A flake-rich assemblage in buried state and in primary context in the NW sub-Himalayas

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A flake-dominated lithic assemblage fabricated on coarse-grained quartzite raw material and found in combination with some potsherds has been recovered from an excavation in north-western Indian sub-Himalayas. The excavated artefacts consist of thousands of fresh, unrolled, and mostly utilized flakes and flake-tools, which were found buried right from about 15 cm below the top to about 1.4 m depth, until the appearance of a clayey bed and the bedrock. This small site exists on an isolated bank of a tributary of Satluj river in Himachal Pradesh, where the raw material had been transported from elsewhere. Different large and small sized flakes and the debitage constitute the bulk of the material, while the cores and core-tools are quite few in the assemblage. Apart from some new tool-types, many artefacts also show signs of edge-grinding. Weathered potsherds mixed with the artefacts, including the edge-ground ones have been found deposited into the bottom of the trench, which points to the existence of a hitherto unknown flake-dominated Holocene lithic industry in the sub-Himalayas.

Keywords: Cores and core-tools, debitage, flakes, Holocene lithic industry, potsherds.

In the northwestern sub-Himalayan region of India, post-independence Palaeolithic investigations have traditionally followed the approach of de Terra and Paterson'. These authors were the first to report on the Mode 1 Soanian industry and its technological evolution based on terrace sequences of the Soan river in northern Pakistan. Researchers in the river valleys of the Satluj and Ravi (H. M. Saroj, unpublished), Beas-Banganga and Sirsa have relied upon the so called 'pebble-tool' tradition. No highly flake-dominated industry has ever been reported from this region, though the representation of flakes was found to increase in the Late Soanian assemblages. The flakes, wherever encountered, were considered to be a component of the heavy-duty assemblages (cores and core-tools), and the possible occurrence of any flake-intended lithic industry was usually denied. The interpretations of previous workers, generally relied on meagre collections of specimens made from unspecified surface contexts, and their sites were close to the geological occurrence of quartzite cobbles and rolled clasts. Large surface collections from well-documented areas have only recently been reported, and many of these collections have been made from sites situated away from the occurrence of raw material. Except for these later collections from OSL-dated terrace-surfaces, lithic assemblages with an older age limit have never been reported from the Indian sub-Himalayas, and as is generally felt, recovering stratified lithic assemblages from buried/sealed sites is very much required. This communication confronts these issues by presenting new data and makes interpretations on a flake-dominated assemblage mixed with potsherds from an excavated context, a rarity.

In a recent find, a huge collection of stone artefacts was made from the lowest remnant terrace of a sub-Himalayan stream 'Jandori-Di-Khad' (District Bilaspur, Himachal Pradesh). This site Jandori-6 (Jd-6 in Figure 1 at 31°20'7"N; 76°27'26.7"E) is on the left bank of the stream which is a fifth-order tributary of the Satluj river. All the artefacts in the assemblage were fabricated on water-borne rolled clasts and boulders of coarse-grained quartzite which do not naturally occur at or near the site, and were probably transported by the hominines from a distance of 3 km or so. The surface of the site is a highly tilted and tectonically deformed terrace of nearly 200 m² sub-triangular area, with its river-side edge 8 m above the present streambed (inset, Figure 1). The uppermost section of the planar portion of the terrace has varying depths (15–30 cm) of sandy clay underlain by the basal Middle...
Siwaliks sandstone rock. Totally 2104 lithic specimens were found at the surface of this site, of which around 95% were the detached pieces (mainly flakes) and the rest were flaked pieces. Such a high concentration of stone artefacts has not been obtained earlier in surface context from any site in northwestern sub-Himalayas. Some test pits covering about 12 m² area in the planar section of the site revealed artefacts only in their upper thin (~15 cm) soil layer. Then a trial trench of 1.5 m² horizontal area was excavated on the sloping surface of the terrace near the bottom of a cliff in its background (inset, Figure 1). The depth of the trench varied from 45 cm along its western (stream side) edge to a maximum of 1.8 m along its eastern (cliff side) edge. The excavated depth was non-uniform because of unevenly bulging sandstone bedrock. The upper 15–50 cm depth of the trench consisted of clayey alluvium, which sporadically contained some artefacts and potsherds. Below this clayey alluvium appeared a big assemblage of stone artefacts embedded compactly in a layer of varying thickness (Figure 2), followed again by clayey alluvium overlying the bedrock.

A total of 3502 stone artefacts fabricated on coarse-grained quartzite raw material were recovered from this small trench. Within this excavated assemblage, about 95% were the detached pieces as also was in the case of the surficial assemblage. From some portions of the terrace slope adjoining the position of the trial trench, many buried artefacts could have got exposed due to tectonic disturbances before the present times, and they probably spread down as a part of the colluvium up to the bank of the stream. These were the artefacts which were found in surface context or were recovered by us from the upper thin colluvial layer. The excavated and the surficial artefacts showed almost the same typological distribution, which implies that all these specimens could have once belonged to a single lithic assemblage. The artefacts found in the surface context were free from any calcium carbonate deposits (having been washed time and again by the torrential rains), while those excavated from the compact layer in the trial trench possessed medium to heavy salt deposition on them (a, f, g, l in Figure 3 A). Potsherds were found mixed with the artefacts (n, o, p, q in Figure 3 B and Figure 4), right from the top to the bottom of the trial trench, and some potsherds also showed signs of wheel-made pottery (n, o, in Figure 3 B). This pottery was apparently used by the fabricators of these artefacts and thus gives us a hint of the age of the industry. Though the maximum size of any flake from this site is 14.2 cm, about 45% of the excavated specimens is in the size range 0.6 to 5 cm, of which nearly 58% belongs to the debitage. A specific point worth mentioning about this assemblage is that around 15% of the total lithic specimens (surficial plus excavated) have smoothly ground edges (a, c, f, g, j, h in Figure 3 A). The presence of wholly or partly ground edges on the stone artefacts is a characteristic only of this site and a few nearby open-air sites. Such specimens are not heard of from any other hitherto reported sub-Himalayan stone-age site. The modified flake found in this assemblage are only slightly retouched and most of them have been shaped into tools without fine retouch, as the same was probably not possible or required. Flakes in the assemblage have as yet been broadly grouped and separated into Toth types (based on the presence and/or location of cortex on the flake), which gives a fair idea about the techno-typological nature of the assemblage. Type-1 and type-2 specimens from both the assemblages show medium to heavy edge-wear and most of the type-3
and type-4 flakes also show utilization marks. About 26% of the flakes are found in the form of sires (d, j in Figure 3A and i in Figure 3B), indicating that a hard-hammer percussion was employed in the knapping of the stones.

Figure 3. A. (a) Large type-2 flake having a ground convex edge. (b) Unifacial side-chopper. (c) End-flaked cobble with peripherally ground working edge. (d) Thicker type-2 sires with ground convex distal edge. (e) Unifacial elongate pebble-like core having a rectangular cross-section and one slightly ground edge. (f) Leaf-shaped type-3 flake with proximal edge ground to convex shape. (g) Type-3 blade flake having a ground distal edge. (h) Type-1 flake with straight ground distal edge. (i) Type-1 flake with a conchoidal proximal scar on dorsal surface. (j) Type-3 sires with a ground straight lateral edge. (k) Small sub-globular core with multiple facets. (l) Almand-shaped semi-burnt sand-stone cobble. B. (a) Point on a type-5 flake with a convex working edge. (b) Unifacial bi-ended point from borer with a central ridge on the ventral surface. (c) Utilized type-4 flake with a lateral borer. (d) Converging asymmetric blade on type-3 flake. (e) Dorsal surface of a haft able javelin point on a type-1 flake. (f) Prismatic blade-flake on a type-3 sires. (g) Two co-joining sires making a single type-1 flake. (h) Type-4 flake with a curved corner having an oblique tang. (i) Borer with a tang on a type-3 sires. (j) Elongate stone peg with a plane cortical base. (k) Small type-4 flake with a tang. (l) Small pyramid-like peg with plane square cortical base. (m) Borer on a small type-4 flake. (n), (o) Wheel-made potsherds from 85 cm depth. (p) Potsherds from 60 cm depth. (q) Weathered potsherds from 120 cm depth. (All the depths are measured from top of the eastern wall of the trench.)

About 12% of the flakes from the total assemblage of the site are found to have been further shaped into different tool-types. Blades and prismatic blades (d, f in Figure 3B), points, borer (b, c, m in Figure 3B) and other tools such as backed blades, knives, haft able arrowheads (e, Figure 3B) and flakes with lateral tangs (h, Figure 3B) are also slightly represented in the industry. The flaked specimens recovered from the trial trench consist of unifacial cores, core-scrapers, pyramidal cores, sub-globular cores (k in Figure 3A), pointed cores, core borer (e in Figure 3A), stone-punches, pointed pegs (j, l in Figure 3B) and core fragments, with many of them having smoothly ground edges. In all, 26 choppers of size up to 12 cm (b, Figure 3A) are found from this site, with 23 of them coming from the trial trench. The presence of many co-joining artefacts in the excavated assemblage (g in Figure 3B) and of flakes knapped from the same stone found in both the assemblages, adds to the integrity of this lithic-fabrication site.

Typically ground-edged specimens found in both the assemblages, and in situ finding of the weathered terracotta pieces throughout the depth of the excavated trench show that this site belongs to a single culture with temporal nearness of original human activities at the site. The presence of potsherds having marks of wheel-thrown pottery mixed with the lithic specimens (abundantly the flakes) shows that a typical flake-dominated stone-age industry flourished in the sub-Himalayan during Holocene (exact dates need to be confirmed with future work). This prehistoric Holocene industry, contemporaneous to the Meso/Neolithic times in the rest of the world, could be the immediate predecessor of the Indus valley civilization of north western India.

Environmental changes from a cold, dry phase during terminal Pleistocene to the warm, humid phase during Holocene could have resulted in population growth in the sub-Himalayan foothills. It appears that most of the
vast spreads of fresh and unrolled stone-artefacts, variously encountered in the sub-Himalayas in open-air context, could be the handiwork of hominines during these last phases.

It may not be out of context to mention here that recently, several Palaeolithic type stone artefacts were found by the present authors, from around the already excavated archaeological mound of Bara (5 km south of Ropar in Punjab plains), which also appears to underlie a geological formation (these artefacts have been deposited with the Superintending Archaeologist, Simla Circle, Simla, Himachal Pradesh, India). If similar stone artefacts also emerge in the stratified context therefrom, the presently identified Holocene lithic industry might telescope into the early Harappan stage.

This is just a preliminary report about a recent excavation which deems to initiate a new perception about sub-Himalayan stone-age research; a detailed article on this will be communicated elsewhere.

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Quantifying the underestimation of soil organic carbon by the Walkley and Black technique – examples from Himalayan and Central Indian soils

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Soil organic carbon (SOC) is an important indicator of soil quality and productivity. The present study focuses on the comparative evaluation of the ‘wet digestion’ and ‘oxidative combustion–infrared analysis’ methods for determination of SOC with examples from parts of the Himalayan and Central Indian soils. It is found that the commonly used wet digestion (Walkley and Black) method underestimates the SOC significantly. The study estimates a correction factor quite different from the standard adopted in most of the investigations. Considering the importance of SOC stock and dynamics being used as inputs in models predicting global climate change and future global carbon cycle, it is emphasized that appropriate correction factors need to be developed for Indian soils, and applied to the SOC estimates obtained from the Walkley and Black method to improve the accuracy.

Keywords: Oxidative combustion–infrared analysis, soil organic carbon, TOC analyser, Walkley and Black method.

The quantification of soil organic carbon (SOC) has recently attracted the attention of many researchers as it is the largest terrestrial carbon (C) pool in addition to be-

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