NEW OBSERVATIONS ON THE AGE AND CONTEXT OF SOANIAN ARTEFACTS IN THE NORTHWESTERN SUB-HIMALAYAS OF INDIA

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ABSTRACT

The Siwaliks or sub-Himalayas are the foothills of Himalayas situated along its southern margin which house the Soanian lithic industries. We recently made surface collections from almost 30 localities on the stream-terraces and alluvial fan surfaces in the Indian sub-Himalayas and excavated two in a buried state. Based on the dates obtained for some sites, it is observed that the Soanian type stone implements existed in the sub-Himalayas even up to late mid-Holocene times. This inference is also confirmed by the discovery of such tools from the post-Urban Harappan sites and from the existence of such tools in association with the Harappan potsherds on young terrace surfaces. Our identification of many new tool-types, especially the pitted cobbles and the edge-ground lithic specimens which are known from mid-Holocene sites elsewhere in the world, also hints at the influence of those lithic industries in this region. We briefly present here lithic assemblages from some dated sites and show that the Soanian and many new tool-types were in use in the Northwestern sub-Himalayas until late mid-Holocene times.

GEOMORPHOLOGY OF SIWALIK FORMATIONS AND ISSUES RELATED TO THE SOANIAN INDUSTRIES

The sub-Himalayas or Siwaliks comprise mudstones, sandstones, and coarsely bedded conglomerates laid down when the region was a vast basin during middle Miocene to Upper Pleistocene times (Valdiya 1993, 2001). The sediments were deposited by rivers flowing southwards from greater Himalayas, resulting in multi-ordered drainage system. Following this deposition, the sediments were uplifted through intense tectonic regimes, resulting in Siwaliks' unique topographical entity. The Siwaliks are located within the political boundaries of Pakistan, India, Nepal, and Bhutan and are spread between 6 to 90 Km in width (Acharyya 1994). These hills are divided stratigraphically into three major subgroups-Lower, Middle and Upper. Intermittently located between the Siwaliks are 'duns', which are flat-bottomed longitudinal structural valleys (Nakata 1972: 39-170). These duns essentially comprise several large Himalayan piedmont alluvial fans and terraces, which formed as a result of tectonic episodes in the flanking Siwaliks. Ongoing erosion and tectonic activity has greatly affected the topography of the Siwaliks and their present-day morphology is comprised of hogback ridges, valleys of various orders, gullies, Choes (seasonal streams), semicircular Choe-divides, water-gaps and Choe terraces (Mukerji 1976). To the south of Siwaliks are the Indo-Gangetic plains and in north, are the Lesser Himalayas.

Virtually all the previously known Palaeolithic sites in this region were in un-datable surface contexts, and the resulting collections are often inadequate for accurate techno-typological or typochronological analyses. An attempt to understand the geological contexts of the stone tools recovered from these sites was first made by de Terra and Paterson (1939), and this British–American team was also responsible for assigning cultural labels to some of these lithic assemblages as 'Soan' or 'Soanian' (Hawkes *et al*. 1934: 1-13; Movius 1948) and 'Soan Flake Tradition' (Sankalia 1957). De Terra and Paterson (1939) broadly placed the origin of these Soanian tools in the Middle Pleistocene (see Dennell and Rendell 1991; Dennell and Hurcombe 1993). The research involving this region made by de Terra and Paterson (1939) was supplemented by Paterson and Drummond (1962), Graziosi, (1964: 55-74), Krantz (1973) which resulted in various cultural stages of the Soanian as; Pre-Soan, Early Soan, Late-Soan etc., with further sub-stages and were thought to be a result of the glacial and interglacial periods. In Pakistan, subsequent Paleolithic investigations took place in the Soan valley, the Potwar Plateau, the Pabbi Hills, and the Rohri Hills in the Sind region (Stiles 1978; Rendell et al. 1989). In India, most investigations took place in the river valleys of Sutlej, Ravi (Saroj 1974), Markanda (Joshi et al. 1975), Beas-Banganga (Lal 1956; Bhattacharya et al. 1981), Sirsa, and Soan ('Swan' of Indian Punjab), and in the intermontane dun valleys (Mohapatra and Singh 1979; Karir 1985: 56-60; Singh et al. 1998: 89-143). Most of the workers in India (Lal 1956; Mohapatra 1981, 2007; Karir 1985: 120-38; Singh et al. 1998: 15-143) relied heavily on de Terra and Paterson's work (1939), ultimately resulting in oversimplified and confusing cultural interpretations (see also Misra and Mate 1995: 1-14).

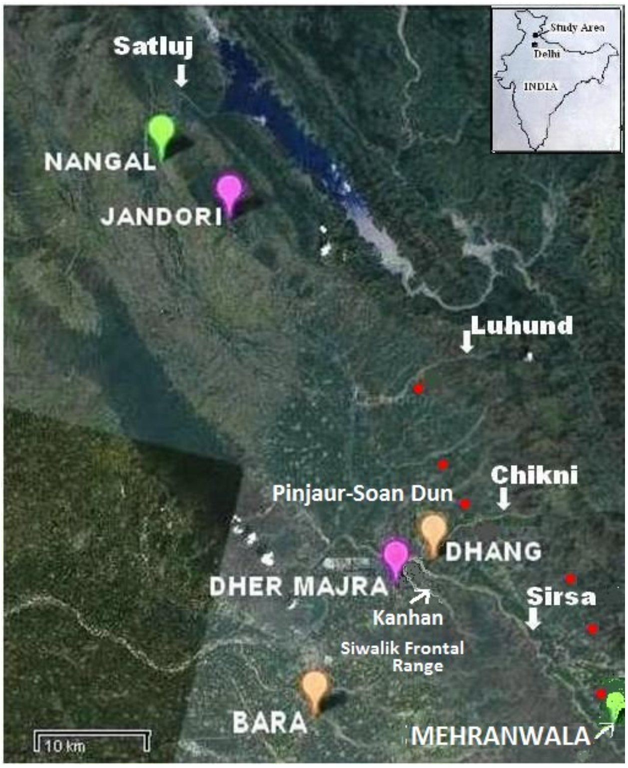

Figure 1. Map of different sites in Punjab and Himachal Pradesh, India. Archaeological stations: bubble; rivers: arrow; Qf2 fans: red spot (satellite view adapted from Google maps).

A general view was presented that the Early Soan consisted of heavy duty tools with the dominance of choppers and in the Late Soan, the occurrence of flakes/flake-tools increased and the tools became smaller in size (de Terra and Paterson 1939; Mohapatra 1974, 2007). The Late-Soan of the Soan valley of north Pakistan is also considered to be belonging to South Asian Middle palaeolithic tradition in typological terms (Allchin and Allcnin 1996: 250-54; Lycett 2007). The typochronological distinction between Early and Late Soan is still not clear because both the tool-types mixed with each other have only been reported in un-datable surface contexts. Doubts about de Terra and Paterson's observations first surfaced through the works of W.D. Gill (1951) and Sankalia (1957). The stratigraphical context of the Soanian industries as first specified by de Terra and Paterson (1939) was questioned by later field studies (Rendell *et al.* 1989). The Soan River 'terraces' as observed by de Terra and Paterson were proven to be erosional features rather than true river terraces (Rendell *et al*. 1989). As a result, Soanian technological evolution (de Terra and Paterson 1939) is no longer considered to be valid (Rendell *et al*. 1989; Chaohan 2007, 2008). There is no evidence of discrete 'Early' or 'Late' Soan entities since the Soanian tools including both large and small types and with varying flake contents have also been found recently even from very young sites (Soni *et al.* 2008; Soni and Soni 2009, 2010, 2011). Also the 'Early Soan' tools (as conventionally defined) have only been found in very small quantities both in India and Pakistan (Mohapatra 1966; Jayaswal 1978: 71-84) and no factory site with exclusive Early Soan assemblage has ever been reported in stratified context from anywhere.

ALLUVIAL FAN DEPOSITS OF PINJAUR DUN IN SUB-HIMALAYAS AND THE TIME BRACKET OF THE LATE SOAN

The important geomorphic features observed within the dun basins are alluvial fans and the river terraces. The prominent duns in the NW sub-Himalaya are Pinjaur-Soan Dun (Figure 1) and Dehra Dun. These duns were formed as a consequence of tectonic activity along the Himalayan Frontal Thrust (HFT) in the Middle Pleistocene (Raiverman 2002: 378) that terminated Siwalik sedimentation in the foreland around 0.2 Ma (Ranga Rao *et al.* 1988). The Pinjaur-Soan Dun is characterized by a series of alluvial fans (Figure 2: Kumar et al, 2007) and depositional fluvial terraces, which occur at multiple levels (Nakata 1972: 77; Mukerjee 1976). Suresh *et al.* (2007) divided the alluvial fans into older fan (Qf1) and the younger fan (Qf2) and the terrace surfaces into T1 and T2 based on relative height and optically stimulated luminescence (OSL) ages. The Qf2 fan deposition started at 72.4 ± 13.4 ka and continued until 24.5 ± 4.9 ka and the sediments were deposited on T1 (upper) and T2 (lower) terraces at 16.3 ± 2.1 and 4.5 ka, respectively (Suresh *et al.* 2007). In an earlier communication, Suresh *et al.* (2002) had dated the Luhund Khad (Figure 1) Qf2 fan deposition to have taken place from >57ka to about 20ka. Soni and Soni (2005) recovered several Soanian tools from the very surface dated to 20 ka by Suresh *et al.* (2002) inferring that the tools might have been fabricated after (or much after) 20ka.

In past years many researchers had assigned 'Late-Soan' stage to the lithic assemblages recovered from these fan surfaces (Mohapatra 1974; Mohapatra and Singh 1979; Karir 1985: 135-38) by assuming that the stone tools were fabricated during mid to late Pleistocene times (the ages of surfaces were not known at that time). Gaillard *et al.* (2011) state that the 'Late Soan' can be dated to between >57 ka and 20 ka in the Sirsa valley (by referring to Suresh *et al*. 2002), but we find no scientific basis behind it since as explained above no terrace surface was laid during this time bracket to subsequently support the Late-Soan. The dates of the Qf2 fan surfaces (some of which have yielded archeological material) are around 20ka, 16ka and 4.5 ka and we cannot imagine that Late-Soan can be dated between 57 ka and 20 ka as speculated by Gaillard *et al.* (2011). So the time bracket of 'Late-Soan' industry, if at all it exists as a separate entity, still remains undefined.

A BRIEF INTRODUCTION TO THE LTHIC INDUSTRIES OF S.E. ASIA AND NEPAL

In the past several decades a lot of knowledge about the lithic industries of Southeast Asia has been generated (Colani 1927; Matthews 1966; Gorman 1969, 1972; Anderson 1990; Raynolds 1992; Hà Van Tan 1997; Higham 2002; Shoocongdej 2004; Bellwood 2007; Marwick 2007; Yi et al. 2008), but our interest with regard to the present paper is in some typical diagnostic tools which are also abundantly available in this region of the sub-Himalayas. Hoabinhian tools usually encountered in Southeast Asia are generally unifacial flaked tools made primarily on water rounded cobbles and large flakes detached from these cobbles. Archaeological sites in Terengganu, Sumatra, Thailand, Laos, Myanmar and Cambodia have been identified as Hoabinhian sites. Beyond this core area isolated inventories of stone artifacts are known displaying Hoabinhian elements in Nepal, South China, Taiwan and Australia (Corvinus 1998; Marwick 2007). The chronology of the Hoabinhian industry dates from late-to-terminal Pleistocene to early-to-mid Holocene. The edge-ground cobble artefacts appear in the upper layers of Hoabinhian deposits (Matthews 1966; Marwick 2007) and flakes with edge gloss are found in Island Southeast Asia (Bellwood 2007: 184). Pitted cobbles have also been reported from some Southeast Asian sites belonging to mid-Holocene times (Esser 1994; Xeuchun et al. 2003) which are of course also found abundantly in California and America's other prehistoric sites (True et al. 1979; Sim 1990; Breschini and Haversat 1993; Fitzerald and Jones 1999; Adams 2001). Edge-ground tools and some tools having affinity with the Hoabinhian have also been reported from various sites in Assam and Naga Hills by T. C. Sharma during his Ph.D. work (Sankalia 1974: 285-95).

During her two decades work in Nepal, Gudrun Corvinus who laid the foundations of the prehistory in the central sub-Himalayas, discovered the first Acheulian elements (Corvinus 1990, 1995) in this part of the sub-Himalayas, and excavated a rich Middle Palaeolithic site (Corvinus, 1994, 2007). She also found many cobble tool assemblages and showed that they came from Late Pleistocene deposits. At Patu site in Eastern Nepal she discovered a unique "macrolithic Mesolithic" assemblage and compared it to the Hoabinhian of South-East Asia, thus suggesting a technical link between the Siwaliks and the South-East Asia (Corvinus 1987, 1989, 2007). Some edge-ground lithic specimens were also reported by G. Corvinus (2007: 383) from Amapur in Nepal.

PROLIFERATION OF LATE HARAPPANS IN THE NW SUB-HIMALAYAS

The Harappan culture evolved during an Early Phase from 5.2 to 4.5 ka from antecedent agricultural communities of the hills bordering the Indus alluvial plain to the west and reached its Mature Phase between approximately 4.5 and 3.9 ka. Deurbanization ensued after approximately 3.9 ka and was characterized by the development of increasingly regional artefact styles and trading networks as well as the disappearance of the distinctive Harappan script (Possehl 1997; Giosan *et al.* 2012). Though this phase is generally referred to as "collapse" many settlements exhibit continuity, albeit with reduced size, whereas many other riverine sites are abandoned (Lal and Gupta 1984: 461-503; Possehl 1997). Between 3.9 and 3.0 ka, there was a proliferation of smaller, village-type settlements (Possehl 1997; Kumar 2009: 1-75; Wright *et al.* 2005; Giosan *et al*. 2012: fig.3), especially in the Himalayan foothills and the western part of the Ganges. During late phase the long-distance trade was almost absent and the production of a wide range of material was curtailed (Possehl 1997). It is also possible that during long spells of drought the procurement of metal for day to day work could also have also become difficult for the late-Harappans; particularly for those who shifted to remote places in the sub-Himalayas.

RECENT FIELD WORK IN THE N.W. SUB-HIMALAYAS

During the past few years, the present authors explored an area approximately 50 km x 6 km in NW sub-Himalayas up to an elevation of 420 m MSL and found several prehistoric sites yielding stone tools in association with potsherds in surface context. A limited excavation of a site Jandori-6 belonging to the mid-Holocene times in Bilaspur (Himachal Pradesh) also yielded a large assemblage of Soanian and new types of stone tools mixed with pottery in a buried state (Soni and Soni 2009). Three terraces of River Satluj adjoining the Siwaliks (two were laid down during mid-Holocene times) also provided us with a large number of Soanian and other stone tools along with plain red ware and Black & Red Ware ceramics. Several other young stream terraces and two late-Harappan mounds showed Soanian type tools on them (Soni and Soni 2008; present paper). In the following we give a brief description of some of these sites.

SOANIAN TOOLS FROM LATE-HARAPPAN SITE BARA (ROPAR, 30.920° N 76.553° E)

The Bara site in Ropar (Punjab-India) consists of an archaeological mound which is known for a typical 'late-Harappan Bara-Ware' (Allchin and Allchin 1996: 251). It is the pottery of this site which is most distinctive and diagnostic (Sharma 1981). This four meter high mound is situated in Punjab plains about 8 km in the southwest of the Siwalik frontal-range (Figure 1). The site was previously situated on the left bank of a stream 'Budki-Nadi' which has since shifted towards north by about one kilometer. In the year 2008, we were invited to witness an excavation being started by K. C. Nauriyal (then Superintending Archaeologist Simla, India) at this site. Surprisingly, we found some stone tools on the surface of that archaeological mound (Soni and Soni 2008) which included a few choppers, scrapers, a point (Figure 2), and many utilized flakes resembling the Soanian artefacts made on coarse-grained quartzite which are known to exist in the neighboring Siwaliks. The excavation has yet been discontinued, but the excavators informed us (see also Nauriyal et al. 2012) that they recovered more such stone tools from just a small depth so far excavated.

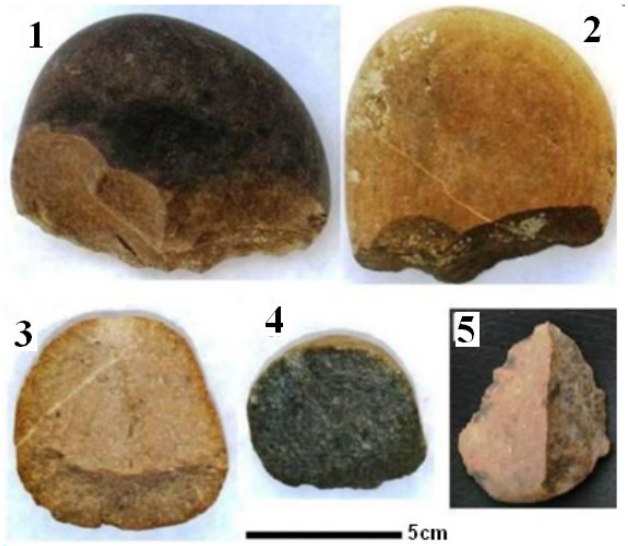

Figure 2. Tools resembling the Soanians found from the post-Urban Bara mound. 1, 2: choppers; 3, 4: thick flake scrapers with cortical back; 5: point.

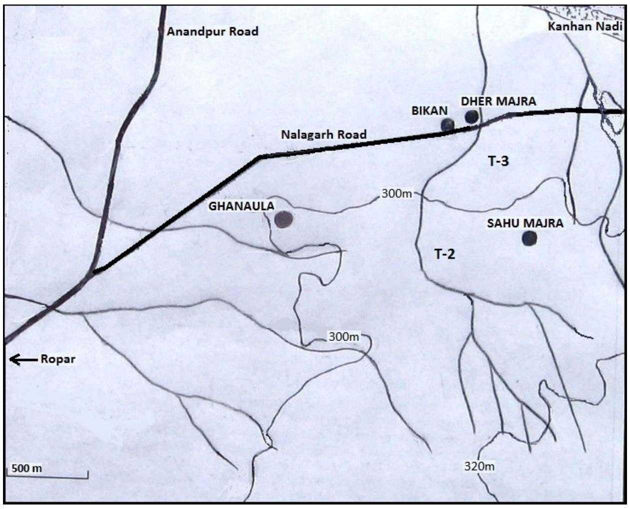

Figure 3. Terrace levels and drainage map of the region around Dhermajra site.

Though the Bara mound has been excavated twice (1955 and 1971) by Y. D. Sharma (A.S.I. 2011), the presence of any stone tool is not mentioned in the material excavated from this site dated to late mid-Holocene (from 3.49 to 3.69 ka: Agrawal and Kusumgar 1973). The scarcity of metal in this site is supported by the fact that only two pieces of copper, a fishing hook and a fragmentary bangle, were recovered from the excavated material (Sharma 1981).

Figure 4. View of the demolished Dhermajra mound wherein the stone tools are indicated by red arrows and the potsherds by green arrows.

Figure 5. Washed down material from the demolished mound. The stone tools are scattered here and there; indicated by red arrows and the potsherds by blue ones.

SOANIAN TOOLS FROM DHER-MAJRA (31.029° N 76.616° E)

Harappan potsherds along with Soanian tools were found by Olaf Prufer (1956: 102) at Dher-Majra (Figure 1) from the top of a 4 m high late-Harappan mound. Prufer (1956) speculated that these tools could have rolled down from a higher surface (terrace T-2 as he called it), but as per our recent survey, there could be no contiguity between the mound-top and higher terrace as the latter is about 600 m from the bottom of that mound (see Figure 3). Also, no stone tool rolling down from the higher terrace (T-2) can be expected on the mound top 4 m above the level of its bottom (terrace T-3).

Olaf Prufer (1956) was comparing the terraces seen by him in Sirsa valley with de Terra and Paterson's (1939) terrace-chronology, and was accordingly following the Soanian typochronology suggested by them. Though he saw some variation in tool types from those encountered

Figure 6. Chopping tools from the remnant part of the Dhermajra mound. 1-3: upper face, work-ing edge and lower face of a reddish chopping-tool with middle one showing heavily utilized working edge; 4-6: similar views of another grey col-ored chopping tool.

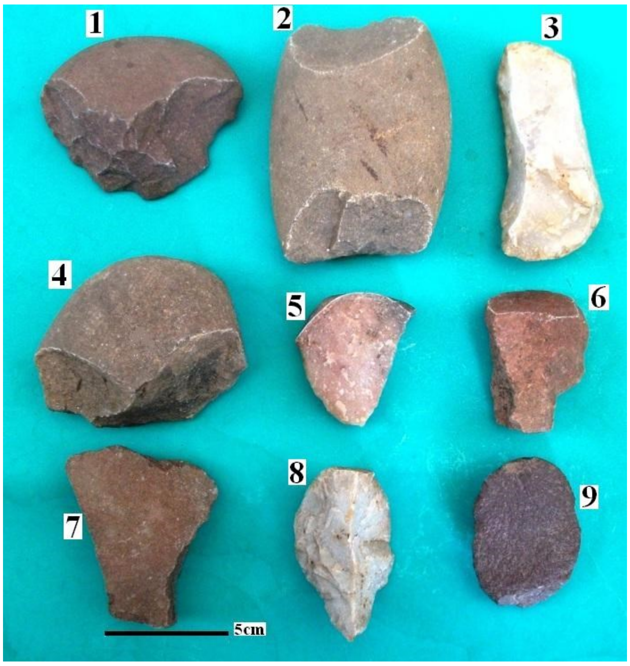

Figure 7. Choppers, core and flake tools from Dhermajra. 1: triangular chopper; 2: flat cobble with unifacial transversal cutting edges; 3: ventral face of a unifacial blade-like flake with used proximal and distal edges; 4: side chopper; 5: Toth type-3 flake; 6: stemmed sub-rectangular core with cortical platform; 7: dorsal face of a stemmed cortical flake; 8: unifacial core borer; 9: end scraper on a type-1 flake.

in west Punjab, he termed the stone tools found from Dhem-Majra and other sites in Sirsa valley as belonging to Early Soan (Prufer 1956: 103). Since the stone tools found by Prufer (1956) were termed by him as similar to those occurring on terrace T-2 (Prufer 1956: 94), he could not find any other explanation than to assume that the stone tools on mound have come from terrace T-2.

Figure 8. Dismantled Mehranwala Harappan mound containing stone artefacts and potsherds on its top; some washed down to lower level.

Figure 9. Stone tools along with potsherds on the mound. Red arrows show the stone artefacts and blue arrows show pot-sherds.

The Dher-Majra site is situated on the left bank of an un-named short-run ephemeral tributary of Kanhan Nadi (Figure 3), both of which emanate from the Siwalik Frontal-Range and join Sirsa Nadi originating from the Upper Siwalik foothills of the Himalayas (Figure 1). At present the mound at that site has almost been leveled by local people but its remnant part is still higher than the surface of the lower terrace (called T-3 by Olaf Prufer). Fresh-looking unrolled Soanian type stone tools (Figures 4-7) as well as potsherds eroded out of the mound (Fig-ures 4, 5) are seen littered all over there, and same tools were collected by Prufer from the mound-top. Therefore, the only possibility is that Prufer's (1956: 102) findings were a part of the culture of that mound and his assump-tion that the mound top showed terrace T-2 tools washed down from a higher level was not a valid assumption.

Figure 10. Core tools from Mehranwala. 1, 2: ventral and dorsal faces of a side chopper; 3, 4: dorsal and ventral faces of a thick rectangular flake resembling a cleaver; 5-7: two facial and a side view of a sub-rectangular core with plane cortical platforms on both ends.

SOANIAN TOOLS FROM OTHER SITES ON YOUNG ALLUVIAL FANS

All the other Soanian-tool sites which are mentioned by Prufer (1956: 92) as Palaeolithic sites are actually situated on the surfaces of Alluvial fans Qf2 or their next lower terraces which were laid down around 20 ka or 16 ka (Suresh *et al*. 2007; Kumar *et al.* 2007) and so the tools shown by Prufer (1956: 104-07) as collected from Dhang, Rampur, Mehranwala, Khokra-Ka-Choa, Manakpura, Malpur-Da-Choa, Rajpura. etc. (Prufer 1956:109-19) are young and are not that old as were speculated by him in line with de Terra and Paterson (1939). Prufer's (1956: 96) statement that the tools found from some sites are fresh and unrolled, also points to the fact that they are young. Soanian tools found by Prufer from Dhang (Qf2 fan surface) were in close proximity to a Harappan site (Prufer 1956; 101) though he did not co-relate the two.

Some Harappan potsherds were also noticed by Mohapatra and Singh (1979) to be occurring in association with the pebble-tools at various sites on the tops of fans Qf2 (Suresh *et al.* 2007) and on the next lower terraces of the streams incising these fans. They did not suspect any temporal nearness among the different type of the surficial archeological material collected by them and speculated a 'Late Soan' date corresponding to 3rd interglacial and 4th glacial stages in accordance with de Terra and Paterson (1939), as also did the later workers (Karir 1985: 130-32; Singh *et al*. 1998: 5-7; Mohapatra 2007).

SOANIAN TOOLS FROM MEHRANWALA (31.029° N 76.822° E)

Olaf Prufer (1956: 96) mentioned that the centre of the Mehranwala site was crowned by a mound belonging to Harappan culture. This site is situated on the left bank of Sirsa Nadi and during our recent visit to that site we found Soanian stone tools mixed with potsherds from the top of that almost destroyed mound. Similar to the case of Dher Majra mound, here also the peak of the remnant Harappan mound was about 2 to 3 m higher than the Qf2 alluvial fan surface (Figure 8). Stone tools akin to those found from other sites in the neighborhood mixed with ceramics (Figures 9, 10, 11) were found spread all over there on its raised surface, or rolled down from it. The evidence from this site also shows that the Harappans were using the Soanian tools.

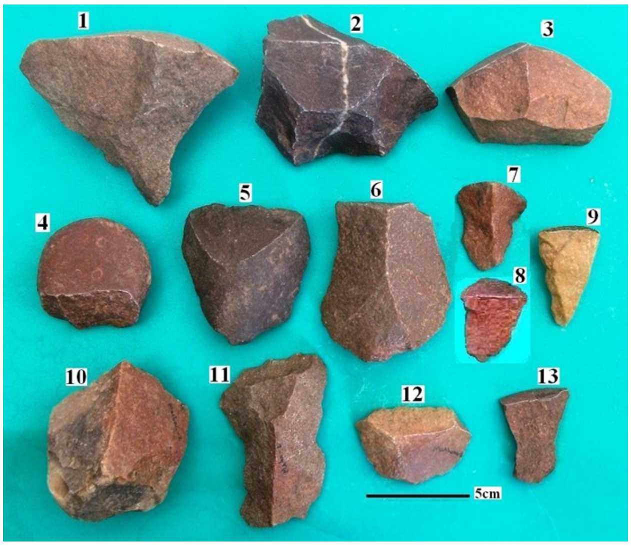

Figure 11. Core and flake tools from Mehranwala. 1: core borer with cortical butt; 2: unifacial sub-peripheral core scraper; 3, 10: sub-rectangular cores with cortex on one face; 4: small chopper; 5, 12: dorsal faces of flakes; 6, 11: dorsal faces of blade-flakes with keels; 7: dorsal face with keel and 8: and ventral faces of a type-3 triangular flake; 9: type-3 triangular flake; 13: ventral face of a type-3 blade-flake.

LITHIC ASSEMBLAGE AND CERAMICS FROM YOUNG-TERRACE SITES OF RIVER SATLUJ NEAR NANGAL (PUNJAB)

Three terraces are visible on the left bank of River Satluj above its flood plain near Nangal Township (Figure 12). Site NGT-1 is on first terrace and the sites NGT-2 and NGT-3 are respectively on next two higher terraces. The riverside edge of first terrace (site NGT-1) is about 9 m above the present river bed, the next higher terrace NGT-2 is nearly 10 m above the south end of terrace NGT-1 and the edge of NGT-3 is about 9 m above the left end of site NGT-2. Initially the sediment of all the three terraces was deposited by River Satluj in the form of pebble-boulder gravel and subsequently three incision events gave the terraces their present morphology. The first incision event started well before 11.3 ka and ended around 11.3 ka giving rise to remnant terraces NGT-3 and NGT-2. The terrace NGT-2 is cut-in-fill terrace whose topmost layer is muddy sediment drawn from the background hill (Figure 12). The muddy sediment went on depositing on the gravel-bottom during Holocene until a little after 4.8 ka. Two soil samples taken at different depths of NGT-

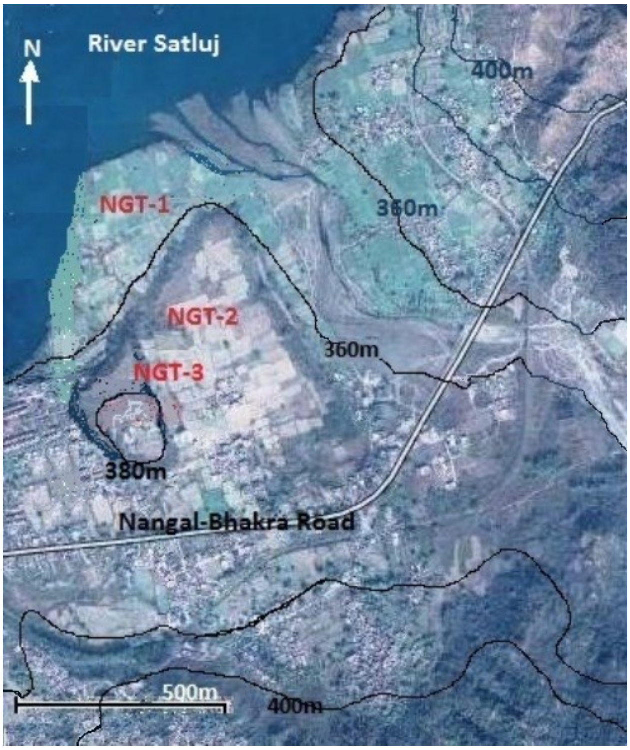

Figure 12 .Map of terraces NGT-1, NGT-2 and NGT- 3 on the left bank of River Satluj near Nangal.

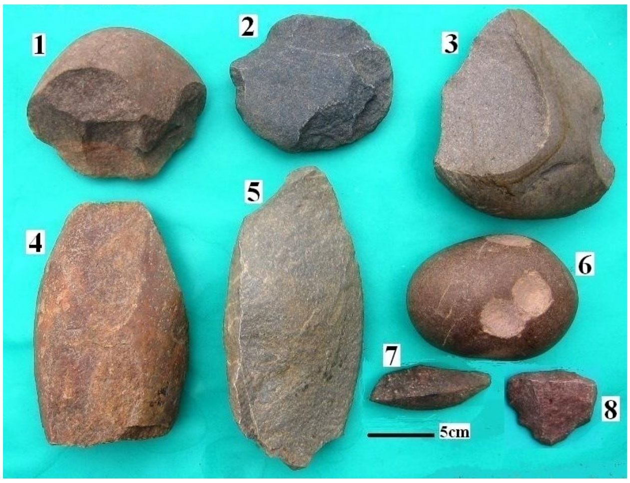

Figure 13. Stone tools from the lower Satluj terrace dated to ~6.25ka. 1: chopper; 2: centripetally flaked flat cobble; 3: dorsal face of a thick pointed bifacial flake; 4: cleaving tool partly flaked on lateral sides with plain butt; 5: knife-like thick backed unifacial flake with long convex cutting edge; 6: pitted cobble; 7: sub-rectangular elongate piercing knob; 8: triangular scraper on a thick type-4 flake.

2 gave OSL dates; 4.79±0.6 ka at 55 cm depth, and 11.31±1.8 ka at a depth of 1.35 m (Table 1).

Further incision of NGT-2 gravel deposit went on up to around 6 ka, and subsequently the terrace NGT-1 was formed. The incision of the terrace NGT-1 up to present bed level took place from mid-Holocene to the present time. A sample taken at 80 cm below the top of the

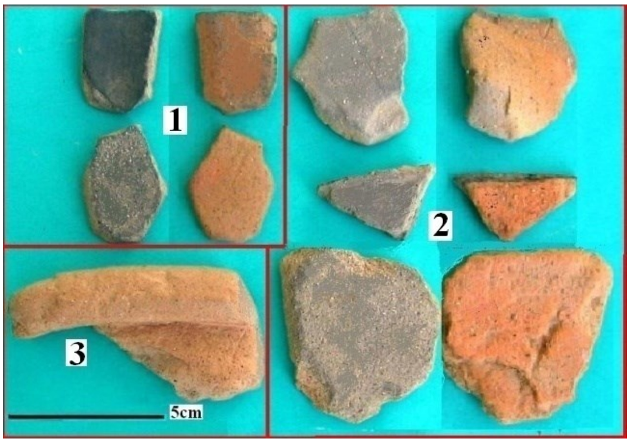

Figure 14. Pottery types from Nangal terraces. 1: inner and outer faces of Black & Red Ware potsherds from lower Nangal terrace NGT-1; 2: inner and outer faces of B& R W from the upper Nangal terrace NGT-2; 3: ill-burnt potsherd from upper Nangal terrace NGT-2

silt/sand deposit on NGT-1 gave an OSL date of the terrace as 6.25 $\pm$ 0.84 (Soni *et al*. 2008).

Most parts of the above mentioned terrace-sites being under present day agricultural activity, the stone tools as well as the potsherds associated with them are not expected to be at the original positions. However, their shifting even due to continuous plowing cannot be that large.

Archaeological material from Site NGT-1 (centered at 31.4013° N 76.3879° E).

This site is spread over an approximate area of 0.1 km^2 and stone artefacts (Figure 13) churned by plowing were found at several spots. Potsherds containing Black & Red Ware (double Figure 14-1) were found in addition to comparatively more number of ill-burnt red ware scattered at several places and they were concentrated more at points where the intensity of stone artefacts was large. Some 513 lithic specimens were recovered from this site which contained about 53% flakes/flake-tools and the rest were flaked pieces which include 6.5% choppers, some core-tools and 8 pitted cobbles (Figure 13-6). The pitted cobbles are found for the first time in the Northwestern sub-Himalayas (Soni and Soni 2011) though they do exist in the mid-Holocene sites of Southeast Asia (Esser 1994; Xeuchun *et al.* 2003) and North America (True *et al.* 1979; Breschini and Haversat 1993; Fitzerald and Jones 1999; Adams 2001). Large cutting tools on thick-butted flakes and cores with sharp lateral or distal cutting edges were also found in good numbers (Figure 13-3, 13-5). Small and moderate sized lithic specimens were exhumed from upper thin layer of silt and sand because very large specimens are generally thrown by the peasants on the ridges between the fields; the visible ones were picked up by us from these margins.

Lab No.	Sample depth from surface (cm)	U (ppm)	Th (ppm)	Potassium K (%)	Moisture Content (%)	Equivalent Dose (De)Gy	Dose rate (Gy/ka)	Age (ka)
LD874	55	2.64±0.3	14±1.4	1.64±0.2	7.06	14.84±1.6	3.10±0.2	4.79±0.6
LD873	135	2.12±0 .2	20±2	1.55±0.2	1.41	39.25±5.8	3.47±0.2	11.31±1.8

Table 1. OSL dating of Soil Samples of mud deposition on the upper terrace of Satluj at Nangal. Material: Sediment sample Mineral used: Quartz Size: 90-125 micrometer SAR protocol (Murray and Wintle 2000).

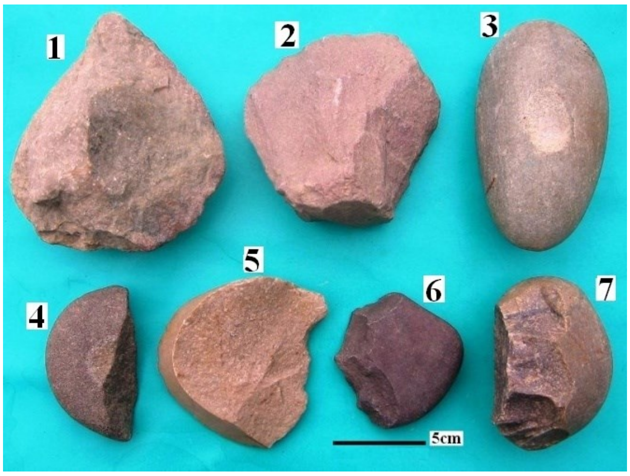

Figure 15. Stone tools from upper Satluj terrace surface dated to 4.7ka. 1: leaf shaped thick unifacial pointed core bulging at the centre; 2: thick flaring core with plane cortical butt; 3: pitted oval cobble; 4: half ring-stone; 5: dorsal face of a type-2 flake; 6: chopper; 7: chopping tool.

Archeological material from Site NGT-2 (centered at 31.3984° N 76.3903° E).

This terrace site NGT-2 is situated on the left side of Nangal-Bhakra road and a colony has recently come there up to about 250 m northwards of the road. A large number of stone artefacts, occasionally in association with potsherds, were recovered from this terrace dated to ~4.7 ka. The site yielded 30 pitted cobbles, 54 chopper-chopping tools and one broken ring-stone (Figure 15- 4) in addition to a good number of cores and typical core tools. Out of a total of 602 lithic specimens collected from this site, there were nearly 42% flakes and flake tools which included a small number of borers, scrapers and points and most of them were broken or waste flakes. Black & Red Ware (Figure 14-2), and some Harappan type potsherds (Figure 14-3) were also collected from this site. Here also some pitted cobbles and generally large-size tools were picked up from the field margins so the actual ratio of flakes to the flaked pieces collected from a given surface area could not be determined.

Archeological material from Site NGT-3 (centered at 31.3975° N; 76.3880° E).

This typically shaped remnant terrace site is situated on the left side of NGT-2 and is raised above its left-end margin by 9-10 meters (see Figure 12). Its central portion is somewhat more raised and the lithic artefacts were found spread all over it. Agricultural activity is going on

Figure 16. A view of the Jandori-6 site.

at this site also and stone tools (n = 51) similar to those collected from the lower NGT-2 and NGT-1 sites were found from here which also included 3 pitted cobbles. There were about 57% flaked pieces and rest were flakes or flake tools in the collected assemblage. A few weathered potsherds were also recovered from this site.

LITHICS, CERAMICS, AND EDGE-GROUND TOOLS FOUND IN BURIED STATE IN THE SITE JANDORI-6 (31.3382° N; 76.4574° E)

Site Jandori-6 is situated in the middle-Siwaliks (Miocene rocks) and lies on the left bank of a stream Jandori-Di-Khad in district Bilaspur of Himachal Pradesh (Figure 1). This site provided us with an almost *in-situ* assemblage of archeological specimens. It is situated on a slope (Figure 16) which has somewhat planar portion near the edge of the stream; most of which has been swept away by the flooding stream during heavy rains. A large number of stone tools were at first noticed on a small area of the site and then a limited excavation at a point (see Figures 16, 17) yielded a huge flake-rich assemblage (Soni and Soni 2009) mixed with weathered potsherds. Some of the potsherds resembled the Harappan types (Figures 18-16, 18-17, 18-18, 19, 20). There were also present many edge-ground artefacts (n = 732) in the total assemblage of about five thousand surficial/excavated lithic specimens (Figures 18-2, 18-3, 18-4, 18-7, 18-8, 18-9, 18-10, 18-12, 18-13, 18-15). Site Jandori-6 appears to have experienced a phase of aridity in the past since all the lithic specimens and the potsherds below 30 cm of the top of the trial

Lab No.	Sample depth from surface (cm)	U (ppm)	Th (ppm)	Potassium K %	Moisture Content (%)	Equivalent Dose (E.D.) Gy	Dose rate(Gy/ka)	Age (ka)
LD637	60	4.35± 0.44	19.02±1.9	1.98±0.2	1	21.41±1.52	4.51±0.27	4.744 ± 0.437

Table 2. OSL dating of a Potsherd excavated from the site Jandori-6. Material: Pottery; Mineral used: Quartz: Size 90-125 micrometer; SAR protocol (Murray and Wintle 2000).

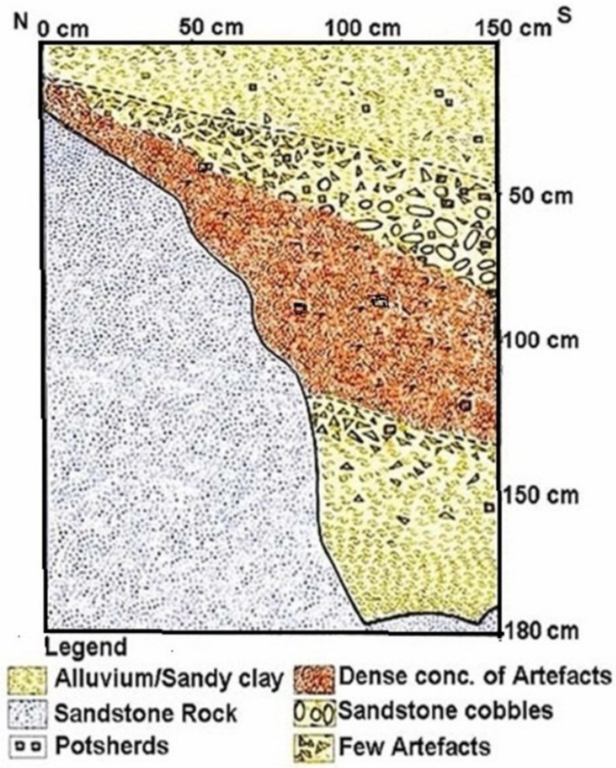

Figure 17. Lithocolumn of the trial trench on slope. Only the eastern wall has full 1.8m length.

trench (when a more dense layer of the artefacts appears: figure 17) were laden with $CaCO_3$ (Figures 18-1, 18-6, 18-13, 18-15). It shows that the artefacts in the lower layers had collected there as a creep wash during aridity (which makes $CaCO_3$ to deposit on them) and hints at the fact that the site could have been occupied by hominines during some mid-Holocene arid phase. The occurrence of Harappan pottery along with Soanian-like stone tools (though there were edge-ground tools also) *in-situ* also points to the presence of Harappans at the site. One date of a potsherd obtained by the OSL method (Table 2) also falls in mid-Holocene. Jandori-6 is as such a first mid-Holocene site in NW India where edge-ground tools were found in association with the Soanian tools and Harappan potsherds. In Southeast Asia, mostly core tools and occasionally flakes with an edge-gloss are reported in upper stages of the Hoabinhian (Ha van Tan 1997; Bellwood 2007: 155, 167, 181-82, 184), but here in Jandori-6 assemblage,

Figure 18. Stone-tools and potsherds from jan-dori-6. 1: chopper; 2-4, 7-10, 12-15: edge-ground lithic specimens; 5: thick cortical flake with 4 steep flake scars on its convex edge; 6: cleaving-tool with steep lateral edges; 11: thick flake scraper; 16-18: Harappan potsherds.

the edge-ground tools are abundantly the flakes (> 95%) and flake tools. This place was a factory site which is evidenced by the presence of a large quantity of lithic shatter in the excavated material. The details of the archaeological material obtained from this site will be reported elsewhere when more dating results are obtained.

DISCUSSION AND CONCLUSION

The co-existence of pottery with lithic artefacts may not be a new observation, but previously it was noted to have occurred only with Meso-Neolithic artefacts (Possehl and Kennedy 1979). Gaillard et al. (2002) had found stone tools of Soanian tradition from some sites in a high altitude region of Hindukush range (north Pakistan) contemporary to Neolithic, but they attributed it to the continuation of archaic technology until Holocene due to the cultural isolation of the mountain populations from the plain populations. In Kashmir many surface sites along the rivers yielded large tools made from basalt cobbles. These artefacts were related by their discoverers to the Aceramic Neolithic culture identified at Burzahom to have occurred in the early third millennium BC (Pant et al. 1982).

Figure 19. Looking at a Harappan potsherd at 50cm depth (shown as No. 18 in figure 18) embedded in situ just below an edge-ground chopper (see inset also) in the trench at Jandori-6.

In the present case, the tools of Soanian tradition are discovered in association with ceramics in numerous sites in the Siwaliks. It is for the first time that the Soanian tools have been found in Harappan sites in the riverine plains neighbouring Siwaliks and are being inferred as contemporaneous to Harappan times. Though Prufer (1956) had first noticed such tools on the Dher-Majra Late-Harappan mound, he simply related them to de Terra and Paterson's terrace chronology and in a way assigned them a mid-Pleistocene age. At Bara also, the occurrence of Soanian tools in that Late-Harappan site went unnoticed by the earlier excavators (Sharma 1981). Furthermore, many new tool-types (like pitted cobbles, edge-ground tools, large core and flake cutting-tools etc) known from lithic sites elsewhere in the world conforming to mid-Holocene times, and found by us from mid-Holocene sites of NW sub-Himalayas (Soni *et al.* 2008; Soni and Soni 2009; 2010; 2011) were also not per chance encountered by the earlier workers in this region. The discovery of such tools in association with the ceramics of contemporary times on young tool-bearing terraces of River Satluj near Nangal dated from mid to late mid-Holocene (Soni *et al.* 2008, and the present paper), indicates the adoption of some expedient stone-technology by the hominines who had gathered in this region in those times.

From the foregoing one can also suspect whether the Soanian tools found at other places in the Northwestern sub-Himalayas and assigned ages much older than the onset of Holocene, were all that old. It is so because no one exactly knows about the earlier (older than Holocene) dates of this industry but young dates are confirmed at several places with sure mid-Holocene occurrence of these tool-types (our recent findings).

Figure 20. Enlarged view of the potsherd (a base of some Harappan vessel) No. 18 in figure 18.

Taking into account the typology of newly discovered tools and new dates assigned to them, one is also made to rethink about the typological classification and chronological setup of the lithic industries of the sub-Himalayas.

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