Harappan Blade Implements: A Literature Review and Future Perspectives

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Abstract*: This paper attempts to make a broad survey of the existing literature on Harappan stone tools, providing particular emphasis on Harappan blade implements. A lot of Harappan sites have been excavated, explored, documented and catalogued along with their material culture from different parts of India and elsewhere. Here we aim to delineate an insightful treatment of the stone blade materials recovered from different Harappan sites.*

Keywords: Harappa, Excavation, Rohri Chert, Blades, Technology, Ribbon Flake Blades, Review

Introduction

Approximately around 1500 Harappan sites (Nath, 2017; Shinde, 2017) are there in the states of Gujarat, Rajasthan, Punjab, Haryana, Chandigarh, Himachal Pradesh and Western Uttar Pradesh. In totality, these sites (Mughal, 1970, 1973) belong to Pre/Early Harappan phase, (Ravi and Kot Diji phase), Mature (Rheman Dheri, Amri, Harappa, Ganweriwala and Mohenjo-Daro in Pakistan; Dholavira, Kalibangan, Rakhigarhi, Rupar, Rangpur and Lothal, in India), Late Harappan and Post Harappan PGW cultural phases (Law, 2008, 2011) and a few sites have yielded Pre-Harappan pottery and other remains (Mehrgarh, Kili Gul Muhammad, Burj Basket-Marked, Togau and Kechi Beg phases, Bhirrana, Rakhigarhi, Girawad, Baror, Kalibangan), located in Eastern Pakistan, Baluchistan (Jarrige and Lechevallier, 1977; Jarrige et al., 1995) and Northeast Afghanistan (Shaffer , 1992; Possehl, 1998, 2012; Kenoyer, 2005, 2006, 2008;), along the Indus-Saraswati river Basins (Khonde et al., 2017) separated by the Thar desert and Aravalli mountain ranges from the Ganga valley, located towards the East. Apart from the Harappan sites (Figures 1 and 2), three chalcolithic culture complexes

were contemporaneous to the Harappans in the North-Western India, namely, Anarta (Harris, 2011), Ahar-Banas (Agarwal and Chakrabarti, 2012; Raczek, 2007; Sarkar, 2011, 2012) and Ganeshwar-Jodhpura (Rizvi, 2007, 2015; Coningham and Young, 2015). Mani (2017) mentions that 'the beginning of settled life patterns have been traced around 6000 BC in Mehrgarh, close to the Indus, Kalibangan and Bhirrana, close to the dried river bed of Sarasvati and Koldihwa, Tokwa and Lahuradewa, close to the Ganga'.

Figure 1: Major Harappan and Pre-Harappan sites and their geographic location discussed in the Paper (Modified after Law, R.W. 2011)

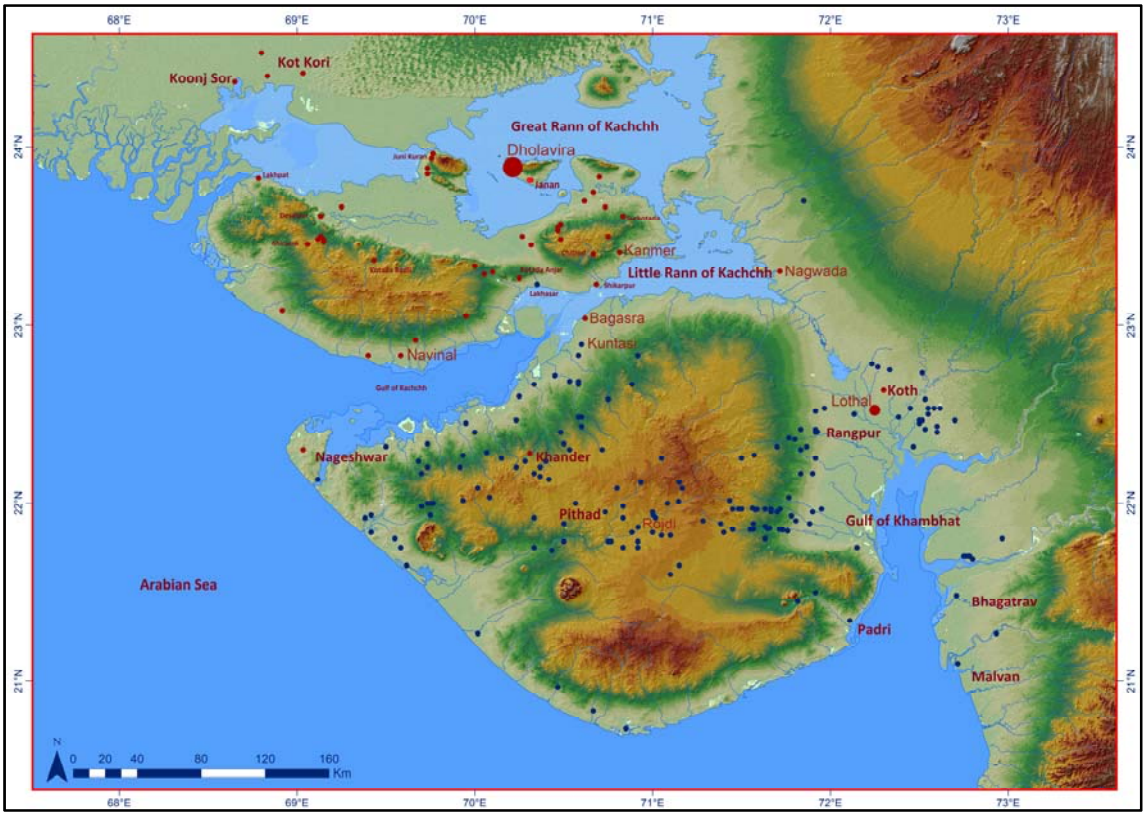

Figure 2: Location of Harappan and Sorath Harappan sits in Gujarat, as discussed in the Paper (Modified after Prabhakar, V.N. and Korisettar, R. 2017)

These chalcolithic cultures of Northern Rajasthan used ceramics (Anarta ware) and lithic materials made of agate-jasper, chert-chalcedony and quartz, however; their relationships with the contemporary Harappans during the Protohistoric periods are still unknown. A few studies have been conducted on these chalcolithic cultures, although, the resolution of research frameworks have been poor and no behavioural and environmental aspects have been captured convincingly, yet. Other nomadic groups were also present in this landscape practicing hunting-gathering modes of life along with pastoralism, like the nomads of the Cholistan (Mughal, 1994). Shinde (2017) argues that 'regional cultures like the Siswal, Regional Hakra Culture Tradition and Sothi may have evolved in the Saraswati Basin as a result of interactions with early Neolithic cultures, either from the Baluchistan region or from Kashmir'.

However, their material cultural aspects in this region have so far been poorly constrained. Besides, the urban and romantic aspects of Harappan archaeology, often cast a huge shadow on other smaller, local and heterogeneous cultures and the importance of studying alternate, sustainable avenues of lifeways. For several excavated Late Harappan sites, lithic tools have not been reported and/or found from the Harappan levels. Discussions on such sites, for example Madina (Kumar et.al; 2009) and Girawad, located in the Rohtak and Mithatal (Shinde et.al.,2008; Prabhakar et.al., 2010) situated in the Bhiwani district of Haryana state, have been omitted.

Moreover, later on in this manuscript all the important aspects will be narrowed down providing a summary of important Harappan sites like Dholavira, Janan et cetera located in the Khadir bet of little Rann of Kachchh district, in the state of Gujarat. All the associated archaeological details and data mining will further be evaluated and discussed within the broader spectrum of Harappan lithic materials and lithic technology cum typology.

Background

In this manuscript we purport to delineate a review of the lithic materials from the excavated Harappan and contemporary sites wherever relevant. A review of the vast literature on Harappan lithic repertoire, excavated stone tools and lithic technology would enable us to examine a few critical factors that are yet unresolved, even after repeated attempts and decades of international research. Only the important sites will be considered for such study providing ample evidences to tackle viable problems. Approximately around 2000 Harappan sites (Shinde, 2017) have been reported from the subcontinent; the thorough archaeological analyses of all the sites are not part of this endeavour. On the contrary we will only consider important Harappan sites and a few contemporary sites, mostly from India and Pakistan, to review the recent problems and prospects.

Most of the Harappan sites are dominated by the presence of long Rohri Chert blades, from the Sindh region of Pakistan. They are also called ribbon flake blades (Soundara Rajan, 1967; Dani and Masson, 1999; Ghosh, 1990; Sali, 1984). Several Harappan sites have local lithic raw materials as well; however, they have been scanty in number and seemed to be infrequently used at the Harappan levels. In other words, the activity or modifications on such, locally obtainable raw materials have been restrictive. These long and short Rohri chert blades are quite important because altered versions of them appear in several Harappan sites, all across North-West India and Eastern Pakistan. However, the routes by which these blades came to the big and satellite settlements of North-Western India remain unclear. The technological aspects and typological variability of these blades in the relative absence of the cores and other debitage materials from the majority of the Harappan sites are poorly constrained. However, a number of cores are available at Dholavira and further the excavation at sites on the Rohri Hills have brought to light working platforms along with a large number of flakes, cores and other debitage products (Biagi, 2007,2010; Starnini and Biagi, 2011). We, now, have a fairly good idea of the provenance of the chert blades, because of the in-depth research work, done by Randall Law (2011), but we don't know the impact of such tools on other cultures like the Anarta, Ahar-Banas and Ganeshwar-Jodhpura and vice-versa. Moreover, several big and urban settlements represent a tremendous variety in terms of long ribbon blade, as such they are heavily retouched and some of them might have served as multipurpose tools. This is not the case for satellite and small Harappan settlements of Northern Gujarat, Rajasthan and Haryana. Hence the economic lifeways and trade mechanisms are still unknown, within the purview of lithic analyses and techno-cognitive aspects.

The reasons of the early movements of other lithic raw materials, like chert-chalcedony, agate-jasper, quartz-carnelian, when not locally available, for producing and using stone tools to serve varied purposes within the Harappan hinterland have not been addressed yet, within the Harappan research framework in the subcontinent. The scientific study of lithic use-wear and corresponding experimentation might provide us important clues to reconstruct the diet of the Harappan peoples. Further, the study of phytoliths and starch grains from the lithic assemblage might be another aspect to ponder upon to understand any use of these tools on agricultural products. Such type of experimentation both in the laboratory and with pertinent raw materials haven't been undertaken to answer prominent and important questions in Harappan archaeology, within the context of Dholavira, as a case study and also as a type site for global standardization in Protohistoric archaeology in the subcontinent. The Mesolithic-Neolithic-Chalcolithic phases witnessed a shift in lithic technology, raw material selection and corresponding function of the tools. During the chalcolithic phases at several sites, heat treatment of lithic materials was quite in vogue. These shifts from one technological aspect to another, hence economic and environmental modes of adaptations between two adjacent phases and their reasons, like when, why and how did they happen are not clear yet both in terms of the present literature on Harappan Lithic tools and conceptual frameworks among archaeologists. Here we will discuss the nature of few Harappan sites and their lithic assemblages first to understand the total scenario and how it looks like.

The Sites and Their Settings

The Early/Mature Harappan site of Kalibangan, circa 3000 BC to 2700 BC (Thapar, 2003 and Lal, 2003) revealed the occurrences of distinct flake tool industry made on agate, jasper, chert and chalcedony materials (Joshi, 2003 and Bala, 2003). Backed blades, serrated and small blades with retouchings have been found from the site. The evidence says a lot about early Harappan phase at the site and how the microlithic tool tradition evolved over a restricted period in this region. The stone tools made of chert and chalcedony materials, mostly cryptocrystallines are absent in the Mature Harappan Phase. According to Joshi (2003) the lithic evidence comprising of twenty-five microliths and twelve chert blades suggest the technological remnants of hunting-gathering communities before the Early Harappan Phase.

The microliths are side scrappers, points, serrated blades, parallel-sided blades and notched blades respectively. Moreover, the findings resemble the flake-blade culture of Lakhmirwala, Gurni Kalan, Hasanpur I and II located in the Mansa district of Punjab. Although, cores are totally absent at Kalibangan, the presence of carnelian beads at this site in a jar exhibiting buckrenian designs suggests apparent trade relations among the people of the then Kashmir regions and the Early Harappans. However, Unlike Mehrgarh-Balochistan region, the middle and upper Ghaggar region has not revealed any Neolithic horizon so far. The results from Banawali, Rakhigarhi and Dhalewan sites should be incorporated with the existing premise from Kalibangan

to understand the broader picture of Harappan Tool Techno-Typology and raw material procurements.

N.C. Majumdar (1999) in his book Explorations in Sind, detailed the occurrences of chert blades, flakes and cores from several tumulus, mounds and excavated Harappan Sites, like Jhukar, Tharro Hill, Amri, Chanhu-Daro and others such sites. According to Majumdar, most of the chert blades had fine cutting edge. A few stone mortars, saddle, urn and discs had also been recovered from some of those sites. A few chert blades possessed long tapering ends, whereas some others could be classified as denticulates with elaborate retouchings. Chanhu-daro excavations in the Nawabshah district of Sindh, present day Pakistan; yielded several types of stone objects and lithic tools are one of the major components in that. Chert ribbon-flakes with trapezoidal sections and retouchings, chert saw and chert cores have been recovered from this Harappan period site (Mackay, 1943).

Excavation from the Late Harappan site of Bhagwanpura (Joshi, 1993) yielded eight globular shaped stone balls from different levels. Sub-period B yielded seven, while sub-period A provided the evidence of one stone ball, which were perhaps either used to kill animals or as weights. Apart from these, eight querns and seven pestles have been found, that were supposedly used to grind grains, (Madhu Bala, 1993).

The Late Harappan (1760 BC - 2110 BC) site of Daimabad is located on the left bank of the river Pravara, which is a tributary of the river Godavari in the Ahmednagar district of Maharashtra, India. This cultural tradition at Daimabad, yielded two hundred and forty-nine microliths comprising of cores, flake-blades made on simple blades, nodules and original lumps of stones. The raw materials are chert, chalcedony, jasper, carnelian and fine-grained green basalt. Chalcedony was exploited heavily at this site (90.3%), whereas chert products saw only a minimal range of use, only around 6.0%. The Harappan tradition of the production of long ribbon-flake blades was made on chert at this site. The average ratio of Length/Breadth/Thickness of the blade tools at this site has been 30.7:5.7:1.9 mm. At this site we see the technological changes happening intra-culturally. The blades of Late Harappan period are longer in size, but shorter by 0.3 mm and in thickness, thinner by 0.1 mm (Sali, 1986). Serrated blades covering 14.8% of the finished tools on blades and penknife blades, also covering 14.8% of the finished tools are the marked feature of this tradition. More than 25% of the finished blade tools come under this category. Serrations have been done by means of steep retouch or notchings on the stone tools.

The retouched variety, being 11.5% comes next; whereas, the lunates cover a total of 9.8% of the total assemblage. Lunates, around 50%, have been crafted on thin blades, where the thickness doesn't exceed 1 mm. The arcs of the specimens were found to be fully worked by vertical retouch. However, in two specimens the arc has only been partly worked leaving the central portion unworked. The point on blade is fashioned by obliquely snapping its lower end on either side. Normally, the blades have been

thinner to make points and if by chance they are thicker, the medial point is deliberately made chisel-ended as a burin.

The backed blades here are denoted by 6.6% of the total finished blade tools. Only one trapeze and one finished notched blade tool have been recovered from the excavations. For the notched variety, both the margins contain a distinct notch at the lower end. Interestingly, retouched blades have been fully retouched and margins show distinguished gloss, resulting from use wear. The penknife blades exhibit minimum working, although they have been found to be vertically retouched only on the lower part of one of the margins. However, in no cases, the margins have been fully backed. The pen-knives have been fashioned via curved and oblique backing respectively. On some occasions, points have been manufactured from pen-knives through alternative retouching on both the margins. A sizable amount of flakes, around 8.5% made of various raw materials showed no signs of secondary working and use wear patterns. The shapes of the flakes have been mostly rectangular, oval, triangular and sub-triangular (Sali, 1986).

The cores mostly exhibit single platform. They are oval and elongated in shapes that have been extensively exploited to exhaust totally. The length of the fluted cores is much shorter than the blades, where the average length of the blades is 30.7 mm and the average length of the cores is 23 mm. The longest blade is 56 mm long, while the longest core is of the dimension of 36mm. Cores were probably rejuvenated overtime for the procurement of suitable blades. The next culture in the sequence is called Daimabad culture, which is phase III, while the Late Harappan has been phase II. The overlapping Daimabad culture has also yielded a variety of microlithic tools, although the technology of tool production differed a bit at this phase.

The microlithic tradition at this stage experienced the introduction of new varieties, like scrapers, end scrapers, notched arrowheads and backed points. Technologically, crested ridged blade specimens appeared in large numbers. Retouchings on different types of blades have been more sophisticated; where a portion on them, between 1 and 2 mm on an average were removed carefully along the margins. The microlithic industry continued till Jorwe culture with several variations in blade morphology, typology and technology, particularly related to truncated, notched, double notched, serrated and crested ridge variations. A few stone objects like maceheads or ringstones, hammers, saddle querns, mullers and pestles have also been recovered from Late Harappan Level, phase II.

Small chert blades have been recovered from the Mature Harappan site of Kunal (IAR 1998-99), located in the Hissar district of Haryana. Provenance of the long chert blades materials from Rohri-Sukkur in present-day Sindh province indicates internal trade within the entire Harappan 'empire' (Agrawal, 2007).

The Harappan site of Surkotada, located in the Kachchh district of Gujarat, has been chronologically categorized mostly by pottery into I A, I B and I C. The habitation

period at this site has been dated to between 2300 BC and 1700 BC through radiocarbon dating. However, period I A of Surkotada is said to be dated between 2055 BC to 1970 BC or 1940 BC. Period I B demarcates the chronology between 1940 BC to 1790 BC subsequently, period I C has yielded the chronology from 1790 BC to 1660 BC. Numerous lithic tools have been recovered from the Harappan site of Surkotada. Different types of Chert blades have been the hallmark of Harappan Civilization and unique identifier, whereby, we could see how the evolution of lithic technology from ancient Stone Age culminated into a highly sophisticated civilization.

Chert blades originated from the Rohri Hills are found in several Harappan sites in Sindh, Baluchisthan, Gujarat and Rajasthan. However, chert blades have a massively wide distribution in India irrespective of cultural connotations. The origin of blades could be traced back to prehistoric period and since then it has evolved in terms of size, shape and functions. Chert Blade Industry has been found in South India, in the Upper Krishna Basin of North Karnataka which is quite similar to the chert products of Deccan Chalcolithic and Western Indian Harappan sites or Gujarat Harappan of Lothal, Rangpur, Surkotada and Dholavira. The dispersal of Chert blades towards Gujarat is still an enigma and we do not understand if the Rohri materials are responsible of all the Gujarat and Sorath Harappan assemblages or it is a diffusion effect from Upper Krishna Basin area. However, no provenance study has been conducted yet for the lithic raw material sources from the Upper Krishna Basin to resolve this ambiguity. Chert is a wonderful material to prepare parallel sided ribbon flakes which might be used to make knife blade, side-scrapper, engraver and points. Flake rejuvenations could be fashioned into scrapers. Both pressure flaking and percussion techniques have been used to detach ribbon flake blades from the respective cores and/or nodules. While pressure flaking provides trapezoidal cross sections, percussion flaking paves the way to thick, short bulbar ends with triangular cross sections. Awls, borers and side scrapers are made from triangular section flakes.

Harappan sites have also seen the raw material exploitation from locally available amygdaloidal nodules of several varieties of crystalline quartz-like chalcedony, carnelian, jasper and milky quartz for preparing different types of stone tools. At Surkotada, the last phase of I C has seen a massive production of microlithic tools comprising of fifty-one cores, forty-four flakes and a total of seventy blades. However, this industry of semi-precious stones originated from the mid-level of Period I B.

It is apparent that the technique and types did not change over a specific period as demonstrated by the cores and flake blades. For the Harappan sites of Lothal, Rangpur and Surkotada these have been found as common features at the late levels, where we normally see no typo-technological changes overtime. Several stone objects have been unearthed from Surkotada, namely Stone balls or sling balls, Querns, Mace Heads, Whet Stones and Sharpeners and finally Mullers and Rubbers. Weights and measures are other varieties that have copiously been collected from this as well. Bone tool industry has also been found at Surkotada. Splitting, scraping, notching, retouching

and grinding techniques were used to fashion bone tools at this site; which could be classified into three varieties, namely, hunting tools, domestic tools and digging tools.

The Harappan site of Lothal (2200 BC – 1700 BC), is located in the Ahmedabad district of Saurashtra where we could see the preponderance of crested guided ridge technique for the productions of small parallel sided blades on locally available materials like jasper and agate. The findings of fluted cores, primary flakes and blades with crested ridge support this hypothesis. Long ribbon flakes, made on Chert got replaced by Short blades at Lothal B, which belongs to phase V of Late Harappan context. Local stone resources or quarries have been non-existent within the fifty miles radius of Lothal.

Therefore, stone and stone materials are found sparingly at this site. Fine grained chert pebbles were shaped as burnishers for smoothening pottery surfaces. Domestic pen-knives and sickle-blades were made from imported chert at the initial phases. Discontinuous flakes scars are also seen in some of the cores suggesting the failed attempt to extract blades from the cores. Scrappers and blades that are found at this site reveal the evidences of secondary retouching, grinding, chipping and trimming to make asymmetrical flake-blades, lunates, engravers, points and scrapers. Apart from the Sukkur-Rohri region in Sindh, the Kaladgi series of Upper Krishna region is a rich source area of chert materials; however, it has not been reported so far that the Harappans used such dark-brownish to light brownish chert, prevalent in this area for the making of blades and other such artefacts.

The Harappan site of Kuntasi (2400 BC – 1700 BC) is located in the Rajkot district of Gujarat state. This site yielded several flake-blade elements made on Chert and chalcedony (Dhavalikar et al., 1996).

The Harappan urban city of Dholavira experienced massive earthquakes several times in the past, most notably in 4500 yr. BP, 4200 yr. BP and 2200 yr BP as envisaged from the evidences at wall alignments, collapse and deformations (Bisht, 2013 and Valdiya, 2017). This site, being located at Khadir is within the proximity of the Allah bund Fault. Later in A.D. 1819 Allah bund Fault generated another massive earthquake, leading to the rise of Allah bund ridge which obstructed the flow of Nara river (Thakkar et al., 2012). The Harappan site of Rangpur, located in the Surendranagar district of Gujarat yielded several microlithic tools like triangle, trapeze, blade, point and arrow-head made on jasper, agate and chalcedony, found from the gravel-lens, un-associated with pottery. Period II A at Rangpur is characterized by several imported materials and chert flakes. The microlithic industry, however, is mostly confined to Pre-Harappan levels.

The geometric microlithic culture at Rangpur has been termed as Late Stone Age, however; a pre-microlithic horizon yielded several Middle Stone Age tools in the Bhadar river sections. The microlithic horizon dates back to 3000 BCE, tentatively; according to (Rao, 1963). It is assumed by the authors that local settlement of

microlithic using people might have been predominant at around 3000 BCE, when allegedly the culture flourished. However, no evidences of local industry have been found at this site. Microliths started to appear in jasper instead of chert by sub-period II A at Rangpur by approximately 2000 BCE. A few lithic implements, like parallel sided blades might have been imported from Lothal via trade networks. Pressure flaking and indirect percussion techniques were used to manufacture retouched blades, backed blades, tanged points, blade-scarpers, end scrapers and side-scarpers on various raw materials of symmetrical and asymmetrical flakes mostly for cutting purposes probably. The neighbouring factory site of Devalio, located around 10 miles from Rangpur; could both have been served as a good source of raw materials and finished tools for the Pre-Harappan people. Different shapes of querns and mullers made of sandstone have been found in abundance from this site.

The Harappan site of Rojdi, located in the Rajkot district of Saurashtra, yielded a few microlithis and the raw materials have possibly been procured from distant factory sites. Rojdi chronology is mostly based on ceramic typology and could be classified into three sub-phases, namely Rojdi A (2500 BC – 2200 BC), Rojdi B (2200 BC – 2000 BC) and Rojdi C (2000 BC – 1700 BC). Within the domain of chipped stone implements, this site revealed the existence of blade cores, fragmented blade cores, trapezoidal blades, triangular blades, crested blades and flake tools made on chalcedony and semi- silicious materials (Possehl and Raval, 1989).

The chalcolithic site of Somnath is located in the Junagarh district of the peninsula of Saurashtra, Gujarat state that yielded pottery with Harappan affinity, namely the Prabhasa Ware. The radiocarbon dates from the Chalcolithic culture at this site, could broadly be subdivided into two periods, where period I dates back to Circa 2000 BC - 1700 BC and period II could be constrained within Circa 1700 BC -1300 BC. The microliths at this site, mostly belong to chalcolithic horizon as evidenced by parallel sided flake-blades, lunates, micro-burins, fluted cores, pen-knife blades, end and side scrapers on chert, chalcedony, agate and other fine-grained stones (Nanavati *et. al.*, 1971). Interestingly, the microlithic tradition at this site continues until the advent of Iron Age and dies off gradually by that time. However, some cores exhibit the presence of crested guided ridge as primary working which could very well be for bead manufacturing. These types of evidences are rare in a few contemporaneous Harappan sites, or sometimes might not have been recorded in great details if not omitted that might have imparted important clues about the spread and demise of the microlithic traditions at Harappan contexts.

Excavations at Harappa yielded several creamy coloured chert flakes and cores. Retouching is present in most of the cases with serrated edge. It is believed that the sharp edges might have been used for cutting meat and vegetables. The largest flake is 5.4 inches long, 1.6 inches in width and 0.4 inches in the middle. It is partly light and partly dark grey in colour. The smallest scraper is 2.65 inches long, 0.55 inches in width and 0.15 inches in thickness. The cores are flat at one end and wedge shaped at

another end. The size of the cores ranges from 1.1 to 3.7 inches in length, 0.4 to 1.6 inches in width and 0.3 to 1.25 inches in thickness. A few cores have been found to be used as burnishers as well. A leaf-shaped chert arrow head of red colour has also been recovered from this site. Five chert burnishers have been recovered so far from Harappan excavation (Vats, 1940). Mohenjo-daro excavations provided a good repertoire of long flakes made on chert, which might have been used for cutting and scrapping purposes (Mackay, 1938).

Two blades have been recovered from the mature Harappan level of the site Farmana, located in the Rohtak district of the state Haryana along with a few grinding stones and pounders (Shinde et.al., 2008). A total of thirty-five (35) blade and bladelets have been documented from the site, mostly made of tan-grey chert, which are essentially Rohri chert materials. Blades have been identified as sickle blades, retouched blades and notched blades. The length to width ratio has been more than 2.0 for both blades and bladelets at this site. Parallel sided lithic implements having the length of less than 1 cm have been termed as bladelets; when having a length of more than 1 cm, they have been regarded as blades at Farmana. Heat treatment of lithic materials has also been reported from this site. Technological details and descriptions have been scanty and the definitions of the lithic materials used in this report are not beyond disputes. Several incomplete interpretations, identifications and methodologies to study the lithic implements have been exclusively site specific without any global connotations, which the authors have failed to recognize and highlight, discussing its importance and other necessary parameters at chapter seven, titled 'Minor objects from the Settlement Area' by Ayumu Konasukawa, Hitoshi Endo and Akinori Uesugi.

Blades, bladelets and retouched tools, sickle blades, notched tools, lunates, drills, denticulates, debitage materials, a few local chert, agate cores and other geometric tools made on chert, agate have been quite common from the Harappan site of Kanmer (Kharakwal et.al., 2012), located in the Kachchh district of Gujarat. Like many other major Harappan sites, in Kanmer no cores have been found, therefore, finished products might have been imported from other regions and retouched and/or refabricated within the site, as evidenced by the debitage.

Edge damage and heat treatments on some of the lithic materials from the total repertoire of lithic tools have been quite frequent at this site, situated close to Mardak bet, a suitable source region for local chert and chalcedony materials. Single, multiple and dihedral platform cores are quite prominent at this site, however, not for Rohri chert materials. At Kanmer, tan gray chert sickles, within the classification of blade and bladelets made of Rohri chert are abundant, further categorized into sickle gloss, edge damage, new damage and punch by copper tools. The concept of copper tool use to modify Rohri chert blades haven't been described properly ascertaining technological details and possible changes, depending on tool types and plausible functions. Nine drill bits made of Rohri Chert have been found at Kanmer and apparently it seems that both Ernestite and Rohri Chert drill bits were in use, however,

why only finished blade implements arrived at the site with the absence of cores is still unresolved. Most probably the stone implements from Sindh have been trade materials in exchange of other finished products or raw materials from the Kachchh region.

Similarly, the differences in terms of use, procurement, functions of local chert and agate and Rohri chert materials are not clear from the text at all. This chapter in the book on miscellaneous and/or minor objects and particularly on lithic implements seems incomplete without proper stress on the technological, functional and typological details of the local and exotic lithic implements. However, all the drawings and photographs of the tools and statistical measures have sedulously been carried out and only from the drawings and photographs, sometimes; it is possible to discern the technological knowhow of the local and foreign products. Often a few tools have been termed as 'Tan-grey chert other tools (1:1)' without any proper classification, particularly for the Rohri chert materials.

The Sorath Harappan (Possehl and Raval, 1989), site of Jaidak (Pithad), located in the Jamnagar district of Gujarat state (IAR-1991-92, Ajithprasad, 2008) yielded a few lithic implements made of locally available chert, chalcedony and jasper via crested guided ridge technique at chalcolithic level comprising of a total of 1543 lithic implements (after, Gadekar, 2014). Only a few implements were recovered from a small-scale excavation and no further details have been given in the paper, published in the edited volume of the Occasional Paper 4 by Toshiki Osada and Akinori Uesugi. Reporting on Prabhas Patan culture (AjithPrasad et.al., 2011), mentioned that; The Prabhas assemblage at Somnath is associated with rubble stone structures and showed the use of stone blades of locally available chert, chalcedony and jasper in addition to copper implements and lapidary beads of semiprecious stones, steatite and faience'.

Randall Law (2011), in his book 'Inter-Regional Interaction and Urbanism in the Ancient Indus Valley' detailed the source region of the raw materials for most of the lithic implements from Dholavira, i.e. tan-gray chert; which was largely quarried from Rohri Hills region of Pakistan. Mineralogical, isotopic and chemical variabilities have been established for both the geological source materials and lithic implements to ascertain the rigour of the provenance studies and methodologies deployed for the said research work. This exclusive work on the provenance of several minerals, stones and chert materials and its variations might help researchers to understand the economic interactions among different phases of the culture, during regionalization, integration and localization eras, delineating different cultural phases like, Ravi, Kot Diji, Harappa and Cemetery H.

The multicultural Mature Harappan/Anarta tradition (Yadav 2005, Madella et al. 2010) site of Loteshwar, located in the Mehsana district of Gujarat has both microlithic (Period I) and Chalcolithic (Period II) horizons. Period I yielded AMS date of 7000 BC (Meadow and Patel 2003), whereas, Period II provided radiocarbon date of 3703 BC –

2250 BC, respectively. However, fluorine dating of bones from this site suggested a shorter time lag between the two periods (Ajithprasad, 2004, 2009). Period I had microliths of Mesolithic period and Period II indicated chalcolithic deposits having cryptocrystallines, quartz, chert and agate tools (total 3745, after Gadekar, 2014). Both debitage and finished products were found from the chalcolithic layers, although crested guided ridge technique was absent at this site, which was profoundly used at other contemporaneous sites.

The multicultural Early Harappan burial site of Santhli (Majumdar, 1999; Meadow and Patel 2003), located in the Banaskantha district of Gujarat, has both a microlithic period and a chalcolithic horizon, akin to Loteshwar. However, the microlithic layer yielded only a few lithic implements suggesting the presence of occasional hunter-gatherers, whereas the chalcolithic layers as well provided a poor lithic assemblage made of locally available chalcedony, chert and quartz through crested guided ridge technique.

The Chalcolithic/ Early Harappan site of Datrana (IAR, 1993.1994) also yielded Mesolithic horizon as characterized by faunal remains and chalcolithic layers having ten heavily retouched parallel sided lithic blades on Rohri chert. Crested guided ridge technique was present at this site, indicated by the availability of prismatic cores, perhaps from the Chalcolithic layers (Ajithprasad, 2002, 2011). Total 87803 lithic implements have been recovered from this site (Gadekar, 2014).

The Early/Mature Harappan site of Moti Pipli (Majumdar and Sonawane, 1997); located in the Banaskantha district of Gujarat, yielded a few parallel-sided Rohri chert blades. However, microliths made on chalcedony have been found from both the Mesolithic and Chalcolithic horizons, delineating crested guided ridge technique. Although, the introduction of this technique at several of the sites like Santhli and Datrana are still unknown.

The Mature Harappan site of Nagwada is situated in the Surendranagar district of Gujarat, nearby the little Rann of Kachchh. Long parallel sided blades made of Rohri chert have been found at this site, along with other cryptocrystalline blades, cores and debitage products. Both crested guide ridge and geometric microliths were present at this site. However, (Harris, 2011) commented that 'Blades and microblades are not retouched (Hegde et al. 1990:193), suggesting they were not used as tools but are waste from creating bead blanks.'

The much-disputed Mesolithic/Chalcolithic site of Langhnaj (Sankalia, 1965, 1987; Possehl, 2002; Lukacs, 2002) yielded a lot of lithic implements, particularly for phase II, dated back to 2479-2153 cal BCE, hence, supposedly suggesting a Mature Harappan phase, similar to Lothal. However, many Mature Harappan materials present at this site from Lothal could have very well been trade materials (Sankalia, 1987). Microliths made of chert, quartz, agate and jasper are abundant at this site, along with two groundstone tools, which were the markers of a Mature Harappan phase.

The disputed Late Harappan site of Zekhada (Parikh, 1977; Chatterjee, 1995), located in the Banaskantha district also yielded a few large Rohri chert parallel sided blades along with a few microliths.

The fortified, industrial Harappan site of Bagasra (Sonawane, 2002; Bhan et.al.; 2004) is located in the Kachchh district of Gujarat. Early stages of Urban Harappan, Sorath and Classical Harappan layers were identified at this site. Geometric and non-geometric microliths made on cryptocrystallines and a few Rohri Chert parallel sided blade-bladelets were identified from this site. Crested guided ridge technique has been dominant at this site. A lot of cores and debitage were also found, which signifies that plenty of lithic implements (total, 5983, after Gadekar, 2014) were made locally from locally available raw materials at different time periods along the lifetime of the site, barring the Rohri Chert materials, which were essentially trade materials and prized exchanges for similar high-end and pricy objects from the northern part of Gujarat.

The Harappan site of Shikarpur, located in the Kachchh district of Gujarat, stratigraphically represented classical, urban and post-urban sequences. This site yielded several parallel sided Rohri chert blades at the Harappan levels along with a variety of lithic implements, debitage and cores, total 5299 lithic implements, after Gadekar (2014).

The Harappan site of Rakhigarhi (Nath, 1998, 1999, 2001, 2015; Nath, et.al., 2015; Sarkar et.al., 2016), located in the Hissar district of Haryana provided unique evidence of fluted cores, chert blades and asymmetrical flakes made of chert and perhaps agate from the early Harappan levels. Nath believes that lithic implements were made locally at this site and have not been trade materials. Another prominent Pre-Harappan site Bhirrana, located in the Fatehabad district of Haryana, yielded typical Rohri chert blades of high quality and retouch. Although no full-fledged reports are available yet on Bhirrana (Dikshit, 2013); but existing data supports the hypothesis that chert materials have been traded in exchange at Harappan levels and all other questions regarding typo-technology, diffusion, transition and the intensity of raw material extractions, raised in the introductory part of this article are still valid and yet to be ascertained, in the light of comparative scientific evidences, convincingly. The Harappan site of Banawali (IAR 1987-88), situated in the Hissar district of Haryana had a chalcedony blade from the Mature Harappan levels. Although, studies on lithic materials from this site has largely been ignored, as it seems from the scant available resources and data from this important site.

The Harappan port site of Bhagatrav, located in the Bharuch district of Coastal Gujarat also yielded a few lithic implements, made on locally available chert-chalcedony and agate materials. No Rohri chert materials have been identified so far from the excavated assemblage. Another important Harappan town of Desalpur (IAR 1963-64:10-12), located in the Kachchh district of Gujarat also provided a few evidences of lithic materials, however paltry in number and typo-technological diversity.

Finally, the pre-urban Harappan site of Janan (Gadekar et. al., 2018) yielded several Rohri chert blade implements made through crested guided ridge technique. Both geometric and non-geometric tools have also been identified from this site, which apparently suggests the continuity of a few categories like lunates, burins, scrapers, points, borers et cetera made of a diverse set of materials like chert, chalcedony, banded agate and moss agate, across time and space.

Discussions

A review of the existing literature from most of the important excavated sites of India and some parts of Pakistan suggest that, in-depth research on lithic remains from most of the sites have not been given due attention so far. Lithic remains provide a wealth of information on technology, economy, behaviour, adaptation, cognition and environmental factors. No wonder, due to the absence of in-depth research, only a few reports from a few excavated sites have partly been able to address these important issues in Harappan archaeology. Hence Harappan archaeology as it stands now is blind in the cloud of data and data mining has summarily been inadequate.

As we see, a tremendous amount of variety exists in terms of chipped blade and bladelets production on Rohri chert. The raw material itself delineates variability with regards to colour, texture, chemical composition, geological sources, isotopic signatures, heat-treatment and diagenesis. At every stage of Harappan timeframe the culture of lithic implements cum technology and production of blade-bladelets have evolved, often making scopes for composite, multi-purpose tools. The blade materials, although look simple, but can be classified into complex systems depending on several parameters, like normal, inverse, bifacial, backing bifacial, alternate, truncated, straight, irregular, concave, convex and many more.

The endeavour to standardize the blade-bladelets culture during the protohistoric times might have been a huge investment for the Harappans across the Indus-Saraswati basin. Moreover, the relative absence of cores from most of the important Harappan sites from India, has added an extra caveat in this research problem. It seems the cores were mostly discarded at the source regions after the production of the blades. However, a few bullet cores on Rohri chert materials can be found from a few sites.

We do not know what exclusive techniques the Harappans from Kachchh and Saurashtra region deployed when compared to their counterparts at Harappa, Mohenjo-Daro and Ganeriwala, regarding edge damage, parallel retouching, polish, heat-treatment and snapping of the long ribbon flake blades into two-three pieces, how and why? It is assumed that copper tools and punches were used to break the lithic implements after they got procured and/or made either by long distance trade or any other sophisticated mechanism; although, no study so far has been able to demonstrate the process and its plausible effects on the stone tools from Harappan levels, or even Chalcolithic levels per se.

General Nature of the Harappan Blade-Bladelets and/or Chipped Stone Tools

The preliminary survery, documentation and basic measurements of the Dholavira lithic materials impart us a glimpse about artefact standardization. Rohri Hills being the main raw material resource centre indicates the importance of the chert materials having excellent trade values. During the mid-third millennium BC and mature Indus Civilization time period lithic raw materials from far off regions played a crucial role within the context of standardized lithic technology, urban growth, craft specialization and social cohesion. Depending on the representational qualities of the Dholavira Blade-Bladelets assemblages, they could be categorized under several types like morphology, physical and chemical characteristics of the raw material, manufacturing technology, manufacturing quality, decoration, function, use, value, social meaning, individual signature and symbolism (Djindjian, 2000). Preliminary reduction sequences deploying crested guided ridge or laminar blade production has been the hallmark technique of local blade production using Rohri Chert materials for most of the Urban Harappan centres. Dholavira and other Harappan sites are no exception; however, Dholavira being a huge urban settlement hosts thousands of lithic materials, including blades of different shapes and sizes. Material evidences, such as these also provide insight into the symbolic and social behavior including long-distance trade mechanisms.

The Dholavira blade elements have been trade materials and probably were exchanged for other important artefacts like beads and other precious materials. Therefore, the Harappans from other urban cities, now based in present day Pakistan, let's say Harappa, Mohenjodaro, Ganweriwala, the three major sites and other surrounding satellite sites of the Indus-Saraswati region used to bring the finished products with them and perhaps curated other used materials made of Rohri Chert within the large settlements of the Sorath Harappan area. Another possibility is that perhaps they used to travel with the raw materials and made the chert blades at the urban and satellite sites and they got distributed according to the needs of the local population within the Sorath Harappan region. However, we can't be sure of any such model as of now, since in-depth research on the lithic materials from Dholavira is required to unearth these complex, competing and tentative hypotheses. The evidences from the Early Harappan settlement of Janan suggest that prepared cores might have been imported from the Rohri hills region for much bigger urban settlements like Dholavira for blade removal deploying crested guided ridge techniques, which is highly unlikely for the early Harappan sites like Datrana and Janan (Gadekar et.al., 2018) where limited knapping activities took place.

A distinctive quality of the Dholavira blade is its length. Long blades ranging to 80-85 mms are present within the assemblage but relatively rare, where most of the artefacts fall within the range of 35-60 mms. Most of the long blades have been purposefully broken into smaller pieces for use and reuse. From the polish at the edges and inner

part of the ventral surfaces of the lithic tools, it is quite clear that they served some purpose. Some of the tools have totally worn out edges due to heavy use and some are relatively fresh in appearance. Macroscopic analyses of the tools from Dholavira suggests that since the artefacts were broken into several pieces for use and reuse, it's length should be the most important criterion for any sort of standard categorization and comparison with other such materials from other large or relatively smaller Harappan settlements. Can any attributes of shape/morphology and form (size and shape) help to determine blade strategy for one particular site like Dholavira? As proposed and surmised earlier length of the blades being the most important characteristic of this site, we could always refer to the individual length of the artefacts as a standard. Using the standard and average size of the lithic implements of Dholavira other such sites and Rohri Chert materials can be compared statistically for a better resolution in terms of tool typology-technology and probable functional analyses. Lithic miniaturization at Dholavira was one of many strategic options for exhaustive use of the tools, either blade-bladelets or drills or any other composite blade materials made of chert. Better tools come from more sophisticated thought processes and that is the hallmark of Dholavira in an industrial scale, probably envied and copied by other Harappan settlements of the Sorath region. The observation of improved, repetitive and standardized workmanship over time indicates a distinct and discreet advance in technological capabilities of the residents in the entire region, with potential impacts in composite tool development skills, and in overall trading capabilities, all of which improved their total civilizational success.

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