as academic articles, interactive online visualization, popular, and academic talks including those of Pune Heritage Festival and UNESCO-ICQHS conference, and virtual exhibit hosted by Living Waters Museums (LWM). She has presented her work in multiple national as well as international conferences and has contributed to academic literature through journal articles and publications in proceedings. For the 50th conference on Computer Applications in Archaeology-CAA2023, she is a session co-chair for Session10- "Computer applications in archaeology – Bringing South Asia together".

INDUS SCRIPTS INCISED ON THE SEALS DISCOVERED FROM THE INITIAL PHASE OF HARAPPAN PERIOD: AN INVESTIGATION OF THE CHRONOLOGY OF INDUS WRITING SYSTEM

SPEAKER: AYUMU KONASAKUWA

EMAIL: kotdiji@hotmail.co.jp

The archaeological study of Harappan Civilization began with the excavation of sites, such as Mohenjodaro and Harappa in the 1920s. More recent excavations in Pakistan and India have resulted in refined

chronologies and new data that are radically changing our understanding of various aspects of this Civilization. The study of Harappan seals also has made advances over the past 10 years.

The chronology of Harappan seal, even if it's still in the research process, must be taken into consideration for discussing various aspects of Indus script, because Indus script is basically incised on the Harappan seal and it has been studied without consideration of their chronology. Based on the typological study under the results of Harappa and Farmana excavations, the Harappan seals having a right-facing animal would be understood as the seals corresponding to the seals from Harappa period 3A (2600-2450 BCE), i.e. the seals of the initial phase of the Harappan Period.

Although it is expected to increase in the future, Indus scripts incised on the Harappan seals having a right-facing animal, i.e., Indus scripts used in the initial phase of the Harappan Period, are restricted in only 71 signs. The number of signs is quite small compared to the number of signs in the Mature Harappan period. Furthermore, there are also examples of the seals shared with the same Indus script(s). Harappan seals having a right-facing animal excavated in the Ghaggar basin include many examples characterized by the same Indus script(s), such as a diamond-shaped sign, a fish-like sign, a spear-like sign, a dot-shaped sign, which is comprised of several dots and a tree-like sign.

In the present paper, various aspects, including carving techniques, of the Indus script used in the initial phase of the Harappan Period, especially in the Ghaggar basin, will be appraised. The results of this paper will examine changes and continuities in Indus writing system from the Initial phase of Harappan to the Mature Harappan periods and do indicate their significance for the better understanding the chronology, context, and interpretation of the Indus writing system.



SPEAKER'S PROFILE

Ayumu Konasukawa – Ph.D., from Deccan College Post-Graduate and Research Institute in Pune, is an Associate Professor, Graduate School of Asian and African Area Studies (ASAFAS), Kyoto University. His research interest is focused on the socio-economic, political, and cultural structure of the Indus Civilization (2600-1900 BCE) that developed in the territory of present-day Pakistan and northwest India with a specific focus on the seals from the Early Harappan (3300-2600 BCE) to the Harappan periods (2600-1900 BCE) in the Ghaggar Basin. Archaeological researches and studies in India and Pakistan were unique opportunity to him for gaining

insight into the Indus Civilization. He has conducted archaeological researches in the Ghaggar Basin, India with the Department of Archaeology, Deccan College Post-Graduate and Research Institute. His publications (in Japanese) are *Socio-economic, political and cultural Structure of the Indus Civilization and the Principles of Ancient Cities* (Doseisha Publishing Co., Ltd., Tokyo, 2016), which won the Prize of Japanese Association for South Asian Studies (JASAS) in 2017, *Comparative Archaeology on the Evolution of Society: Ancient Cities, Power, and State*, co-edited with Yoshitaka Hojo and Yui Arimatsu (Yuzankaku Publishing Co., Ltd., Tokyo, 2021), and *Population, Resources, and Environment in South Asia*, co-edited with Koichi Fujita and Takashi Oishi (INDAS-South Asia (Integrated Area Studies on South Asia) project at the National Institute for the Humanities (NIHU), Center for South Asian Studies, Graduate School of Asian and African Area Studies (ASAFAS), Kyoto University (KINDAS), Kyoto, 2022).

SESSION TEN: HARAPPAN CIVILIZATION VS. VEDIC CULTURE: POSSIBLE POINTS OF CONTACT / TRANSMISSION

STATE OF THE ART IN THE “ARYAN” DEBATE

SPEAKER: KOENRAAD ELST

EMAIL: koenraad.elst@gmail.com

Indians in large numbers assume that the argument against the Aryan Immigration / Invasion Theory (AIT) has won, so that the AIT is a thing of the past. True, the argument against the AIT has by now become impressive, but it will only be victorious once the pro-AIT establishment concedes. This is not the case at all: an established Indo-Europeanist who even knows what the rival Out-of-India Theory (OIT) actually says, is hard to find. For them, any Homeland debate is between various sites around the Black Sea. So, let us take stock of what much debate with the OIT has actually taken place, and deduce which steps to take next.



SPEAKER'S PROFILE

Koenraad Elst was born in a Catholic family in Leuven, Belgium, in 1959. He earned M.A. degrees in Sinology, Indology, and Philosophy. While starting a family of four, he built a precarious professional existence as a foreign affairs journalist and columnist, mostly freelance (punctuated by stints as an assistant in the Belgian Senate and as a guest professor in two Indian universities), keeping his hands as free as possible for Orientalist research. His then-dissident findings on Ayodhya made him a target of cancel culture but also opened the doors of many stalwarts of Hindu assertion. This made possible a Ph.D. dissertation packed with

original information about a topic usually monopolized by “underinformed but overopinionated” academics. It was made available to the public as two books, *Decolonizing the Hindu Mind* and *Who Is a Hindu?*. By then, he had already published a critique of this same movement: *BJP vs. Hindu Resurgence*. In contrast, his verification of the common allegation of “Hindu Fascism” through *The Saffron Swastika* and its sequel are read as a defence of this movement against slander. Presently his focus is more on Hinduism itself than on the Hindutva movement, in keeping with the emancipation of a Hindu intellectual ecosystem from the latter, as in *Hindu Dharma and the Culture Wars*. But he has also written on very different themes, altogether 30 books and numerous papers and contributions to collective research volumes, also in his Dutch mother tongue. Most conspicuous here is his pioneering role in the “Aryan” Homeland debate.

PROF BB LAL'S CORRELATION OF HARAPPAN CIVILIZATION WITH VEDIC CULTURE

SPEAKER: RAJESH LAL

EMAIL: lalrajesh@hotmail.com

The paper “Prof BB Lal on the Harappan Civilization and the Rigvedic People” traces the authorship of the Harappan civilization.

Prof. Braj Basi Lal's study of the Harappan Civilization and its relation to the Vedic Culture had two major pillars. One was archaeology and the other was literary. He always believed that literature must support the archaeological evidence (See *Testing Ancient Indian Traditions on the Touchstone of Archaeology*, 2017, Aryan). In his study to negate the Aryan Invasion Theory (AIT), he traced the evolution of our civilization by tracing the evolution of the people in the plains of Sarasvati, commencing with the findings at Bhirrana and Kunal, dating back to the fifth-fourth millennium BCE. He records further sites in the basin and traces the civilization's next stage nomenclatured "Early Harappan" which was around 3000 BCE. This was followed by "Mature Harappan" around 2500 BCE and the civilization's ending was by about 1900 BCE. This continuity thus established the perpetuity of the civilization commencing from the fifth millennium BCE, and which was indigenous to India. Hence, there was no question of an invasion / immigration of any foreign group. Ergo, no question of AIT.

In his monumental excavations at Kalibangan on the banks of River Ghaggar, established to be the River Sarasvati of the ancient times, and where Prof. Lal discovered the earliest agricultural field, he wanted to ascertain the cause of abandonment of Kalibangan. A team of Indian and Italian hydrologists led by Robert Raikes bored several holes in the dry bed of Sarasvati. In a paper published in *Antiquity* (1968) titled "Kalibangan: Death by Natural Causes" the team concluded that the death of Kalibangan was due to drying up of Sarasvati River around 2000 BCE. Putting this in perspective with what the *Rigveda* says about the Sarasvati being 'a mighty flowing river', he averred that it can safely be assumed that the river could well be thriving around 2500 BCE. It was, therefore, evident that the *Rigveda* had also to be dated to around the third millennium BCE, Sarasvati being an integral part of it.

Prof Lal takes up the literary evidence by quoting the *Rigveda*'s 10.75, verses 5 and 6. Translated, these verses speak of the spread of the Rigvedic people from river Ganga in the east to the river Sindhu in the west, thus:

O Ganga, Yamuna, Sarasvati, Sutudri (Sutlej), and Parusni (Ravi), O Marudvridha and Asikni (Chenab), O Arjikiya with Vitasta (Jhelum) and Sosuma (Sohan), please listen to and accept this hymn of mine. [5]
O Sindhu (Indus), flowing, you first meet the Tristama (and then) the Susartu, the Rasa, and the Sweta (Swat), and thereafter the Kubha (Kabul), the Gomati (Gomal), the Krumu (Kurram) with Mehatnu; and finally you move on the same chariot with them (i.e. carry their waters with you). [6]

Putting in his own words, Prof. Lal concludes:

"Now, a forthright question may be asked: Archaeologically, which culture occupied this very area in the 3rd-4th millennia BCE, i.e., during the time of Rigveda? The inescapable answer will have to be: the Harappan. In other words, the Vedas and the Harappan Civilization are but the two faces of the same coin".

Therein lay Prof. BB Lal's relationship between the Harappan Civilization and the Vedic Culture.



SPEAKER'S PROFILE

Air Vice Marshal Rajesh Lal (Retd.) was commissioned in the Indian Air Force in 1968 as a fighter pilot. He fought actively in the 1971 war with Pakistan and headed an operational base during the Kargil war. A qualified flying instructor, test pilot, and a graduate of the National Defence College,

India, he commanded a frontline Mig 21 Bis fighter squadron and two fighter bases. He held staff appointments at Air Hq level and at the Ministry of Defence.

On his retirement from the IAF in 2006, he was invited to take over as the chief pilot of Indira Gandhi Rashtriya Udaan Academy, Fursatganj, Rae Bareilly. He retired from active flying in 2013 after having spent 46 years in the aviation sector.

He has authored *Glimpses of India: Some 5000 years Ago* (2018); *Still Researching at 96: BB Lal* (2018) and *Connecting with the Mahabharata* (2022). He has also co-edited *Indraprastha Revisited* (2017); *Draupadi and Her Panchal* (2018); *Mahabharat Manthan* (2 vols. 2019) and *Felicitating a Legendary Archaeologist: BB Lal* (3 vols. 2019).

FROM THE GREAT DROUGHT TO THE MAHĀBHĀRATA WAR: VEDIC, EPIC, AND PURĀNIC SOURCES IN COMPARISON WITH THE ARCHAEOLOGICAL PHASES

SPEAKER: GIACOMO BENEDETTI

EMAIL: giacomobenedetti@hotmail.com

The relation between Harappan civilization and Vedic culture can be analysed with the help of the epic and Purānic tradition and chronology. The starting point is the date of the Mahābhārata war, to be placed around 1400 BCE. That period corresponds archaeologically to the end of the Late Harappan phase between Haryana and Gujarat and to the spread of Black and Red Ware in Western UP. These facts correspond well to the descriptions of the migration of the Yādavas from Kathiawar and of the invasion from Magadha of Jarāsandha. In this frame, the Sanauli burial, involving Harappan and Ochre Coloured Pottery elements, belongs to the Rigvedic period of the first half of the second millennium BCE. Around 2000 BCE we have the age of Sudās and Viśvāmitra, associated in the epic tradition with the passage from Tretā to Dvāpara Yuga and with a great drought lasting 12 years, that can be traced also in climatic history and has likely caused a crucial crisis of the Harappan civilization, with the abandonment of several sites and finally the end of the Integration Era. Following these synchronisms, Rigveda and Late Harappan civilization are contemporary, involving both the Sarasvatī valley (that is the central region of early Rigveda) and the Indus valley. The Central Asian elements in Cemetery H can be connected with the invading Pakthas and Bhalānas mentioned in RV VII.18, the hymn of the Battle of the Ten Kings.



SPEAKER'S PROFILE

Giacomo Benedetti has studied Classical Literatures and Indology at the University of Pisa, Italy, completing his Ph.D. with a thesis on the figure of the Rishi in Vedic culture. He has done postdoctoral research in Göttingen, Paris and Kyoto on Vedic, epic and Buddhist texts. He is an honorary fellow of the University of Florence in Indology since 2018. In the last two years he has taught Asian religions at the University of Urbino, Italy.

IMPORTANCE OF THE LEGEND OF DHRUVA FOR INDIAN CHRONOLOGY

SPEAKER: RN IYENGAR

EMAIL: rn.iyengar@jainuniversity.ac.in

The story of the child prince Dhruva who by his penance became the Pole Star is a captivating children's story. This can be traced to the *Brahmānda Purāna* (BP) and the *Visnu Purāna* (VP) which were scripted into their present form in the early centuries of the Common Era (CE). But, there was no visible star at the North Celestial Pole (NCP) during the above period that could have been called *Dhruva* meaning fixed. From where did the Purānas inherit such an astral legend so vividly? Thereby hangs a piece of Indian history of seminal importance going back to early Vedic times (Taittirīya Āraṇyaka) when the star *Abhaya* (Fearless) was stationary, to be popularly called *Dhruva* (Fixed) at the tail end of a group of fourteen stars looking like a four footed aquatic animal called *Śiśumāra*. This constellation forgotten over millennia, except by a handful of orthodox Hindus through their sacred texts, is recognizable as the modern constellation Draco. *Abhaya* the fourteenth star on this whale-like animal figure is α -Draconis (Thuban), which was the North Pole Star for a fairly long period during 3200-2400 BCE. Due to the effect of precession, this sky picture changed with a Vedic text mentioning Dhruva to be moving. There are Vedic rituals of drawing *Soma* juice in *Dhruva Graha* or *Sthālī* (Dhruva cup) that has one to one correspondence with the fixed star of the same name. Even as late as 11th century Alberuni writes that the Hindus he knew, claim that their Pole Star is in a group of stars called *Śākvara* or *Śiśumāra*. Irrespective of when the *Taittirīya Āraṇyaka* and the *Brahmānda Purāna* got fixed, these texts carry cultural layers of the epoch *circa* 3000 BCE as long term societal memory.



SPEAKER'S PROFILE

RN Iyengar (Formerly Professor IISc, Bangalore and Director CSIR-CBRI, Roorkee) is a Distinguished Professor at the Jain University. After establishing a unique Fire Engineering Research Laboratory, currently he is the Director of the Centre for Ancient History and Culture. He is renowned for his contributions to Seismology, Random Vibrations, Mathematical modeling, and Natural Sciences in Sanskrit. He has developed, combining Indic knowledge traditions with modern methods, a new line of study of history of science in India. His findings on comets, eclipses, earthquakes, ancient geography, effect of precession and the Pole Star Dhruva

in Vedic literature, Concept of Probability in classical music, have attracted worldwide attention. He reconstructed the *Parāśaratantra*, an ancient Sanskrit treatise on astronomy and natural sciences, with technical notes in 2013. He has edited *Nāradaśilpam*, a medieval text on Architectural Civil Engineering with introduction, translation, figures, and notes. He is presently editing *Vrddha-gārgīya Jyotisa* an ancient Sanskrit text on astral sciences from 10 unpublished manuscripts.

REVISITING HARAPPAN AND VEDIC HORSES

SPEAKER: MICHEL DANINO

EMAIL: micheldanino@iitgn.ac.in

The presence or absence of the horse in the Indus-Sarasvati civilization has been a bone of contention for decades, especially in the context of the Aryan invasion theory. The argument is familiar: since the Rig-Veda uses the word *ashva* over 200 times, the Vedic society must have been full of horses, and the Harappan civilization, from which the noble animal is conspicuously absent, must be pre-Vedic and non-Aryan. The horse must therefore have been brought into India in the second millennium BCE

by the Indo-Aryans, who used its speed to crushing advantage in order to subdue the native, ox-driven populations. This line of reasoning is regarded as so evident that countless scholars and studies of India's protohistory continue to regard it as the final word on the issue.

However, on closer view, there are serious flaws at every step of the argument: First, the physical evidence of the horse from various protohistoric sites, both in terms of skeletal remains and depictions, is not exactly nonexistent and has been treated with bias. More significantly, colonial and persisting misreadings of the Rigveda have imposed on it a militaristic context, conjuring up armies of invaders hurtling down the Khyber Pass in horse-drawn chariots; in reality, apart from the physical impossibility of such a feat, a scrutiny of the Rigveda shows both ashva and ratha to be, more often than not, metaphorical, imaginary objects, and with no context of warfare; in fact, the text's best kept secret is that not once in the entire Rigveda do we have a mention of a horse-drawn chariot with spoked wheels. The whole argument of a horseless, chariotless, and therefore pre-Vedic, Harappan culture has shaky foundations and needs serious revisiting.



SPEAKER'S PROFILE

French-born Michel Danino has lived in India since 1977. A student of Indian civilization, he has written on protohistorical India (*The Lost River: On the Trail of the Sarasvati*, 2010) and Indian culture (*Indian Culture and India's Future*, 2011; *Sri Aurobindo and India's Rebirth*, an edited volume, 2018). Since 2011, he has been teaching courses on Indian civilization and knowledge systems at IIT Gandhinagar, where he has been assisting its Archaeological Sciences Centre. He is also the convener of a CBSE committee for the course Knowledge Traditions and Practices of India, whose two-volume textbook he co-edited (with Prof. Kapil Kapoor, 2013

and 2015). He is a former member of ICHR, a member of the Central Advisory Board on Culture, and of the National Steering Committee for the implementation of the National Education Policy 2020. In 2017, he was awarded Padma Shri for his work on education and culture.

USING IMMERSIVE TECHNOLOGIES TO DOCUMENT THE HARAPPAN LEGACY

SPEAKER: AJIT PADMANABH

EMAIL: ajit@whovr.in

When Angus Maddison, British Economist and Asst. Director of Organisation for Economic Co-operation and Development (OECD), said, "In 1 CE, China and India together contributed 60% of the world's GDP with India alone accounting for 33%", there was a sense of pride and ecstasy. How did we do it aeons ago? What was it like to live in such a time?

With today's immersive technology, visualising our distant past and being a part of it – is a reality! Every tangible artifact of this civilization can be recreated in its full splendour using a combination of Virtual Reality (VR) and Artificial Intelligence (AI). Aided by decades of research work undertaken by many scholars, all their discoveries and theories can be brought alive using immersive technologies. This could be the culture, lifestyle, the navigable waterways that enabled flourishing trade in the civilization, their ethics and principles, the Tin revolution, the meaning of the ingots (and to touch and feel them through haptic technology), the significance of today's archaeological finds, and their re-construction in 3D.

Marking the centenary of the discovery of probably the greatest civilization, it is time we look at immersive, modern technologies to bring out the greatness and depth of ancient technologies of our ancestors and relive their seemingly “mythical” achievements.

We can change the way the History of this great civilization is taught in our schools and enable more kids and youngsters to partake in re-discovering this great civilization and, in a way, re-discovering themselves.



SPEAKER'S PROFILE

Ajit Padmanabh is the founder and CEO of Who VR, a Technology startup focused on Digital Heritage, Arts, and Culture. Born in Bangalore and brought up in Delhi, he has absorbed a lot of culture and humanity through his 41-year life on this planet. He did his engineering from RV College of Engineering in Bangalore and went on to join Infosys – an organization he served for 18 years of his life. Having gained varied experience in India and abroad, working with reputed clients and markets, he wanted to do something on his own for his country.

Being passionate about music since childhood, he is a self-taught guitarist and musician and has released two albums, available on all music platforms. Known as World Void Web, he creates symphonic rock instrumental music with spiritual and historical themes. He had set his eyes on making music outside of IT but life had other plans for him. Never did he realise that he will found a startup focused on Heritage, Arts, and Culture, fusing the ancient with the modern and bringing out our History and Heritage through the latest technologies like VR, AR, AI, and Blockchain.

Who VR is his soul-purpose – a mission to put India on the world stage in terms of tourism, arts, and culture and expose the world to the richness and depth of our ancient temple architecture, ancient sciences and arts, and ancient metaphysics. He has dedicated his life to this startup and has brought together a multi-dimensional team of Historians, Artists, Film-makers, Sound Engineers, Neuroscientists, and Temple Architects apart from hard-core techies in VR / AR, AI, and Blockchain – to realise this mission. An empathetic, self-driven leader who has a spiritual side and intends to blend modern working styles with ancient spiritual knowledge to bring about a transformation in work culture within Who VR.

A dreamer, a visionary with a proven track-record of execution excellence, he looks forward to nurturing Who VR with values that are core to our culture and build the Indic Metaverse.

LACTASE PERSISTENCE AS A FACTOR IN ESTABLISHING THE COMMON IDENTITY OF THE RIGVEDIC AND HARAPPAN CIVILIZATIONS

SPEAKER: SHRIKANT G TALAGERI

EMAIL: sgtalageri@gmail.com

There have been many studies establishing the commonality or common identity of the Rigvedic and the Harappan Civilizations on the basis of different data. Here, I present the data concerning what is known as lactase persistence: lactase is the enzyme in the body which helps to digest milk, and in all mammals (including human beings) it decreases sharply after the weaning phase. However, in many (but not all) communities of humans, where dairy products are an important part of the diet, the human body continues to produce this enzyme into adulthood.

In the “Aryan” debate, the fact that North Indians, like Europeans, continue to have lactase persistence, that the Rigvedic culture (like the reconstructed PIE culture) is known to be a very much “pastoral” culture where cattle and milk play a central role, and that both North Indians and Europeans are aided in this by the same mutation, which enables lactase persistence, is treated as proof of the invasion of India by “pastoral Aryans” after 2000 BCE. However, the above conclusion contains many basic flaws:

1. The Harappan culture was also a pastoral culture: The Harappans were actually one of two ancient people who domesticated cattle: one in Turkey and the other in the Harappan areas in present-day Pakistan.
2. All the cattle in India, till recent colonial and modern times, have only belonged to the single “indicine line” of domesticated cattle. Which means that the cattle in the Rigveda were of the local indicine line.
3. In fact, recent scientific genetic studies of cattle have confirmed that the Indian humped zebu cattle, domesticated in the Harappan area since 1000s of years, spread out into West Asia 2200 BCE. The Mitanni people also migrated to West Asia from northwestern India during that period, which characterizes the appearance not only of the indicine Harappan cattle but also of the Indian elephant and the Indian peacock in West Asia.
4. The phenomenon of lactase persistence in the Harappan areas goes back as far as 5000 BCE; when the Harappans domesticated the indicine cattle, long before any alleged arrival of “Aryans” after 2000 BCE as per the AIT.
5. The distribution of high lactase persistence in India is restricted almost exactly to the areas of the Harappan sites in the Harappan days: i.e. roughly the *same* people occupy those areas today whose ancestors occupied them in the days of the Harappan civilization. And the Dravidian speakers in the South are *low* in lactase persistence, and cannot have migrated from the indicine-cattle-breeding from the Harappan areas, and must by and large have always been people of the South.



SPEAKER'S PROFILE

Shrikant G Talageri completed his education in Mumbai. With wide interests in philosophy, history, culture and linguistics, he made a special study of his mother tongue, Konkani. He has also made an in-depth study of the theory of an Aryan invasion of India, and proposed a fresh internal chronology of the Rigveda. He has authored several books, in particular *The Aryan Invasion Theory: A Reappraisal* (1993), *The Rigveda: A Historical Analysis* (2000), and *The Rigveda and the Avesta: The Final Evidence* (2008), marshalling linguistic and textual evidence, among other, for the Out of India Theory (OIT).

ABSTRACTS OF POSTER PRESENTATIONS

RESERVED SLIP WARE: AN APPRAISAL

AUTHOR: ADRIJA CHAUDHURI

EMAIL: officialadrija2021@gmail.com

The term Reserved Slip Ware (RSW) is defined as, "a particular kind of surface treatment given to the pre-fired ceramic where initially, two slip layers were applied to the surface of the vessel; the upper slip was then skillfully combed and selectively removed to leave two contrasting colored surfaces, in either a straight or a wavy line pattern". RSW is one of the regional ceramic traditions found all over Gujarat. However most find-spots concentrate in the Kutch region. RSW sherds found from the excavated sites: Shikarpur (Kutch) and Dhaneti (Kutch) have been documented and studied alongside the RSWs from Ghaggar-Hakra basin, Baluchistan, West Asia, and Mesopotamia. The samples from Dhaneti does not show much variation, both in color and designs, while samples from Shikarpur show variation in both. Furthermore, the forms differ in both the sites. Anarta ceramics appear along with Classical Harappan ceramics in Shikarpur, which supports the theory of integration. RSW with Anarta type of painting appears from the same site which might be evidence of coexistence, competitiveness, and artistic assimilation. When inspected under a microscope, it was observed that the reserving was done after the painting was completed on the second slip in all cases. Interestingly the discovery of RSW at Dhaneti pushes back the date to the Early Harappan period. However, it is to be kept in mind that these were found from a disturbed context and the site has not yet been dated. This poses yet another problem by widening the gap between the so-called preliminary phase of RSW from Dhaneti and the well-developed, high-quality RSW found in places like Dholavira, Surkotada, and Shikarpur. RSW is present throughout the Harappan period, spatially as well as temporally, which makes it an important witness of the regional, intra-regional, and inter-regional cultural aspects of the Harappan Civilization.



AUTHOR'S PROFILE

Adrija Chaudhuri has completed her Bachelor's degree and is currently pursuing Master's in Ancient History and Archaeology from Maharaja Sayajirao University of Baroda, Gujarat. She has the opportunity to work under the guidance of Prof. K Krishnan, Prof. Vrushab Mahesh, and Mr. Devara Anil Kumar for the completion of her projects. She presented her research paper entitled, "A Comparative Study Between Gandharan Hariti and Mathuran Hariti" in the National Conference on Recent Archaeological Investigation in South Asia, organized jointly by Archaeological Exploration and Excavation Department, Heritage Society, Patna and IQAC and,

Maharaja Lakshmeshwar Singh Memorial College, LN Mithila University, Darbhanga. My article entitled, "Dasavatar cards of Bishnupur" was published by Rath Ngo where she worked as an intern. She worked with India Lost and Found (ILF) by Amit Pasricha as a Research Authenticator, leading a group of seven researchers, who worked on several sites from all over India.

UNDERSTANDING THE FUNCTIONALITIES OF THE PERFORATED VESSELS IN THE HARAPPAN CULTURE WITH PARTICULAR REFERENCE TO THE EXCAVATED SETTLEMENTS OF KARANPURA, RAJASTHAN, AND ROPAR, PUNJAB

AUTHOR: AHANA GHOSH

CO-AUTHORS: VN PRABHAKAR, ELEANORA A REBER, AND PHANINDRA KUMAR

EMAIL: ahanag@iitgn.ac.in

VN Prabhakar is an Associate Professor in the Archaeological Sciences Centre, Discipline of Humanities and Social Sciences, IIT Gandhinagar.

Eleanora A Reber is working in the Department of Anthropology, University of North Carolina, Wilmington, USA.

Phanindra Kumar is working as a doctoral student in Discipline of Chemistry, Indian Institute of Technology, Gandhinagar.

This research probes into the utility of perforated jars of the Harappan culture with particular reference to the excavated settlements of Karanpura (Rajasthan) and Ropar or Rupnagar (Punjab), both in India. The perforated jars are an important Harappan ceramic type from most of the Harappan settlements, both in habitational and as well as burial contexts. Interestingly, the burial contexts indicate its use in association with a wide-mouthed pot and never found in isolation. Such association is found in the burials at Harappa and Kalibangan.

The previous studies on the perforated jars of Harappan culture mainly focused on typological, morphological, and ethnographic analogies. Until recently, only a few pilot studies employed lipid residue analysis techniques to peek into the kind of product(s) processed inside them. This poster explores the relationship between the form and functions of the perforated jars by evaluating the absorbed lipids adhered to the matrices (rim, body, and base). This research enquires about the reason for the perforations and explores their possible use as strainers.

From the methodological purview, this research nestles around the amount of lipids available inside the sampled sherds and possible contaminants affecting lipid preservation. From the theoretical stance, this research is based on the conjectures of 'Practicality' and 'Prestige'; the former encompasses the original function of the above unique form of ceramic, and the latter envisages the cultural use of the above ceramics and its position in the social hierarchy of the Harappan culture. This research opens unprecedented possibilities for studying unique forms of vessels using scientific tools moving away from the research encircled by conventional forms found in the excavated settlements.



AUTHOR'S PROFILE

Ahana Ghosh is a doctoral scholar at the Archaeological Sciences Centre, under Humanities and Social Sciences at the Indian Institute of Technology, Gandhinagar. Previously she held an 'Early Career Researcher' position in the Rewriting World Archaeology program at Durham University and Antiquity. She is using scientific tools like lipid residue analysis to understand the ancient foodways of the Harappan culture. Her research also focuses on the concept of 'the culinary landscape and different aspects of realities and representations of food. She worked as a Visiting Researcher at the Archaeological Research Laboratory, at Stockholm University,

Sweden, and the Ceramic Residue Analysis Laboratory at the University of North Carolina, Wilmington. This year, she has been awarded the 'Research Support Award by The Society of Archaeological Sciences' for conducting a substantial part of her doctoral research. She has recently been nominated for the Fulbright-Nehru doctoral research scholarship for the year 2023-2024.

CULINARY BEHAVIOUR OF HARAPPAN CIVILIZATION: ADDRESSING SPACES, UTENSILS, AND METHODS OF COOKING

AUTHOR: AKASH KUMAR SRIVASTAVA

EMAIL: akashkrsrivastava.rs.hss21@itbhu.ac.in

Food and Foodways are the prominent features of any civilization and mark human enrichment in the course of development. Harappan civilization, which endorses the first urbanization in South Asia, also enjoyed a well-equipped food culture and there are multiple shades of gastronomical activities in this river valley civilization. Archaeologists have unearthed a lot of evidence related to the food habits of the Harappan people from paleo-botanical studies, but more light is yet to be shed on the methods of cooking and the objects related to them. However, many sites having planned settlements feature kitchen spaces and a variety of cooking appliances, reflecting the distinctive food behavior of its inhabitants, many of whose issues are mysterious and unresolved. In this regard, a schematic analysis is needed to bring together new approaches and diverse evidence to confer the lacking knowledge of the culinary practices of Harappans.

To illustrate a novel insight into this problem, I examine culinary data from major Harappan sites, highlighting cooking spaces, utensils, and different methods for food preparation. Hence, by compiling non-biological evidence of food-related activities, the goal of this poster is to show the special behavior of the Harappans toward fulfilling their basic need. It also involves some innovative interrogations of past lifeways and material culture, to explore how early Indians feed themselves. Here, I review and delineate the remains of the exigent element of foodways and present the multifarious information in a plenary form. This thematic poster seeks to ignis the understanding of a wide range of narratives dealing with nourishment and reorient the present research in Harappan archaeology to address the rich and engaging topics of culinary behavior.



AUTHOR'S PROFILE

Since Akash Kumar Srivastava belongs to Banaras, the cultural capital of India, his academic background and research interests are also influenced by the ethos of this city, which in his mind nurtured the seed of Archaeology. Originally, he was a student of science till Intermediate but after that, he turned to different aspects of culture, history, and traditions and joined Banaras Hindu University for an undergraduate course in AIHC and Archaeology. Then he did his post-graduation from the same Department of AIHC and Archaeology, BHU. During post-graduation, he passed Junior Research Fellowship twice, one in Archaeology and the other in

Indian Culture. He has also cleared the NET in History and just after postgraduation, he entered the prestigious institute IIT BHU as a researcher where his Ph.D. work deals with the material culture of ancient India with an Ethno-archaeological perspective to give new insight into the culinary behavior of early Indians.

EXPLORATIONS AT PABUMATH: REVISITING A LATE HARAPPAN SITE

AUTHOR: ANIRUDDH RAMANUJAM

EMAIL: aniruddhr@live.com

The Harappan culture in Gujarat is typified by the existence of varied regional chalcolithic traditions at all levels of the Harappan sites, such as Anarta and Prabhas along with a regional manifestation of the Harappan cultural assemblage in Gujarat, i.e., the Sorath Harappans. Earlier excavations and explorations at sites, such as Nadapa in Nakhatrana taluka of Kachchh or Navinal in Mundra taluka have classified these sites as belonging to the Late Harappan phase of the Harappan culture. Recent work at Nadapa (2013-16) and Navinal (2011-13) indicate their cultural affinity towards the Sorath Harappan and calls for further research with regard to the Late Harappan sites in Kachchh. Recent surface explorations were conducted at Pabumath (2022) with a view of examining the possibility of the existence of regional Chalcolithic ceramic wares at the site. Results indicate the existence of multiple chalcolithic ceramic assemblages at the site which include Anarta ware, Classical Harappan ware, Sorath Harappan ware, and Late Sorath Harappan ware. A relative chronology was assigned to the site using the Rojdi classification scheme broadly categorizing the site according to radiocarbon dates; pottery coterminous to Rojdi A indicates an earlier occupational date of roughly 2699 BCE and the presence of Late Sorath Harappan ware indicates a final occupational date for the site by around 1700 BCE. The existence of the Anarta ware, conventionally dated between 3600 BCE and 1900 BCE suggest a possibility of a pre-Harappan cultural assemblage at the site.



AUTHOR'S PROFILE

Aniruddh Ramanujam is a postgraduate student of Archaeology and Ancient History at The Maharaja Sayajirao University of Baroda. His research interests include Harappan archaeology, ceramic typology, and ethnoarchaeology with additional interests in learning more about scientific analyses of artifacts, geoarchaeology, and GIS applications in archaeology.

SOCIAL LIVES OF FIGURINES: GENDERING THE FEMALE REPRESENTATIONS IN CLAY FROM HARAPPA (CA. 3300–1700 B.C.E)

AUTHOR: ANJANA M NAIR

EMAIL: anjanasm13@gmail.com

This poster dispels some long-standing misconceptions regarding the identity of Harappan terracotta female figurines which have been identified as the “Mother Goddess type”, carried over from the Neolithic to the Mature Harappan sites, such as urban Harappa and Mohenjo-daro as a blend of folk realism and modeled clay. The “erect phallus” motif on the seals from Mohenjo-daro previously identified as “Paśupati or Proto-Siva” is also identified as the girdle characteristic of Harappan female figurines, thus attributing to it the “Paśupati” imagery, which complements the mother-goddess representation. My argument is that, these might have been clay models of actual homely women or brides, used as the paraphernalia of loosely structured private household rituals revolving around the concept of motherhood and reproduction, rather than being symbolic of some organized fertility cult imagery. Their physical benignity disassociates themselves from the later ferocious martial goddess imagery prevalent in the Indian subcontinent. Further, archaeological context-specific interpretation reveals that these figurines were found in garbage pits and inner corners of homes rather than in

association with luxury objects, thus indicating purely decorative, toy-like or votive purposes. The “big-breast imagery” attributed to female figurines can be as much applicable to courtesans as to the patriarchal construct of “Mother Goddess”, which simplistically presupposes chastity attached to motherhood as the culmination of womanhood. The matronly, pot-bellied, and baby-holding ordinary female figurines may have been symbolic of prosperity and the dangers of pregnancy, but they do not reflect divinity. The assertive presence and boyish femininity of the Bronze Dancing Girl from Mohenjo-daro is supportive evidence of the ordinary woman’s individualized presence in the Harappan Civilization. This research thus provides insights into Harappan society’s dynamic and possibly fluid perception of sex, gender, and sexuality based on a multi-faceted analysis of this large corpus of female figurines.



AUTHOR’S PROFILE

Anjana M Nair is a Ph.D. scholar of the Department of History, University of Hyderabad working under Prof. Suchandra Ghosh. She completed her undergraduate and postgraduate degree from the University of Delhi (2016-2021). She was the Gold Medalist of University of Delhi in Master’s in History (2019-2021). She has qualified UGC-NET twice in 2021 and 2022. Her area of interest lies in gender history, archaeology, women’s studies, and the Indus Valley Civilization. She has presented her research papers at conferences like the South Indian History Congress, Indian History Congress, and a few online seminars. Her articles have been

published in peer-reviewed journals and she has attended multiple workshops related to academic writing, historical methods, and gender constructs of society.

NEW INSIGHTS INTO GENETIC PAST OF INDIA

AUTHOR: APARNA DWIVEDI

EMAIL: aparna.dwivedi@bsip.res.in

Burzahom, the Neolithic archaeological site in Kashmir, demonstrates transitions from the Neolithic era, to the Megalithic era, to the early historic period. However, today five decades after the excavation has passed, questions on the genetic identities and interactions of the people residing in Burzahom are still unanswered. This study utilizes ancient DNA analysis to characterize the genetic ancestry of individuals from Burzahom. Petrous bones and teeth of seven individuals from the site were used for DNA extraction, which were sequenced on the Illumina HiSeq platform. Five of the seven samples confirmed authentic ancient DNA by DNA damage patterns using the software MapDamage. Of these five samples, only two could be proceeded for downstream analyses. The genetic sex identification showed that both samples belong to male individuals. One sample was dated using Accelerator Mass Spectrometry to 2027-1778 BCE, while results from the other are awaited. These individuals were assigned to mitochondrial haplogroups M65a and U2b. Both these haplogroups are present in South Asia today. Haplogroup U2b has been reported previously in an ancient individual from the Harappan site of Rakhigarhi, India. Autosomal data analysis for both samples will help us further understand the genetic ancestry and migratory history of residents as well as their genetic relationships to contemporary and later populations in South and Central Asia. This study represents one of the oldest ancient genomic datasets from South Asia thus far and is a milestone for ancient DNA analysis in the Indian as well as South Asian context.

AUTHOR’S PROFILE

Aparna Dwivedi belongs to Ayodhya, UP. She studied Biochemistry in M.Sc., where she fell in love with



the subject. She received the Chancellor's Gold medal in M.Sc. Later she secured all India 69th rank in CSIR-UGC NET JRF and 95 percentile in GATE 2018. She completed her Master's dissertation from CSIR-IITR and wanted to complete the project, so she worked there as a Project Assistant II for one year. Currently, she is working on the ancient DNA aspects in the samples of Burzahom. The study excites her as it is one of the oldest genomic data from South Asia. This work will help understand the Neolithic settlement of Kashmir and give us ideas about the admixture of south Asian population. In this conference, she looks forward to meeting people working in archaeology and get to know the perspectives of the Harappan civilization from other participants and renowned speakers.

REVISITING KUNTASI PAINTED POTTERY MOTIFS FROM MATURE HARAPPAN PHASE IN GUJARAT

AUTHOR: APARNA SHARAD KULKARNI

EMAIL: aparnajoshi74@gmail.com

The Gujarat region shows numerous Harappan sites dating from the Early to Late Harappan phases and has yielded a variety of ceramics in different shapes, fabrics, and painted pottery motifs. Each excavated site has its style of painting motifs on the pottery. The basic art forms remained constant over a long period in vast areas. Kuntasi is a small ancient Harappan site located on the right bank of river Phulaki in the Rajkot district of Gujarat, it is locally known as Bibi-No-Timbo. The excavations have revealed two phases of Harappan Culture, i.e. Mature Harappan and Late Harappan. The site provides evidence for the manufacturing of pottery, shell-working, bead making, and copper objects. In this context, the author has analyzed the Kuntasi mature Harappan phase ceramics assemblage, excavated (1987-1990) from the 55 trenches of layers no 8 to 14. There are different types of slip combinations used as the background color to draw motifs on the pot. The motifs are seen in the different shapes of the pot like the bowl, jar, dish, lid, and knob. At Kuntasi, horizontal lines, wavy lines, and vertical lines are used. The beaded motif was used as a border pattern. The simple fish scale motif and circles are seen on the potsherds. Fishes, animal, and bird motifs are absent on the pottery. Few floral / flower-like pattern is seen on the potsherds. The new additions of endulum shape floral motifs and abstract motifs are seen in the design elements. The author did not find any conventional tree motifs.



AUTHOR'S PROFILE

Aparna Kulkarni is presently pursuing her postdoctoral fellowship on the topic, "To Study and Reconstruct the Stylistic Variation in the Harappan Ancient Accessory: with special reference to Semi-precious Beads of Gujarat" from Deccan College PGRI, Pune, for the years 2021-23. She was awarded her Ph.D. on the topic "Harappan Painted Pottery Motifs: A Study of Aesthetics, Elements of Design and Textile Tradition" from, Deccan College PGRI, on 20/03/2019. She submitted her M.A. Dissertation in 1996, on "Geoarchaeology of Kalas, on Parvara River, Akola Taluka, Ahmednagar District, and Maharashtra", to Deccan College, PGRI, Pune. Dr Aparna completed

the Research Methodology course conducted by the Department of Sanskrit and Lexicography, Deccan College, PGRI, Pune (24/01/2013 to 22/06/2013). She studied the ancient Kuntasi Beads that were curated in the Deccan College Museum under the NMMS Project (July 2014 to December 2014). Dr

Aparna received the Junior Research Fellowship from the Indian Council for Historical Research for doctoral research for 2 years (2014-2016). Publication: Kulkarni, A.S. 2015. Late Pleistocene Deposits at Kalas on the Pravara River, Akole Taluka, Ahmednagar District, Maharashtra. Bulletin of Deccan College Post-Graduate and Research Institute, Volume-75:37-48.

NEW LIGHT ON HARAPPAN CULTURE - RECENT RESEARCH IN RAKHIGARHI HINTERLANDS

AUTHOR: ARTI CHOWDHARY

EMAIL: artichowdhary111@gmail.com

The Harappan Civilization is characterized by spectacular expansion and affluence, remarkable cultural uniformity, mass production of crafts, and extensive internal and external trade mechanisms carried out over both ocean channels and land routes. Rakhigarhi is the largest Harappan site situated in Haryana, Northwest India. It is located in the basin of Ghaggar and Saraswati. There are 127 hinterland sites of Rakhigarhi have been reported, among these 52 sites are related to the Harappan settlement and the rest of the sites are related to other cultural parameters. These hinterland sites are significant because they give information about the different activities of these sites during the Early, Mature, and Late Harappan period in the third millennium BCE and create a clear picture of land settlement strategies. These small hinterland sites are neglected by the archaeologists but on the basis of current exploration, and excavation many interesting facts are unfolding. These sites are also occupied by the Harappan people since the Early, Mature, and Late periods. The present researcher had visited major parts of the study area to establish the precise location of the different hinterlands as well as when the Harappan people occupied them and why? In order to fulfil the objectives, the village-to-village survey, use of GPS digital mapping of sites, collection of published literature, and other scientific methods will be used. This paper presents a discussion of the Rakhigarhi hinterlands, their features, and various significant aspects of these sites which played an important role in the flourishing of Rakhigarhi as the largest Harappan site.



AUTHOR'S PROFILE

Arti Chowdhary's area of work is archaeological science. She is doing phosphate analysis of archaeological soils which she collected from the excavation in Rakhigarhi Hinterland. She also undertook EDAX and Petrological Analysis training. She actively participates in the scientific programmes related to Harappan archaeology.

EXPLORING THE ROLE OF RIVER SABARMATI AND NAL CORRIDOR IN HARAPPAN TRADES

AUTHOR: EKTA GUPTA

CO-AUTHOR: VN PRABHAKAR

EMAIL: ekta.g@iitgn.ac.in

VN Prabhakar is an Associate Professor in the Archaeological Sciences Centre, Discipline of Humanities and Social Sciences, IIT Gandhinagar.

Dholavira and Lothal are two important Harappan sites located on Khadir island in the Great Rann of

Kachchh and around 25 km northwest of the Gulf of Khambhat, respectively. Both have extensively participated in procuring and distributing both raw materials and finished products, both for internal and external trade. This is substantiated by the movement of raw materials and finished products such as semi-precious stones, copper, and shell products from the Gujarat region to other Harappan sites in Sindh, Punjab, and Haryana. Various studies indicate that the Great and Little Rann of Kachchh were navigable, and tidal flow was reaching near the Lothal town during the Harappan civilization (4500 to 3900 BP) as the sea level was higher at that time. Further, historical records also mention the connectivity between Little Rann and the Gulf of Khambhat (GoK), separating Saurashtra from the Gujarat mainland. The present study investigates the widely discussed conjecture about the existence of a navigation route between the Kachchh region and Lothal via the Little Rann and Nal-Bhal region using multi-temporal and multispectral remote sensing data and early cartographic records. The study also attempts to reconstruct the paleo-coastline of the northwestern part of GoK during the Harappan Period. Analysis of the paleo landscape around the Lothal town suggests that the Sabarmati River flowed near Lothal and sheds light on how its course might have changed. This study has expanded the existing understanding by proposing an alternative hypothesis, which might explain some of the important questions on trade route and navigation during the Harappan period and even in later periods.



AUTHOR'S PROFILE

Dr Ekta Gupta is an Early Career Fellow at Archaeological Sciences Centre, Indian Institute of Technology Gandhinagar, Gujarat. She has conducted her Doctoral Research at the National Institute of Advanced Studies (NIAS), Bengaluru, India. She did M.Tech in Geographic Information System (GIS) from NIIT University, Rajasthan and M.A. in Geography from Savitribai Phule Pune University, Pune. Her prime research interests include the study of historical cartographic documents, heritage studies, landscape archaeology, geoarchaeology and geomorphology using Remote Sensing (RS), and GIS.

ANTHROPOGENIC AND NATURAL HAZARDS THREATENING THE PRESERVATION AND CONSERVATION OF HARAPPAN SITES IN GUJARAT

AUTHOR: HARITHA KADAPA

EMAIL: haritha.kadapa@iitgn.ac.in

Heritage Impact Assessments are procedures to identify and analyze the potential impacts of threats on cultural heritage. They are useful in understanding ways of better protection and management of heritage. They provide information on various aspects, such as the hazards to which heritage is susceptible, the outcome and the resulting cost of damages or costs avoided through future mitigation projects. In heritage management, hazards are any kind of disaster that have the potential to cause disruption or damage to cultural property. This work focuses on assessing the risks to the conservation and management of Harappan sites in India, with special reference to Harappan sites located in Gujarat. To do so, first, a geodatabase of all the sites has to be made along with characteristics like conservation status, excavation status, etc. Then, all the possible hazards have to be identified. Following that, the internal weakness of the sites which makes them vulnerable to the hazards has to be determined. The significance of the sites being lost also has to be determined. Finally, the extent of damage due to hazards has to be assessed and conservation strategies have to be proposed. In the poster, anthropogenic hazards, such as intentional vandalism, noticed through preliminary field work will be presented. Along with that, a methodology to assess natural hazards such as soil erosion and vegetation growth will be presented and discussed. This is a work in progress.



AUTHOR'S PROFILE

Haritha is a Ph.D. student at the Archaeological Sciences Centre, Humanities and Social Sciences discipline, IITGN. Her research interests include Remote Sensing and GIS, Harappan Archaeology, Geoarchaeology and Heritage Management. She has a Master's degree in Ancient Indian History Culture and Archaeology from Deccan College, Pune. For Master's dissertation, she conducted Phosphorus and Organic Carbon chemical analysis for the soil samples of the Rakhigarhi site. Currently, her research interests include using Remote Sensing and GIS for heritage management. Her ongoing research is studying the effect of natural and man-

made threats to the heritage sites of India, especially the nationally protected monuments and the Harappan sites.

ISOTOPIC STUDIES OF ANIMAL REMAINS FROM THE HARAPPAN SITE OF DHOLAVIRA FOR PALAEODIET, MOBILITY AND PALEO-ENVIRONMENTAL RECONSTRUCTIONS

AUTHOR: MANISHA KESARWANI

CO-AUTHORS: SHARADA CHANNARAYAPATNA AND RS BISHT

EMAIL: manisha.k@iitgn.ac.in

Sharada Channarayapatna is an Assistant Professor in the Archaeological Sciences Centre, Discipline of Humanities and Social Sciences, IIT Gandhinagar.

RS Bisht is affiliated with the Archaeological Sciences Centre, Indian Institute of Technology Gandhinagar, Gujarat, India.

Dholavira, recently recognized as a UNESCO world heritage site, is a prominent urban Harappan site located in a unique geographical location of Khadir bet (Kachchh District, Gujarat). This site was inhabited through all chrono-cultural phases of the civilization and thus reflects an essential osteoarchaeological record through systematic excavations for more than a decade. The present work is a part of the ongoing DST-SERB Power grant project titled "Reconstruction of Human-Animal Interactions at the World Heritage Harappan Site of Dholavira, Gujarat, India: Inferences from isotopic composition of archaeological bone and teeth remains". As the site shows a well-established exchange network with smaller sites in its hinterland, it is therefore, crucial to determine whether this interdependency extended to its faunal requirements and management. Multi-element isotopic studies (C-N-O-Sr) of animal teeth are successful biogeochemical proxies for the reconstruction of their palaeodiet, water source / seasonality, and mobility / migration patterns. At the initial stage of our project, the results from the systematic documentation of taxonomic and anatomical identification



of the domestic animal (cattle, buffalo, sheep, goat, and pig) teeth enamel and dentine for age and wear pattern will be discussed. We will also review the sampling and archaeozoological protocol vis-à-vis published literature and highlight some challenges we encountered. The study will also present the interdependencies and subsistence patterns of the Harappan city site (Dholavira) with other rural sites.

AUTHOR'S PROFILE

Manisha Kesarvani is a Postdoctoral Fellow at Archaeological Science Centre, IITGN working with Prof. Sharada CV She is working

on isotopic fingerprinting of animal remains to address various archaeological questions related to dietary reconstruction, paleo-climatic information, and ancient migrations. She did her Ph.D. from IIT-ISM Dhanbad in the department of Applied Geology and Master's in Applied Geology from University of Allahabad. Her expertise is in isotope geochemistry and its various applications in geology and archaeology.

RECENT ARCHAEOLOGICAL EXPLORATIONS AT DESALPUR IN KACHCHH, GUJARAT: NEW PERSPECTIVES

AUTHOR: MOHAMMED MUHASEEN B

EMAIL: muhasin.muhammed9@gmail.com

The Archaeological site Desalpur, located in Kachchh District in Gujarat, was discovered in the 1950s and excavated in 1963-1964 by ASI under KV Soundararajan. This fortified Harappan settlement covers an area of 130x100x3 meters. The excavator assigned two cultural periods for the site; Period I: Harappan (sub-period I A: Urban Harappan and I B: Post Urban Harappan) and Period II: Early Historic. The reported ceramic assemblage from the site includes Harappan ceramics and Micaceous Red Ware. One steatite seal, copper seal, and a terracotta sealing were also found in excavations. Other finds from the site consists of terracotta weights, copper knives, chisels, rods and rings, terracotta cart frames, and animal figurines. The excavator relatively dates the Period I of Desalpur between c. 2000-1600 BCE.

The region of Kachchh is known for inter- and intra-regional interactions during the Harappan times. Indus sites like Dholavira, Junj Kuran, Kanmer, Shikharpur, Surkotada, and Khirsara are in the proximity of Desalpur. Apart from the Classical Harappan artefacts, regional Chalcolithic ceramics were also unearthed from these sites. Desalpur might have also played a significant role in this interaction network. Unfortunately, no detailed excavation report has been published about the site. As the site was excavated in the 1960s, the regional Chalcolithic remains from the site remained unreported. Therefore, to understand the characteristics of the highly disturbed site, Department of Archaeology, University of Kerala, conducted a series of archaeological explorations in 2015 and 2016. The exploration yielded Classical Harappan ceramics, Sorath Harappan pottery, Anarta ceramics, Reserved Slip ware, and Late Sorath Harappan pottery. Apart from the ceramic assemblage, a number of other artefacts such as shell bangles, beads, animal figurines, grinding stones, copper objects, and pottery discs were also documented from the site. This poster tries to elucidate the results of the analysis of artefacts and features of various exposed structures from Desalpur.



AUTHOR'S PROFILE

Mohammed Muhaseen B S is a Ph.D. research scholar in the Department of Archaeology, University of Kerala. His research topic is 'Localization Era of Harappan Culture in Gujarat, India: A Multifaceted Investigation". He has been part of three seasons of excavations at Juna Khatiya, an Early Harappan burial site in Gujarat, India. He has also participated in Megalithic cist burial excavation in Enadadimangalam, Pathanamthitta, Kerala. He actively participates in various research activities, archaeological explorations, and field activities of the Department of Archaeology at the University of Kerala. So far, he has eight published articles

and has also presented papers in various archaeological academic events. He has also been a resource person for different educational institutions in Kerala for the past years.

RE-ESTIMATING THE TREND MARKERS OF CULTURAL CONTINUITY

AUTHOR: PRANJAL GARG

EMAIL: pranjal@cutn.ac.in

The urban debate has seen never-ending discussions that refuse to change their course. However, the character of the Harappan civilization seems to hold a clue that could be decisive in understanding how and why the cultures following the Harappan civilization had certain urban characters. Although this very indicator could probably suggest why others didn't have certain urban characters.

While even the urban character of the Harappans is being questioned, one can at least re-investigate and trace a possible continuity of the features that hold until now the ultimate key to understanding and determining a settlement to be urban or not. This research paper attempts to reopen the chapter that has come to stand-still, regarding the urban character of first and second urbanization in the Indian subcontinent and how and whether their respective subsequent and antecedent cultures can be seen as a responsive continuity. Although the finds some support in archaeological evidence complemented by literary sources, but the inquiry is still in its preliminary stages, while it gains strength with every new evidence that surfaces in the new world of "unsettling archaeology".



AUTHOR'S PROFILE

Pranjal Garg has done his doctoral research on understanding the cultural and technological exchanges between the Anarta and Ahar regions, through an understanding of their ceramics. He has been teaching in the Central University of Tamil Nadu since 3 years and takes interest in Archaeology, art and architecture, science and technology of ancient India and esoteric vedic studies. He has been conducting research on microbial archaeology, urbanization in protohistoric and early historic periods, public archaeology, Itihasa, Vedic hymns of philosophical importance, etc.

NEW LIGHT ON THE HARAPPAN CULTURE IN THE CENTRAL SOUTHERN PART OF PUNJAB

AUTHOR: RAHUL

EMAIL: archaeologyharyana@gmail.com

The land of Punjab and its natural resources have attracted human beings since ancient times. A huge number of archaeological sites have already been discovered and excavated by researchers in the eastern part of Punjab in the Malwa plain. The present poster is an announcement of the extension of Harappan culture in the Bathinda district, which is situated in the Central southern region of the Malwa plain of Punjab. The study aims to find out the culture's extension in the dry region. Also known as the Settlement Pattern of Harappan Culture in this area, it highlights the archaeological potential of the study region. The authors carried out a systematic and extensive village-to-village survey in this region. The present research is mainly based on the first-hand archaeological cultural remains (ceramic assemblages and other associated finds) collected from ancient sites that surfaced during the extensive and intensive investigations in the study region.

AUTHOR'S PROFILE

Rahul is a research scholar in the Department of History and Archaeology (Central University of Haryana). He is working on "Archaeological Investigation in Shri Muktsar Sahib, Bathinda and Jalandhar



districts of Punjab". He has qualified for the UGC Net examination in History and Archaeology. During post-graduation, he visited many archaeological sites in Haryana and Madhya Pradesh like Rakhigarhi, Banawali, Mitathal, Balu, Tigrana, Farmana, Madina, Thaneshwar, Agroha, Tosham, Sagban, Pakasma, Kunal, Masoodpur, Naurangabad, Bhirrana, Hathnora, Bhimbetaka, Pili Karar, and Baneta. He participated in the Kunal and Tigrana (Bhiwani) excavations. He has presented three papers related to his research work. In addition, he was a team member that discovered a Harappan burial at the Samchana Site in Haryana.

POTENTIAL SOURCE AND ESTIMATION OF RESERVOIR STORAGE CAPACITY OF DHOLAVIRA HARAPPAN SITE

AUTHOR: RAHUL KUMAR KAUSHAL

CO-AUTHORS: RAVIKANT PRASAD, VN PRABHAKAR, AND VIKRANT JAIN

EMAIL: rahulkiitgn@gmail.com

Ravi Kant Prasad serves as a Scientific officer (Scientist) at the Bihar Mausam Sewa Kendra, Patna. He has postdoctoral experience in the field of Geo-archaeology at the Archaeological Sciences Centre, IIT Gandhinagar, working with Prof. VN Prabhakar.

VN Prabhakar is an Associate Professor in the Archaeological Sciences Centre, Discipline Humanities and Social Sciences, IIT Gandhinagar

Vikrant Jain is a Professor in the discipline of Earth Sciences at IIT Gandhinagar.

During the third millennium BCE, Dholavira was one of the six greatest Harappan cities. It has been inhabited for at least 1500 years, beginning around 3000 BCE. Around 600–700 years of this period are considered to be the urban period. Dholavira site is situated on a secluded island in the Great Rann of Kachchh. It is suggested that past favorable climatic conditions, together with the need to harness the enormous mineral resources of the Gujarat region appear to be plausible factor for their occupation of Dholavira. Dholavira was a wealthy city in its prime, with strong indications of a well-planned layout, water harvesting and harnessing systems and a variety of funerary architecture. This ancient settlement had two monsoon channels namely Manhar and Mansar which appear to be one of the potential sources for the water storage in their well-planned reservoirs. These reservoirs served as possible source of water for their daily needs for the rest of the year. In this study, we aim to estimate the reservoir storage capacity through high-resolution data. Therefore, we carried out extensive mapping surveys to map the remnants of structures, walls of citadel, excavated reservoirs along with geomorphic attributes of Manhar stream by employing Real-Time Kinematic Global Positioning System (RTK-GPS) and Drone mapping. This is the very first study on Dholavira, where such data were used to generate a high-resolution digital elevation model (DEM) to prepare (1) 3-D model of water harvesting structures (2) map of major features of Citadel. A minimum volume of about 5425 m³ for the eastern reservoir is estimated using the 3-D DEM data. Other remaining smaller reservoirs would require further analysis to anticipate average per capita per day water consumption for the people of Harappan civilization. The overall study will highlight the Harappan occupation at Dholavira and their techniques for water conservation and harvesting. Further, the geomorphological and geological controls appropriate for the water conservation can be discussed.



AUTHOR'S PROFILE

Dr. Rahul Kumar Kaushal is currently a post-doctoral fellow Physical Research Laboratory (PRL), Ahmedabad since November 2019. He obtained his Ph.D. in Earth Surface process in 2019 from IIT Gandhinagar. His current research focus is in quantifying earth surface processes at different spatio-temporal scales using multidisciplinary approaches such as Cosmogenic nuclide, and Optically Stimulated Luminescence (OSL) dating with their application, GIS and remote sensing applications, Field mapping, Landscape evolution modelling.

MULTI-FACETED ANALYSIS OF CERAMICS FOR IDENTIFYING THEIR PROVENANCE AND PRODUCTION TECHNOLOGY: A CASE STUDY OF THE RUPNAGAR HARAPPAN SITE, INDIA

AUTHOR: RAVI KANT PRASAD

CO-AUTHOR: VN PRABHAKAR

EMAIL: ravi.prasad@iitgn.ac.in

VN Prabhakar is an Associate Professor in the Archaeological Sciences Centre, Discipline Humanities and Social Sciences, IIT Gandhinagar

Rupnagar, variably known as “Ropar”, is an extensive Harappan site located at the bank of the Sutlej River in Punjab, India. The site is well known for the production of a wide variety of ceramics having different functional, cultural, and economic significance during the third to second millennium BCE. Pottery found at this settlement, excavated during 2011-12, showed the emergence of multiple chrono-cultural sequences starting from the Harappan and their mingling with Bara cultural (end of 3rd and beginning of second millennium BCE); Painted Grey Wares (PGW) (end of second millennium BCE), and the historical ceramics. The ceramics from these different cultural horizons were chosen for the multi-faceted analysis like thin section petrography, XRD, pXRF, and SEM-EDS. Additional clay samples were also collected within a radius of 15 km from Rupnagar. A total of 187 potsherds and 4 clay samples were subjected to the analysis. Our preliminary results show that quartz and feldspar predominate as inclusions in almost all samples, while variability in their grain sizes / frequency is observed. The ceramic fabrics, both within and across the different ceramic classes, show variability, with most of the fabrics matching well with the local geology near the site (within the Sutlej basin). Further, PCA analysis based on pXRF results reveals three main ceramic groups based on different chemical compositions. At the same time, two of these groups are probably made of raw materials from the nearby geological area, whereas the last group is perhaps non-local. The combined petrological and XRD and pXRF analysis clarified the aspects related to paste recipe, temper materials, and their variations in forming and firing conditions. The firing temperature of most of the ceramics ranges



between 700°C and 900°C. The Rupnagar ceramics were, for the first time, systematically studied for the petrography, mineralogy, and chemical analysis to interpret the raw material provenance, ceramic manufacture technology, and their probable trade and exchange with other contemporary Harappan sites. Therefore, the ceramic fabrics and chemical characteristics derived from these analyses may serve as a reference for future ceramic studies.

AUTHOR'S PROFILE

Ravi Kant Prasad serves as a Scientific officer (Scientist) at the Bihar Mausam Sewa Kendra, Patna. He has postdoctoral experience in

the field of Geo-archaeology at the Archaeological Sciences Centre, IIT Gandhinagar, working with Prof. VN Prabhakar. He did Ph.D. from IITGN in the discipline of Earth Sciences. Ravi Kant has a core subject background of geology and geochemistry. He has expertise in geochemistry, petrography, remote sensing, and GIS. He has the experience of working at a petrography lab at IITGN. Ravi Kant has also worked on ceramics and raw materials from various Harappan sites to interpret ancient technology, trade and exchange, material acquisition, and its geological and archaeological provenance.

RECONSTRUCTING POPULATION HISTORIES OF HIGH ALTITUDE LADAKH, HIMALAYA USING PALAEOGENOMICS APPROACHES

AUTHOR: RICHA RAJPAL

EMAIL: richa.bsip710@gmail.com

Ladakh or the land of high passes, is situated 3000m above sea level in the trans-Himalayan region of India. It extends approximately halfway between the western shores of the Black Sea and the eastern coast of China's Yellow Sea, and is bound between two mountain ranges, the Himalayas to the south and the Kunlun to the north. As part of the Silk Road and located at the geographic confluence of Eastern and Western cultures, this region has long served as a major crossroads for trans-Eurasian exchanges of people, cultures, and agriculture and was likely accompanied by spread of languages. It is characterized by extensive population movements and demographic shifts in both prehistoric and historic times, that created mosaics kind of pattern in contemporary populations. Modern-day human populations show a complex population history, with genetic links to both Eastern and Western Eurasia. Moreover, archaeological studies had tried to understand the deep-rooted ancestry of the population structure. However, due to the lack of ancient genomic data, it has remained elusive which source populations contributed to the Ladakh population and what was the timing and the number of admixture events. Furthermore, the influence of ancient trading networks on their genetic structure is still unclear.

To understand the population ancestry of this region, we have analyzed ancient DNA from human skeletal remains recovered from a prehistoric cave site in Nyoma valley, Ladakh. Paleo genomics and carbon dating results revealed that different groups of people were there that belonged to different time period. We find that the early Iron Age population was genetically closer to the west and east Eurasian population. Mitochondrial haplogroup analysis revealed the presence of different maternal lineages among the individuals in the cave, including U7a3b, H2a1a, and M52a1b. Our results support that a migration event occurred during the Iron Age transitions in Ladakh that can be seen in the long-lasting genetic signature in present-day people. Here, I will discuss the complex population structure of Ladakh region and future research directions to understand the deep ancestry components of this region at the Eurasian and global scales, patterns of admixture, and migrations derived from studying ancient and modern genomes. This is the first study from an ancient perspective on this region that provided glimpses of unpredicted insight into genetic ancestry on this region that had not been documented yet.



AUTHOR'S PROFILE

Richa is currently pursuing her Ph.D. under the supervision of Dr. Niraj Rai from Birbal Sahni Institute of Palaeosciences, Lucknow. She did her Master's in Forensic Science from Kurukshetra University. She is interested in understanding and reconstructing the human population ancestry of South Asian people from ancient samples. Currently, she is working on ancient Ladakh samples that had been dated to 2000 years old. This is going to be a remarkable

study from ancient perspectives, like how population structure had been shaped by over a period of time. She is very efficient in handling ancient as well as modern samples, extraction of DNA, and library preparation for next generation sequencing. Her experience has made her an independent researcher and she is excellent in laboratory techniques related to more than 1000 years old samples. She can confidently handle high-throughput sequencing data on Linux server. She is also skilled in data representation with R programming.

INDO-ARAB INTERACTIONS: SPECIAL REFERENCES TO CERAMIC EVIDENCES FROM URBAN HARAPPA AND EARLY HISTORIC TAMILAKAM

AUTHOR: RIZVAN PS

EMAIL: psrizvan66@gmail.com

The maritime interactions between the Indian subcontinent and Arabian Peninsula have been well connected since the third millennium BCE, when the earliest evidence of the connections came from the Indus Civilization. A significant number of the Indus ceramics such as black slipped jars, Indus fine painted wares, pedestalled dishes, perforated jars, cooking pots, etc., were widely distributed across various sites in the Arabian Peninsula, which were contemporary to Indus sites. Some of these ceramics went through various morphological changes and had local imitations. No Indus pottery has been reported from the early phase (2600-2450 BCE). Whereas the middle phase (2450-2300 BCE) and late phase (2300-1900 BCE) revealed evidence of more active interactions. The final phase based on the ceramic evidence from Bahrain sheds light on the natives of Gujarat who played an important role in the interactions. During the early historic period (500-500 CE), there emerged Indo-Arab interactions with the South Indian sites of ancient Tamilakam. The ceramics evidence of Arabian sites like Mleiha, Suhar, Ed Dur, Khor Rori, Qana, etc., had imitations and similarities with ceramics of Arikamedu, Alagankulam, Pattanam, etc., when it comes to the Rouletted ware, Indian Coarse Red ware, Black and Red Ware etc. The site, Pattanam, yielded South Arabian Ovoid Jars and Khor-Rori-Pattanam Ware. The latter was very significant since it was only reported from these two sites. This poster will look into a comparative study of Indo-Arab interactions from the Indus period to Early Historic Tamilakam with the help of ceramics from both periods. It will try to address the questions like which all changes occurred in the pattern of interactions, development of inter-regional relationships, ceramics types, items of exchange, role of sites, etc., to indicate the significance of ceramics of Indian subcontinent origin, unearthed from the Arabian peninsula and vice versa.



AUTHOR'S PROFILE

Rizvan is a Ph.D. scholar, Department of History, University of Hyderabad working under Prof. Suchandra Ghosh. He completed his B.A. and M.A. from Hindu College, University of Delhi (2015-2020). His area of interest lies in archaeology, maritime trade, Indian Ocean studies, early historic period, etc. He has worked in the Pattanam excavation for two seasons. He presented papers at conferences like the South Indian History Congress, Indian History Congress, and a few online seminars. His articles have been published in UGC-listed journals and peer-reviewed journals.

PRELIMINARY RESULTS FROM THE TRACEOLOGICAL INVESTIGATIONS ON THE DHOLAVIRA WORKED BONE CORPUS

AUTHOR: SHARADA CHANNARAYAPATNA

CO-AUTHORS: SANDHRA S AND RS BISHT

EMAIL: sharada.c@iitgn.ac.in

Sandhra S is affiliated with the Department of Humanities, Università degli Studi di Ferrara, Italy.

Prof RS Bisht is affiliated with the Archaeological Sciences Centre, Indian Institute of Technology Gandhinagar, Gujarat, India

Dholavira, a key site of the Harappan Civilization in western India, has yielded a substantial corpus of worked bone and ivory. Unlike their inorganic counterparts, the osseous artefacts from the site, have not been put through rigorous multi-method analyses to reconstruct aspects of their typo-technology, functionality, and role in the lives of the Dholavirans. A pilot traceological study was therefore carried out on 8 worked bones, categorized as pointed objects, recovered in varying states of preservation from the Castle, Bailey, Middle, and Lower Town areas of the site. The chief objective was to document and infer the nature, frequency, location, and association of various marks present on them. A literature review at the outset aided in creating an exemplar of existing definitions and descriptions of such marks and whether those of manufacturing could be distinguished from use-wear. Microscopic examination (stereo and SEM) revealed that three points clearly displayed the signatures of the pre-depositional manufacturing process like profuse longitudinal scraping and polishing on the curved surfaces attributed to blank preparation either on fresh or semi-fresh bones. The same points on their flattened apices evidenced use-wear such as oblique grinding marks, numerous and closely situated. Other marks noted were concentric circles, short and broad gouging marks below the tip, and a deep chop mark. A majority of them were stained black in patches because of the presence of manganese oxide in the surrounding matrix, while cortical surface exfoliation, porosity due to waterlogging, and recent breakage with chipped edges mimicking micro flake scars attested to active post-depositional taphonomic agents and their impacts. Heavy encrustation in 2 points contributed to the obliteration of manufacturing or use-wear marks. No apparent trends or correlations could be highlighted after integrating the data from the worked bone type, their traceological history, and their contexts, pointing to the need for additional research on the rest of the repertoire.



AUTHOR'S PROFILE

Sharada Channarayapatna is an Assistant Professor in Archaeology at the Archaeological Sciences Centre and an Affiliate faculty at the Kiran C Patel Centre for Sustainable Development at IIT Gandhinagar. She has two Master's and two doctorates - awarded by Deccan College, Pune, University of Ferrara, Italy, and National Museum of Natural History, Paris, France, respectively; specializing in Ancient Indian History, Culture, and Archaeology and European Quaternary and Prehistory. Prior to this, she completed her B.A. in History, Economics, and Sociology from Mysore University. She has been the recipient of the Erasmus Mundus Scholarships,

the Nehru Trust Small Study Grants for independent projects, the Indian Council of Historical Research's Fellowship, and more recently DST-SERB's POWER grant. In the last 15 years, she has analyzed faunal remains from more than a dozen sites in India and Europe to delineate the sites' prehistoric and protohistoric animal-based subsistence strategies and their taphonomic trajectories.

CHARACTERISATION OF DIAGENESIS OF BONES FROM THE HARAPPAN SITE OF DHOLAVIRA, KUTCH, GUJARAT, INDIA

AUTHOR: SHRADHA MENON

CO-AUTHORS: SHARADA CHANNARAYAPATNA AND ANANDU MURALIDHARAN

EMAIL: shradha.menon@iitgn.ac.in

Isotopic studies on archaeological bones are repositories providing insights into their provenance, paleopathology, paleodiet, and paleoclimate. However, taphonomic and diagenetic processes cause morphological and chemical variations in the bones. Studies in India have only begun to emphasize on the effect of diagenesis in hindering the accuracy of isotopic analysis. In this study, the extent and mechanism of diagenesis of ten ancient and one modern animal bone from Dholavira is investigated. The 5000-year-old Harappan Civilization site is located near the Rann of Kutch in the arid western part of India. This would enable ascertaining changes in extent of diagenesis under arid tropical climatic conditions. X-Ray Diffraction and Fourier Transform Infrared studies were conducted to discern the viability of the laboratory techniques in characterizing diagenesis. Samples were also taken from various parts of the bones to determine inter-bone variability. The results indicate extensive chemical incorporation in the bone samples, which were corroborated using soil samples taken adjacent to the site. Overall, all the ancient bones exhibited greater extent of diagenesis as compared to the modern bones. For majority of the ancient bones, the collagen content is also observed to have been lost / destroyed. This would inhibit proteomic studies. Inter-bone variability was also observed in the ancient bone samples. Possible mechanisms of diagenesis include physical weathering inducing groundwater movement within the bones, leading to chemical exchange between soil and bones. Hence, diagenetic studies should be used as a preliminary analysis to determine the suitability of further isotopic analysis

on archaeological bones. The study also elucidates the necessity to carry out analysis on specific sites on bones (inner porous layer / outer layer) for accurate results.



AUTHOR'S PROFILE

Shradha Menon is pursuing her Ph.D. in the Discipline of Earth Sciences at IIT Gandhinagar, Gujarat, India. Her research involves discerning the sea level histories and the carbonate sedimentological aspects of the Lakshadweep Archipelago. Her other research interests include isotope geochemistry and paleo-oceanography.

DOCUMENTATION AND ANALYSIS OF THE CERAMICS OF TRENCH 55, BURIAL 5 OF DHANETI

AUTHOR: SNEHA DABADGAON

EMAIL: sneha.dabadgaon@gmail.com

The North-Western frontier part of the Indian subcontinent is known for its fairly rich and continuous record of the Harappan settlement over the years. During the 1950s, surveys were carried out in Saurashtra and Kachchh reporting many burial sites. Recent surveys added Mathal and Dhaneti to the list. Dhaneti is an Early Harappan burial site located in Kachchh, Gujarat. The burial site known as Rozimata no saran is located about 2.5 km north of the village, on the bank of a monsoonal storm-drain, the Ramaya Vango. Excavations were carried out by the Department of Archaeology and Ancient History, The Maharaja Sayajirao University of Baroda from 2016-19; exposing burials, burial goods, and skeletal remains. The current study emphasizes on the conventional archaeological analysis to document and represent the 19 vessels yielded from Trench 55, Burial 5 of Dhaneti. The washing

with soft and hard brushes, removal of encrustations by immersing it in the diluted acetic acid solution, labeling, reconstruction, applying a coat of B-72 solution to conserve the vessel, and detailed documentation was done. This was followed by a systematic classification of the vessels based on their vessel types, ware, surface treatment (which includes slip and paintings), and fabric with the help of a Munsell chart. Red ware dish on stands, pots, jars, and beakers were the representative vessel type but with different hues and chromas of red. The vessels were made of refined clay and had medium-fine fabric. Decorative patterns such as painted black bands, festoons, and loops were evident. Finely made beakers with even thickness throughout showed similarity with the Damb Sadaat beakers. The rim features, i.e., short thin rims and out-turned thick rims were similar to the Kot-Dijjan vessels. To be noted, this particular trench yielded only burial goods excluding the skeletal remains and orthostats.



AUTHOR'S PROFILE

Sneha Dabadgaon is a second-year Master's student of MSU, Baroda. Previously, she has worked upon the Shell bangle fragments of Nani Rayan, which was an early historic site in Kachchh. A detailed documentation was done along with which she also tried to create a typology chart for the shell bangles. She also assisted Prof. JM Kenoyer during his brief visit to Baroda and her department. His work on the Indus valley civilization intensified her interest in the Harappan culture. Further, the study of the proto-history paper is what unfolded her interest toward the burial practices observed by the Harappans. which encouraged her to study more about their

burial goods. Also, ceramics represent the largest class of artefacts thus, providing a relative date, chronology, and cultural sequence to a site. Therefore, the analysis of ceramics as the topic of her research and the site of Dhaneti were chosen for this research.

हड़प्पा सभ्यता में खेल- खिलौनों का कलात्मक वैभव

AUTHOR: TULIKA TIWARI

EMAIL: tiwaritulika500@gmail.com

प्रारम्भ में सिंधु घाटी से समय- समय पर कुछ विचित्र मोहरें प्राप्त होती रहीं, किंतु वैज्ञानिक आधार पर इस टीले की खुदाई भारतीय पुरातत्व विध श्री राखलदास बैनर्जी द्वारा करवाई गयी, जिन्हे बौद्ध अवशेषों के नीचे एक सुविस्तृत नगर के खंडर मिले। 1921 व 1922 ई. में जॉन मार्शल द्वारा सिंधु घाटी के दो महत्वपूर्ण नगर खोज निकाले गए। जिसके भारतीय संस्कृति की प्राचीनता पर नया प्रकाश पड़ा। पहला स्थान पाकिस्तान के पंजाब प्रान्त में स्थित मॉन्टगोमरी जिले में रावी नदी के बांये तट पर स्थित "हड़प्पा" था और दूसरा प्रान्त सिन्ध में लरकाना नगर से 25 मील दूर "मोहनजोदड़ो" था। हड़प्पा सभ्यता विश्व की अत्यंत प्राचीन सभ्यताओं में से एक मानी जाती है, इसे कला, संस्कृति, और वास्तुकला का केंद्र माना जाता था। इन सभ्यता स्थलों पर की गई खोजें हमें अपने पूर्वजों के जीवन और उनकी जीवन शैली से अवगत कराती हैं। प्रारंभिक हड़प्पा काल 3500 ईसा पूर्व से 2600 ईसा पूर्व और परिपक्व हड़प्पा काल 1800 ईसा पूर्व व उत्तर हड़प्पा काल 1800 ईसा पूर्व माना जाता है। पूर्व अज्ञात सभ्यता का नामकरण उसके पहले उत्खनित स्थल के आधार पर करने की पुरातात्विक परंपरा के अनुसार, सिंधु घाटी सभ्यता को "हड़प्पा" सभ्यता भी कहा जाता है। हड़प्पा से



प्राप्त प्राचीन वस्तुओं में, अवशेषों के आधार पर प्राप्त मूर्तियाँ, मोहरें, आभूषण, व पात्र की सामग्रियाँ प्राप्त हुई हैं। इसके अतिरिक्त उस समय व्यक्ति मनोरंजन व शारीरिक गतिविधियों को सुचारू रूप से बनाये रखने के लिए पासों का खेल, शिकार, व मछली पकड़ने जैसे खेलों में रुचि लेते थे, जिसके अवशेष हमें कला व शिल्प में खेल- खिलौनों के रूप में दृष्टिगोचर होते हैं। जिसके अवशेष हमें हड़प्पा सभ्यता से प्राप्त लघु किन्तु आकर्षक मृण मूर्तन के रूप में प्राप्त होते हैं। विभिन्न प्रकार के खेल खिलौने मनुष्य जीवन के महत्वपूर्ण पक्ष हैं, जो प्रारम्भ से अंत तक एक जीवंत क्रिया है, जो मनुष्य की शारीरिक एवं मानसिक गतिविधियों को प्रबल बनाने में सहायता करती है। प्रत्येक सभ्यता एवं संस्कृति इनकी अभिव्यक्ति अपने रचनात्मक रूपों में करता आया है, हड़प्पा सभ्यता में भी हमें ऐसे अनुपम अवशेष प्राप्त होते हैं, जो मानव जीवन में खेल के महत्व व उसके कलात्मक पहलू को भी प्रदर्शित करते हैं, जिसकी उपयोगिता वर्तमान समय में भी खेलों

के महत्व को अलग करती है।

AUTHOR'S PROFILE

Ms. Tulika Tiwari is currently pursuing her Ph.D. in drawing and painting in the field of Indian miniature painting, and has completed her Graduation in visual art in 2017 and Post Graduation in Mural art 2019 from Dayalbagh Educational Institute, Agra.

MULTI-FACETED ANALYSIS OF SHELLS FROM THE PREHISTORIC SHELL MIDDEN SITE OF BAMBHANKA NEAR DHOLAVIRA, DISTRICT KACHCHH, GUJARAT (INDIA)

AUTHOR: UNGKA PADI

CO-AUTHORS: VN PRABHAKAR, SHARADA CHANNARAYAPATNA, VIKRANT JAIN, AND JS RAY

EMAIL: padiungka@iitgn.ac.in

VN Prabhakar is an Associate Professor in the Archaeological Sciences Centre, Discipline of Humanities and Social Sciences, IIT Gandhinagar.

Sharada Channarayapatna is an Assistant Professor in the Archaeological Sciences Centre, Discipline of Humanities and Social Sciences, IIT Gandhinagar.

Vikrant Jain is a Professor in the Discipline of Earth Science at IIT Gandhinagar.

JS Ray is the Director at the National Centre for Earth Science Studies, Earth System Science Organization, Ministry of Earth Sciences, Government of India.

Shell middens play a crucial role in archaeology because they preserve pertinent information about the paleoenvironment of the sites, the diet, and the technology of the prehistoric inhabitants. Additionally, they exhibit their shell-based survival economy and other cultural practices. In order to understand the past socio-economic conditions it is essential to also understand the long-distance trade for exotic raw materials. Evidence for procurement of shell varieties from Karachi- Gulf of Kachchh, Makran and Omani coast are attested from Mehrgarh, the earliest evidence for settled human occupation in the Indian subcontinent. There was a dearth of settlements of such remote age from the coastal areas until the discovery of shell midden sites near the Karachi area and Omani coast, datable between the eighth and fifth millennium BP. The recent discovery of a shell midden site near the Harappan site of Dholavira and its antiquity dating back to the seventh millennium BP has enabled it to be correlated with the Makran coast evidence. The Gastropod shell discovered from Bambhanka is of the species *Terebralia palustris*. Several methods like NISP and NRE (MNI) count, statistical analysis, macro and microscopic analysis, X-ray diffraction (XRD), and Scanning electron microscopy (SEM) have been employed in order to understand the breakage pattern and the state of integrity of the assemblage. The communities along the coast exploited shell species originating from a mangrove environment. They might have participated in the long-distance trade with inland settlements due to their proximity to



the shell raw materials of different varieties. This discovery of shell midden site on Khadir island has enabled a better understanding of the prehistory of this area, at least 2 millennia before the emergence of the Early Harappans. The continuation of exploiting the same shell species has also been noticed in Harappan sites like Lothal and Dholavira.

AUTHOR'S PROFILE

Ungka Padi is a Ph.D. Scholar in the Archaeological Sciences Centre at IIT Gandhinagar. She received her Master's degree in Archaeology and Heritage Management from DIHRM in 2016. In 2017, she

joined the Institute of Archaeology, ASI, for postgraduate diploma. She has also worked as a Research Assistant with the Directorate of Archaeology, Assam, for the World Heritage Project, Charaideo, in 2021. She has done archaeological fieldwork in Arunachal Pradesh, Assam, and Western UP, including excavation in the site of Barnawa, Uttar Pradesh; Alichinga Tengani, Assam; and Charaideo, Assam. She has participated in lithic, bead-making, and epigraphy workshops and structural and chemical conservation training. Her research interests revolve around megalithic traditions, and she is currently working on the ethnoarchaeological aspect of it for her Ph.D. in Arunachal Pradesh.

DECODING MISSING AND UNCLEAR INDUS SIGNS AND IDENTIFYING ANOMALOUS INDUS TEXTS FROM WEST ASIA USING MARKOV CHAIN LANGUAGE MODELS

AUTHOR: VARUN VENKATESH

EMAIL: varun.v9725@gmail.com

The writing system developed between 2500 and 1800 BCE in the Indus Valley Civilization in the Indian subcontinent remains undeciphered. Indus script texts found so far in the archeological digs are limited in number and include a lot of damaged artifacts with unclear and missing signs. Identifying the missing and illegible signs and extending this text corpus will benefit further research. This work aims at building advanced n-gram Markov chain language models using the ICIT text corpus and using that to predict the missing and unclear signs, along with identifying some anomalous texts based on their geographical distribution. With a thorough understanding of the concordances of the Indus signs, we built Markov chain language models based on n-grams, augmented with positional probability. We devised and implemented an effective sign fill-in algorithm on top of these language models. Using the language models and the sign fill-in algorithms, we then identified missing single signs in the test dataset and tuned our parameters to improve the accuracy of a match of a single sign to about 63% out of 10 predicted signs. Then we filled in the actual unclear texts with our predicted signs. Our results also show that the model perplexity was high for several West Asian Indus texts and that some of these texts did not fit in well with the language model built with Indus texts from just the Indian subcontinent. From this, we conclude that the language and / or the syntax in several West Asian Indus texts are quite different from the Indian subcontinent. We believe that the statistical models we developed here will add more complete texts to the Indus text corpus as well as indicate that the language encoded in the Indus script outside of the Indian subcontinent might have been different.



AUTHOR'S PROFILE

Varun Venkatesh is a student in his Junior year studying at Dublin High School in San Francisco Bay Area, California. He was introduced to the Indus scripts by his Indian parents and with his interest in machine learning, and Natural Language Processing, he was able to collaborate with his mentor Dr. Ali Farghaly, an expert in NLP, to do research work on the Indus script last year as part of Polygence research program where he presented his work in the symposium. He is the first author of the following research papers: Statistical Model for Identifying Missing and Unclear Signs of the Indus Script - Journal of Emerging Investigators (accepted) and

Identifying Anomalous Indus Texts from West Asia using Markov Chain Language Model - Journal of Student Research (In review). He has published his code at <https://github.com/varundataquest>. He hopes to continue to build his expertise in computational linguistics, machine learning, and deep learning.



Contact Us



<https://asc.iitgn.ac.in/>
asc colloquium@gmail.com

ARCHAEOLOGICAL SCIENCES CENTRE



IIT GANDHINAGAR
PALAJ, GANDHINAGAR, GUJARAT

