Chapter II

PRE URBAN HARAPPAN TO
POST URBAN HARAPPAN: AN APPRAISAL

Knowing the past is as astonishing a
performance as knowing the stars.
(Kubler 1962: 19)

Introduction

This chapter incorporates a review of Chalcolithic studies in Gujarat since 1930s. Chalcolithic researches of eighty years in Gujarat proved to be highly productive of unexpected insights, new ideas, and lasting results regarding the cultures/traditions of Pre Urban Harappan, Urban Harappan and Post Urban Harappan phases of Harappan culture. The aspects discussed here include a review of different excavations, explorations and a variety of studies conducted in Gujarat during 1930s to 2010. This chapter also deals with various dating methods employed in Chalcolithic Archaeology of Gujarat and its merits and demerits.

Excavations

Various organizations like Archaeological Survey of India, State Archaeology Department - Gujarat, Department of Archaeology - Saurashtra, The Maharaja Sayajirao University of Baroda – Vadodara, Deccan College Post Graduate and Research Institute – Pune, Bombay University, Rajasthan Vidyapeeth – Udaipur, National Institute of Oceanography - Goa, Cambridge University – Cambridge, University of Pennsylvania - USA, University of Wisconsin-Madison, USA, Bradford University, UK, University of Bologna – Italy, Research Institute for Humanity and Nature – Kyoto, University of Wisconsin, Madison and Spanish Council for Scientific Research – Barcelona conducted excavations in Gujarat. Excavations in 55 Chalcolithic sites in different regions of Gujarat provided
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evidence for the existence of Classical Harappan, Pre Urban Harappan Burial Pottery tradition and Regional Chalcolithic cultures/traditions like Anarta, Padri, Pre-Prabhas, Sorath Harappan, Micaceous Red, Prabhas, Lustrous Red, Malwa Ware and Jorwe Ware in Gujarat assignable to Pre Urban Harappan, Urban Harappan and Post Urban Harappan respectively. Based on the c14 dates from various excavated sites, Chalcolithic phase in Gujarat can be roughly dated between 3700 BC – 1000 BC. A brief description of the excavated Chalcolithic sites in Gujarat is mentioned below.

Vallabhipur (22° 41' 15" N, 71° 38' 31" E)
The first excavated Chalcolithic site in Gujarat was Vallabhipur (Vala) located in eastern Saurashtra. The excavation was conducted in 1930 by Father Henry Heras of Bombay University and several objects of the Proto-Historic period were unearthed from the lower level of the foundation of a later Buddhist monastery. Other details regarding the site are unknown except the mention of an excavated Indus graffiti bearing potsherd (Heras 1938: 141-143; Possehl 2007: 302).

Bet Dwarka (22° 20' 00" N, 69° 05' 00" E)
Hiranand Shastri excavated Bet Dwarka Island in Okhamandal taluka of Jamnagar District also in 1930 and dated the earliest occupation of the site to 3rd century BC (Rao 1987). However, further explorations (IAR 1969-70: 59) and excavations (Rao 1990: 59-98; Rao and Gaur 1992: 42-47; Gaur and Sundaresh 2003: 57-66) proved the existence of human habitation in the island from Chalcolithic/Post Urban Harappan times. The excavator’s interpretation to the reason which led to continuous habitation at the site was availability of marine shells, and based on its location considered it as a safe harbor in the ancient past (Gaur et al. 2005).

Rangpur (22° 23' 56" N, 71° 55' 19" E)
Rangpur, the archaeological mound measuring 1100 m north-south x 850 m east-west in Surendranagar district was first excavated by M. S. Vats of ASI in 1934-35
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(Dikshit 1950: 3-55) and based on the artefacts the excavator suggested that the part of Rangpur where he excavated might correspond to the late period of the Indus civilization or probably fall between that time and the period of Cemetery H at Harappa (Vats 1937: 34-38). In 1936, excavations were conducted at the site by G. S. Ghurye of the University of Bombay and agreed with the evidence acquired by the former (Ghurye 1939: 3-12). In order to ascertain the nature of the site, Rangpur mound was again excavated under the guidance of H. D. Sankalia and M. G. Dikshit in 1947 and according to the excavators, the ceramics of the Rangpur culture are basically dissimilar from the Indus Valley pottery and that it perhaps represents a late phase of the post-Harappan period (Dikshit 1950: 14-16). Therefore, in 1953-54 a thorough and systematic excavation was undertaken by S. R. Rao of ASI and established convincingly that Rangpur had Harappan contacts. In spite of severe criticisms, Rao’s ceramic sequencing at Rangpur still stand as the base of relative dating of most Chalcolithic sites discovered in Gujarat (Rao 1963: 1-207; Misra 1965: 44-52; Sankalia 1974; Possehl 1980; Bhattacharyya 1991: 53-57; Herman 1995: 187-198; Herman 1997: 77-112).

Langhnaj (23° 27' 00" N, 72° 32' 00" E)

In 1942 and in the following years H. D. Sankalia of Deccan College Post-graduate and Research Institute, Poona, conducted a series of excavations at Langhnaj in Mehsana district, a Mesolithic site having Chalcolithic affinity and unearthed artefacts and burials. In 1953-54, The Maharaja Sayajirao University of Baroda also unearthed microliths and human burials from the site. With a view to restudy its archaeological content, Langhnaj was excavated in 1963-64 by a joint team from the University of Poona, The Maharaja Sayajirao University of Baroda and the Government of Gujarat. Some 21 burials were unearthed from the site through different excavations and comparative study of skeletons from Langhnaj and Lothal (Harappan site) indicated close similarities between the Harappans of Lothal and hunter gatherers of Langhnaj. It was further attested by the recovery of
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a copper knife of 98% purity from the middle phase of Langhnaj. Black and Red Ware pottery of the Urban Harappan period and steatite disc beads were also unearthed from the site. Radio carbon date obtained from the mid phase of the site (2040±110 BC) is also comparable with the age of Lothal and many other Harappan sites in Gujarat (IAR 1953-54: 8; IAR 1963-64: 12; Karve and Kennedy 1964: 44-57; Clutton-Brock 1965; Ehrhardt and Kennedy 1965; Sankalia 1965; Agrawal and Kusumgar 1969: 191; Possehl and Kennedy 1979: 592-593; Possehl 2002: 62-76).

Machiala-Mota (21° 41' 00" N, 71° 14' 00" E)
In 1953, S. R. Rao of Archaeological Survey of India excavated Machiala-Mota (Mota-Machiala) in Amreli taluka, Amreli district. The site revealed evidence for Lustrous Red Ware, which is similar to the pottery of late levels of Rangpur (RGP III). Blades with short parallel sides of chalcedony were also recovered from the site (Rao 1963: 177).

Kanasutaria (22° 47' 00" N, 72° 16' 00" E)
S. R. Rao of Archaeological Survey of India excavated the Chalcolithic mound at Kanasutaria in Dholka taluka, Ahmedabad district in 1954-55. Two cultural periods were noticed at the site. Period I was the habitation deposit of Microliths using communities, and it was followed by a stratigraphical break. Period II was Chalcolithic cultural deposit of about 1.8 to 2.4 m and the ceramics unearthed from this deposit include Lustrous Red Ware, Coarse Red Ware, Coarse Buff Ware and Black and Red Ware. The ceramics from the site showed affinity to Rangpur IIC and III ceramics (Rao 1963: 188-189).

Lothal (22° 31' 25" N, 72° 14' 59" E)
During 1955 – 1962, S. R. Rao of Archaeological Survey of India excavated the fortified and stratified site of 7.5 hectares at Lothal in Ahmedabad district and clearly established that the Harappan culture did not confine itself to north-west
India (Rao 1956: 82-89; 1962: 14-30; 1965: 30-37). The site was a carefully planned one with a citadel comprising two public buildings and lower town consisting of a domestic quarter, workshops and market place. On the eastern side of the habitation area is a large brick lined rectangular enclosure and Rao termed it as a dockyard intended to harbour ships (Rao 1979; Bindra 2003). Leshnik (1968a: 911-922) argued that it was a tank meant to impound water for irrigation and domestic use. To the west of the citadel, between the peripheral wall and river, lay the cemetery (Rao 1973; 1979; 1985). Regional Chalcolithic ceramics were the dominant artefacts of the early stage of the site. In the last stage, there was decline in all aspects of town planning and artefacts underwent changes. From the artefacts of Lothal, it becomes clear that the settlement was a commercial and manufacturing centre, the productive capacity of the settlement was far greater than the needs of the small number of inhabitants of the site, or it had an exchange relationship with a group of people who procured raw materials and traded them for the surplus finished products from the settlement (Possehl and Kennedy 1979: 592-593). According to Rao (1979) the site was destroyed five times by the flood and Pandya (1987: 177-186) divided them into usual type floods and devastating type floods. In order to understand the significance of Lothal as a major centre of local and long distance trade; ‘Lothal Revisitation Project’ was initiated jointly by Archaeological Survey of India and University of Bologna, Italy and preliminary magnetic survey (2008) and excavations (2009) were conducted at the site (Frenez and Tosi 2010).

Lakhabaval (22° 24’ 00” N, 70° 00’ 00” E)

In 1955-56, excavation was carried out at Lakhabaval in Jamnagar district jointly by the Department of Archaeology Saurashtra and The Maharaja Sayajirao University of Baroda, under P. P. Pandya and B. Subbarao respectively to find out the cultural sequence and the characteristics of Harappan culture in Saurashtra. The archaeological mound located about 100 meters to the north of Lakhabaval
village on the western bank of the rivulet called Nagamati, measured approximately 150x100 meters. The excavation revealed a habitation deposit of three distinct cultural periods of which Period I represented Harappan/Chalcolithic phase associated with Rangpur IIB termed as Late Kathiawad Harappan (Subbarao 1958), Period II belongs to the Kshatrapa period while Period III is characterized by the material and structural remains of Medieval period (IAR 1955-56; Rao 1963).

Amra (22° 16' 00" N, 69° 56' 00" E)
The excavation at Amra in Jamnagar district in 1955-56, jointly by the Department of Archaeology, Saurashtra and M. S. University of Baroda, under P. P. Pandya and B. Subbarao respectively revealed three fold cultural sequences namely, period I, II and III. Period I is Post Urban Harappan phase associated with Rangpur IIC and III termed as Post Kathiawad Harappan (Subbarao 1958). Period II yielded Early Historic cultural materials and Period III is later in date (IAR 1955-56).

Prabhas Patan/Somnath (20° 53' 00" N, 70° 24' 00" E)
Archaeological mound at Prabhas Patan/Somnath locally known as Naghera in Junagadh district was first reported in 1938 by Father Heras of Bombay University. The excavations at the site in 1955-56 and 1956-57, by the Department of Archaeology, Saurashtra and The Maharaja Sayajirao University of Baroda, under P. P. Pandya and B. Subbarao respectively revealed six periods beginning from Post Urban Harappan to Medieval. To understand the cultural aspects of the site, excavations were conducted in 1971-72, 1975-76 and 1976-77 at the site by the Department of Archaeology, Saurashtra and Deccan College Post Graduate and Research Institute, Pune under J. M. Nanavati and H. D. Sankalia. The site revealed a sequence of five cultural periods datable from 3000 BC - 600 AD. The importance of the site lays in the fact that for the first time it unveiled the existence of two regional Chalcolithic traditions in Gujarat namely Pre-Prabhas
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**Bhagatrav (21° 29' 00" N, 72° 42' 00" E)**

Bhagatrav located in Bharuch district was excavated by S.R. Rao of Archaeological Survey of India in 1957-58. Excavations at the 2.25 m high mound revealed two cultural periods namely Period I and II. Period I is divided into two sub-periods, IA and IB representing respectively the Urban Harappan and Post Urban Harappan phases of the Harappan culture. Period IB revealed Post Urban Harappan pottery forms like dish with a short projected rim and small jar with slightly elongated neck and period II is Medieval (IAR 1957-58; Rao 1963).

**Mehgam (21° 42' 00" N, 72° 45' 00" E)**

Mehgam, near Bharuch on the Narmada estuary, was subjected to trial excavation by S.R. Rao of Archaeological Survey of India in 1957-58. This Chalcolithic site yielded Urban (Sorath) and Post Urban Harappan (Late Sorath) ceramics and no structures were reported. In 1959-60, from this site K. V. Soundara Rajan discovered microlithic tools typologically equitable with those found at the lowest levels at Rangpur and stone points formed a major type in the collection (IAR 1957-58; IAR 1959-60; Rao 1963).

**Telod (21° 42' 00" N, 72° 46' 00" E)**

Telod in Bharuch district was excavated in 1957-58 by the Archaeological Survey of India. The low lying mound situated on the south bank of river Narmada yielded storage jars and bowls with straight sides. The chief ceramic group from the site was sturdy Red Ware painted in black. The excavator relatively dated the site to late phase of Rangpur IIB (IAR 1957-58; Rao 1963).

**Rojdi (21° 51' 47" N, 70° 55' 08" E)**

The Chalcolithic mound at Rojdi situated on the bank of river Bhadar in Rajkot
district was excavated in 1957-58 and 1958-59 by P. P. Pandya of Department of Archaeology, Saurashtra. In the excavations, pottery similar to Pre-Prabhas Ware and Prabhas Ware were stratigraphically reported along with the Harappan ceramics. Early Historic artefacts were also reported from the site. In 1962-63, the site was again excavated by J. M. Nanavati of Department of Archaeology, Government of Gujarat, and he noticed Harappan and Micaceous Red Ware, Prabhas, Early Historic and Medieval levels in the site. In 1964-65, the Department of Archaeology, Government of Gujarat, during an exploration recovered five hundred and twenty microbeads of steatite and eight bicone barrel beads of gold, belonging to a necklace below a structure of Prabhas level. In 1982-83, The Department of Archaeology, Government of Gujarat, carried out excavations at Rojdi and recovered Harappan and non-Harappan artefacts. The excavations from 1983 to 1986 and 1992 to 1994, by a joint team of the Department of Archaeology, Government of Gujarat and the University of Pennsylvania, USA, under Gregory L. Possehl threw much light on the site and its chronology. However, in the excavation report and articles he has not mentioned Micaceous Red Ware in its name or the pottery similar to the Pre-Prabhas type which was noticed in the site by the earlier excavator. Based on differences from the Classical Harappans in movable and immovable antiquities, Possehl termed its material culture as Sorath Harappan and based on c14 dates, he divided the occupational strata of the site into three periods namely, Rojdi A, Rojdi B and Rojdi C corresponding to Rangpur sequence. As a relative dating technique, Rojdi sequence is gaining popularity. (Possehl et al. 1984; Possehl and Chitalwala 1985: 80-100; 1986: 467-468; 2004: 80-88; Possehl and Rawal 1989; Weber 1989; 1990: 333-348; 1991; 1999: 813-26; Fairservis 1991: 108-113; Bedigian 2004: 329-353; IAR 1957-58; IAR 1985-86; IAR 1992-93; IAR 1993-94).

Adkot (22° 00' 00" N, 71° 05' 00" E)

Trial excavation at Adkot in Rajkot district by P. P. Pandya of Department of Archaeology, Saurashtra.
Archaeology Saurashtra in 1957-58, revealed 5ft occupational deposits representing the Harappan culture. Among the Classical Harappan and Sorath Harappan artefacts unearthed from the site, black painted designs of a human figure feeding a pet on a potsherd is noteworthy (IAR 1957-58).

Pithadia/Pitharia (21° 46' 00" N, 70° 40' 00" E)
Trial digging at Pithadia (Pitharia) in Rajkot/Jamnagar district by P. P. Pandya of Department of Archaeology Saurashtra in 1957-58, revealed two periods of occupation viz., Urban Harappan (Bowls of Rangpur IIB) and Post Urban Harappan elements (lamps, flat dish of Rangpur IIC and Lustrous Red Ware) respectively represented material inventory of both the periods (IAR 1957-58).

Motidharai (21° 58' 00" N, 71° 57' 00" E)
Trial excavations at Motidharai in Bhavnagar district by P. P. Pandya of Department of Archaeology, Saurashtra in 1957-58 revealed two periods of occupation, with a considerable gap in between. Period I was characterized by the Harappan elements, while period II was distinguished by Early Historic artefacts (IAR 1957-58).

Kanjetar (20° 45' 00" N, 70° 40' 00" E)
In 1958, S. R. Rao of Archaeological Survey of India excavated the Chalcolithic site at Kanjetar in Kodinar taluka, Amreli district. The site measuring 150x150 m revealed a habitation deposit of 1.8 m. Site revealed almost all Harappan ceramic types and few evolved shapes in Sturdy Red Ware and Buff Ware. The paintings executed on pottery include black over Red Ware and chocolate over Buff Ware. The vessel shapes recovered from the site include bowls, dishes and jars. The site can be relatively dated to Rangpur IIB and IIC (Rao 1963).

Randaliyo (21° 48' 00" N, 71° 03' 00" E)
In 1958-59, Randaliyo in Randal Dadwa in Rajkot district was excavated by P. P.
Pandya of Department of Archaeology Saurashtra. The site contained a cemetery and one of the graves excavated exposed an extended skeleton. Fragments of Harappan ceramic were recovered from the vicinity of the skeleton (IAR 1958-59: 19).

Nagal (21° 34' 00" N, 72° 53' 00" E)
The excavation at Nagal in Bharuch district in 1961-62 by K. V. Soundara Rajan of Archaeological Survey of India revealed Chalcolithic cultural occupation. Vestiges of microlithic industry associated with Black and Red Ware and small fragments of Ochraceous Red Ware similar to the ceramics from Maheswar and Nasik-Jorwe were recovered from the mound. In the lowest level of the trench, a north-south oriented extended human burial was noticed and its cultural affiliation is unclear. Based on location and nature of occupation, the excavator opines that Nagal would bridge the gap between the late and Post-Harappan Chalcolithic sites in South Gujarat (IAR 1961-62).

Warthan (21° 22' 00" N, 72° 51' 00" E)
The trial excavation at Warthan in 1961-62 by K. V. Soundara Rajan of Archaeological Survey of India revealed two fold cultural sequences. The earliest of these was represented by the occurrence of a Black Painted Red Ware. The upper one which followed after a desertion was marked by the occurrence of plain Black and Red Ware similar to that found at Nagal. According to the excavator (IAR 1961-62), the site, however, continued in occupation until the beginning of Christian era, as evidenced by pottery and other finds. The painted pottery from the site was mainly characterised by concave sided carinated dishes decorated with series of oblique slashes, grids, honeycombs, etc., on the red slipped convex exterior. A thicker pottery in sturdy fabric with painted designs both in black and chocolate pigments was excavated from the site. Potsherds bearing graffiti and few stone flakes were also unearthed from the site (IAR 1961-62).
Andhi (21° 23' 00" N, 72° 47' 00" E)
The trial excavation at the site of Andhi in 1961-62 by K. V. Soundara Rajan of ASI yielded Chalcolithic black painted red and plain black and red wares, besides a number of fluted cores and flakes of microlithic order. The cultural sequence at the site revealed that in the upper levels of the Chalcolithic strata the Black Painted Red Ware was overlapped by the Plain Black and Red Ware (IAR 1961-62).

Desalpur (23° 25' 00" N, 60° 10' 00" E)
K. V. Soundara Rajan of the Archaeological Survey of India excavated the fortified Harappan site of Desalpur (Gunthli) measuring 130x100x3m, located on the northern bank of the stream Bamu-Chela, a tributary of river Dhrub in taluka Nakhrthana, district Kachchh in 1963-64. Among the two cultural periods assigned to the site, Period I comprised two sub phases - Period IA (Urban Harappan) and Period IB (Post Urban Harappan). Period II is Early Historic assignable to Rang-Mahal complex. Both stone and mud brick structures of Harappan period were exposed from the site and three structural phases were reported from Period IA. Apart from the Harappan ceramics Micaceous Red Ware was also reported from the site. Most notable finds from the site are two script bearing seals, one on steatite and the other on copper, lettered terracotta sealing, jasper and terracotta weights, copper knives, chisels, rods and rings, terracotta cart frames and animal figurines. Based on the comparative study of artefacts, the excavator relatively dated period I of Desalpur into 2000-1600 BC (IAR 1963-64; Soundararajan 1984: 217-226).

Jokha (21° 17' 00" N, 73° 00' 00" E)
In 1966-67, R. N. Mehta and S. N. Chowdhary of The Maharaja Sayajirao University of Baroda undertook the excavation at Jokha in Surat District. The site measuring about 150x100x2 m revealed three cultural periods. Period I (circa
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1500-1000 BC) was marked by the occurrence of Post Urban Harappan ceramics, Malwa Ware and Jorwe Ware, etched beads, fragment of copper celt, microlithic cores, flakes, blades, lunates, triangles and trapezes and terracotta objects. The most noteworthy finds from this period was a Neolithic celt. Two other celts were also obtained from the surface of the mound. Based on the ceramic evidence, the excavators identify Jokha as the junction of three cultures: Harappa from the north, Malwa Chalcolithic from the east and Deccan Chalcolithic from the west. Based on ceramics, Period II is dated to circa 6th century BC-1st century AD and Period III to circa 1st to 6th century AD (IAR 1966-67; Mehta et al. 1971).

Dhatva (21° 09' 00" N, 72° 46' 00" E)

In 1967-68, The Maharaja Sayajirao University of Baroda, conducted the excavation at Dhatva in Surat district to determine the extent of the Chalcolithic cultures in South Gujarat. The site revealed two cultural periods; Period I (circa 1500-1000BC) was characterised by the Chalcolithic pottery showing affinities with similar cultures of Saurashtra and Malwa and stone tools like lunates, scrapers and blades of jasper, agate and chert. Period II (circa 500 BC-AD 200) was characterised by Early Historic antiquities such as punch marked coins and Red Polished Ware. Based on limited quantity and variety of Chalcolithic pottery the excavators suggested that this site was just a small village settlement (IAR 1967-68; Mehta et al. 1975).

Malvan (21° 06' 00" N, 72° 43' 00" E)

In 1969-70, F. R. Allchin of the Cambridge University and J. P. Joshi of Archaeological Survey of India undertook an excavation at Malvan in Surat district. The 1.3 m thick habitation deposit yielded evidence of two cultural periods and of these, period I is assignable to the Post Harappan culture and Period II to the early medieval times. Apart from the Chalcolithic ceramic, blades of jasper, agate, chalcedony and bloodstone, cores, flake blades, objects of copper or bronze (small rod and bangle), terracotta humped bulls, circular or bun shaped
terracotta cakes, beads of carnelian and bones of animals like cattle, goat, sheep, dog, pig, deer, barasingha, birds and fishes were also unearthed. The structural remains of Period I comprised of a ditch (18x1.5x1.1m) cut into the natural soil, running in east west direction. The sides of the structure were found to be inclined at an angle of 30° and gradually widen towards the eastern side. A mud brick structure was present in northern side and size of the brick was 27x17x9 cm. The occupation of Period II was temporary in nature and was distinguished by the occurrence of Black Ware ascribable to the end of the first millennium AD (IAR 1969-70; Allchin and Joshi 1995).

Surkotada (23° 37' 00" N, 70° 50' 00" E)

In 1970-71 and 1971-72, J. P. Joshi of Archaeological Survey of India undertook excavations at Surkotada in Kachchh. The excavation brought to light remains of Harappan culture divided into three sub-periods namely IA, IB and IC. The inhabitants of Period IA was Urban Harappan with some traits of an antecedent culture and significant feature of the period was the occurrence of steatite seal, beads, long blades of chert and four different ceramic industries along with the Harappan namely non-Harappan Sturdy Red Ware, Polychrome Ware with designs painted in purple, white and black showing wavy lines, vertically grouped latticed arches, bands with chequered patterns, etc.; fine Cream Slipped Ware bearing painted designs, showing chain loop patterns, oblique slashes within borders and Reserved Slip Ware. During period IB, the Harappan elements continued in a decreasing order along with non-Harappan painted Coarse Red Ware, Reserved Slip Ware, Cream Slipped Ware and Polychrome Ware. Other important antiquities recovered of the period were a flat copper celt and a chisel. The occurrence of a thick layer of ash marked the end of Sub period IB. Period IC was characterised by white painted Black and Red Ware mainly represented by bowls with or without carination, Stud-handles and an inscribed seal; Harappan elements continued in a restricted manner. The fortified settlement consisted of a

Khanpur (22° 44' 00" N, 70° 41' 30" E)

In 1976-77, Chitalwala and Thomas conducted some section scrapings at the Chalcolithic mound at Khanpur in Morbi taluka of Rajkot district to collect animal bones. The artifacts were collected from the sections of a number of neatly cut shallow trenches dug for the construction of a pond. Based on ceramic evidence the site was divided into two chronological horizons corresponding to Rangpur IIB and IIC respectively. Bones of cattle, sheep, goat, pig, gazella, turtle and mollusca shells were the major biological finds from the site (Chitalwala and Thomas 1978).

Zekhada (23° 51' 00" N, 71° 28' 00" E)

In 1977-78, The Maharaja Sayajirao University of Baroda, conducted an excavation at the 1.5 m thick Chalcolithic site known differently as Hamasari, Harpasari or Amasari no Tekro in Zekhada/Jekhda village, Santalpur taluka, to investigate its cultural content. The excavations revealed evidence for the existence of eleven wattle and daub circular huts, occasionally provided with porch. The floorings of the huts were made of rammed earth. The ceramics recovered from this site include Gritty Red Ware, Coarse Red Ware, Coarse Gray Ware, Buff Ware, Black and Red Ware and Lustrous Red Ware. These ceramics showed similarities with those from Harappan and Post Harappan sites like Rangpur, Surkotada and Ahar. Other antiquities from the site include stone beads, cores, blades; copper bangles, awl, wires of copper and triangular and rectangular terracotta cakes and balls.
Bones of cow, buffalo, goat/sheep, pig, nilgai, camel, mongoose and fish represent the animal remains from the site (IAR 1977-78; Momin 1983: 120-125; Bhattacharya 1981; Chatterjee 1995).

**Kanewal (22° 27' 00" N, 72° 30' 00" E)**

In 1977-78, The Maharaja Sayajirao University of Baroda, carried out excavations on two mounds known as Kesrisimha-no-Tekro and Sai-no-Tekro, situated on the bank of the lake at Kanewal village, Anand district. Kesrisimha-no-Tekro comprised of a single culture occupation belonging to the Chalcolithic period, divisible into two phases, A and B. Two circular hut of wattle and daub, having rammed earth floorings were encountered at different levels and from these huts, household articles such as pots, quern, terracotta lamp and twenty two complete terracotta balls were recovered. The ceramic industry showed affinities with Lothal B, Rangpur IIA, IIB, IIC and III. At Sai-no-Tekro mound, the Chalcolithic occupation was preceded by Mesolithic people. In the Chalcolithic levels two circular huts, similar to those found at Kesrisimha-no-Tekro, were exposed. Two fragments of dish on stand, dish, miniature pots, vases and bowl in plain and painted red ware were recovered from the huts and the pottery in its form and fabric is comparable to the ceramics from Rangpur IIB and IIC (IAR 1977-78; Mehta et al. 1980).

**Pabumath (23° 37' 00" N, 70° 31' 40" E)**

The Department of Archaeology, Government of Gujarat, carried out excavations at Pabumath in Rapar taluka, Kachchh district during 1977-78, 1978-79 and 1980-81. The excavation revealed 5 m thick cultural deposit belonging to Urban and Post Urban Harappan periods separated by a burning activity. Apart from a building complex, ceramics of both the periods, inscribed steatite seal, stone beads, shell bangles, ear ring and beads of the bones and copper awl, arrow head, bangle, needle and antimony rods were also unearthed from the site (IAR 1977-78; 1978-79; 1980-81).
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Taraghda (21° 44' 00" N, 70° 26' 00" E)

In 1978-79, the Department of Archaeology, Government of Gujarat carried out a small scale excavation at Taraghda in Rajkot district to ascertain its cultural sequence. The Harappan mound was disturbed to a depth of 1 meter by the intensive digging of local people. The single cultural period site has not revealed structural remains. According to the excavators, the ceramics showed similarity with the ceramics from Prabhas Patan. Other artefacts recovered from the site include shell objects, copper ring, carnelian beads and weights (IAR 1978-79).

Valabhi (21° 53' 00" N, 71° 55' 00" E)

In 1979-80, The Maharaja Sayajirao University of Baroda conducted an excavation of the Harappan (Urban Harappan and Post Urban Harappan) site at Valabhi/Nesadi in Bhavnagar district. The small site with 0.5 M thick deposit revealed evidence for the existence of circular huts. The ceramic types are represented by red, Buff, Lustrous Red and Black and Red Wares. Vessel shapes from the site include dish on stand, bowl (with or without stud handle), goblet, basin, lamp and dish. A few other antiquities from the site include terracotta bull figurines, beads, lamps, spindle whorls, toy cart wheels, discs and scrapers. Based on artefact evidence the settlement is roughly dated to the time bracket of the second-third millennium BC (IAR 1979-80; Mehta 1984).

Dwarka (22° 13' 00" N, 69° 00' 00" E)

In 1979-80, S. R. Rao of ASI carried out excavation in the forecourt of the Dwarakadhish temple at Dwarka in Jamnagar district to ascertain the antiquity of the site. Four trenches were excavated at the site and 10.10 m deposit revealed evidence for 8 successive stages of habitation. Earliest inhabitants of the site were Post Urban Harappan and Lustrous Red Ware using communities relatively datable to 15th-14th century BC. Second stage of the site was marked by house floors
and thin black on red ware pottery datable to 900-500 BC and rest of the stages are later in date (IAR 1979-80).

**Oriyo Timbo (21° 54' 00" N, 71° 32' 00" E)**

Department of Archaeology, Gujarat State and University of Pennsylvania conducted an excavation at Oriyo Timbo near Chiroda village of Gadhada taluka, Bhavanagar district in 1981-82. Excavations at the Chalcolithic mound measuring 175x250m revealed two periods of occupation with microliths using inhabitants preceding a pastoral camp of Lustrous Red Ware using community. The site contained deep storage pits, chuhlas and hearths. Artifacts from the Chalcolithic period include terracotta bead/pendant with incised geometric design and ceramic forms like pots, jars, bowls and basins. Remains of goat, sheep, gazelle, antelope, blue bull and rhinoceros were also recovered from the site. In 1989-90, Department of Archaeology, Gujarat State and University of Pennsylvania resumed the excavations at Oriyo Timbo with a view to confirm the sequence, gather additional radiocarbon dating samples, investigate the nature of the microlithic and Lustrous Red Ware settlement and expand the sample of palaeobotanical remains for both periods. The findings from the Chalcolithic level include chulhas, hearths, storage pits, tandoor and ceramics. A true microlithic component was not found during the excavation, even though the new trenches were laid directly next to the trenches excavated in the earlier period (IAR 1989-90; Rissman and Chitalwala 1990).

**Vagad (22° 19' 00" N, 71° 52' 00" E)**

Vagad, a Chalcolthic site is located on the right bank of Bhadar river in Dharidhuka taluka of Ahmedabad district. The mound locally known as Kedio Timbo excavated by M. S. University of Baroda in 1981-1982 covers an area of 450 m north south and 300 m east west and rises to a height of 2 m from the surrounding plain. The single cultural period site is divided into three sub periods viz., Period IA, IB and IC based on three successive structural levels. Six circular hut remains were unearthed from the site. *Yajna vedikas* /fire pits were also
unearthed from the site. The ceramics excavated from the site include Sturdy Red Ware, Buff Ware, Chocolate Slipped Ware, Micaceous Red Ware, Crude Red Ware, Crude Grey Ware and White Painted Black and Red Ware. Other finds from the site include terracotta and stone weights, pulley shaped terracotta ear ornaments, beads of various materials, shell bangles with chevron motif, toy cart wheels, discs, spindle whorls, crucibles, copper objects, saddle querns, pestles, rubber stones and sling balls. Faunal remains recovered from the site are of animals like the cow, buffalo, goat, sheep, dog, spotted deer, gazelle, black buck, blue bull, pig and rat. Calibrated Radio Carbon date of Vagad IA is 2190-2080 BC, IB is 1800-1600 BC and Vagad I C must be later in date (Sonawane and Mehta 1985; Krishnan 1986; Dimri 1994).

Nageshwar (22°20' 00" N, 69° 03' 00" E)

In 1983-84, The Maharaja Sayajirao University of Baroda conducted an excavation at Shell object manufacturing Harappan settlement situated near a large sweet water lake in Nageshwar village, Okhamandal taluka of Jamnagar district. The Pindara and Poshitra Bay coasts which are rich in Turbinella pyrum and Chicoreus ramosus shells, raw materials for manufacturing various objects are in close proximity of the site. The site destroyed in 1976 by local earthwork contractors' revealed evidence of Harappan culture divisible into two phases, Period IA (.70-1.20 m deposit) and IB (1.30-1.40 m deposit). Period IA yielded Harappan artefacts and Period IB was represented by structures made of stone slab paved floors and rubble walls, fire altar (?)/ pottery kiln and other artefacts. Apart from Classical Harappan ceramics and one stud handled bowl; shell bangles, pendants, broken ladles, inlays, beads and debitage; stone weight, beads, blades and polishers; folded copper sheet and terracotta triangular cakes, bangles and toy cart frames were recovered from the site. Animal remains from the site include those of cow, goat, sheep, buffalo, blue bull, antelope, spotted deer, sambar and
Pre Urban Harappan to Post Urban Harappan: An Appraisal


Ratanpura (23° 28' 00" N, 71° 48' 00" E)

In 1984-85, The Maharaja Sayajirao University of Baroda carried out excavation at the Post Urban Harappan settlement located in Ratanpura village (23° 28' N 71° 48' E) Sami taluka, Patan district. The site comprising four mounds was divided into 10 sq m grids and soil samples were collected from alternate grids for phosphate analysis to determine the relative intensity of human intervention in different parts of the site and based on its results twelve trenches were dug, one each in mound I and III, seven in II and three in IV. Excavation in Mound I revealed Post Urban Harappan ceramics. Mound II revealed 85 to 95 cm thick cultural deposit broadly comparable with Rangpur IIC. A number of rammed earth floors of circular huts with U shaped chullah of mud built on the floor were the structural remains. Antiquities from the mound include ceramic wares like Harappan plain and painted sturdy Red Ware, Buff Ware, Lustrous Red Ware, white painted and plain Black and Red Ware, Coarse GreyWare and Coarse Red Ware; pestle stones and saddle querns and beads of carnelian, steatite, paste, shell and terracotta. Mound III revealed large quantities of bone fragments along with Mesolithic tools such as fluted cores, flakes of chert, chalcedony and was devoid of pottery. The excavation at mound IV brought to light three circular pits containing ash, charcoal, charred and uncharred bone pieces, pottery, fragments of terracotta sealings and terracotta lumps with or without thread mark (IAR 1984-85).

Nagwada (23° 18' 15" N, 71° 42' 45" E)

During 1985-86 to 1989-90, The Maharaja Sayajirao University of Baroda carried out excavation at the Harappan settlement locally known as Godh in Nagwada Village, Dasada taluk, Surendranagar district. The mound was divided into 10x10 m grids and soil samples were obtained from each grid for phosphate analysis. Based on its results trenches were selected for excavation. The 1 m thick deposit
revealed four structural levels of Harappan period divisible into two periods IA (layer 5) and IB (layer 1-4). Few burials, both inhumation and symbolic, represented period IA and the ceramics associated with the burials showed affinity to Pre-Harappan pottery from Amri, Nal and Kot-Diji. First phase of structural activity in the site was marked by post holes that went into natural soil in fifth layer. Rectangular structures made of undressed stones were observed in second phase and moulded mud brick rectangular structures represented third phase. Rectangular structures constructed out of rubble stones were observed in fourth phase. Classical Harappan ceramics were less in quantity in comparison to Anarta pottery; white painted Black and Red Ware also encountered. The site revealed evidence for craft activities like shell working and stone bead making. An inscribed Steatite seal/ pendant, terracotta sealing, female figurine, agate weights, gold beads and copper celts were the noteworthy findings. C14 date for the upper level of Period IB is 2180+/-80 BC (IAR 1985-86; 1986-87; 1987-88; 1988-89; 1989-90; Hegde et al. 1988: 55-65; Hegde et al. 1990: 191-195).

Shikarpur (23° 07' 00" N, 70° 35' 00" E)

The Harappan site at Shikarpur locally known as Valamiyo Timbo located in Bhachau taluka, district Kachchh was first excavated by Department of Archaeology, Government of Gujarat during 1987-1990. According to the excavators, the layers 1 to 9 at Shikarpur represent Urban Harappan and layers 10 to 19 belong to Pre Urban Harappan. Harappan ceramics, terracotta animal figurines, toy carts, bangles and triangular cakes, shell beads and bangles, semi precious stone objects like pendants and beads, copper objects like rings, bangles and chisels, chert blades and bone objects were unearthed from the site. The faunal remains from the site were of cattle, buffalo, sheep, goat, pig, dog, blue bull, blackbuck, jackal, hare and rhinoceros. During 2007-08 to 2009-10, the fortified settlement was re-excavated by Maharaja Sayajirao University of Baroda with a view to establish the cultural sequence as well as the settlement features in terms
function of the site. After preparing the contour map of the site using total station, site was divided into 5x5 m grids or excavation units. The excavation revealed a 6.40 m habitation deposit divisible into three phases of Harappan occupation. Phase I was marked by artifacts of Classical Harappan, Anarta and Sorath Harappan (very few from mid level onwards); Phase II by Sorath Harappan, Classical Harappan and Anarta and Phase III by Post Urban Sorath Harappan. Both mud brick and stone structures were unearthed with an open place at the middle of the site. Apart from the ceramics, the major artefacts recovered from the site include terracotta tablet, sealings, steatite pendant, female and male figurines, animal figurines, cart frames, copper celt, Rohri chert core and blades, weights, beads and drill bits (IAR 1987-88; 1988-89; 1989-90; Bhan and Ajithprasad 2008: 1-9; 2009: 1-9).

**Kuntasi (22° 50' 40" N, 70° 37' 30" E)**

During 1987-88 to 1989-90, Deccan College, Pune and Department of Archaeology, Government of Gujarat carried out excavations at the fortified Harappan settlement locally known as Bibi-no-Timbo located in Kuntasi village, Rajkot district. Excavations at 7 m habitation deposit revealed two main cultural periods at the site; Urban Harappan and Post Urban Harappan respectively. The fortification encloses an area about 125 m square. Though the lower town is absent in the site, there were a few houses outside the fortification. The houses inside the fortification were arranged along four sides leaving an open area at the centre. Both stone and mud brick structures are present at the site. Period I yielded Harappan ceramics, terracotta toy cart frames, beads of carnelian, faience and steatite, cubical chert weights and a square faience seal. Another discovery was that of a small pot embedded in one of the rooms of a house, containing thousands of steatite micro-beads, some copper bangles and two rings of copper. Period II, showed signs of decadence in the area of the settlement. Some of the Harappan ceramic shapes continued and the stud of the bowls became longer. The
occurrence of the Ahar type of black and red ware was another noteworthy feature. Based on local traditions, artifact remains and location of the site, the excavators believe that Kuntasi may have functioned as a high tide estuarine port. (IAR 1987-88; 1988-89; 1989-90; Dhavalikar 1992: 73-82; Dhavalikar 1994; Dhavalikar et al. 1996).

Dholavira (23° 53' 10" N, 70° 13' 00" E)
Dholavira excavated in 1989-90 to 2003-2004 by R.S. Bisht of ASI is one among the five largest Harappan cities in the subcontinent and is located in Bhachau taluka, Kachchh district. Ruins of the site are spread over an area of about 100 hectares in Khadir Island. Two seasonal water channels Manhar and Mansar are flowing on the south and north of the walled settlement. The site is remarkable for its exquisite planning, monumental structures, aesthetic architecture, efficient water harvesting system and funerary architecture. The excavator identified seven stages of cultural change at the site. The first settlement that was raised at the site in stage I was a fortress now lying buried in the citadel mound and in stage II, a residential area was added to the north of the walled settlement. Stage III was the most creative and important phase during which the fortress was made into a formidable castle and another walled sub division, viz. bailey, was added to it from the west. In the north, residential area of stage II was cleared of its structures for carving out a ground. Further north, an extensive walled town i.e. middle town was founded. Reservoirs were created on the south, west and north of the built up divisions. An outer fortification was also constructed during this stage. During stage III, the settlement was damaged by a natural catastrophe and repairs were undertaken and the lower town was added. Stage IV belonged to the Classical Harappan phase and almost all the salient features of the city planning were maintained along with the monumental structures such as the gateways, fortification, and drainage system. Stage V is characterised by the general decline, particularly in the maintenance of the city, was followed by a temporary desertion
of the site. The stage VI is a state of transformed Harappan Culture i.e. the Post Urban Harappan phase. Domestic buildings were laid out in a different planning and probably, after a century the Post Urban Harappans of stage VI abandoned the settlement. The new comers of stage VII did not use the Classical Harappan ceramics. They built their houses in the circular form and no planning as such was followed. The site was never occupied once the people of stage VII left. The funerary structures which are found in a cemetery that lay to the west of the city are also remarkable for the density of structures. Excavations also brought to light the existence of large tumuluis which are circular in the plan and these hemispherical structures were made of mud bricks. The site has yielded an inscription widely known as the signboard made up of ten large-sized signs of the Indus script and fragment of a large slab engraved with three large Indus signs. Apart from the huge amount of Chalcolithic pottery, human and animal figurines, chert blades, stone weights, copper objects, steatite seals, terracotta sealings, beads of semiprecious stones and drill bits were also unearthed from the site. According to excavator, the seven cultural stages of Dholavira can be dated between 3500-1700 BC (IAR 1989-90; 1990-91; 1991-92; 1992-93; 1993-94; 1996-97; 1997-98; 1998-99; 1999-00; 2000-01; Bisht 1989a: 397-408; 1989b: 265-272; 1991: 71-82; 1994; 1997: 107-120; 1999: 14-37; 2004: 35-48; 2006: 283-338).

**Babar Kot (22° 16' 30" N, 71° 34' 00" E)**

The fortified Harappan settlement at Babar Kot located in Paliyad village, Botad taluka, Bhavnagar district was excavated in 1990-91 by Gregory L. Possehl of University of Pennsylvania and M. H. Raval of the Department of Archaeology, Gujarat. The mound measuring 190x140x2.5 m was divided into small grids and 25 trenches located in different parts of the site were excavated. The top most strata represented artefacts of both Early Historic and Medieval periods. Three structural phases were noticed at Babar Kot and the first was represented by the remains of walls oriented north-south and east west. The noteworthy feature of this phase
was the bowl-shaped pit, resting on the occupational surface. Phase II was associated with Rojdi C. The stone walls running either north-south, or east-west, meeting with each other without any intersection, were the main feature of this phase. Remnants of floor having a complete pot and grinding stone were noticed from this phase. Remains of a hearth were also found on the northwest corner of the floor. The last building activity at the site was associated with the historical period. Apart from the ceramics microlithic blades, grinding stones and chipped stones were recovered from the site. Both wild and domestic animal bones and plant remains were also recovered from the site. Based on ceramic evidence, the Harappan settlements at Babar Kot can be dated equivalent to that of Rojdi B and i.e. c. 2200-1700 BC (IAR 1990-91; Possehl 1994: 193-204).

Padri (21° 20' 21" N, 72° 06' 32" E)
During 1990-91 to 1995-96 Deccan College, Pune excavated the Chalcolithic mound at Padri locally known as Kerala no Dhoro located in Talaja taluka, Bhavnagar district. The site revealed 4 fold cultural sequence i.e. the Pre Urban Harappan (Padri Ware), Urban Harappan (Phase I and II), Post Urban Harappan and Early Historic. Period I was represented by the remains of a mud pressed structure, Padri Ware, Sorath Harappan sherds and Steatite beads. The C14 dates for the Pre Urban Harappan phase at Padri go back to a fourth millennium BC (3636 BC). The Urban Harappan period yielded a large amount of fine painted and coarse pottery, which is similar to Rangpur IIB and Rojdi B and C14 date for the uppermost levels of this Phase is 2300 BC. Period III yielded ceramics akin to Rangpur IIC and Early Historic period was marked by Red Polished Ware (IAR 1990-91; 1991-92; 1993-94; 1995-96; Shinde 1991: 87-89; 1992a: 79-86; 1992b: 55-66; 1998: 173-182; 2006: 151-158; Shinde and Kar 1992: 105-110; Shinde and Thomas 1993: 145-147; Pathak 1992: 87-89; Bhagat 2001; Shirvalkar 2008).

Loteshwar (23° 36' 00" N, 71° 51' 00" E)
In 1990-91, M. S. University of Baroda and in 2009-10 under the direction of
Ajithprasad of M. S. University of Baroda and Marco Madella of CSIC, Barcelona, Spain, carried out excavation at Loteshwar in Sami taluka, Patan district. The site, locally known as Khari-no-Timbo, is located on a high sand dune close to the left bank of Khari Nadi, tributary of Rupen river. The excavation revealed habitation deposit of 1.8 m divisible into two periods, Period I belong to the Mesolithic Culture and II to the Harappan affiliated Chalcolithic culture. Period I was represented by 1 m thick habitation deposit of microlithics using community. The occupational debris of the microlithic period included both geometric and non-geometric tool types, lithic debitage, grinding/pallet stones, hammer stones and animal bones. One human skeleton belongs to this period was unearthed from one of the trenches. Chalcolithic period was represented by Anarta pottery, few Harappan sherds, blades, beads, bangle pieces of shell and copper, copper punch (?), grinding/pallet stones, hammer stones, terracotta pellets, terracotta female figurine (?) and spindle whorls. No structural remains were unearthed from the site and an important feature noticed at the site was the occurrence of a large number of pits, which were dug during this period. Their size varied from about 2 m in diameter and 0.5 m to 2 m in depth in diameter and, and they were filled with ash, charcoal, pottery, animal bones and microliths. This period also revealed one human burial. The earliest C14 date for the Mesolithic occupation at the site is 7300 BC and Chalcolithic deposit can be dated between 3700 - 2200 BC (IAR 1990-91; Mahida 1992; 1995: 85-87; Patel 1992; Brahmbhatt 2000; Ajithprasad 2002: 129-158; Yadav 2005; Patel 2008: 123-134; 2009: 173-188).

Jaidak (22° 41' 00" N, 70° 35' 00" E)

During 1991-92, 2005-06 and 2006-07 The Maharaja Sayajirao University of Baroda, carried out excavation at fortified bipartite Sorath Harappan settlement at Jaidak/Pithad locally known as Jaidak no Timbo in Jodiya taluka, district Jamnagar. The site has two mounds; Jaidak-1, the larger one measuring 300x150 m with a height of about 5 m from the surrounding plain and Jaidak 2, probably an
extension of the first mound, measures 140x90 m. In 1991-92, excavation was carried out on the Jaidak-2 mound and it revealed 1.40 m habitation deposit belonging to two distinctive periods. Of these, Period I belong to the Mesolithic/microlithic culture and Period II is Sorath Harappan. During 2005-06 and 2006-07, excavation was carried out at Jaidak -1 mound and it revealed two phases of Period II (Sorath Harappan) and flimsy evidence for medieval occupation. Period IIA is noted for the construction of the fortification and many stone structures within it. The ceramics of this period bear close similarity with pottery from the sites of Rangpur IIB, Rojdi B, Kuntasi IA and IB and Bagasra III. Other antiquities from this period include stone beads, copper ornaments, terracotta beads, perforated and imperforated pottery discs and bull figurine. Period II B represents the economic decline of the occupants of the site. Ceramics recovered from this period bears close resemblance to those from Rangpur IIC, Rojdi C and Bagasra IV (IAR 1991-92; Ajithprasad 2003; 2008: 83-99; Dwivedi 2009; Sen 2009).

Moti Pipli (23° 49' 00" N, 71° 32' 00" E)

In 1992-93, The Maharaja Sayajirao University of Baroda conducted an excavation at Moti Pipli in Radhnapur taluka, Banaskantha district. The site, locally known as Shaktari no Timbo is situated next to a large inter dunal depression known by the name Shaktari Talav. Excavation at the 600x120 m site yielded 90 cm thick habitational deposit of Mesolithic, Harappan affiliated Chalcolithic and Historic periods. The Chalcolithic period has a deposit of about 50 cm, and it was concentrated in the southern part of the mound. No structural remains were unearthed from the site. The ceramics from the site include Gritty Red Ware and Fine Red Ware of Anarta tradition, Black and Red Ware and the Pre-Harappan Burial pottery similar to those from Amri, Nal, Kot Diji and Balakot. Other antiquities found in the excavation constitute copper/bronze nail, folded strip of copper, fish hook, chert blades, beads of chalcedony, steatite, lapis lazuli,
terracotta, shell and faience, terracotta lumps and triangular cakes. The artefacts of late Early Historic (5th-6th century AD) and late Medieval period was also unearthed from the site in limited quantity (IAR 1992-93; Majumdar and Sonawane 1996-97: 11-17; Majumdar 2006: 159-166; Majumdar 1999).

Santhli (23° 54' 00" N, 71° 29' 10" E)
In 1993-94, M. S. University of Baroda carried out excavations at Santhli locally known as Gachi no Thumdo (Santhli II) in Radhanpur taluka, Banaskantha district. The site measuring 120x90 m revealed 40 cm habitation deposit belonging to two cultural periods. Period I at the site is Mesolithic having 25-30 cm deposit and Period II is Chalcolithic of 10-15 cm cultural deposit. Mesolithic artefacts of geometric and non-geometric nature including lunates, triangles, trapezes, crescents, points, backed blades along with blade cores, flake cores and lithic debitage were excavated from the site. A number of small pieces of flat sandstone slabs or palette stones were also unearthed from the site. This level also yielded a large quantity of skeletal remains of the animals. Period II was represented by few ceramic sherds, stone and shell beads, shell bangles and two extended inhumation burials. One of them was an adult double burial and associated with five ceramic vessels of different shapes. Second burial was of a child, also associated with few vessels. The noteworthy feature of the site is the lone presence of Pre Urban Harappan Burial pottery types (IAR 1993-94; Majumdar 1999; Ajithprasad 2002: 129-158).

Datrana (23° 46' 00" N, 71° 06' 00" E)
During 1993-94 and 1994-95, The M. S. University of Baroda carried out excavations at Datrana (Mounds II, IV and V) in Santalpur taluka, Banaskantha district. The artefact spread, consisting of stone blades, lithic debitage and few potsherds, covered an area of about 50 hectares. Mound IV locally known as Hadka walu Khetar revealed total habitation deposit of 75-90 cm incorporating two cultural periods, Period I being Mesolithic and Period II being Chalcolithic.
The Chalcolithic period was represented by long crested ridged blades, prismatic blade cores, stone beads and rough-outs, copper punch point and ceramics. The ceramics from the mound include Pre-Prabhas, Anarta and Pre Urban Harappan Burial pottery. The occurrence of Anarta and Pre Urban Harappan Burial pottery in upper level close to the surface indicates that Pre-Prabhas pottery using community were the earliest Chalcolithic inhabitants at the site. Datrana V, locally known as Patel no Khetar revealed a cultural deposit of 70-90 cm belonging to Mesolithic and Chalcolithic periods. The 15-20 cm Chalcolithic deposit revealed Pre Urban Harappan Burial pottery and long chalcedony blades. Datrana II locally known as Ravechi Mata no Timbo revealed a single period of Chalcolithic occupation. Habitation deposit in this mound was confined to pits of different dimensions - the largest one with a diameter of about 2 m and 1 m deep, while the smaller ones measured about half meter. The pits yielded Sorath Harappan pottery analogous to Rojdi A and B types. One of the pits yielded a number of lustrous red ware bowls and dishes. Most of the pottery recovered from another pit was of Anarta tradition. Another interesting find was that of a pottery kiln stacked with Sorath Harappan pottery (IAR 1993-94; Ajithprasad 2002).

Mathutra (23° 44' 00" N, 71° 05' 00" E)
In 1994-95, Abhijit Majumdar of The M. S. University of Baroda conducted trial excavation at Mathutra I (Madhavya no Timbo) in Santalpur taluka, Banaskantha district. The excavation in the northern part of the mound revealed that the spread of pottery was mainly on the surface except disc bases of bowl and pot and a grinding stone those were found buried in the trench. The shreds showed affinity to the Pre Urban Harappan Burial pottery. Excavation at the centre of the mound revealed three vessel bases associated with human teeth. Surface finds from the site include Anarta pottery and Post Urban Harappan ceramics (Majumdar 1999).

Bagasra (23° 03' 30" N, 70° 37' 10" E)
During 1995-96 to 2004-2005, The Maharaja Sayajirao University of Baroda
conducted excavations at fortified Harappan settlement at Bagasra, locally known as Gola Dhoro in Maliya taluka of Rajkot district. The site measuring 160x120 m is roughly rectangular in layout. The excavations at the site uncovered 7.75 m thick deposit of habitation belongs to four distinct phases; Phase I to Phase IV. Phase I represents the early stage of the Urban Harappan along with Anarta pottery. Phase II demarcates the construction of a fortification. As in Phase I, this phase incorporates both Classical/Urban Harappan remains and Anarta pottery. In addition to these, isolated sherds of the Sorath Harappan pottery were also found in the upper layers of this phase. Phase III is remarkable for the predominance of Sorath Harappan pottery over the Classical Harappan and a general disorganisation of construction activities at the site. Phase IV is the Post Urban Harappan habitation and is characterised by a group of Sorath Harappan pottery resembling Rangpur IIC and Rojdi C pottery; and by the absence of Classical/Sindhi Harappan artefacts in the deposit. The material remains unearthed from the site includes blades, cores, grinding stones, polishers, skin rubbers, weights, beads and drill bits of various stones; copper objects namely chisels, knives, bangles, beads; shell objects such as ladle, circlets, beads, bangles, inlay pieces, balls; steatite beads, seals; faience bangles, beads; bones and bone points, scrapers; otoliths; clay objects namely sealings, balls, clay lumps with reed impressions, and varieties of terracotta objects like animal figurines, toy-cart frames and wheels with projected hubs, spindle whorls, tops, pottery, pottery rings, pottery discs, triangular cakes, bangles, beads, pendants, ear studs and inlay pieces. The site provided clear evidence for shell working, stone bead manufacturing, faience making and copper working (IAR 1995-96; 1996-97; 1997-98; 1999-00; Sonawane et al. 2003: 21-50; Bhan et al. 2004: 153-158).

Juni Kuran (23° 27' 00" N, 69° 47' 00" E)

The Harappan settlement at Juni Kuran located on the north eastern corner of the Pascham Beyt island in Taluka Bhuj, District Kachchh was excavated under...
Shubra Pramanik of Archaeological Survey of India during 2003-04 to 2005-06. The rough rectangular shaped settlement covers an area of 410 x 350 m with an average deposit of 7 m. Structures made of mud brick and stone were observed continuously from the Urban Harappan to the Post Urban Harappan levels. Excavations also unearthed a fortified city with gateways, middle town and two stadiums. The pottery recovered from the excavation includes Reserved Slip Ware, Cream Slipped Ware, Grey Ware, Incised Red Ware and plain and painted Red Ware. Jar, dish on stand, vase, handi, dish, basin and goblet are the main vessel forms. Shell bangles and inlay pieces, terracotta objects like animal figurines, balls, hopscotch, blades of semi-precious stones, copper objects like the arrow heads, wire and fish hook were also recovered. Burials were also unearthed from the site (Pramanik 2004: 45-67).

**Bokhira (21° 39' 20" N, 69° 36' 10" E)**

Excavations at Bokhira in Porbandar District by Marine Archaeology Centre National Institute of Oceanography, Goa in 2005, revealed a Protohistoric settlement dating back to the mid-3rd millennium BC. Four trenches laid in the agricultural land located on the western side of the Porbandar creek revealed a habitation deposit of 50 cm. A large quantity of pottery, animal bones and other antiquities recovered from the site is akin to the material remains of Rojdi and Rangpur. One of the trenches revealed a rubble structure. The main pottery types are Red Ware, Buff Ware and Grey Ware. Major shapes are bowls, jars, lids, basins and pots. Paintings on the potsherds are roundels, wavy lines, cross lines and thick bands. Other antiquities from the site include stone tools, terracotta beads, clay balls, sling balls and a copper ring (Gaur et al. 2006: 33-39).

**Kanmer (23° 23' 00" N, 70° 52' 00" E)**

During 2005-06 to 2008-09, JRN Rajasthan Vidyapeeth, Udaipur, Gujarat State Department of Archaeology and Research Institute for Humanity and Nature, Kyoto, Japan jointly excavated the fortified Harappan settlement at Kanmer locally
known as Bakar Kot situated 35 kms east of Rapar in Kachchh district. The fortified site measuring 115x155x10 m revealed fivefold cultural sequence namely KMR I – Pre Urban Harappan (2888-2623 BC), KMR II– Urban Harappan (IIa-2130-1785 BC and IIb - 2470-2149 BC), KMR III – Post Urban Harappan, KMR IV– Early Historic (673-888 AD) and KMR V – Medieval (1224-1239 AD). Period I (Pre-fortification level) revealed 40 cm deposit and Period II (Urban Harappan) is divided into two phases based on the changes in ceramics and a 10 cm thick layer of whitish material. Phase IIA is ashy in nature and thickness of deposit varies from 2.5 to 1.8 m. Thickness of the Phase IIB varies from 2 to 3.5 m. Average thickness of Period III (Post Urban Harappan) varies from 40 to 100 cm. Period IV (Early Historic) has a deposit of 1.5m and a large number of pits measuring 2 m deep dug during this time disturbed the Harappan level. Period IV is marked by a flimsy medieval deposit of 20 cm. Architectural elements recovered from the site include fortification and residential structures. Though, stone was widely used as the building material, mud brick constructions are also present in the site. Ceramics from the Harappan levels include Black and Red Ware, Anarta pottery and other Harappan pottery types. Antiquities from the site include beads of steatite, faience, semiprecious stones, terracotta, shell and gold, steatite and terracotta seals, sealings, terracotta cakes, dices, gamesman, amulets, polishers, drill bits, rough outs, bangles of shell, copper and terracotta and weights. Remains of wild and domestic animals and plants were also recovered from the site (Kharakwal et al. 2005: 115-123; 2007: 21-46; 2008: 5-23; 2009: 147-164; Agrawal et al. 2010: 1-2).

Khirasara (23° 30' 00" N, 69° 08' 00" E)

During 2009-10, fortified Harappan settlement at Khirasara (Gadhwalivadi) located near Desalpur was excavated by ASI. The fortified settlement measures 310mx230 m. Maximum thickness of the sandstone and mud brick fortification wall exposed in the south-eastern side of the settlement is 4 m. Bastions were also exposed in corners of the fort wall. The site revealed evidence of residential
structures along with a warehouse. Artifacts from the sites show classical Harappan features and noteworthy findings are of three steatite seals, two bearing Harappan script and one having geometrical lines on it, beads and drill bits. In 1978-79, the Department of Archaeology, Government of Gujarat discovered a seal bearing Harappan characters from the site (IAR 1978-79; Jam 2010).

Kotada Bhadli (23° 22' 00" N, 69° 26' 00" E)

Kotada Bhadli located in Nakhatrana Taluka of Kachchh District was excavated in 2010-11 by Shirvalkar of Deccan College Post Graduate and Research Institute, Pune. The Chalcolithic settlement measuring 130x115x5 m has a stone fortification wall. The artifacts unearthed from the site showed similarities to those of Sorath harappan, Post Urban Sorath harappan and Classical Harappan. Various artifacts from the site include ceramics, pottery discs and terracotta beads (Shirvalkar Personal Communication).

Explorations

The history of eighty years of explorations to identify and understand the nature of Chalcolithic sites in Gujarat can be divided into 7 stages and in each advancing period research became more and more scientific and problem oriented. The various stages of explorations are discussed below.

Period of Chance Findings

Before 1950, the Chalcolithic archaeology of Gujarat was linked by stray finds and most of the sites were discovered accidently. According to present understanding, Vallabhipur was the first noticed Chalcolithic (Protohistoric) site in Gujarat in 1930 (Heras 1938). Chalcolithic site at Rangpur came to the notice in 1934 while digging the mound for the construction of a road and M. S. Vats excavated the site in 1935 (Rao 1963). In 1938, Father H. Heras reported the presence of the ancient mound at Somnath. Langhnaj, a Mesolithic site having Chalcolithic affinity was
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reported in 1941-42 by H. D. Sankalia of Deccan College, Pune during the First Gujarat Prehistoric Expedition (Sankalia 1946, 1965).

Decade of Nationalism and Beginning of Village to Village and River Valley Surveys

After the partition of India in 1947, due to the loss of the well-known remains of its rich cultural heritage to Pakistan and prompted by the feelings of nationalism Indian archaeologists conducted vigorous explorations in various parts of India including Gujarat. Soon after the partition, explorations in Gujarat were carried out by the Archaeological Survey of India; Department of Archaeology, Saurashtra; Department of Archaeology Government of Gujarat; The Maharaja Sayajirao University of Baroda and Deccan College, Pune. This period is noted for the beginning of the systematic village to village surveys. Archaeological explorations in Gujarat during 1951-1960 by P. P. Pandya (Bhadar Valley and various parts of Saurashtra), S. R. Rao (Bhal Region, Kachchh, Saurashtra, Mahi and Tapi Valley) and K. V. Soundara Rajan (Narmada Valley) resulted in the discovery of around 100 Chalcolithic sites in various regions except North Gujarat (IAR 1953-54; 1954-55; 1955-56; 1956-57; 1957-58; 1958-59; 1959-60; Subbarao 1958).

Decade of the Entry of Foreign Schools

1961-1970 is remarkable for the introduction of foreign scholars into the Harappan Studies of Gujarat. During this decade Chalcolithic sites were also discovered by J. M. Nanavati of Department of Archaeology (Aji, Khelo, Kalubhar and Kshetrunji river valleys in Amreli, Bhavnagar, Jamnagar, Rajkot; Demi river valley Surendranagar; Ahmedabad and Banrnaskantha), J. P. Joshi of ASI (Surendranagar, Kachchh), K. V. Soundararajan of ASI (Oldpad in Surat), R. N. Mehta of The Maharaja Sayajirao University of Baroda (Surat), F. R. Allchin and B. Allchin of University of Cambridge and J. P. Joshi of ASI (lower courses of Narmada and Tapi and estuaries of Ambika, Auranga, Damanganga, Kim, Mindola,

Decade of the Beginning of District Surveys

This decade is notable for the introduction of district surveys to discover Harappan sites by the Archaeological Survey of India and the research scholars from The Maharaja Sayajirao University of Baroda.

During 1971-80, explorations of Department of Archaeology, Government of Gujarat (Kachchh, Ahmadabad, Bhavnagar, Junagadh, Rajkot and Amreli), G. L. Possehl and Department of Archaeology, Government of Gujarat (Bhavnagar – Umrala and Gadhda taluka), Suman Pandya (Bhavnagar Taluka), The Maharaja Sayajirao University of Baroda (Banaskantha, Kheda, Jamnagar, Ahmedabad and Bhavnagar districts), The Maharaja Sayajirao University of Baroda (Banaskantha and Mehsana), Chitalwala (Rajkot) and Archaeological Survey of India (Banaskantha, Mehsana, Bhavnagar, Surendranagar and Ahmedabad) resulted in the discovery of hundreds of sites in various parts of Gujarat. Second half of this decade is notable for the discovery of a considerable number of Chalcolithic sites in North Gujarat (IAR 1970-71; 1971-72; 1972-73; 1973-74; 1974-75; 1975-76; 1976-77; 1977-78; 1978-79; 1979-80; Chitalwala 1979: 113-121; Mehta et al. 1971; Mehta et al. 1975; Mehta et al. 1980; Mirchandani 1980; Momin 1974: 57-63; 1976a: 54-56; 1976b: 51-54; 1979; Nanavati et al. 1971; Pandya 1973; Parikh 1977; Possehl 1980; Rao 1979).

Decade of the Introduction of Grid Surveys

In this period different seasons of grid surveys were conducted at the site like Dholavira prior to the excavation. During 1981-1990 explorations for Chalcolithic sites were conducted by the Department of Archaeology, Government of Gujarat (Kachchh, Rajkot, Mehsana, Amreli and Bhavnagar), The Maharaja Sayajirao
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Decade of Surveys for Regional Chalcolithic Sites and Introduction of GPS Surveys

During 1991-2000 most of the explorations were conducted to identify regional Chalcolithic sites and was mainly carried out by The Maharaja Sayajirao University of Baroda. The explorations of the University were concentrated in Mehsana, Banaskantha, Surendranagar and Ahmedabad (Bhogavo, Bhadar and Lilka river basins). Archaeological Survey of India explored parts of Kachchh, Junagadh and Vadodara districts. Lower reaches of Shetrunji river in Bhavnagar district were explored by Deccan College Pune (IAR 1990-91; 1991-92; 1992-93; 1993-94; 1994-95; 1995-96; 1996-97; 1997-98; 1998-99; 1999-2000; Ajithprasad and Sonawane 1993; Allchin and Joshi 1995; Dimri 1999; Majumdar 1999; Possehl 1994: 193-204; Sonawane and Ajithprasad 1994: 129-139).

Decade of the Beginning of Digital Documentation and Transect Survey of Sites

2001-2010 is noted for the introduction of the use of electronic devices in the explorations. GPR surveys were carried out at sites like Lothal (Bologna University and ASI), Kanmer (Rajasthan Vidyapeeth Udaipur, State Archaeology Department Gujarat and RIHN Kyoto) and Shikarpur (The Maharaja Sayajirao University of Baroda and RIHN Kyoto). Total Station surveys and GIS data generation were carried out at sites like Lothal (Bologna University and ASI), Kanmer (Rajasthan Vidyapeeth Udaipur, State Archaeology Department Gujarat
and RIHN Kyoto), Songadh, Jaidak, Shikarpur (The Maharaja Sayajirao University of Baroda) and Loteshwar (The Maharaja Sayajirao University of Baroda and CSIC Spain). Small scale Transect survey was carried out at Saurashtra by Mark Manual of Durham University. Other explorations were conducted by The Maharaja Sayajirao University of Baroda (Rajkot - Maliya and Surendranagar- Halvad and Drangadra, Coastal area of Surat and Bharuch, Junagadh, Bhavnagar – Talaja, Ahmedabad – Dhandhuka and Dholka, Jamnagar – around Jaidak), Archaeological Survey of India (Junagadh and Banaskantha), Deccan College Pune (Bhavnagar and Amreli - Vallabhipur to Jafrabad creek), National Institute of Oceanography (area around Mul Dwarka in Saurashtra) and Department of Archaeology, Government of Gujarat (Vasal River valley, Surendranagar)(IAR 2000-01; Ajithprasad 2008: 83-99; Bhagat 2001; Bhan et al. 2004: 153-158; Gaur et al. 2005; Kharakwal et al. 2009: 147-164; Krishnan and Dimri 2005: 199-204; Shirvalkar 2008; Sen 2009; Sonawane et al. 2003: 21-50).

All these explorations brought to light more than 773 sites in different regions of Gujarat. Hundreds of newly discovered sites await publication. Coordinates of many sites are not available. Even if available the coordinates are incorrect. In most publications, the term site is not defined. Hence it is necessary to undertake an exploration programme and digitally document all details regarding the sites. A list of Chalcolithic sites in Gujarat is given in Chapter IV- Table 4.1.

Architectural Studies

Architectural studies related to the Harappan sites in Gujarat are limited to excavation reports and few articles. Vyas (1998) also described various architectural features of Harappan sites in Lothal, Dholavira, Surkotada, and Rangpur. Tripartite architectural division of the site into citadel, lower town and middle town are reported from Dholavira (Bisht 1991: 71-82) and Juni Kuran (Pramanik 2004: 45-67). Stadiums were also reported from both the sites (Bisht 1998-99: 14-37; Pramanik 2004: 45-67). Bipartite division of the sites are noticed
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at Lothal (Rao 1979; 1985), Surkotada (Joshi 1990) and Shikarpur (Bhan and Ajithprasad 2008: 1-9; 2009: 1-9). Houses outside the fortification are reported from sites like Bagasra (Sonawane et al. 2003: 21-50; Bhan et al. 2004: 153-158) and Kuntasi (Dhavalikar et al. 1996). Roads and lines were observed in sites like Dholavira (Bisht 1989a: 397-408; 1989b: 265-272; 1991: 71-82; 1994; 1998-99: 14-37; 2004: 35-48). Architectural elements of the Harappan sites are defence structures like fortifications; monumental structures like burials; public structures like dockyard, reservoirs, water tanks, wells, warehouses, drainages and residential structures. Kitchens, toilets, living rooms and porches were noticed in residential structures. Workshops and kilns were also noticed in many sites. Some of the kilns are interpreted as fire altars (Hegde et al. 1990; Sonawane 2005: 326-331; Sonawane and Mehta 1985: 38-44). A large number of huge pits were reported from many sites and some of them may have been used for storage purposes and living. Shapes of the structures were square, rectangular, circular, curvilinear, octagonal and polygonal. Stones, sun dried mud bricks, burned mud bricks and clay were the major mediums of construction. The bricks used for construction were in the approximate ratio of 1:2:4. Mortar was used as binding medium and walls were plastered by lime.

No structures were reported during Pre Urban Harappan phase except the fortified settlement at Dholavira (Bisht 2000: 11-23), mud pressed rectangular structure at Padri (Shinde 1998: 173-182) and some clay lumps with reed impression from Somnath (Dhavalikar and Possehl 1992: 72-78) and Loteshwar (IAR 1990-91). Urban Harappan is notable for the presence of various structures of different utilities which showed architectural heightness of the Harappans. Both fortified and unfortified settlements were reported from this period and size of the sites varied from less than half hectare to 60 ha. Domestic structures like circular huts with mud floor and probable wattle and daub super structure (sometimes postholes in alignment) were excavated from sites like Kanewal (Mehta et al. 1980), Nesdi (Mehta 1984: 227-230), Zekhda (IAR 1977-78), Vagad (Sonawane and
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Mehta 1985: 38-44) and Ratanpura (IAR 1984-85). Some of these huts had a diameter of 3.5 - 4 m. The floorings of these huts were made with rammed clay or kankar. In these circular floorings, post holes were traced almost at equal distance on the circumference and central part. The post holes indicate the wattle and daub super structure. Multi room structures of brick and stone were also noticed at Kuntasi (Dhavalikar et al. 1996), Bagasra (Sonawane et al. 2003: 21-50), Surkotada (Joshi 1990), Khirasara (Jam 2010), Jaidak (Ajithprasad 2008: 83-99), Lothal (Rao 1979), Juni Kuran (Pramanik 2004: 45-67), Dholavira (Bisht 1989a: 397-408; 1991: 71-82), Shikarpur (Bhan and Ajithprasad 2008: 1-9; 2009: 1-9), Rojdi (Possehl and Raval 1989), Babarkot (Possehl 1994: 193-204), Nagwada (Hegde et al. 1988: 55-65), Rangpur (Rao 1963) and Kanmer (Kharakwal 2009: 147-164) during this period. In the Pre Urban Harappan phase medium of construction remained the same and in this period there was a general decline in architectural style and plan compared to Urban Harappan. This period also had circular, octagonal, curvilinear, rectangular and square structures.

Fortifications were noticed at excavated sites like Lothal (mud bricks and burnt bricks), Rojdi (stone), Desalpur (stone, mud bricks and burned bricks), Surkotada (stone and mud bricks), Shikarpur (mud bricks), Kuntasi (stone and mud bricks), Dholavira (stone and mudbricks), Babar Kot (stone), Pithad (stone), Bagasra (stone and mud bricks), Juni Kuran (stone), Kanmer (stone and mud brick) Khirasara (stone and mud brick) and in the explored sites at Kotada Bhadi (stone) and Songadh (stone). Thicknesses of these fortifications having gateways (carved and simple) varied from site to site ranging from (1.3 - 4 m at Kuntasi to 18 m at Dholavira). Most of these fortifications revealed evidences for the existence of bastions at corners. These fortifications were constructed/reconstructed in various phases of occupation at the site. Both Classical Harappan and Sorath Harappans used mud bricks and stones for the construction of fortifications. According to Ajithprasad (2008: 83-99), Sen (2009) and Jam (2010) there is a clear distinction between the architecture of Sorath Harappans and Classical Harappans. The
Classical Harappan fortification walls are massive construction and even small sites (Bagasra, Surkotada) have disproportionately huge protection walls. The fortifications in Sorath Harappan sites like Jaidak/Pithad and Rojdi are only 2 to 3 m thick and these sites are many times bigger than Bagasra and Surkotada. Fortification at Jaidak, a Sorath Harappan site is inferior in construction techniques compared to the Classical Harappan fortifications in Gujarat. According to Jam (2010) craft activities carried out at particular site and its geographical location necessitated the construction of forts. She also suggests two major purposes of fortifications: as protection against enemies and natural calamities such as floods and it as a hallmark of social authority over the area they commanded. It also controlled the human movement in and out of the town. According to Mate (1985: 75-84), the Harappan fortifications were local security measures and it did not play any role in the Indus Valley polity and the Indus military system. He further points out that lack of evidence of destruction by the human agency either of the fortifications or of the towns except in the last phase of the Harappan culture which shows that they fulfilled most successfully the role of internal security.

A rectangular structure, identified as dockyard (Rao 1979) is the most controversial architectural feature at Lothal (Possehl 1976: 120). This baked brick structure measures 219x37x4.5 m. Leshnik (1968: 911-922) suggest it as a tank for the storage of irrigation water. Wells were noticed at Dholavira and Lothal and possehl (1976: 121) suggest that people of the Harappan settlement at Lothal might have used the water from the well rather than the open and stagnant water from the rectangular structure. Another important architectural feature is reservoirs unearthed at Dholavira (Bisht 2000: 11-23). Around 10 hectares of the walled area of Dholavira was covered by 16 huge reservoirs. There was also a well equipped drainage system. Another important architectural monument is the large hemispherical mud brick burial structure having deep and wide square rock cut chamber and spokes like radiating walls (Bisht 2004: 35-48).
Artefact Analysis  
From the Chalcolithic sites in Gujarat, artefacts of ceramics, terracotta, stone, faience, metal, bone and shell were recovered in various quantities and many of the objects were subjected to conventional typological analysis and few of them were analysed using scientific methods. Various studies regarding the same are as follows.

Ceramics  
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Devi (2000) conducted metrical analysis of Sorath Harappan pottery from Datrana in comparison to those from Rojdi and Rangpur and found prominent constriction of necks of pots. Study of ceramics from excavated Early Dilmun site of Saar, Bahrain showed evidences for the export of Post Urban Sorath Harappan pottery from Saurashtra, Gujarat (Carter 2001: 183-201). Post Urban Harappan pottery was the most common imported pottery recovered from the periods 2 and 3 of Saar and it is absent in period 4. From this evidence from Arabia it can be assumed that there were trade relations between modern Bahrain and Saurashtra during Post Urban Harappan period (Carter 2001: 193-194). At Nageswar, vessel description and terminology were given based on the standardised classification system developed at Mohenjodaro for ceramics (Dales and Kenoyer 1986). At Rojdi standardization of the colour of ceramics is achieved through Munsell soil colour chart (Herman 1989: 53-156).

Apart from conventional analysis, some scientific analyses were also done on ceramics from sites like Nageswar (Hegde et al. 1990), Lothal (Rao 1979; 1985),
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Kuntasi (Dhavalikar et al. 1996) and Rangpur (Rao 1963). Forty seven sherds belonging to various periods of Rangpur were chemically analysed by Lal to understand the techniques or methods employed in their fabrication. The study hasn’t provided significant results regarding the methods of fabrication or decoration (Lal 1963: 133-137). Panjwani (1989: 83-86) conducted thin section studies of Chalcolithic ceramics and modern clay samples from Lothal and suggested the possibilities of the use of locally available clay for the manufacturing of the vessels. Thin section and XRD studies were carried out on the ceramic samples collected from Nageswar, Vagad and Ratanpura to understand the provenance of clay, materials included in it and to know the production techniques (Krishnan 1986; Krishnan and Hegde 1988: 27-56). The study revealed the probable sources of clay, probable ceramic production technique and its inclusions. Krishnan (1982; 1992: 125-132) also carried out scientific studies to determine the composition of pigments used in the decoration of Chalcolithic pottery from Nageswar, Vagad and Ratanpura. Chemical and petrographical studies were conducted on the ceramics from Nageswar to understand the technology involved in its production, characterise the materials present in it and provenance of the clay (Bhan et al 1990: 31-40). Krishnan and Rao (1994: 113-117) analysed the grain size of ceramics from Ratanpura and modern ethnographic samples to understand various clay paste preparation techniques and found lot of variation in the grain size of inclusions in Harappan pottery from Ratanpura and based on the data they argued that different workshops practising different raw material processing techniques existed in the same site. Krishnan and Hegde (1998) and Dimri (1994) scientifically analysed the Micaceous Red Ware from Vagad and argues the use of local clay for manufacture of vessels. Kumar (1996) undertook chemical analysis of ceramics from Vagad to understand the complementary nature of chemical and petrographic characterization. His study threw light on the probabilities of differential clay collection and identified three distinct groups of ceramics as in the case of Herman and Krishnan (1994). Bhagat
(2001) analysed the thin section of samples from Padri to understand the paste preparation techniques, textural grades in various pastes and to identify and characterise the presence of ceramic petrographic fabrics. The study revealed change in raw material in different phases and continuity in paste preparation techniques (Bhagat 2001). Shah (1994) conducted ethnographic studies and thin section analyses to understand clay paste preparation techniques of different potters and changes in microstructure. Shah (2001) studied the Black and Red Ware of Western Indian chalcolithic cultures and from Gujarat analysed the thin sections samples from Nagwada and Ratanpura. At Nagwada, the ceramic group represented a different technological tradition in raw material selection and processing. At Ratanpura, it was a skilled mode of production. At Nagwada it was associated with Gritty Red Ware, while in Ratanpura it was found along with Coarse ceramics. Reserved Slip Ware from Shikarpur were analysed using scanning electron microscope with energy-dispersive X-ray, X-ray diffraction and thin section and based on the results suggested the name 'sintered' Reserved Slip Ware (Krishnan et al. 2005).

Thin section and XRD studies of ceramics samples from Nageswar and clay samples from Bhimgaja Talav in the vicinity of the site showed that most important source of clay is the bed of the lake (Krishnan 1986; Krishnan and Hegde 1988: 40). Analysis of the ceramics from Vagad showed three forms of clay and one was from the bank of river Bhadar and second from beds of the depressions (forming lakes) around the site at Vagad (Krishnan 1986; Krishnan and Hegde 1988: 41). Study of the samples from Ratanpura showed that the Harappans produced the ceramics using the clay from the lake bed near the settlement (Krishnan 1986; Krishnan and Hegde 1988: 41). The study collectively proved that the inhabitants of Harappan settlements at Nageswar, Vagad and Ratanpura used the ceramics made by local clay (Krishnan and Hegde 1988: 42).
XRD analysis of Harappan ceramics and clay samples from the nearby sources of Kuntasi showed that all the ceramics at the site were locally produced (Gogte 1996: 349-353). Comparison of XRD patterns of representative potsherds from Lothal, Rangpur and Somnath with those of Ras al-Junayz in Oman by Gogte (2000: 7-14) showed that pottery from Lothal had greatest affinity to the same. Results showed that two different ceramic types which were different in colors, surface treatment and mineral compositions at Ras al-Junays and Lothal were mineralogically exactly identical. The variations in the relative proportions of minerals, from one potsherd to the other, are also the same at both sites. On the basis of this result and comparison of the published materials from the excavations of Lothal and Ras al-Junayz, Gogte (2000: 11-13) argued that probably most of the pottery was produced at Lothal and brought to Ras al-Junayz during maritime contact. Comparative study of XRD patterns of ceramic samples from Padri and modern clay samples from a pond near by Tarasara village (2 km south west of Padri) showed that all wares of Padri were manufactured locally and did not come from distant regions (Shirvalkar 2008: 140-145).

Terracotta Objects
Terracotta objects unearthed from excavated sites in Gujarat consists of human figurines, animal figurines, toy carts, wheels, discs, rings, spindle whorls, fishnet weights (net sinkers), stoppers, weights, sealings, balls, triangular cakes, clay lumps with finger impressions (mushtikas), bangles, beads, pendants, ear studs, inlay pieces, ladles, crucibles, pipes and pottery. No scientific studies were carried out on the terracotta objects from Harappan Gujarat. Conventional studies of terracotta objects from Gujarat include those of Bet Dwarka (Gaur et al. 2005: 26-28, 31-39), Dhatva (Mehta et al. 1975: 12-17, 20-23), Jokha (Mehta et al. 1971: 49-50, 53-55), Kanewal (Mehta et al. 1980: 61-66, 68), Kuntasi (Dhavalikar et al. 1996: 191-212, 224, 240-258), Lothal (Rao 1985: 319-333, 475-519, 584), Malvan (Allchin and Joshi 1995: 76-79, 81), Nageswar (Hedge et al. 1990: 140-143), Oriyo
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Stone Objects

Different kinds of stone objects were unearthed from Chalcolithic sites in Gujarat. They include beads, blades, cores, scrapers, lunates, triangles, seals, weights, polishers, grinding stones, pestles, sling balls, hammer stones and manufacturing wastes. Almost all studies related to the stones were conventional in nature and all the excavation reports contain description of stone tools from various sites. Stone beads, sling balls and stone weight were excavated from Bet Dwarka (Gaur et al. 2005: 30, 39). Microliths including cores, scrapers, lunates, triangles and blades were excavated from Chalcolithic level at Dhatva (Mehta et al. 1975: 23-27). Cores, flakes, lunates, triangles, trapeze, blades, balls, querns, door-supporters etc made out of jasper, chert, carnelian, chalcedony, sandstone, lime stone, basalt and garnet were discovered from Jokha (Mehta et al. 1971: 36-51). Apart from the microliths like core, lunates, trapeze, points and scrapers, querns, mullers, rubber stones and beads of carnelian, chert and agate were recovered from Kanewal (Mehta et al. 1980: 55-61, 65, 67). Beads of carnelian, chalcedony, agate, feldspar, gneiss, quartz, lapis lazuli, jasper and galuconite; pendants of granite and agate; weights of chert, quartzite and basalt; gamesman of chert, ear stud of chert; querns of basalt; rubber stones of basalt and quartzite; mullers of basalt; hammer stones of chalcedony, quartz and quartzite, sharpener, anvil and mace heads of chalcedony and basalt; sling balls of quartz and basalt; anchor stones of miliolite; chert blades and cores comprised the stone tool kit of Kuntasi (Dhavalikar et al. 1996: 191-212,
A lot of stone objects were unearthed from Lothal and they include steatite seals, sand stone rotary mill, saddle querns, mullers, pounders, dishes, bowls, polishers, burnishers, wet stones, touch stones, hammer stones, mace heads, net sinkers, sling balls, blades, flakes, cores, lunates, weights, anchors, beads of lapis lazuli, agate, carnelian, steatite, jasper, opal, chrysoprase, onyx, cairngorm, bloodstone, plasma, chalcedony, amethyst, crystal and amazonite (Rao 1985).

Stone objects unearthed from Malvan include steatite and carnelian beads, rubber stone, hammer stone, saddle quern and marbles (Allchin and Joshi 1995: 81-82).

From Nageswar, cores, scraper, burin, flakes, blades, querns, mullers, pounders, weight, hammer stones, whet stones and carnelian beads were unearthed (Hegde et al. 1990: 137-143). Apart from the microliths, stone ball, shaped stones and jasper bead blank were recovered from Oriyo Timbo (Rissman and Chitalwala 1990: 107-109). Beads of steatite, carnelian, jasper and agate' querns, mullers and weights of sandstone and schist were recovered from all the levels of Rangpur (Rao 1963: 142-148). Stone weights, burnisher, carnelian beads, limestone beads, cores, blades and flakes were recovered from Rojdi (Possehl and Raval 1989: 157-159). Agate and lapis lazuli beads, fluted cores, lunates, burins, retouched blades, scrapers, lime stone ball and sandstone muller were unearthed from Somnath (Nanavati et al. 1971: 73-77). Chert and chalcedony blades, razor knife, cores of chert, agate, quartz and jasper, flakes, balls, querns, mace heads, whet stones and sharpeners, mullers and rubbers of sandstone, gameboard, polishers, beads of sandstone, agate, jasper, serpentine, lapis lazuli, carnelian, chalcedony, chert, weights of chert and jasper were unearthed from Surkotada (Joshi 1990: 252-266, 276-281, 311-339). Stone artefacts recovered from the Chalcolithic levels at Jaidak/Pithad include blades, flakes and scrapers of chert, chalcedony and quartz (Dwivedi 2009: 52), beads of chert and carnelian, grinding stones, pestles, and hammers stones. Chert blades, semiprecious stone beads, sandstone monitor lizard/mongoose, limestone seated human figurine, seals, weights, grinding stones, mullers and hammer stones was recovered from Dholavira (IAR 1996-97: 17-18;
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IAR 1997-98: 22; IAR 1999-2000: 27). Study of the stone tools from Bagasra revealed large amount of stone tools made of chert, Rohri chert, moss agate and chalcedony (Gadekar 2006: 82-83). Bagasra also revealed evidences of Rohri Chert blades in post urban Harappan phase (Gadekar and Ajithprasad 2010). It is contrary to the popular belief of complete absence of Rohri Chert blades in Post Urban Harappan phase. Study of stone artefacts from Loteshwar revealed that there is no significant variability between the Mesolithic and Chalcolithic assemblages and the site is also noted for the complete absence of blades and blade cores with crested guiding ridge technique (Brahmbhatt 2000: 75). Raghubans (1996) analysed various stages of stone bead manufacturing at Nagwada and the raw materials used to make beads were carnelian, jasper, amazonite and agate. XRD analysis was carried out on the stone beads from Kuntasi and identified the lapis lazuli beads from Kuntasi as sodalite found in the Aravalli hills (Dhavalikar et al. 1996: 353-356).

Law (2008: 400, 777) tried to locate the probable source of the steatite used to make the broken seal at Gola Dhoro and stone fragment from Nagwada using INAA and the results showed that people of both the sites acquired raw materials from very different sources from their contemporaries at Harappa and Mohenjo-Daro. The fragment from Nagwada is closely related to steatite from Shiv Bola mine in Udaipur, Rajasthan and to Dev Mori-Kundol occurrence in Sabarkantha, Gujarat and hence the Harappans may have acquired the steatite from any one of these sources. The source of the steatite used to carve the seal from Gola Dhoro needs to be located. Study of the ivory coloured chert blade fragment from Nagwada showed its most probable origin was from Rohri hills (Law 2008: 276-280, 284). Out of the three agate flakes analysed from Nagwada two were assigned to Mardak Bet and one was from Ratanpura sources (Law 2008: 454). ICP-AES analysis of banded limestone fragments from Harappa shows that majority of them derived from Pachchham formation of northern Kachchh, probably from the ancient quarry near Dholavira itself (Law and Burton 2006: 309-314).
Faience Objects

Lot of faience objects were recovered from Harappan sites in Gujarat and the objects include beads, bangles, ear studs, pendants and seal. 32 faience beads were reported from Kanewal and their shape varied from long barrel to short barrel to cylindrical to disc. Surface of all beads were damaged due to salinity of soil and they were dull red in colour (Mehta et al. 1980: 67). From Kuntasi 101 faience beads were reported (Dhavalikar et al. 1996: 191-192). According to Dhavalikar et al. (1996: 200), at Kuntasi the Harappans probably used to make faience beads which were coated with cobalt and when heated at a high temperature it might have produced bluish green colour. Small clay furnaces may have used for making such beads. A square faience seal having a boss at back and decorated with deep incised horizontal and vertical lines resulting in small squares in relief was recovered from Period I at Kuntasi (Dhavalikar et al. 1996: 266, Fig. 7. 57-58) and similar kind of seal was reported from the intermediate levels at Harappa (Vats 1940: II. Pl. XCV. No. 395). XRD analysis of faience beads from Kuntasi showed that quartz was the major content with small varying amounts of cristobalite and one variety of nepheline is found in small amount. The glassy surface of faience beads is due to this mineral. The binding material used in the bead making might have lost its crystalline structure during firing. The only naturally available mineral confirming such requirement is kaolinite breaks down when heated above 500°C which is found in large deposits in Gujarat and is snowy white in colour (Dhavalikar et al. 1996: 353-354). Lab experiments at Deccan college Post Graduate and Research Institute, Pune proved that 80% quartz and 20% kaolinite is the best paste for preparing tubular beads. Though the beads became harder at 700°C and XRD patterns became similar to faience, the beads did not show glassy surface characteristic of faience beads. Dhavalikar et al. (1996: 366) also suggested that addition of sodium salt to the mixture of quartz and kaolinite in proper proportion would probably give desired glassy surface by forming nepheline. From Surkotada, a total of 33 faience beads were recovered and out of this 5 belong to
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IB, 25 to IC and 3 to Surface. Tubular, segmented tubular, biconvex, barrel and disc beads were recovered from the site (Joshi 1990: 311-312, 322). At Somnath, faience beads were reported along with Pre-Prabhas pottery (Dhavalikar and Possehl 1992: 72; Possehl 2007: 321). From Rangpur (Rao 1963: 143) 85 faience beads were reported and 73 of them belong to IIA, 5 to IIB, 3 to IIC and 4 to III of Rangpur sequance.

Only two tubular blue faience beads were reported from Nageshwar (Hegde et al. 1990: 142). Two small broken vases, ear studs, bangles, buttons, ring and beads in blue, green and sea green colours were recovered from Lothal. One groove in an ear ornament was painted in red colour and bangle was decorated with incised chevron motif. Although the soil at Lothal is salty in nature, the faience beads recovered from the site retained green color and glossy surface. Some beads and bangles showed pitted surface. Faience almost disappeared from the site by Period B. Rings, bangles and ear studs were more popular in Phases II, III and IV while beads were most popular in IV. (Rao 1985: 583, 609-612). Out of 818 faience beads recovered from Lothal 711 belong to Period A and 107 belong to Period B (Rao 1985: 587). Chemical analysis was conducted on sixteen objects and it showed that highly silicious faience has been used for fabrication of ornaments like beads and bangles. Analysis has not revealed any indications for the technique of glazing or coating beads with steatite powder consolidated with any adhesive Rao 1985: 661-664). Beads of faience were also unearthed from Loteshwar (Yadav 2005), Jaidak/Pithad (Sen 2009), Shikarpur (Bhan and Ajithprasad 2008: 1-9; 2009: 1-9), Nagwada (Hegde et al. 1988: 55-65), Kanmer (Kharakwal et al. 2009: 147-164) and Moti Pipli (Majumdar 1999).

Large number of tubular beads including segmented variety, a few bangles and a knob of miniature vessel lid were reported from Bagasra/Gola Dhoro (Makwana 2002: 65-69; Sonawane et al. 2003: 42-43; Bhan et al. 2004: 156). Local manufacture of the faience at the site was identified from the recovery of a large
number of chunks of white colour quartz that might have been used as a source of silica powder for faience production (Bhan et al. 2004: 156). The areas associated with silica powder are also associated with intense burning, whitish powder and confined only in the fortified area. One area (a thin wall with single row of mud bricks separates this area from silos) measuring 3.5x2 m close to the eastern periphery of fortification wall revealed a fine patch of fire and contained thick layer of white powder and small quartz pieces. The X-ray Diffraction analysis of the white powder proved it as quartz (Sonawane et al. 2003: 42; Bhan et al. 2004: 157). By the side of the fire place bottom half of two large pots buried firmly in the ground was noticed (Makwana 2002: 66). Recovery of large number of heavy stone querns and pestles from this area probably suggests their industrial use. Repeated firing and subsequent crushing of quartz may have been practiced to produce fine silica powder at the site (Sonawane et al. 2003: 42-43; Bhan et al. 2004: 157). Fourteen samples were selected for thin section studies and the colour of these samples varied from blue, light green, green and light pink. Thin section studies revealed that quartz was the dominant mineral present and grain size varied from silt to very fine sand to fine sand. From the minerology of non-plastic inclusion it is proposed that Deccan trap source probably somewhere near the site was used to collect the clay. Presence of elongated quartz grains showing high degree of angularity indicate that crushed quartz grains may have been added during the time of manufacture and less angularity might be present in the raw material itself. One specimen showed vitrification in both external and internal and it is an indication of high temperature of baking. But micro structure of the same hasnt showed any evidence of complete vitrification and its microstructure was similar to those potteries which were fired between 800-820°C. This also showed that inorder to attain high temperature there is the need to add flux but in the absence of chemical analysis it is impossible to identify the presence of flux. Bagasra samples contained quartz, feldspar, augite, basalt, cryptocrystalline silica and iron oxide (Makwana 2002: 72-74).
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Shell Objects

Many scholars worked on the shell objects from Gujarat and till the first half of 1980's most studies were typological in nature. After that most works were based on the models Kenoyer (1983) proposed in his thesis. His research included identification and classification of various shell species, study of archaeological shell objects from India and Pakistan and ethnoarchaeological studies of living traditions of Bengal. Using a combination of all these technique, he was able to interpret the development of shell craft or shell industry and socio-economic structure more effectively.

Sites like Oriyo Timbo (Rissman and Chitalwala 1990), Malvan (Allchin and Joshi 1995), Moti Pipli (Majumdar 1999), Santhli (Majumdar 1999), Datrana (Majumdar 1999), Vagad (Sonawane and Mehta 1985: 38-44), Ratanpura (IAR 1984-85), Kanmer (Kharakwal et al. 2009: 147-164), Desalpur (IAR 1963-64), Pabumath (IAR 1977-78; 1978-79; 1980-81) yielded very less amount of shell objects and manufacturing wastes and many of these sites with flimsy evidences were considered as manufacturing centres (Majumdar 1994: 164; Hegde and Sonawane 1986). Rao (1973: 136) described the evidences for the presence of shell manufacturing at Lothal as the indicator of a shell industry meant for the export of the finished products to peripheral sites and to Mesopotamia. Kenoyer (1983) mentions that at Lothal bangles have high frequency among shell artefacts and there were evidences for C. ramosus (21 nos.) and Tivela damoides (1). Both these types of bangles may have been brought to the site from somewhere else is indicated by the absence of manufacturing waste. After comparing the frequency of finished products and wastes Kenoyer (1983) came to the conclusion that Lothal was only producing the bangles for local people in less quantity. Ladles were produced at the site and the frequency of manufacturing waste at the site was more compared to Harappa and Mohenjodaro (Kenoyer 1983: 234). Shell buttons, studs, ladles, bowls, burnishers, needle, handle, compass, bangles, rings, inlays, ear
stud and games men were also unearthed from the site (Rao 1985: 614-624). Some
T. *Pyrum* bangles with chevron motif (Rao 1963: Pl. XXXVII), inlays, beads,
spoons, games men, inlays and incised shell caps were recovered from Rangpur.
Kenoyer (1983: 239) argues that the spoons and possibly some bangles of the site
were made from *C. ramosus* somewhere else. One of the terracotta cake from
Rangpur bearing drill mark (Rao 1963: Fig. 140B) may have used for sharpening
the tubular drills and the inlay pieces from the site may have been used to produce
rings. From Surkotada various kinds of shells were recovered (Joshi 1990: 307-312,
319, 320, 330-332, 342, 383-388). In Phase I bangles were thinner with chevron
motif. Though thinner variety continued in subsequent phases, wider variety with
shallow or deep grooves also occurred. Grounded columella and finished rings
from the site may be an indication of reprocessing of columella carried out at the
site. At Kuntasi *T. pyrum*, *P. bucephala* and *C. Ramosus* were probably used for
of finished bangles to manufacturing waste indicates that the site was probably
producing the objects for local use only (Gowda 2003: 42). Nageshwar is an
important manufacturing centre of shell bangles and ladles (Bhan and Kenoyer
160-162). At the site, bangles from *T. pyrum* were made and *C. ramosus* used
rarely. The site yielded large amount of wastes compared to finished products and
the neatly kept piles of columellas suggests the reprocessing of the same and the
meagre evidences for the reprocessing of columellas at the site is an indication of
sending them to other sites for making rings and other items (Gowda 2003: 42).
Another feature of the site is the production of ladles from *C. ramosus*.

The study of shell objects from Nagwada included analysis of various shells used as
raw materials, its habitat and distribution, shell industry at Nagwada and
ethnoarchaeological parallels from stone ring manufacturing at Kambhat and
comparative study with other Harappan sites (Gowda 2003; Bhan and Gowda
2003: 51-80). Based on the analyses they proposed that shell cutters at Nagwada
had no direct access to the raw material and *T. pyrum* probably reached the site in semi finished stage (manufacturing waste very less compared to finished bangles). In addition to *T. pyrum* they occasionally used *Pugilina bucephala* and *Chicoreus ramosus* for bangle manufacture. At Nagwada, columella of *P. bucephala* which occurs in Gulf of Kachchh were probably used for bead production. While comparing the rings and wastes (so called inlays), they argue that large amount of rings might have been produced at the site for local and regional markets.

Deshpande-Mukherjee (1999: 110-113) conducted preliminary study of the shell objects from Bagasra and she identified various shell species occurred at the site during the initial years of excavation. A shell workshop was excavated within the fortified settlement and it yielded more than 5000 complete shells and more than 3000 unpolished bangles piled (Sonawane et al. 2003: 21-50; Bhan et al. 2004: 153-158). Large quantity of manufacturing waste and complete shells as compared to the finished bangles from the workshop and site indicates that Bagasra was an important shell bangle manufacturing centre. The workshop also contained copper lumps, a broken seal, stone slabs (grinding stones) and some ceramic vessels. Most of the complete shells had worm holes and were small in size (Bachani 2005). The undersized or worm holed shell suggested that tidal mud flats in the vicinity of Bagasra may have been the source of edible shells and smaller gastropods and larger gastropods must have been procured from the coral reefs in Jamnagar district, which is nearly 150 km away (Bachani 2005: 54). Site also yielded some shell beads, compass and ladle. Availability of finished shell objects, manufacturing waste and complete ones throughout the site is an indication of spread of manufacturing activity in whole site (Bachani 2005: 56). Phase II of the site had maximum shell working evidence (beginning also) and in Phase III, shell working continued but in limited quantity and in Phase IV there is discontinuity in tradition (Bachani 2005: 54-57). A Post Urban Harappan shell seal (?) was reported from Bet Dwarka in 1986 (c.f. Gaur et al. 2005: ix, Pl. 1).
Bone Objects

Not many studies were conducted on Bone tools from Harappan Gujarat except their mere description in the excavation reports. Wide varieties of bone tools were reported from Surkotada and they are divided into hunting tools, domestic tools and digging tools (Joshi et al. 1990: 343-356). All tools were made out of fresh bones with rare occurrence of cooked ones. Natural long bones, fragments of artificially broken bones, ribs of large animals, phalanges and antlers were used as raw material for bone tools. The tools were produced using the techniques like percussion, splitting, flaking, cutting, notching, scraping, grimming and tempering. In certain cases steaming was done to get a curvature. In the making of bone tools first a rough shape was made and after this grinding was done to make the working end smooth or sharp. Splitting, flaking and scraping were performed with chert and chalcedony blades. To give strength, the whole or part of the tools were treated with fire. Apart from kohl sticks, polishers and stylus (Joshi et al. 1990: 339-342), spear heads, points, burnishers, burin, borer, awl, scrapers, piercers, engravers, spatula and digging tools were recovered from the site. Period IC revealed maximum (25) followed by Period IA (14) and Period IB (5). At Jokha there is mention of bone tool from Chalcolithic levels (Mehta et al. 1971: 51). Point, knives, chisel and ornament were among the nine bone tools excavated from Kuntasi (Dhavalikar et al. 1996: 259). Twenty six awls and pins, scrapers, arrow head and engraver were discovered from Lothal. In Rao’s opinion (Rao 1985) sharp pointed engravers from Lothal may have been used for engraving steatite and other soft materials. According to Rao cutting and sharpening of bone must have been done with the help of knives and razors made of chert, copper and bronze and flat pieces of bone with sharp edges were used as razors (Rao 1985: 624-626).

From Bagasra/Gola Dhoro 186 bone tools were reported with a Maximum concentration of bone tools occurring in Phase III (93) followed by Phase II (73),
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Phase IV (17) and Phase I (3). Tool types reported from Bagasra are points with rounded tip, flat and pointed tip, pointed tip, broken tip, hairpin, and modified vertebrae, splinter, splinter cum point and handle (Devi 2006: 30-43, 47). Broken tips of the points from Bagasra indicate the extensive use of the same by the Harappans. Site also revealed points with various kinds of tips and it suggests the various uses of the points. Three knives from Bagasra showed bone handles and how they fixed copper and bone is still to be studied. Points with pointed tip occur in all periods. Hair pins from the site is an indication of sense of decoration of the inhabitants. Most of the points were found near the fortification both outside and inside (Devi 2006: 47-52). Study of the bone tools using Leica S6D binocular microscope under varying magnifications proved evidences for wear and tear, grinding marks, techniques of production and decorations which were not visible (Devi 2006: 44-46). Some bone tools were also noticed at sites like Jaidak (Goyal and Joglekar 2009; Joglekar and Goyal 2009) and Shikarpur (Bhan and Ajithprasad Personal Communication).

Metal Artefacts

Almost all the excavated sites in Gujarat showed evidences for the use of metals and scholars concentrated on typological or functional study of metal objects. Hence, problem oriented studies are very less in number. Major metals used during the Harappan times are copper/bronze (most common metal), gold, silver and lead. The metals artefacts from Gujarat include various ornaments, figurines, tools, weapons, objects of domestic use and seals. Chemical and spectrometric analyses were conducted on the sample collected from the axe from Jokha. Though the axe was made out of unalloyed copper the source of the metal remained sceptical (Mehta et al. 1971: 55, 66-69). According to Dhavalikar et al. (1996: 212) there is no evidence of bronze at Kuntasi where all objects were made of copper devoid of arsenic and tin. There is evidence for two copper furnaces (one each from both the periods) probably used for melting the copper (Dhavalikar
Dhavalikar (1997: 278) argues that Harappans exploited the copper available in Gujarat to the maximum, smelted it in their industrial centres like Lothal and Kuntasi and instead of keeping it for their own use they exported as much as possible to Mesopotamia. The absence of ample proof makes this view obscure. Chemical, spectrometric and metallographic examination of Bronze axe from Somnath revealed that it is an alloy of copper and tin. The analysis also showed evidences for casting, forging and probable cold working practices of Harappan time (Nanavati et al. 1971: 91-93). Copper and gold objects were reported from Rangpur (Rao 1963: 149-153) and scientific analyses were carried out in 13 copper objects. Chemical analyses showed that both copper and bronze (both high tin and low tin) were used to make objects. Some of them had traces of arsenic, lead and nickel. Analysis of the copper bangle from Rangpur revealed 12% of silica adherent to copper which was in the form of oxide and carbonate with traces of iron (Dikshit 1950: 4). From Lothal more than 1500 copper objects (Rao 1985: 520-554) in various stages of preservation were unearthed. According to Hoffman and Miller (2009: 257) rod tool types dominate the assemblage at Lothal, specifically the category of pointed tools. Two probable areas of copper working were unearthed from Lothal, one belongs to the phase V located near the nullah had 5 sink like pavements bordered by brick on edge and near each sink, pot furnace containing ash and pieces of muffles were noticed. In the Lower Town, in one of the rooms of a small mud brick structure, a rectangular furnace, anvil, ash, fragments of crucibles and stone mould were noticed. The stone mould for casting is interpreted by Kenoyer and Miller (1999: 124, 126) as grinding stone of stone beads or other materials. At the site, there are evidences for casting, hammering and forging techniques. They used both low tin bronze and high tin bronze. They might have imported refined crude copper or refined copper and melted or reused in the site (Rao 1979: 149). Hot concentrated hydrochloric acid test and chemical analysis of scrapings from crucibles proved the absence of copper in the same and
also proved that chunks of copper recovered from the site are not slag pieces. Scientific studies also indicated the absence of arsenic in objects (Rao 1985: 651-660). Based on this finding Rao (1985: 524) argues that copper smiths of Lothal did not use the Rajasthan ore as indicated by the absence of arsenic in Lothal objects. Apart from copper hundreds of gold and one silver object were recovered from the site. According to Rao gold objects were beaten into foils and joining of the pieces was done by sweating or soldering (Rao 1985: 632-635). Gold in its pure form was not used. Gold objects are noted for the use of silver in good amount and absence of copper (Rao 1985: 664-665). Some gold ornaments were also unearthed from Nagwada (Sonawane 1990). The availability of crucibles from Surkotada is connected to local smelting of copper which was probably imported from Afghanistan or Rajasthan (Joshi 1990: 267). But in the absence of ore, slag and other kiln wastes it is a matter of suspicion. Lahiri (1995: 118, 123) mentions about the use of pure copper and bronze (tin/arsenic) at the site. Chemical and metallographic examination of copper knife from Langhnaj showed that it was made out of nearly pure copper (Hegde 1991: 31-35) with lead and copper inclusion. The knife was formed by both hot and cold work (Hegde 1991: 35). Bagasra (Sonawane et al. 2003: 21-50; Bhan et al. 2004: 153-158; Patel 2006: 222-231; Patel 2010) showed evidences for copper working. The most important discovery from the site was bone handle knives (two with handle and one with impression) and a hoard containing copper pot, 8 bangles and a celt (Sonawane et al. 2003: 21-50; Bhan et al. 2004: 153-158; Patel 2006: 222-231). Sen (2009) carried out preliminary typological study of copper objects from Jaidak/Pithad. A copper fish hook (with barbed point and loop on the other end) recovered from the excavations at Padri is worth mentioning due to its size (14 cm), its the largest fish hook recovered from any Harappan site (Shinde and Thomas 1993: 145-147). Cork (2005: 411-423) tried to test the validity of peaceful Harappan model on the basis of the claim that weapons are scarce at Indus sites and the number of weapons were also lower compared to Mesopotamian sites. For this he compared the copper
artefacts from Harappa, Mohenjo Daro, Chanhudaro, Lothal and Surkotada to Ur, Nippur, Tell Barak and Megiddo. Based on his analysis he argued that the original reason behind the absence of warfare in Indus civilization is the inadequacy of metal working (Cork 2005: 419). He further suggested that design, distribution and function of Harappan metal weapons probably differ from the centres selected (Cork 2005: 420). He also says that absence of complex technological forms especially of weapons is an indication of Harappan elite’s reluctance to use them as symbol of power and Harappan graves without tools are not an indication of totally peaceful society and graves in Ur with weapons do not indicate a society engaged in permanent warfare (Cork 2005: 420-421).

Seshadri worked on metal technologies of Harappan and copper hoard cultures and interpreted the presence of iron in the composition of copper/bronze objects from archaeological context as the result of inferior smelting techniques or improper resorting of iron rich ore (Seshadri 1994). Seshadri conducted chemical and metallographic analyses to locate the provenance of the raw material and to reconstruct the smithy techniques used in copper objects recovered from Nagwada. The studies conducted using energy dispersive X-ray micro analysis, atomic absorption spectrophotometry and reflected light microscopy revealed that the axes recovered from Nagwada were made of unalloyed copper and the chisel was of bronze. The chisel was fabricated by cold hammering and the axes were cast in smooth well-ventilated mould (Seshadri 1990; Seshadri 1992: 7-12).

Seshadri (1992: 7-12) tried to trace the provenance of raw material used in copper axe and bronze chisel from Nagwada by comparing the trace element of them with that of samples from Khetri, kolihan, Singhana and Ambaji. The impurity pattern of the samples showed great difference with the samples. The source of silver used to make ring belonging to the earliest level of Nagwada is southern Balochistan (Law 2008: 680-681).
Burials

Burials were reported from ten Chalcolithic sites in Gujarat. They are Nagwada (Hegde et al. 1988: 55-65), Santhli (Majumdar 1999) and Loteshwar (Ajithprasad 2009: 24-28) in north Gujarat, Dholavira (Bisht 2010: 75-76), Surkotada (Joshi 1990) and Juni Kuran (Pramanik 2004: 45-67) in Kachchh, Lothal (Rao 1979) and Randaliyo (IAR 1958-59) in Saurashtra and Nagal (IAR 1961-62) in South Gujarat. From, Langhnaj (Sankalia 1965), the Mesolithic site having Chalcolithic affinity revealed 21 skeletons and those burials are dated to Mesolithic period.

At Randaliyo, the site contained a cemetery. Excavations at one burial revealed an extended skeleton and Harappan pottery was also recovered from the vicinity of the skeleton. More details about the burial are unknown (IAR 1958-59).

The cemetery at Dholavira is located northwest of the citadel. A number of symbolic pot burials were reported from Dholavira. The excavations also brought to light a large hemispherical structure made of mud bricks. It had a deep and wide square rock cut chamber and spokes like radiating walls. It also had a series of rectangular chambers marked by stone slabs arranged in radial fashion at the periphery of the circular structure. It was surrounded over ground by a massive circular mud brick structure made in two tiers. It contained no skeleton or pottery (Bisht 2010: 75-76).

At Surkotada, cemetery is located 300 m northwest of citadel. Four graves were excavated at the site and they were pot burials and associated with secondary internments of Homo sapiens Linn. The ceramics of these graves comprised of Harappan red ware, painted black on red ware and cream slipped ware with paintings. The vessel shapes include dish on stand, basins, dishes, bowls on stand, cylindrical vases with horizontal drawn grooves and a cream slipped vase with an alternate hut and boat design and a squat dish on stand. According to the excavator the pot burials belong to Period IA. Other features of the burials from
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Surkotada are the presence of a horizontal slab or small heap of stones on top of the pit (Joshi 1990). On the basis of pottery from cemetery and radio carbon dates, Possehl (1997: 81-87) chronologically placed the cemetery of Surkotada to the later portion of Pre Urban Harappan (Amri/Nal or Kot Dijian) or the transition between the Pre Urban Harappan and the Urban Harappan.

At Juni Kuran eight cairn circles were located on the north eastern terrace outside the outer fortification wall. Only one cairn was excavated in this area and it measured 3.2 m in diameter and rose to a height of 60 cm. It was circular in plan and oriented north south direction. The cairn was covered with small flat stones. The cairn consisted an extended burial with few pieces of coarse grey and red wares. The burial was in east west direction and its head faced towards north (Pramanik 2004: 55-56, 66).

From Nagwada two inhumation burials and three symbolic pot burials were reported. As all the burials were found to be sealed by the fifth layer they belong to the earliest inhabitants at Nagwada. The symbolic pot burials were not associated with any burial goods except vessels ranging from two to twelve. The vessel shape include storage jars with convergent rims, beakers, dish on stands with upturned straight rims, shallow bowls and medium size pots with constricted rim and squat profile. These ceramics showed similarity to those from Kot-Diji, Balakot, Amri and Dam Sadaat. The habitation level at Nagwada doesn’t contain the pottery found in these burials and it suggests the special purpose of this pottery at the site. The extended burial contained a complete skeleton in an oblong pit dug in the east-west direction. Two ceramic pots were placed near the foot of the skeleton (Hegde et al. 1988: 55-65; Ajithprasad 2009: 24-28).

Chalcolithic deposit at Santhli incorporated two extended inhumation burials. Both the burials were oriented east-west with head resting on the east. Among these one burial was an extended joint/double burial of two adult individuals
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interred in the same pit. The skeletons were found resting on their back with head tilted in an awkward position and facing each other. This burial was associated with five pottery vessels of varied shapes akin to those from the burials at Nagwada. Second burial was of a child and associated with large beaker type vessels and large, shallow bowl or dish with straight rim similar to the types found in the first burial. The habitation level at the site also revealed same kind of pottery. Similar kind of pottery is reported from around 10 sites in north Gujarat and 3 sites in Saurashtra (majumdar 1999; Ajithprasad 2009: 24-28).

A fluxed burial is reported from the Chalcolithic levels at Loteshwar and it should be the earliest burial of this period from Gujarat. This Chalcolithic habitation can be dated from 3600-2900 BC (Ajithprasad 2009: 24-28).

G. L. Possehl discovered eight fragments of human bones in association with ceramics of Rangpur IIB-C at Rampara II where road cutting was done by the villagers. This was discovered about 80 cm below the surface level and examination of area revealed no outline of the burial pit. The analysis of the bones suggests that the individual was a female (Possehl 1980).

At Lothal the cemetery (40x36 m) was located at the western periphery of the mound i.e. northwest of lower town. Twenty burials belonging to three burial phases comparable to structural phases III, IV and V have been traced within a maximum deposit of 5 ft. Among these, four graves are assigned to Phase III, seven to Phase IV, five to Phase V and in four pits lines were not clear. These burials altogether contained skeletons of twenty one individuals. Three graves contained joint burials of two skeletons and three were urn burials. Extended burial was common at the site and there is no evidence of fractional burials. Maximum number of grave goods found in a single burial was five. In a joint burial, the internal portion of the grave-pit has mud brick lining, forming almost a structural coffin as in the case of Nal cemetery. In two graves bones of goat and teeth of
cattle were found (Rao 1979). Predominant burial pottery type at Lothal is Micaceous Red Ware. Some of the burials show both Harappan and Micaceous Red Ware together and it indicates the level of integration existed between the two traditions (Ajithprasad 2009: 24-28). A close biological relationship between the Harappan people of Lothal and hunter gatherers of Langhnaj has been documented craniometrically. It suggests that genes may have been flowed between these two populations (Lukas 1990: 183-186). According to Possehl and Kennedy (1979: 592-593) the ancient people of Lothal are not so similar in phenotypic pattern to their contemporaries in the Indus valley centres. They further suggest that a number of physical variables present in the skeletal series suggest that their closest biological affinities are with some of the hunting gathering communities whose descendants survive as tribal enclaves in modern India.

The burials at Dholavira and Surkotada in Kachchh are almost 300m northwest of the acropolis but the burial at Lothal was found closer to the settlement. But in smaller sites like Nagwada, Loteshwar and Santhli the burials were found within the habitation area (Ajithprasad 2009: 24-28). This reflects the architectural planning that prevailed in big settlements. The availability of burial goods of regional communities and the skeleton similarities between Lothal and Langhnaj suggest the harmonious coexistence of Harappans and regional people.

At the lowest level of the trench at Nagal in Bharuch a north-south oriented extended human burial was noticed. The mound revealed evidences for Jorwe ceramics, Black and Red Ware, Ochrous Red Ware and microlithic industry. Due to the limited nature of the excavation, the cultural affiliation of the burial is unclear (IAR 1961-62).

Chase (2007: 412) mentions about a complete human metacarpal from a pit in the first layer of trench Eo6 at Bagasra/Gola Dhoro. But the details regarding the
original context of the bone are unknown. Similarly, one human tooth is reported from Mathutra along with three bases of vessels (Majumdar 1999).

Rao (1963: 188-89), during the excavations at Mehgam noticed a small pit containing two high necked jars, a bowl, a dish on stand and a flat dish. According to him the contents of the jars had decomposed and the skeletal remains must have been washed away by tidal waters. The contents of the pits showed that the dead may have been buried there. The A carnelian bead and a terracotta biconical bead were also recovered from the site. The burial can be relatively dated to Rangpur IIb.

**Faunal Analysis**

A variety of animal bones were recovered from excavated Calcolithic sites in Gujarat and most of the faunal studies till date were concerned with the identification of animal species. These studies provided evidences for the use of various domestic and wild animals at different sites. Based on the chopping mark present in certain animal bones from Rangpur, Rao (1963: 154, 58) suggests that the inhabitants used the animals for food and on the basis of large quantity of young animal bones unearthed from the site he proposes that domestication of animals was in vogue. Based on the animal and plant remains Mehta et al. (1975: 59-60) also argues that the subsistence economy of the people of Dhatva heavily depended on farming and cattle breeding with subsidiary economy of hunting and fishing. No fish bones were reported from Dhatva, a site very near to Tapi river and Mehta et al. (1975: 58) proposes that it might be due to limited excavation, decomposition of fish bones or that they may have escaped the excavators attention.

Analysis of the animal remains from Jokha showed evidences of domestic and wild animals (Mehta et al. 1971: 73). Some long bones from the site were split, cut, chopped or charred and it might be an intentional attempt to extract born marrow
or for manufacturing tools (Mehta et al. 1971: 73). While analysing the bones from Sai-no-Tekro (Trench II and IV at 40-45 cm depth) at Kanewal, Mehta et al. (1980: 75) noticed a very little number of bones and hinted the possibilities of non-vegetarian food habits becoming secondary to Chalcolithic people, probably due to the scarcity of animals or plentiful vegetarian food supply. Dhavalikar et al. (1996: 305, noticed maximum exploitation of wild fauna at Kuntasi during Post Urban Harappan period at sites like Rangpur, Surkotada, Nageshwar and Mohenjodaro and he presumes that it might be due to over-population. On the basis of the excavation data Dhavalikar et al. (1996: 305) suggested the possible existence of husbandry practices and planned economic strategies at Kuntasi.

On the basis of limited availability of bones of Bubalus bubalis compared to Bos indicus at Lothal, Rao (1985: 637) suggests that inhabitants of Lothal may not have maintained large herds of them.

Chitalwala and Thomas (1977-78: 13) based on the results of analysis of animal remains from Khanpur postulated that cattle farming was an important economy of the Harappans next to agriculture and hunting of the wild animals indicates that a part of population procured their livelihood in that way. Animal bones from the re-excavation of Somnath by Deccan College were studied by Thomas (1979: 176-186) and he concluded that economy in the first period (Harappan culture) was the combination of hunting, stock raising and domestication and agriculture were practiced on a large scale in the later cultural periods (Thomas 1979: 185).

According to Patel (1989: 50) high abundance of wild animal remains in the fifth layer (earliest period) of Nagwada indicates the dependence of the community on hunting in their subsistence activity. On the basis of decrease in the animal remains in the upper layers (4, 3 and 2) she (1989: 50) suggested the possibility of more stabilized economy probably based on agriculture and stock raising. The
count of the wild animals was highest in the first layer (1989: 50-51) and this phenomena was noticed in the later phases of almost all Harappan sites.

The study of animal bones from Padri suggested that bones of domestic animals (cattle amounting half of the identified bones) were lot more than wild animals as other sites in Gujarat and proportions of the use of domestic and wild animals remained almost similar in the Pre Urban and Urban Harappan levels and it changed remarkably in the Early Historic phase (Joglekar 1996-97: 61, 64). Cattle, sheep/goat and buffalo were the domesticated animals of Pre Urban Harappan phase; during Urban Harappan period there were addition of pig and dog (dog was a non food species at the site) and in the Early Historic phase domestic pigs were much more than the previous one (Joglekar 1996-97: 66).

In the recent years the faunal studies are becoming more problem oriented and the researches on the animal bones from Bagasra/Gola Dhoro by Brad Chase (2007) provided information regarding the organization of subsistence economy at the site. During the Phase I, inhabitants of Bagasra/Gola Dhoro preferred the meat of domestic animals and use of the meat of wild animals and fish and crab was very rare (Chase 2007). In the subsequent Phases, food preferences and preparation techniques of the residents within the fortification wall (more mutton, pork and fish) were different from those who lived outside (similar to that of the sites of first residents) (Chase 2007: vii). His study of meat provisioning indicated potential independence and self sufficiency of the communities living in the two distinct sectors of the site (Chase 2007; 2010: 534). The site also provided evidences for the use of aquatic wealth for the production of bangles and ladles and the major raw materials were Turbinella pyrum and Chicoreous ramosus (Sonawane et al. 2003: 41-42; Bhan et al. 2004: 55). Comparative study of animal bones from Shikarpur and Gola Dhoro by Chase (2009) showed significant difference in pattern of meat consumption in both sites and at Bagasra, remains of cattle and buffalo were less in comparison with Shikarpur. Domestic animals were
raised similarly at both sites and there were no evidences for intersite trade in livestock (Chase 2009).

Analysis of the animal remains from Loteshwar showed that in the aceramic microlithic layers wild animals were only exploited with black buck dominating the assemblage (Patel 2009: 178). Though the bones of black buck dominated the bone remains of Chalcolithic period, there was a significant addition of domestic animals and domestication of cattle was vogue in the site from the beginning of fourth millennium BC (Patel 2009: 178, 181). Another interesting find from Loteshwar is the absence of the remains of sheep and goat in the Microlithic or in the early Chalcolithic levels (Patel 2008: 132). Patel (2008: 132) further suggests that sheep and goat pastoralism seems to have been introduced in North Gujarat only in the 3rd millennium BC. A comparative study of the remains of the animals like sheep and cattle from Dholavira, Harappa and Nausharo suggested the presence of animals of different sizes and proportions in different environmental zones during the Harappan phase (Meadow 1991: 89-106; Patel 1997: 101-113; Meadow and Patel 2002: 391-408; Meadow and Patel 2003: 82).

Study of the animal bones from Pithad/Jaidak suggest that though the economy of the site was largely dependent on domestic animals, exploitation of wild animals was at its peak towards the end of the Harappan culture (Goyal and Joglekar 2009; Joglekar and Pankaj 2009 in press). They (Goyal and Joglekar 2009; Joglekar and Goyal) 2009 in press) also noticed some evidences of bone working/modification at the site and observed that the animal based subsistence of Sorath Harappan sites like Pithad/Jaidak, Kuntasi and Rojdi were similar to the Classical Harappans. Fish bone remains were recovered from Bet Dwarka (Gaur et al. 2005: 30-31).

Based on the higher proportion of domestic animals like cattle, buffalo, sheep and goat at Kanmer, Joglekar (2007: 57) and Goyal and Joglekar (2008: 39) suggested that stock raising and pastoralism was an important component in the subsistence
activity of the Harappans of all periods. They (2008: 39) also noticed that proportion of the use of wild animals was much higher at the site during Post Urban Harappan phase.

**Floral Studies**

The study of plant remains can provide information for the interpretation of a range of questions regarding changing patterns and continuing trends in the environment, subsistence pattern and economies of the past (Reddy 1991: 73). Only a small number of Chalcolithic sites in Gujarat were excavated with the purpose of collecting botanical remains to determine the above mentioned aspects. A comparison of plant remains from different Chalcolithic sites of Gujarat belonging to various periods can supply data regarding the plant based subsistence economy.

Dry and wet separation methods were used at various sites in Gujarat for the collection of plant remains. The types of plant remains from various sites include grain impressions, carbonised seeds and un-carbonised seeds. Finds from Kuntasi contradicted the general belief of Harappan subsistence based on winter crops and the evidences suggested that the usual subsistence of the people of the site were relied on millets (Dhavalikar et al. 1996: 286). The abundance and intra-site distribution of croix beads in the site was considered as the result of trade relations (Dhavalikar et al. 1996: 286). Availability of the remains of various forest trees including teak from Lothal is an indication of a richer and varied vegetation cover of the region during Harappan period (Rao 1985: 679, 682), but there is also a possibility of the arrival of the same to the site through trade relations. Comparatively large amount of millets recovered from Oriyo Timbo suggested the increasing dependence on the same (grain as food and rest of the plant as fodder) during Post Urban Harappan period (Rissman and Chitalwala 1990: 137). Palaeoethnobotanical reconstructions at Oriyo Timbo clearly indicated that the Post Urban Harappan pastoral community at the site were not cultivating millets
(cultivation by the occupants elsewhere in the region is a probability) and they were probably bringing grain during the onset of occupation in each season or were trading and exchanging for grain from neighbouring agriculturists (Reddy 1994: 393). The diet of domestic animals at Oriyo Timbo probably consisted of wild forage (Reddy 1994: 394). Floral remains of Rangpur also indicate that the area was fairly well wooded with trees of various sizes, shrubs and grasses (Rao 1963: 173). The study also revealed that climate and rainfall has not changed much as the tree types identified at Rangpur are still present in the surroundings of the site (Rao 1963: 173-174). However, there are possibilities of little more arid condition in present days due to biotic factors, denudation and erosion (Rao 1963: 174). Meticulous sampling strategies at Rojdi yielded nearly 10000 seeds from around 70 taxa suggesting considerable variety in plant usage strategy (Weber 1989; Possehl and Raval 1989: 180). Food grains such as Setaria, Eleusine and Panicum species were identified at the site and most of them may have cultivated with occasional collection and use of wild plants (Possehl and Raval 1989: 180). There are also evidences for the change in plant use pattern during earlier and later periods (Possehl and Raval 1989: 180). Availability of some plant remains noticed in Harappan levels at Rojdi indicates similar kind of environment in both recent and Harappan times and non-availability of certain types in modern times are probably due to change or fluctuation in local habitat (Possehl and Raval 1989: 180). Evidences from Surkotada indicate that the Harappans at Surkotada practiced cultivation (millets) as well as collection of wild plants (Joshi 1990: 391). The sceptical views regarding the collection of wild seeds are either to prepare gruel, medicines or to feed cage birds (Joshi 1990: 392). Evidences from Babar Kot suggest that they cultivated both summer and winter crops and evidences for crop processing were also unearthed (Reddy 1994: 393). A patch of charred millets (over 500 seeds) were also noticed at Babar Kot in association with domestic trash (Possehl 1994: 199-200). Domesticated animals at the site were probably fed millet by-products (based on availability) and wild forage supplemented their diet during
other seasons (Reddy 1994: 394). Remains of weeds and other wild taxa reported from Kanmer are interpreted as indication of ecological conditions and ground vegetation (Kharakwal et al. 2009: 159). Pollen analysis was carried out at sites like Kuntasi (Dhavalikar et al. 1996: 291-296) and Malvan (Allchin and Joshi 1995: 103-106), but they are too preliminary in nature. Weber et al. (2010: 35-43) based on comparative analysis of grains from various sites of Indus Valley Civilization argues that, the seed size is an important variable in understanding plant-use strategies in Prehistory. They (2010: 42) suggest that, all large sites of the Harappan period were associated with large grained cereals, while, small Harappan communities were focused on either large or small grained cereals depending on their ecology. During the Post Urban Harappan period, grain size became less important as communities became smaller and more independent.

**Pastoralism**

Chang and Koster (1986: 97-148) defines pastoralism as dependence upon domestic herd animals held and bred as capital. Meadow (1996: 392) defines pastoralism as raising of livestocks and according to him any one who husbands grazing or browsing animals is a pastoralist. In case of Near Eastern sheep and goat pastoralists, Abdi (2003: 398) defines pastoralism as a mode of production concerned with the exploitation of domestic animals which occurs in a continuum from fully sedentary (village-based herding) to fully mobile (nomadic) pastoralism. He identified three kinds of pastoralism and they are: 1. mobile pastoralism - a form of pastoralism that involves movement of the herd beyond the agricultural zone, usually one to a few day's walk from the village, 2. transhumant pastoralism - a specialized form of mobile pastoralism that is still based on settlements but involves seasonal movement of the herd between pastures with some use of campsites and 3. nomadic pastoralism - the extreme form of mobile pastoralism, which is a mode of subsistence (i.e., a way of living) primarily relying on
pastoralism involving high mobility and changing dwellings throughout the year, living in a succession of campsites along vertical or horizontal routes.

The pastoral studies in Gujarat is not much developed and Leshnik (1972: 151-152) mentions some of the difficulties in identifying the pastoral communities in archaeological record like non-specific nature of pastoral nomad's artefacts, their likely origin with village artisans, sometimes close physical co-existence of peasants and nomads, probable practice of supplementary agriculture or hunting and expectedly thin traces of their habitation remains. Choksi (1991) carried out ethnographic studies at Saurashtra and north Gujarat and compared the results to those of Harappan sites like Jokha, Rojdi, Ratanpura, Kanewal and Zekhda/Jekhda to understand the pastoral adaptation during the Harappan period. Her study showed that structural activities of present and past rarely show any big difference. She also found a pattern of migration and settlement which remained unchanged over thousands of years. Varma (1991: 279-300) reviewed the evidences for mobile pastoralism in Post Urban Harappan Gujarat by giving special emphasis on settlement pattern and site types. In her study she tried to provide ethnographic examples of pastoral adaptations and classify archaeological sites and distinguish pastoral camp sites. Based on Varma's (1991: 279-300) observation of meagre animal possessions which Gujarati herdsmen carry; Ratnagar (1991: 181) interpreted the modern pastoralists of Gujarat as "fringe groups, without economic or military might, and in recent times have been scattered amongst farming communities as members of low ranking castes". Kavoori (1991: 255- 278) analysed the movement of modern pastoral communities/transhumance and live stocks from Rajasthan and noticed that the direction of migration of these communities is towards areas bordering Uttar Pradesh, Madhya Pradesh and Gujarat. He also noticed that this migration pattern begins approximately in October and they return to the home tracts by the beginning of monsoon. But the scope of both the works are limited to modern times. Reddy (1994) based on ethnographic and archaeological studies interpreted the Post Urban Harappan site
at Oriyo Timbo as a pastoral camp. Similarly, Patel (1997: 111) identified that the animal economy of Dholavira was chiefly pastoral in nature. Bhan (2004: 243-272) carried out ethnographic studies on pastoral communities in Gujarat and tried to find out the similarities with Post Urban Harappan pastoral camps of summer and monsoon season. He considered the factors in choice and discard of site location and choice of vessel preference by the community. In this study he proposed that the proliferation of Chalcolithic settlements in north Gujarat is probably due to the availability of nutritious grasslands that are rich in various minerals and salts, water in inter-dune depressions and presence of sand dunes which provided excellent breeding grounds. Due to the location and patchy deposits, most of the Chalcolithic sites in north Gujarat are considered as pastoral encampments (Bhan 1994: 71-90). Swayam (2006) in his work made an attempt reconstruct the practice of Urban Harappan life in Gujarat using ethnographic, excavation and exploration data. His study (2006: 121-122) showed that pastoral practices existed in the Pre Urban Harappan phase at multiple sites including Padri and continued in the Urban Harappan phase. He further suggests that though pastoralism continued in different cultural phases, its character differed in these phases.

**Language and Script**

In Gujarat not many studies were conducted on the Harappan script and Language. The evidences for the Harappan script occur in the form of writings in seals, sealings, signboard and graffiti on potsherds and copper artefacts. Script bearing seals/sealings were recovered from Lothal, Dholavira, Bagasra, Surkotada, Pabumath, Desalpur, Kanmer, Khirasara, Bet Dwarka, Nagwada and Shikarpur. Potsherds bearing scripts (incised-prefiring/ postfired or painted) were recovered from most of the excavated sites. Rao analysed the script from Lothal and other sites and according to him (1979: 170) Harappan writing system incorporated pictures and ligatures (combination of linear signs and simple linear signs). Based on his studies and cultural periods he divided the Indus writing into two namely,
Harappan script and Post Urban Harappan script. According to Rao (1979: 170) the earliest Harappan writing consisted of 52 signs including 12 pictures and 40 linear designs and Post Urban Harappan script consisted only 20 signs. The pictures were phonetized and used as syllables. Another feature of the Indus writing is the combination of basic signs to form compound signs. The direction of writing is from right to left and the writing is boustrophedon when two or more lines are inscribed. In spite of these arguments he failed to provide a convincing explanation due to the absence of bilingual inscriptions. Parpola (1986: 401-402) analysed the sealings from Lothal and identified impressions of 77 number. Parpola (2007: 1-12) reanalysed the seal impressions on the clay tags from Lothal and identified 96 clay tags having seal impressions (1 with 5, 2 with 4, 4 with 3, 26 with 2 and 63 with 1). According to him in some sealings the texts were unique and some cases they were complete or broken. In all excavation reports there is also mention about the graffiti or Harappan script but no other detailed study was carried out.

Ethno Archaeology/Ethnography

Reddy (1994: 49-50, 54; 1997: 162-187) carried out ethnographic studies of millet crop processing (summer cultivation in Gujarat and opportunistic/winter flood plain cultivation in Andhra Pradesh) to interpret the subsistence system based on the archaeobotanical remains from Post Urban Harappan sites like Oriyo Timbo and Babar Kot in Gujarat. Biological characteristics and harvesting methods necessitated various crop processing methods and she focussed on composition of botanical assemblages produced during each stages of processing (products and by-products), location of their deposition in respect to domestic facilities, the products from other stages and condition of preservation. Based on these data she developed various models and interpreted the plant based subsistence system at Oriyo Timbo and Babar Kot. She interpreted Oriyo Timbo as a pastoral camp which used to procure plant products cultivated and initially processed
somewhere else and Babar Kot as settled village which produced crops itself (Reddy 1994: 393).

Choksi (1991) carried out ethnographic studies at Saurashtra and north Gujarat for better understanding of pastoral adaptation in Post Urban Harappan period. She examined the elements like environmental and ecological constraints on the pastoral system, variables affecting location decision, pastoral mobility and abandonment behaviour and post occupational inventories of material culture in preliminary levels, compared its results with Harappan sites like Jokha, Kanewal, Zekhda/Jekhda and Rojdi and found that structural activities of past and present are not much different. Her study also pointed out the necessity to conduct comprehensive ethnological studies about different pastoral communities of Gujarat for better understanding of Harappan pastoral communities. Bhan (2004: 243-273) carried out ethnographic studies on pastoralism in Gujarat and considered the factors in choice of site location, discard and choice of vessel preference by the community and tried to find the similarities with Post Urban Harappan pastoral camps of summer and monsoon season. Swayam (2006) in his study of pastoral life in Proto-historic Gujarat describes the current practices of pastoral communities in Gujarat. It covers the ecological, cultural, religious and political aspects of pastoral communities like Bharwads and Rabaris. It also focussed on subsistence pattern and their material culture. By using this data along with exploration and excavation he made an attempt to reconstruct the practices of pastoralism in Urban Harappan phase in Gujarat.

Various scholars carried out ethnoarchaeological studies to interpret various aspects of craft specialization, organization and technology. Kenoyer et al. (1991; 1994) research in the contemporary agate bead industry at Khambhat revealed the existence two different organizational models by which artisans practicing similar techniques were organised. In the workshops organised under central authority only certain works were carried out in the premises of workshop and other works
were done elsewhere. Control over the employee was very strict as he was
required to report to the employer with both products and by-products of their
labour. But in small workshops all stages of production were conducted near the
workshop. The comparison of these data with those from archaeological sites like
Chanhu-daro, Mohenjo-daro, Lothal and other sites showed that Chanhu-daro
represented more controlled workshop and other sites represented small scale
entrepreneurial operations. They (Kenoyer et al. 1991: 44-63, Vidale et al. 1992:
181-194) also described the layout of workshops and debris associated with various
stages of production. The research also indicated that part-time specialization may
be subjected to hierarchic control as full time specialization (Bhan et al. 1994: 141-
157). To interpret the skill involved in the production of Harappan long carnelian
beads Roux et al. (1995: 63-87) carried out ethnographic studies at Khambhat. This
study revealed the duration of apprenticeship, procedures of handling complexity
of taste and its achievement. This result was used to differentiate beads on the
basis of skill involved in its making and interpret them on terms of symbolic value
and maker’s socio economic condition. Ethnographic and experimental Study of
copper working at Dariyawad in Rajasthan (Bhan et al. 2000: 35-49) describes the
need to collect the detailed information to understand and interpret the
manufacturing process of archaeological objects.

Choksi (1994; 1995: 87-108) worked on the potters from Gundiyali and Lodai
villages in Kachchh and she suggested that technical choices made by the potters
in these villages were channelized by the economic network and ideological
considerations in which these villages were situated. She also noted that potters in
the study area produced several identical vessel forms in variety of decorative
styles depending on the demand of consumers from different communities. She
also mentions that the reduction in demand for many vessel forms had lead many
potters to adopt new labor saving techniques to increase the quantity of
production and argues that economic considerations influence the technological
choices. Her observation of some groups of potters may regularly producing

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variety of distinct vessels lead her to seriously reconsider the way in which ceramic typologies are constructed and how they have been used to define chronological relationships in Gujarat (Choksi 2002: 273-92). Her study of design rules in painting shows that art and aesthetics form a very small component of the whole design process and the particular design combination belongs to a particular location (Choksi 1997: 227-40).

Krishnan and Rao's (1994: 113-117) attempt to distinguish different clay paste preparation practices, in archaeological samples based on their ethnoarchaeological and experimental research among contemporary potters of Muzpur in Mehsana and Baroda is very important. They exhibited how different methods were used in the preparation of clay paste are reflected in micro structure of the end product. They documented various stages of manufacturing process in two different workshops which use clays from different resource areas and prepare clay through different methods. The thin section study of clay samples, prepared using different techniques from each workshop in comparison to ceramics from Post Urban Harappan site of Ratanpura showed different clay sources as well as different preparation techniques. It also showed different paste preparation technique probably used for different functional categories and significant variation present in abundance of different sizes of inclusions in different vessel category were also noticed. In the light of these results, they argued that different workshops, each having different paste preparation techniques may have supplied similar vessel types to the site. Chase (2005: 123-136) during his ethnoarchaeological studies at Bathinda observed the marketing and processing of animals and meat, collected discarded bones and conducted excavation at a butcher's dump to identify the mortality profile of the animals. In his thesis (2007), he demonstrated the similarities and differences between the data from Bagasra/Gola Dhoro and Bathinda. Bhagat (2001: 217-279) carried out ethnographic studies at Tarasara village, Talaja taluka, Bhavnagar district to understand the traditional pottery making techniques, their role and significance
in modern day traditional society and also to explain the pottery manufacturing techniques, stylistic variability and significance in the past. Clarke (2007) conducted ethnographic studies at different villages and shrines around Gujarat to reconstruct social lives of terracotta figurines of Harappa. Her study pointed out the necessity to conduct detailed ethnographic studies to understand the potential meaning and function of the ancient figurines and illustrate the complexities of interpreting representation and function (Clarke 2007: 56). Based on earlier ethnoarchaeological studies (Bengal and Khambhat) and new sampling techniques more reliable interpretations were given to craft production in sites like Nagwada (Gowda 2003: 2; Bhan and Gowda 2003: 51-80), Nageswar and Bagasra. Ethnographic work of Bhagat (2001) and Bhagat et al. (1993: 143-185) at Tarsara pointed out that change in paste preparation resulted from the exhaustion of the clay source and complacency about an assured market.

Religion and Ritual
Till date, there is no clear cut evidence is available regarding the religious beliefs of the Harappans. Four circular clay lined fire pits unearthed from Vagad are interpreted as fire altars and fire worship, which is considered as Indo-Aryan feature, may have developed from elements of Harappan culture (Sonawane 2005: 328). A structure unearthed at Nageswar is also interpreted as a fire altar (IAR 1983-84; Hegde et al 1990: 13). There are evidences for domestic fire worship at Rangpur throughout the occupation (Rao 1963: 47). A painted terracotta bull figurine from the site is considered as a cult object (Rao 1963: 48). Fire altars were also reported from Lothal and they include rectangular and circular pits cut into the floor and lined with mud plaster and enclosures built on mud brick altars (Rao 1979: 216-218). Charred animal bone, gold pendant, carnelian bead and sherds of storage jar found associated with a mud platform and mud brick enclosures are identified as evidences of animal sacrifice (Rao 1979: 218). Rao pointed out that if the double burials of Lothal contain the skeletons of females along with males it
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might be the indication of the existence of a form of sati during that period (Rao 1979: 219). But Sankalia considers it as ceremonial burial of the wife or servant or dependent, after the death of husband or master rather than sati (c.f. Rao 1979: 219). Some ritual association was assigned to the terracotta cakes found from fire altar at Lothal (Rao 1985: 518). Religious significance is attested to the terracotta female figurine (mother goddess) unearthed from Nagwada (Hegde et al. 1990: 194). A horn headed human figure is painted on a large jar recovered from Padri and Shinde (1991: 87-89) proposes the prevalence of the worship of the same in the Harappan empire. Pathak who studied the pot painted with horned headed figure from Padri in comparison with vedic texts argues that it is a ritual pot and the horned anthropomorph is the personified form of Soma (the sacred keeper). He interprets the Harappan Jar at Padri as Soma-dhana-kalasa 'the jar for storing the soma juice' (Pathak 1992: 87-89).

Dating in Gujarat

Archaeologists working on Chalcolithic Gujarat make use of an array of dating techniques and time-referents similar to those used in other parts of the world. Dating techniques used in Gujarat can be divided into two main categories viz., chronometric (radiocarbon and thermo luminescence dating) and relative (contextual and typological/seriation).

Radiocarbon Dating

As other parts of the world, radiocarbon dating is the backbone of Gujarat's Chalcolithic archaeology with petite number of dated sites. Among them many dates have never been published, either by excavators or by laboratories; hence it is difficult to develop a full list. Sites like Loteshwar (Sonawane and Ajithprasad 1994: 129-139; Bhan1994: 71-90), Rojdi (Possehl and Rawal 1989) and Bet Dwarka (Gaur et al. 2005) have comprehensive suites of dates for individual stratigraphic sequences or for cultural periods. However, many sites have only one or two radiocarbon dates and it prevents the assessment of the reliability of individual...
dates. As a result it is difficult to explain the occupational history of these sites authentically. It also leads to unjustified assumptions of continuity of equivalent site-use over many millenniums (Bird and Frankel 1991: 179-80). Calibration of radiocarbon determinations is ignored in some sites of Gujarat. According to Agrawal and Yadava (1995: 14-16), the effect of calibration is important where comparative rates of change are discussed and where radiocarbon dates used in combination with other radiometric techniques. AMS and conventional radiocarbon dates from Loteshwar helped to clarify the understanding of occupation history of the site (Patel 2008: 123). The conventional radiocarbon dates from the site probably show a temporal gap between the Microlithic and Chalcolithic periods even though there is no distinguishable stratigraphic break (Meadow and Patel 2003: 74, Patel 2008: 129). As the Chalcolithic studies in Gujarat become more problem oriented, in the recent years there is a growing tendency to collect series of samples from all occupational levels of every site to get more accurate dates.

**Thermo-luminescence Dating**

Though archaeologists of Gujarat normally operate within radiocarbon method as absolute dating system; thermo-luminescence dating is also used in sites like Langhnaj, the Mesolithic site having Chalcolithic affinity (Sankalia 1965; Clutton-Brock 1965) and Bet Dwarka, the Post Urban Harappan site (Gaur et al. 2005). Almost all samples from Bet Dwarka provided accurate results except one sample which exhibited a TL fading factor of more than 20% and created doubt upon the reliability of the final age computed (Gaur et al. 2005).

**Contextual Dating**

Excavation strategy determine the contents of assemblages and so inextricably link dating and explanation (Frankel 1988: 41). In many excavated sites in Gujarat, site's sequences are divided into chronological units with a duration of thousands of years and it denies us the possibility of demonstrating significant
variation in site-use. In Gujarat, one major problem due to the contextual dating is the poorly understood concept of continuity of site use. In many sites in north Gujarat, Chalcolithic culture follows the Mesolithic/Microlithic culture without any visible break. In the same way Urban Harappan period is followed by Post Urban Harappan without a significant gap. Likewise, in many sites sterile deposits of even 5 cms differentiates Mesolithic and Chalcolithic cultures and excavators put them in chronological frameworks based on their convenience. As a result of this, it is very difficult to determine the processes which lead to the culmination of different culture(s).

**Typological Dating/Seriation**

In Gujarat, Chalcolithic artifacts can be classified into generally accepted technological and morphological types as lot of similarities can be identified in excavated and explored Chalcolithic assemblages. Based on the archaeological data from Lothal, Rangpur, Somnath, Amra, Lakhabawal, Vadnagar, Ahar, Maheshwar, Navdatoli and Nevasa; a provisional relative sequence for Protohistoric cultures of Western and Central India was suggested by Subbarao in 1958. He constructed a cultural sequence for Gujarat starting from Palaeolithic period to Early Medieval period. He also identified the differences between the Harappan artifacts from Sindh region and Saurashtra and called the Saurashtran Harappans as Kathiawad Harappans (Kathiawad Harappan, Late Kathiawad Harappan and Post kathiawad Harappans). In the 1950s most of the excavated and explored artifacts from Gujarat were typologically compared with those from Somnath/Prabhas Patan. On the basis of architecture, flooding layers and seriation of ceramics and other finds from Rangpur, Rao (1963) proposed a new relative dating technique for Chalcolithic sites in Gujarat and based on that principle, he classified the explored and excavated sites of Gujarat. Though Rao's relative dating technique was criticised by many scholars (Possehl 1980; Allchin and Allchin 1982: 243-44; Sankalia 1974: 379-83, Misra 1965: 44-52, Herman 1997: 77-112), it still remains as most popular
relative dating technique. According to Herman (1997: 83), Rao's investigations for the first time provided the material evidence and frame work of the transformation of the Harappan Culture down to Post-Harappan times. Misra (1965: 44-52) classified the Chalcolithic sequence at Rangpur into II. Period IIA, which incorporated Rangpur IIA and IIB, was termed as Late Impoverished Harappan Settlement and Period IIB which included Rangpur IIC and III was termed as Lustrous Red Ware related Post Harappan Settlement. But this classification scheme wasn't adopted by the scholars of Gujarat. Sankalia (1974) considered the pre-structural layers in trench RGP 3 in Rangpur IIA with Micaceous Red Ware, Buff Ware and Coarse Grey Ware as Period I: Pre-Harappan culture, rest of Rangpur IIA, IIB and IIC as Period II: Harappan culture and Rangpur III as Period III: Post-Harappan culture. Both these classification schemes were not applied in the sites of Gujarat. Possehl (1980) called Rangpur IIA as Urban Harappan and IIB, IIC and III as Post Urban Harappan. By the end of 1980s, Possehl and Rawal (1989) classified the artifacts of Rojdi based on absolute date and ceramic seriation. The Rojdi sequence is also widely using to date the Sorath and Post Urban Sorath Harappan sites in Gujarat.

Similarly, sites belonging to regional Chalcolithic cultures/traditions like Anarta Tradition (based on Loteshwar/Nagwada), Padri Ware (based on Padri), Preprabhas and Prabhas Assemblage (based on Somnath), Micaceous Red Ware (based on Lothal/Rangpur/Vagad) and Pre Urban Harppan Burial Pottery (based on Santhli/Motipipli/Nagwada) are dated. In 2004, Ajithprasad (115-132) proposed a chronological sequence and stratigraphical structure for Mesolithic and Chalcolithic assemblages of North Gujarat based on artifacts and absolute and relative dates from important excavated sites in north Gujarat. Though typological dating helps us to fit the material assemblages of various sites into broader time frames; it has a series of discrepancies. Chalcolithic researches in Gujarat brought to light evidences for the existence of various regional cultures or traditions which survived for millennia without any directly visible change in their material
culture. If one follows the typological dating system in these sites; errors of thousands of years may occur. Similarly, typological dating presents serious problems in incorporating the surface finds which make up the bulk of Gujarat's archaeological record.

Geo-archaeology

Detailed geo-morphological and stratigraphical study was conducted around and at Kuntasi to understand site selection and sea level changes during the Harappan occupation at Kuntasi (Dhavalikar et al. 1996: 5-13). The study proved that the site was occupied by the Mesolithic people (?) before Chalcolithic community. Three successive flood silt deposits in stratigraphy of the mound clearly showed that floods were occurring frequently in this area as the site is located in the lower bank of the river. They also found that sea level was higher during the Harappan period and Kuntasi might have engaged in some kind of trading activity. According to them (Dhavalikar et al. 1996: 11) a tectonic activity that occurred during Holocene may be one of the reasons behind the defunctioning of the site (Dhavalikar et al. 1996: 11). A comparison of the results of phosphate analysis of soil samples from Kuntasi and Shikarpur (preliminary analysis of samples from 1980s excavation) revealed that Shikarpur had less human activity than Kuntasi (Dhavalikar et al. 1996: 357-370). Analysis of carbonate and phosphate contents and particle size determination of soil sample from a representative trench from Oriyo Timbo revealed that all the layers were formed of sediments derived from alluvial deposition (Rissman and Chitalwala 1990: 142-144). The studies revealed evidences of break between Mesolithic and Chalcolithic stratas at the trench. This strata (Layer four) showed evidences of dampness (swamp) and it was interpreted as the probable result of rain water logging and this layer was devoid of artifacts (Rissman and Chitalwala 1990: 144). The subsequent top layer inhabited by the Harappans was clayey and not formed a swamp and appeared well drained (Rissman and Chitalwala 1990: 144). Analysis of sediments from Malvan showed
that the settlement was spread out on the shore of a lake and thickness of the mud deposit in the lake indicated that it was not an ephemeral one. Shell remains collected from this deposit were of fresh water and this indicated that the salt water from the sea during high tide probably did not reach the lake. The lake began to silting up during the Post-Harappan times and the gradual silting process destroyed the lake at Malvan (Allchin and Joshi 1995: 13-14, 99-101). Analysis of the soil samples from Jokha haven’t provided expected results. The black soil at the site was almost as much mature at the initial stage of the Chalcolithic settlement as it is today (Mehta et al. 1971: 60-65). Based on the succession of phytoclasts and palynomorph in sedimentary soil sequence from Bet Dwarka, Gaur et al. (2005: 88-91) interpreted that sea level was close to its present level some 4000 to 3500 years ago and present position of shoreline should have reached sometime during the Little Ice Age. Flourine-Phosphate analysis of bone samples from Datrana and Moti Pipli showed a clear chronological difference between Mesolithic and Chalcolithic, while a sample from Loteshwar showed overlapping of the values of data (Ajithprasad 2004: 126-127). The study around Lothal using satellite multi spectral data revealed a number of palaeochannels and the most important features were a sinuous channel adjoining Lothal to the north, single thread palaeo-tributaries south east of Lothal and a palaeoesturay east of Lothal and adjacent to its shoreline (Khadkikar et al. 2004: 896-903). Geoarchaeological studies are also in progress in the Harappan site at Kanmer (Rajaguru and Deo 2008: 1-3).

Archaeological Heritage and Tourism

Studies dealing with the tourism prospects of Chalcolithic sites in Gujarat are less in number. Bisht (2004: 35-48) emphasised the tourism potential of Dholavira in Kachchh and the measures adopted by the Archaeological Survey of India and Government of Gujarat to develop it as an international heritage destination. According to Bisht (2004: 35-48) central protection was offered to the site; the
govt acquired 66.6 hectares of land in and around Dholavira; enhanced telecommunication facilities; upgraded the electricity supply by starting high power substation at Balasar in Kachchh; widened existing road from Chitrod to Dholavira; partially constructed new road between Dholavira and Jam Kunharia across the Rann and constructed a building complex in a garden setting consisting halls for documentation, display, storage, accommodation of visitors, office and cafeteria. Patel (2004: 14-19) emphasised the prospects of heritage tourism in Gujarat by describing selected excavated Mesolithic and Chalcolithic sites as tourist destinations. Patel (2005: 4-11) proposed management strategies for Harappan heritage of Gujarat. She dealt with current tourism scenario of Dholavira and Lothal and emphasised the need to develop the infrastructure, partnership with local communities, marketing and promotion of tourism products and training of cultural tourist guides. Ajithprasad (2005: 22-33) also dealt with the Indus civilization and cultural heritage in Gujarat by emphasising selected excavated sites. Kharakwal et al. (2005: 115-123) mentioned the potential of Kachchh as a tourism destination by describing various explored and excavated Harappan sites located there. Patel (2006) described the tourism perspectives of potential Indus sites of Gujarat, problems in showcasing Indus sites, profiling tourists, potential Indus museum in Gujarat, management and maintenance of heritage sites and its infrastructure, promotion and publicity of tourism products and development/design of tourism circuits. Sharma (2000; 2005; 2008) emphasized the tourism potential of excavated Harappan sites like Lothal, Dholavira and Kuntasi.

Field Documentation

Until recent times manual techniques were used in Gujarat to record the antiquities and other features of archaeological sites. Songadh is the first Chalcolithic site in Gujarat where topographic survey was carried out using total station (Bhan personal communication). Contour plan of the site was prepared.
using data generated by total station and GIS software. Kanmer (Kharakwal et al. 2009: 147-164) in Kachchh is another site which was documented digitally. Topographic survey (GPS and Total station), GPR survey and photogrammetric surveys were carried out at the site (Teramura et al. 2008: 45-101). Rare antiquities like seals and sealings from the site were documented three dimensionally (Uno and Teramura 2010). Total station based topographical surveys and preparations of contour maps and digital elevation models using GIS software were conducted at the sites like Pithad/Jaidak (Bhan and Ajithprasad personal communication), Shikarpur (Bhan and Ajithprasad 2009: 1-9) and Loteshwar (Madella et al. 2010). At Shikarpur GPR survey and was also carried out to identify the presence of structures and photogrammetric recording of some structures were made. At Loteshwar context of all important antiquities and features including section of the trench were recorded using total station. Accurate section drawings of the trench were made with the help of GIS and CAD based softwares. At Lothal in 2008 preliminary magnetic surveys were carried out to identify various structures by ASI and University of Bologna, Italy (Frenez and Tosi 2010). The use of such techniques can assure more accurate results and reduce human labour.

From this review it is very clear that in Chalcolithic context, Gujarat is one of the best explored and excavated states in India. The excavations, explorations, data procuring techniques and methods of analyses in the state have changed a lot from the inception. Although, it is necessary to conduct more scientific studies to understand various cultural processes that happened in Gujarat between 3700 BC-1000 BC.