Introducing Kasohal: A Newly Discovered Palaeolithic Site in the Siwalik Frontal Range, Himachal Pradesh, India

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Abstract

The Indian Siwalik Hill is well-known throughout the Indian Subcontinent for producing abundant implimentiferous and fossiliferous sites. Acheulean and Soanian are the most prevalent Palaeolithic technologies in this region, with Acheulean being less common than Soanian. In the absence of absolute dates, lithic technology has been used to compare the Palaeolithic sites from a Chronocultural point of view. Recent fieldwork in Siwalik Frontal Range of Himachal Pradesh led to the discovery and study of Kasohal and the documentation of lithic assemblage variability, typo-technological traits, and raw material utilization. To better understand the dimensional variances, the lithic data from the site was compared with that of other lithic sites on the Indian Siwalik Hill. The study also focuses on local geology and geomorphology.

***Keywords*:** *Siwalik Hill, Kasohal, Seer Khad River Basin, Geology, Geomorphology, Lithic technology, Raw Material exploitation*

Introduction

The Siwalik Hill of the Indian Subcontinent offers archaeologists rich and diverse lithic evidence, which is represented by two distinct cultural traditions; the Ache lean and Soanian. The Acheulean assemblage is distinguished in this zone by the presence of hand axe and cleaver, whereas the Soanian assemblage is constituted chiefly of various types of core, chopper, discoid, scraper, and flake. The Palaeolithic evidence of this area is often characterized by open-air sites distributed in different eco-geographic zones and indicates diverse patterns of intra-regional mobility and land use. Most of this evidence is from the surface context and thus cannot be dated. Understanding changes during the Palaeolithic periods in the Indian Subcontinent is complex, making it difficult to place them within a chronological framework. With over 100 occurrences in various settings (Bain and Bezbaruah 2019: 25–29), the Indian Siwalik Hill is a significant zone for studying Palaeolithic assemblages in the Subcontinent. This paper discusses the Palaeolithic evidence from Kasohal, a newly discovered site in the Indian Siwalik Frontal Range, Himachal Pradesh. Primary objectives are (i) to introduce a new Palaeolithic site and (ii) to understand the site's lithic technology through typo-technological analysis. The study also looks into raw material availability and

exploitation to learn more about hominines' adaptability and cognitive abilities in North-West India, as well as disseminate new archaeological data for South Asian Palaeolithic archaeology.

Review of earlier studies in the Siwalik Frontal Range

In the Siwalik Hills, Wadia (1928: 39) reported the presence of hominines for the first time by discovering a few lithic artefacts by the Geological Survey of India. After a few years, a team of international scientists carried out the first extensive interdisciplinary study on the Quaternary deposits of India through the Yale- Cambridge expedition in 1935, which produced meaningful results for the Quaternary research in South Asia (De Terra and De Chardin 1936: 234; De Terra and Paterson 1939: 252-257). It quickly became a classic work of reference for all future prehistoric studies of the subcontinent. Indeed this team carried out explorations to explain their ideas about Indian Stone Age cultures (Bain 2020: 157). This study identified the lithic artefacts of the North-Western part of the subcontinent through a few cultural labels (Hawkes et al., 1934: 4; Movius 1948: 334-347; Soni and Soni 2017: 118) and firmly established their origins in the Middle Pleistocene (Dennell and Hurcombe 1993: 70; Chauhan 2007: 413-416). Graziosi's work (1964: 57) in the western sub-Himalayas was another important study that later attracted many scholars for different multidisciplinary investigations in this area. During the middle of the 20th century, the Archaeological Survey of India investigated several regions in the sub-Himalayas. It came up with various lithic localities which demonstrated the presence of hominines and provided a magnificent database for further prehistoric research in this part of the subcontinent (IAR 1954–55). Prufer (1956: 94-99) also found several Stone Age localities from the Pinjore-Nalagarh Dun area of Sutlej valley. While studying the Dun areas by the scholars, Soanian lithic remains were recovered from the Kangra (Lal 1956: 61-68; Joshi et al., 1978: 84) and Beas (Lal 1956: 75-79) valleys as well as from Sirsa terraces of Himachal Pradesh (Sen 1955: 178-180; Karir 1985: 159-166) for the first time. Sen's comparative study on the lithic industry of Nalagarh and the early Soanian assemblage of West Pakistan (1955: 181-183) showed a critical observation of the core and flake assemblages of the sub-Himalayas. Subsequently

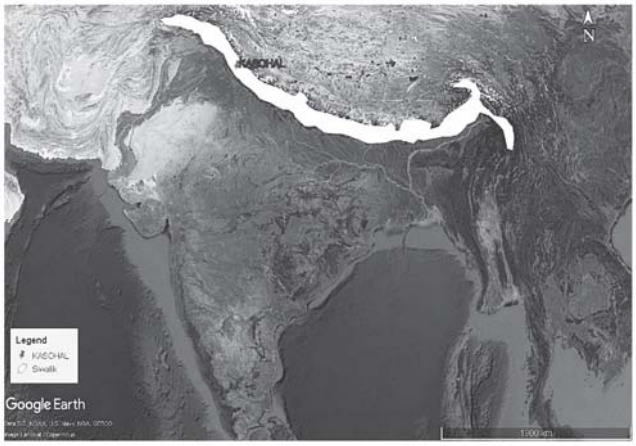


Figure 1: Map showing the position of Kasohal in the Siwalik Frontal Range (Siwalik Frontal Range has been marked with white colour. The map has been prepared through Google Earth).

various scholars and organizations started to focus on Himachal Pradesh, which produced a good number of prehistoric studies in different parts of this state and adjoining areas. These made a significant contribution to our knowledge of cultural remains of hominines (Khatri 1963: 162-167; IAR 1964; IAR 1965–66; 1968–69; 1969–70; Mohapatra 1966: 227, 1974: 211, 1976: 9-10; Mohapatra and Saroj 1968: 11-12, Sankalia 1971: 541-543 and Joshi et al. 1974: 85). Saroj (1974: 105-108) with a view to expanding the work of Yale- Cambridge expedition of 1935 at the valley of Kashmir, chose the area between the Chenab and the Ravi river. He examined the lithic remains of the Jammu region and classified the artefacts. Joshi (1975: 464-465; 1978; 90-92) extended his work in Markanda valley of Himachal Pradesh and found several core and flake implements. He studied and compared the lithic remained with other reported sites and suggested that there is no need to relate them with the cultural labels made earlier by de Terra and Paterson. His observation brought to light some important aspects of the cultural evolution of early man in North-Western India. In 1980 Mohapatra recovered the first Acheulean site in the Indian Siwalik Hills from Punjab, which provided important data on Acheulean hominines and their technological behaviours in Punjab plain (Mohapatra 1981: 233-235, 1990: 254-255). From the site Toka, Chauhan (2007: 230-236) recovered the highest collection of Soanian remains, which suggests tremendous technological diversity within the Soanian industry in Indian Siwalik Hills. A team of archaeologists under the Indo- French Prehistoric Mission 2009 explored the Siwalik Hills in Punjab (near Chandigarh) and recovered many Soanian localities, providing huge data on lithic artefacts and paleontological remains (Gaillard et al., 2016: 344-346). Though several works have been done in different parts of Himachal Pradesh, the prehistory of Bilaspur district remains unexplored. In this region, a few studies were conducted (Verma 1975: 518-521; Sharma 1977: 94-95; Prasad 1982: 101- 104; Sankhyan 1979: 360; 1983: 26; 2017: 63738-63740; Bain 2020: 159-164; Bain & Bezbaruah 2020: 3-9). The studies mostly reported paleontological remains and a few cultural remains from different Siwalik deposits at Haritalyangar and its surrounding areas. Despite almost a hundred years of investigations in the Siwalik region, our understanding of Palaeolithic industries in this area has remained poor. Most studies of the past relied on insufficient data samples and ambiguous terrace sequences, resulting in biased artefact collections and inconsistent interpretation (Bain & Bezbaruah 2019: 15-17).

Material and Methods

The study region comprises of the Seer Khad River Basin of Himachal Pradesh. It is part of the lower Sutlej valley of the same state and covers 107.07 km^2 (76.26°- 76.36° E and 31.22°-31.31° N). It comes under the Survey of India topographic sheet no 53A/11. River Seer Khad, a tributary of river Sutlej, and its streams have created this basin. Kasohal (31°28'49.16 N; 76°41' 40.87 E) comes under the Kasohal Village in Ghumarwin Tehsil (Figure 2). It is located 19 km north of the District headquarters in Bilaspur; 72 km from the State capital Shimla. Kasaru (3 km), Dadhol (3 km), Kothi (3 km), Ghumarwin (4 km) and Pater (4 km) are the nearby Villages to Kasohal. Kasohal is surrounded by Jhandutta Tehsil towards the South,

Bhoranj Tehsil towards the North, Bijhri Tehsil towards the west and Bilaspur Tehsil towards the South. Multiple transect surveys have been conducted along the Seer Khad, covering 26 km^2. The grid method (3m X 3m) is applied for systematic surface collection. During the field visit, various localized features were noted, such as, site distance from the riverbank; discreetness of the scatters; the association of the artefacts with the raw material blocks and such other techniques. The artefacts recovered are recorded at the site and were analysed in the laboratory with the use of the typo-technological method. Satellite imagery, and topographical maps were used for better understand of the geographical setting and features. The maps were created with the use of the ARC GIS- 9.3 software and data from the ISRO satellite were used. The ASTER DEM of 30 m resolution with Universal Transverse Mercator (UTM Zone 43) was used to generate topographical information, as well as to generate and calculate geomorphic indications of the basin using image processing and ARC GIS- 9.3 software. The primary terrain attributes, such as slope aspect, curvature (plain and profile), and topographic wetness, were computed from DEM. The lithic assemblages were analyzed using quantitative and qualitative attributes.

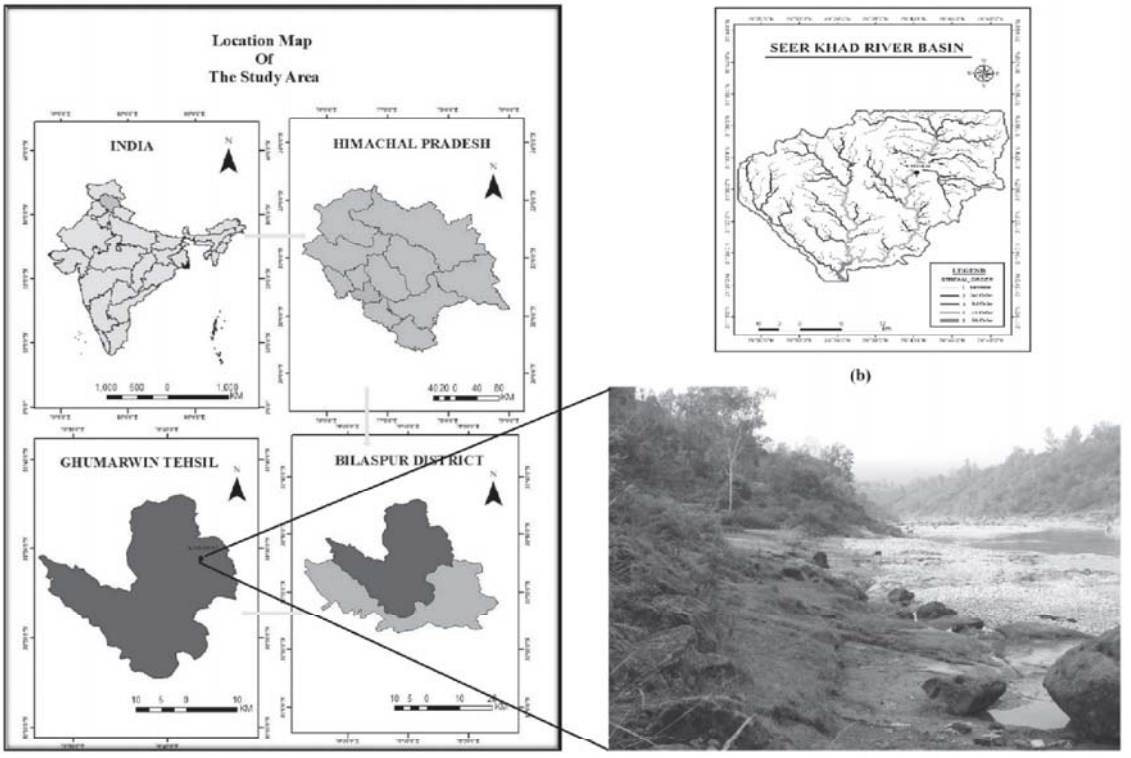


Figure. 2. (a) Location of Kasohal site in Gumarwin Tehsil of Bilaspur district, Himachal Pradesh (Source: ISRO Bhuvan). (b) Location of the site in the Seer Khad Basin (Source: ARC GIS- 9.3), (c) General view of the site.

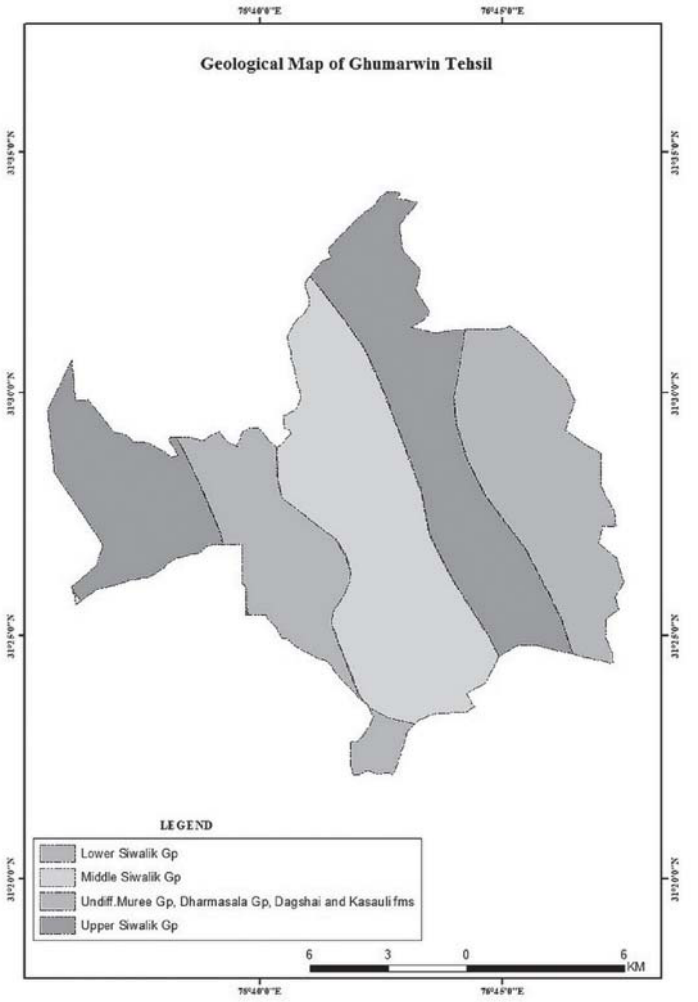


Figure 3: Geological settings of Ghumarwin Tehsil (Source- Bain & Bezbaruah, 2021).

Results

Local geology, geo-morphology, lithology and drainage system

Ghumarwin Tehsil comprises the Tertiary and Quaternary deposits of Siwalik and the unidentified Muree, Dharma–sala, Kasauli, and Dagshai groups of the Oligocene and Miocene periods (Bain & Bezbaruah, 2021: 7) (Figure 3).

The morphological land form map of the study area (Figure 4) provides categorical information about the studied locality, which comprises ten physical features. Many highly dissected hills and valleys were observed in the studied area. Some portions of the area are covered by moderately dissected hills.

The unconformity between Upper Siwalik sediments and post-Siwalik conglomerates is an important geomorphologic feature of the study area (Bain & Bezbaruah, 2021: 7). The rock types of the study area are granite, syenite, diorite, siliceous sandstone, quartzite, and volcanic rocks. The Sub-Himalayan terrain in this area is the uplifted Siwalik piedmont zone between the Lesser Himalayan slope on the east and the Boulder Conglomerate Formation on the west. These were deposited 1.8-1.1 million years ago (Valdiya, 1993: 875-877; Kumar et al., 2007: 10-13). The post-Siwalik Quaternary sedimentations resulted in the aggradations of two prominent Quaternary fans (Qf). The olderone is known as Qf-1 and the younger one as Qf-2 (Kumar et al., 2007: 14-16). The piedmont streams, which were formed at the foot of

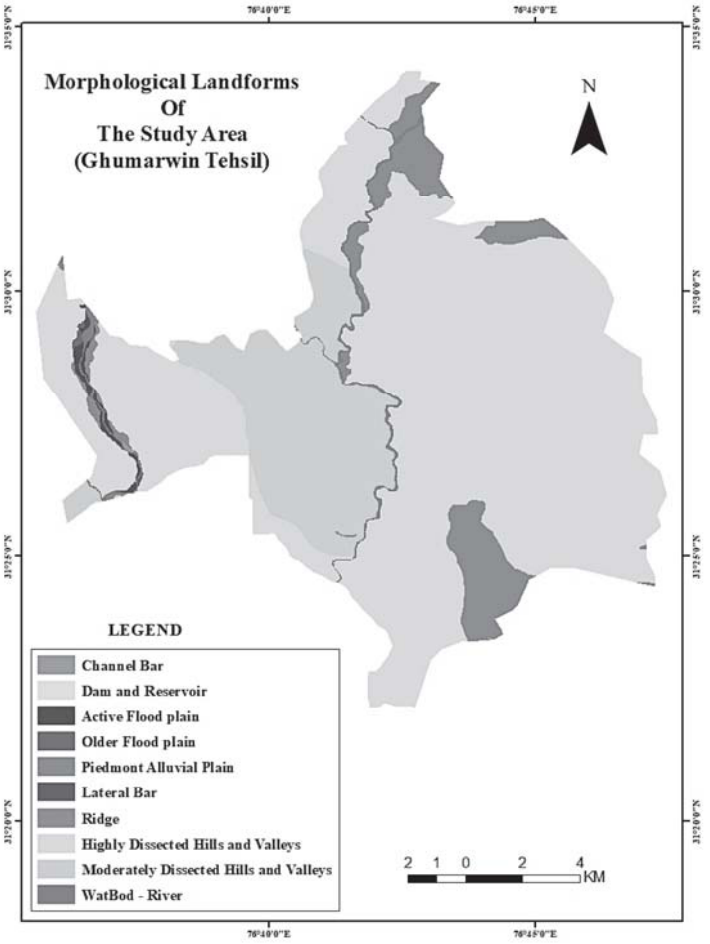


Figure 4: Morphological landforms of Ghumarwin tehsil (The data for preparing the map has been retrieved from ISRO RISAT –I satellite and the maps have been prepared through ARC GIS- 9.3 software).

hilly tracts by debris deposits, are the only feeders to the alluvial fans. The largest stream formed in the study area is the Seer Khad. The graded layers of boulders, cobbles, gravel, sand lenses, and silt in the Qf-2 section in the study area are roughly 3-4 meters thick. During fieldwork, various aspects of geomorphology have been studied and special attention has been given to exploring its outstanding features. Samples of sand, pebble, cobble, and boulder were collected from in and around the studied locality that yielded artefacts to ascertain their origin, mode of deposition, and paleo geographical conditions at the time of sedimentation. Several naturally exposed sections were observed during the field visit. The stratigraphy at the sections were composed of topsoil, followed by layers of brownish clay, shale, poorly sorted and crudely bedded conglomerate and boulder beds. The bedrock is of sandstone. The layers vary in thickness. Topsoil is displaced in some areas due to agricultural activity and the mining of sand, gravel, cobbles, and medium-sized boulders; exposing the pebbly gravel layer beneath. The gravels vary in size, mostly of quartzite, though there are some sandstone gravels. The elevation of the site is 598 m. The site's relief varies greatly from 452 to 1828 meters, due to local and regional tectonic conditions, depositional and nature of erosion, and denudation during the Pleistocene period (Figure 5). The Digital Elevation Model shows that the eastern side of the site is undulating and rough, while the slope on the South-East side is higher than the west side (Figure 6).

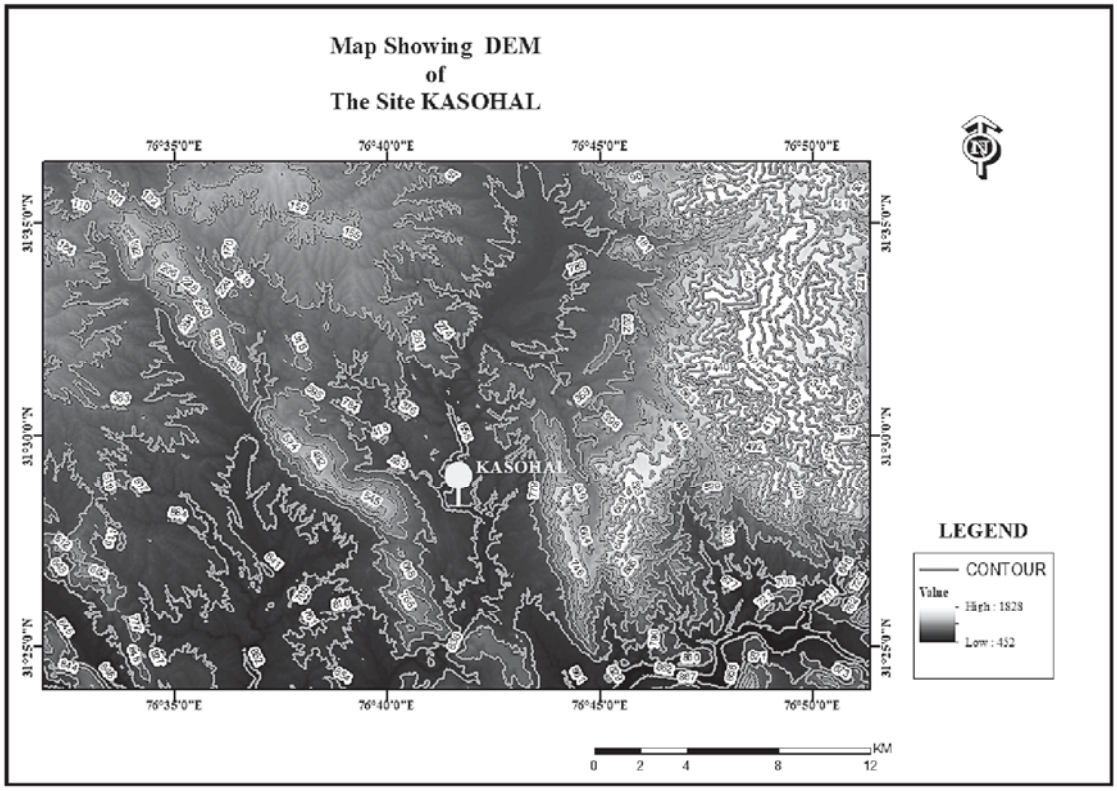


Figure 5: Digital elevation model of the region showing the studied locality (The data for preparing the map has been retrieved from ISRO RISAT –I satellite and the maps are prepared through ARC GIS- 9.3 software).



Figure 6: Sectional view of the studied locality (The data for preparing the map has been retrieved from ISRO RISAT –I satellite and the maps have been prepared through ARC GIS- 9.3 software).

The study area goes under the frontal slope of the Siwalik Hills of North-West India, is undulating, and contains fertile valleys and streamlets. The area falls in the humid subtropical zone, meaning annual rainfall varies between 1100 and 1400 mm. The principal river of the study region is the Seer Khad River, fed by streams originating from the sub-Himalayan foothills on the east; the Siwalik and the c*hoes* that rise from the Siwalik on the west. The basin's overall elevation ranges from 476 m at its lowest point to 1968 m at its highest point, and it contains the Barsar Thrust Fault and Folds, making it a tectonically active zone. The drainage basin area reflects the fluvial geomorphic cycle development from late youth to earth maturity. The present study delineated the stream order using Strahler's method (Strahler 1952: 225-230). Snow melt and monsoon runoff are the Seer Khad River's water sources. Seer Khad is associated with several small streams and *nullahs*. The streams bear flash flood release as a significant part of the precipitation is connected to monsoonal deluges. The Seer Khad River has a first to fifth-order basin and is characterised by a dendritic to the sub-dendritic river basin. To evaluate the magnitude of permeability and infiltration qualities in the analysed region, the greatest number of first-order streams was taken into consideration (Bain & Bezbaruah 2020: 14). Basin asymmetry (AF) implies that the basin is tilted to the east due to the existence of the Barsar Thrust and that tectonic upliftment is taking place in the basin. The basin elongation ratio (0.10) indicates tectonic activity. At the source, the basin has a concave value between 620 and 630 m, followed by elevation changes caused by active fault zone development around knick zones. This suggests that tectonics have significantly impacted the Seer Khad river course (Sharma et al., 2018: 408-411).

Palaeolithic assemblage

Exploration at the Kasohal has revealed 200 lithic artefacts (Figure 7), which have come from the surface context. Artefacts have been recovered from different locations such as river banks, dried river beds, and eroded hill slopes with a density exceeding ¯3 - 5 artefacts /m2. The grid method (3 m X 3 m) was applied to the systematic surface collection due to the differential density of artefacts. The investigators could not identify a few lithic pieces and mentioned them as unidentified. Lithic artefacts are further subdivided into various subtypes for analysis (Table 1). Quartzite cobbles and angular fragments have been used for manufacturing lithic artefacts. The primary source of quartzite is the local boulder-conglomerate formation observed near the study area ≤ 1 km North-West). At Kasohal, hominins used quartzite as fluvially- rounded clasts (cobbles (approximately 60-240 mm) and angular clasts of various colours. The colours were broadly divided into a shade of grey and black, a shade of white, a shade of red, a shade of yellow, and a shade of green. Fluvial clasts are formed by water continuously working on present rocks in rivers and streams abundant in the Seer Khad. Angular clasts are formed by colluvial activities that break down rocks into smaller angular pieces. They can be found in abundance at the foothills of the

nearby hilly tracts of the studied area. Kasohal stone tools were made from three different blank types. Fluvial transportation is the primary cause of weathering on artefacts in the study area, which is divided into four categories (Table 2).

Table 1: Kasohal assemblage composition with select attributes.

Types of Artefacts	*n*	%	Length (cm.)				Width (cm.)				Thickness (cm.)				Weight (kg.)			
			Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD
Core and core fragment																		
Single platform	3	1.5	15.3	13.8	14.56	0.75	13.8	9.7	11.83	2.05	12.3	11	11.63	0.65	1.10	0.83	1.01	0.15
Multi platform	6	3	16.8	11.3	14.26	1.13	15.7	8.9	12.86	3.03	13.6	5.6	10.43	3.12	1.3	0.97	1.13	0.15
Core fragment	7	3.5	16.2	7.7	12.07	2.81	14.6	8.9	11.21	2.03	11.7	4.9	8.11	2.06	1.12	0.69	0.84	0.13
Irregular discoid	4	2	11.3	7.1	9.62	1.79	8.9	6.9	8	1	5	3.2	4.1	0.73	0.36	0.14	0.26	0.09
Chopper																		0.04
Unifacial end	8	4	12.8	8.1	9.52	1.35	11.2	6.4	8.56	2.06	7.5	2.9	5.36	2.02	0.49	0.34	0.39	
Unifacial side	4	2	9.5	6.3	8.05	1.34	11.6	6.4	8.62	2.19	7.2	2.7	5.45	2.10	0.60	0.37	0.48	0.12
Unimarginal side	3	1.5	10.3	8.4	9.2	0.98	9.6	8.7	9.2	0.45	5.2	4.8	5	0.2	0.29	0.26	0.28	0.01
Irregular	3	1.5	10.1	9	9.56	0.55	7.6	6.4	7	0.6	5.2	4.6	4.86	0.30	0.36	0.33	0.35	0.01
Peak	10	5	17.5	10.8	13.79	1.96	10.8	5.9	8.01	1.54	7.1	3.6	5.17	1.07	1.30	0.31	0.52	0.28
Scraper																		
Lateral sided	22	11	12.2	5	8.11	1.73	15.2	3	6.67	2.79	4.7	1.5	2.90	0.86	0.73	0.02	0.21	0.15
Double sided	7	3.5	15.2	5.1	9.77	3.84	8	5.5	6.92	0.80	4.6	1.9	3.01	0.95	0.55	0.05	0.34	0.18
Peripheral	10	5	18.8	6.3	10.61	3.78	15.1	4	7.83	3.23	5.7	1.6	3.41	1.31	1.57	0.06	0.40	0.46
Sub- peripheral	2	1	9.9	6.1	8	2.68	7.3	5.6	6.45	1.20	5.4	2.3	3.85	2.19	0.20	0.07	0.13	0.08
Flake																		
Unretouched	35	17.5	12.3	4.3	7.25	1.60	7.9	3.3	5.54	1.15	4.8	1.3	2.69	0.86	0.32	0.01	0.14	0.07
Retouched	38	19	15.5	4.9	8.65	2.54	14	3.4	7.82	2.67	5.2	1.1	3.06	0.96	1.05	0.03	0.26	0.22
Split cobble	14	7	9.8	6.1	7.37	1.22	8	4.1	5.57	1.14	4.6	1.9	2.98	0.84	0.31	0.06	0.19	0.07
Broken artefact	8	4	11.3	6.8	8.76	1.49	6.2	4.9	5.63	0.51	4.6	3.1	3.6	0.46	0.68	0.22	0.39	0.13
Unidentified piece	16	8	15	6.4	9.18	2.15	8.4	4.2	6.39	1.11	5.1	2.7	3.88	0.69	0.53	0.27	0.36	0.07

Table 2: Percentage of types of preservation of the artefacts

Tyepe of Preservation	**n**	**%**
Fresh	19	9.5
Silghtly weathered	28	14
Moderately weathered	66	33
Heavily weathered	87	43.5
Total	**200**	**100**

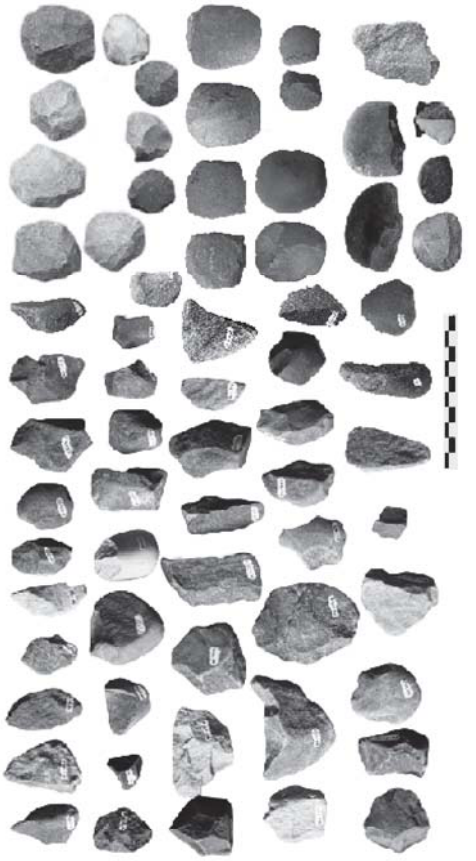


Figure 7: Lithic artefacts from Kasohal.

Core and core fragments

Cores (n= 9) in the Kasohal assemblage clearly show a cortex patch on the surface, indicating that they are river cobbles or boulders (Figure 8). Technologically, they are divided into two categories: single platform core and multi platform core. The mean values for the length, width, and thickness of single platform core and multi platform core are 14.56 X 11.83 X 11.63 cm (L X W X T) and 14.26 X 12.86 X 10.43 cm (L X W X T), with the largest core being 16.8 cm in length. The mean weights of these two types of cores are 1.01 kg and 1.13 kg (Table 1). Angular fragments and chunks represent core fragments. The artefact was manufactured using both sides struck and end struck flakes. The dorsal face of the specimens is variable: It is either without a cortex or little cortex. The length, width, and thickness of core fragments vary between 16.2 cm- 7.7 cm (mean- 12.07 cm; SD- 2.81), 14.6 cm- 8.9 cm (mean- 11.21 cm; SD- 2.03), and 11.7 cm- 4.9 cm (mean- 8.11 cm; SD- 2.06) (Table 1).

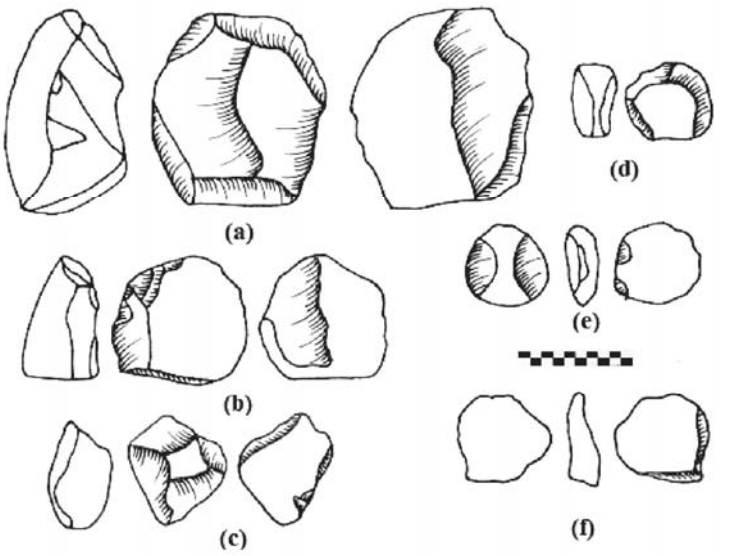


Figure 8: A variety of cores on different kinds of quartzite clasts.

Irregular discoid

Discoids are circular residual cores formed by varying numbers of flake scars. The flake scar direction in the irregular discoid type (n= 4) shows converging, semi-converging, and non-converging ridges at the center (Figure 9). The artefacts vary in length, width, and thickness, ranging from 11.3 cm-7.1 cm (mean- 9.62 cm; SD- 1.79), 8.9cm- 6.9 cm (mean- 8 cm; SD-1), and 5 cm- 3.2 cm (mean- 4.1 cm; SD- 0.73).

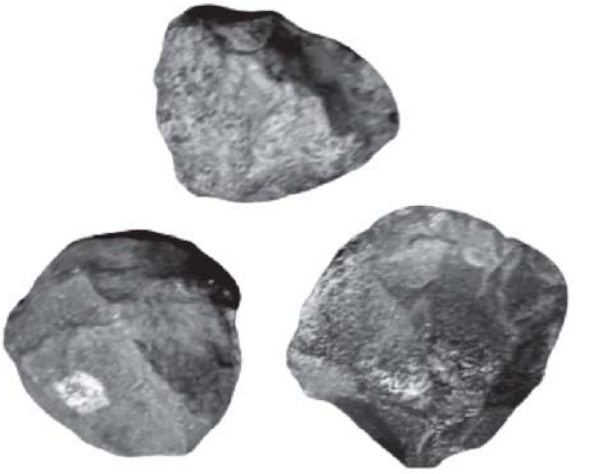


Figure 9: Recovered irregular discoids from Kasohal.

Chopper

At Kasohal, 18 choppers were discovered. These are made of whole cobbles, as well as split cobbles, broken cobbles, and flakes. Choppers on split cobbles indicate that the knapper obtained the blanks by splitting the cobble on the anvil in half. The authors used a

hammerstone to obtain two half-split pebbles in an experimental study on the cobbles. The choppers' edges are sometimes sharp and not blunt. There are four types of choppers: (i) unimarginal side chopper (n= 3), (ii) unifacial end chopper (n= 8), (iii) unifacial side chopper (n= 4), and (iv) irregular choppers (n= 3). The mean measurements are 9.52 X 8.56 X 5.36 cm (L X W X T) for the unifacial end chopper, and the largest is 12.8 cm in length (Table 1& Figure 10). For the unifacial side chopper, the range of length, width and thickness vary between 9.5 cm- 6.3 cm (mean- 8.05 cm; SD- 1.34), 11.6 cm- 6.4 cm (mean- 8.62 cm; SD- 2.19) and 7.2 cm- 2.7 cm (mean- 5.45 cm; SD- 2.10). Unimarginal side-choppers are oval to semi-rounded in form and composed of cobble pieces or broken cobbles. Irregular choppers are amorphous and do not fit into any of the above-mentioned chopper categories. A high number of broken choppers (n= 12) have been recovered during the study. Breakage was largely found along with the proximal end (n= 7). A moderate number of choppers (n= 5) had broken edges. Few complete choppers (n= 6) have been recovered (Table 3). A closer view of the breakage exhibit shows that these are not recent. The breakage part also exhibits patination on both surfaces (dorsal and ventral).

Table 3 : Chopper types with their broken areas

Chopper types	Parameters	No	Percentage value
Unifacial end	Broken (Proximal end)	3	16.66
	Broken (Edge)	2	11.11
	Complete	3	16..6
Unifacial side	Broken (Proximal end)	1	5.55
	Broken (Edge)	2	11.11
	Complete	1	5.55
Unimarginal side	Broken (Proximal end)	1	5.55
	Broken (Edge)	1	5.55
	Complete	1	5.55
Irregular	Broken (Proximal end)	2	11.11
	Broken (Edge)	0	0
	Complete	1	5.55
	Total	18	100

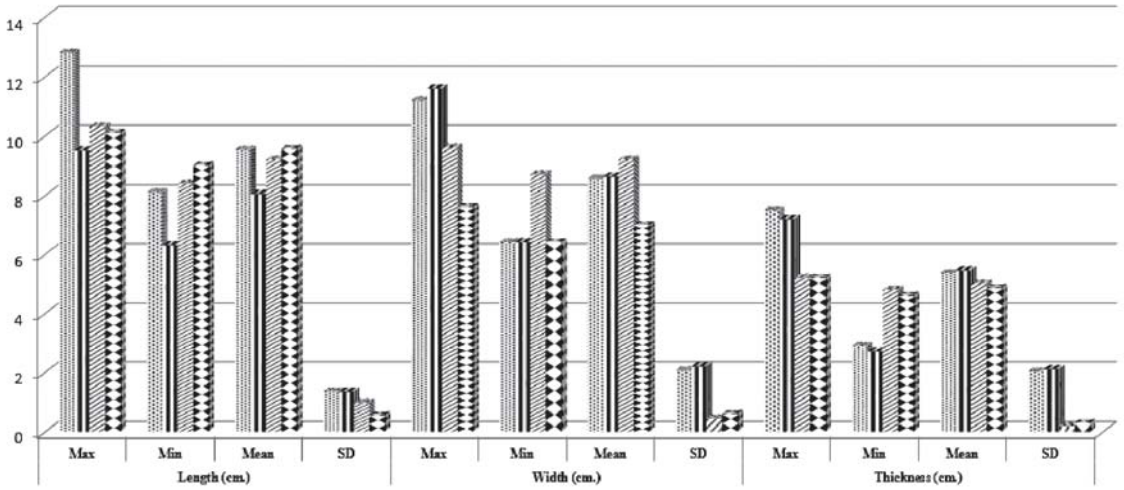


Figure 10 : Dimensional attributes (maximum, minimum and average of length, width, and thickness) of chopper types.

Pick

There are ten (n= 10) picks in the Kasohal assemblages. These are angular flakes and are blank types for manufacturing picks (Figure 11). Though the artefacts are rolled in nature, some flake scars are noticed on the surfaces of the tools. The mean measures are 13.79 X 8.01 X 5.17 cm (L x W x T) for the picks, and the largest is 17.5 cm in length. Six of the artefacts have approximately 25-50% of the surface as cortex. The majority of the picks are unifacial in nature, with no ventral surface modification. Pick weights range from 1.30 kg to 0.31 kg, with a mean value of 0.52 kg (Table 1).

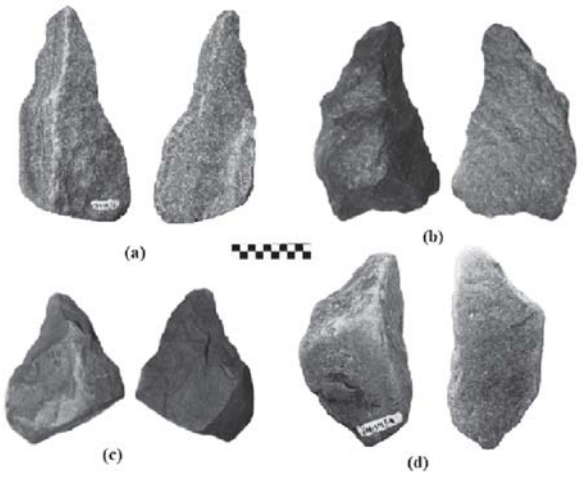


Figure 11: Recovered picks from Kasohal.

Scraper

The assemblage contains 41 scrapers (Figure 12), which are classified into four groups: lateral sided scraper (n= 22), double sided scraper (n= 7), peripheral scraper (n= 10), and sub-peripheral scraper (n= 2). They are fashioned on flakes. This type of artefact was made on thick, broad, pear-shaped, and more or less rectangular quartzite flakes. The most common

type of scraper is the lateral sided scraper. The maximum length of 18.8 cm is found in the peripheral type of scraper and minimum length of 9.9 cm is found in sub-peripheral type of scraper (Table 1 & Figure 13). Lateral-sided scrapers (n = 30) have a lateral working edge parallel to the longitudinal axis. A few scrapers (n = 7) have a concave working edge made by deliberately removing flakes, whereas double-sided scrapers (n = 8) have two working ends produced by the intersection of primary flaking. The peripheral scraper is roundish or oval in form and has a sharp working edge that spans almost the entire diameter of the flakes of the distal end. The dorsal surfaces of the artefacts are thoroughly prepared by removing flakes with steep flaking.

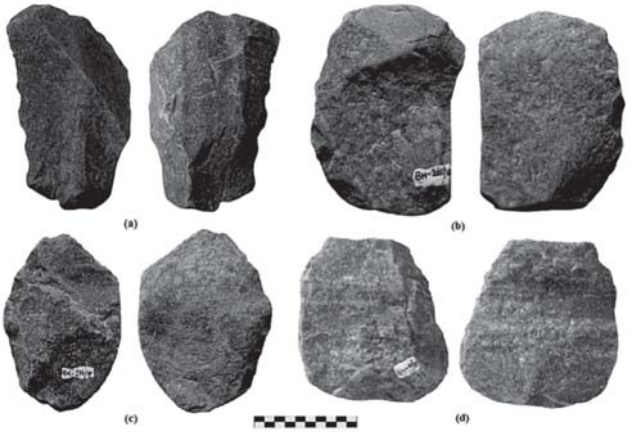


Figure 12: Scrapers from Kasohal.

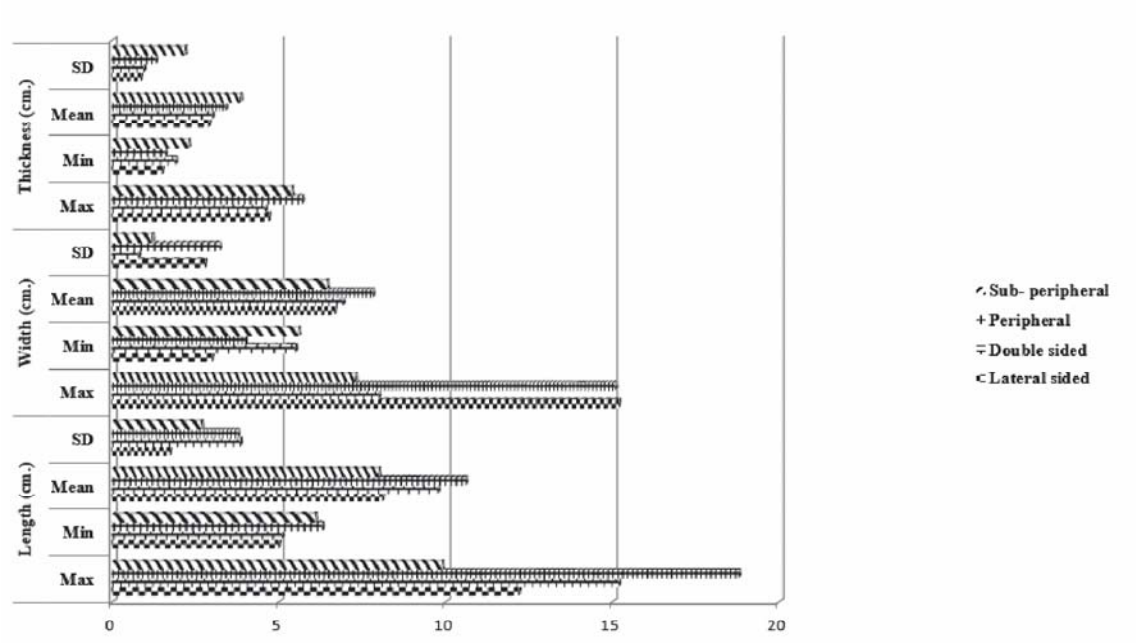


Figure 13: Dimensional attributes (maximum, minimum and average of length, width, and thickness) of scraper types.

Flake

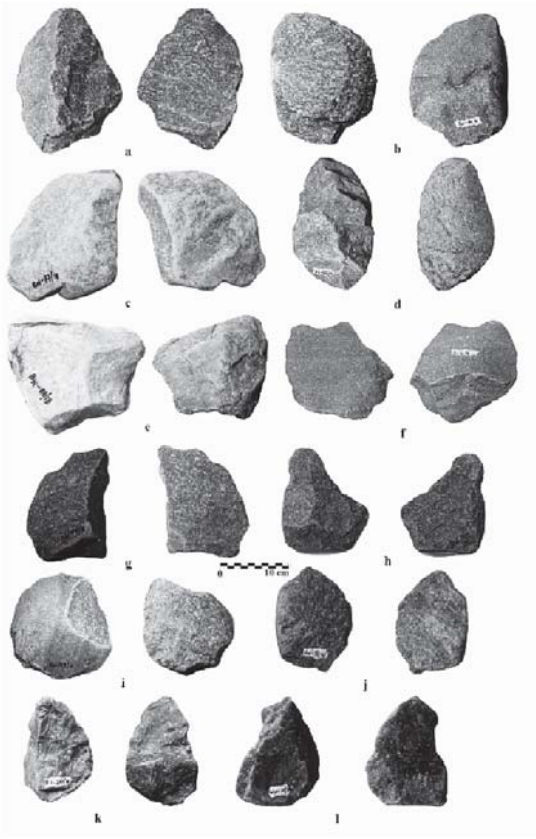


Figure 14 : Diverse flake types from Kasohal

This group contains 73 artefacts (Figure 14) and has been typologically categorized as retouched (n= 38) and unretouched flakes (n= 35) and technologically divided into side struck and end struck flakes. The dorsal portion of some flakes is partially to completely cortical. Three types of striking platforms, namely, flat (n= 47), complex (n= 11) and abraded (n= 15) are found on the flakes (Table 4). The mean measurements for unretouched and retouched flakes are 7.25 x 5.54 x 2.69 cm and 8.65 x 7.82 x 3.06 cm (L x W x T). The maximum length and thickness is found in retouched flakes (15.5 cm and 5.2 cm) (Table. 2). The majority of flakes (n = 58) have a cortical dorsal surface, but a handful of the flakes (n= 6) have cortexon both ventral and dorsal surfaces. The striking platform of the flakes is sometimes cortical. The shape of the cortex at the striking platform indicates that flakes were split from cobbles. Retouching is found on various sides of the artefacts (Table 5). The number of flake scars on the dorsal surface ranges between 2 and 9, while those on the ventral surface range from 1 to 4. The range of edge angles of both unretouched (97°- 130°) and retouched flakes (91°- 119°) of the Kasohal show similarity with adjoining localities of the Siwalik Frontal Range (Table 6). 19 flakes were broken, probably due to high energy fluvial or anthropogenic activity.

Table 4 : Platform types of the flakes

Type of platform	n	%
Flat	47	64.38
Complex	11	15.06
Abraded	15	20.54
All Total	73	100

Table 5. Number of sides retouched flake

Side	No of flake scars
Left side	5
Right side	2
Left and right side	8
Dorsal end	4
Proximal end	3
Dorsal end and proximal end	2
Left side and dorsal end	4
Left side, right side, and dorsal end	6

Table 6. Edge angle of the flakes from different sites of Siwalik Frontal Range

Artefact type	Site	Range	Average	Reference
Unretouched flake	Khoiwala, Himachal Pradesh	75^0- 112^0	95^0	Karir, 1985
	Marhanwala, Himachal Pradesh	90^0- 118^0	108^0	
	Baddi, Himachal Pradesh	104^0- 112^0	108^0	
	Sandholi, Himachal Pradesh	102^0- 111^0	107^0	
	Nalagarh, Himachal Pradesh	103^0- 107^0	105^0	
	Dhang, Himachal Pradesh	104^0- 122^0	115^0	
	Dabhar, Himachal Pradesh	105^0- 109^0	107^0	
	Dagah, Jammu	100^0- 122^0	Not available	Saroj, 1974
	Kasohal, Himachal Pradesh	97^0- 130^0	108^0	Present study
Retouched flake	Khoiwala, Himachal Pradesh	88^0- 99^0	94^0	Karir, 1985
	Marhanwala, Himachal Pradesh	103^0- 123^0	112^0	
	Sandholi, Himachal Pradesh	93^0- 122^0	108^0	
	Nalagarh, Himachal Pradesh	107^0- 123^0	111^0	
	Dhang, Himachal Pradesh	83^0- 105^0	95^0	
	Dabhar, Himachal Pradesh	89^0- 109^0	99^0	
	Dagah, Jammu	91^0- 114^0	Not available	Saroj, 1974
	Ambran, Jammu	81^0- 132^0	Not available	
	Kasohal, Himachal Pradesh	91^0- 119^0	101^0	Present study

Split cobble

The lithic assemblage reveals that some cobbles were split into two parts before being turned into cores, with remnants of flat or slightly convex surfaces in between. The length of the split cobbles spans from 6.1 cm to 9.8 cm, with a mean of 7.37 cm.

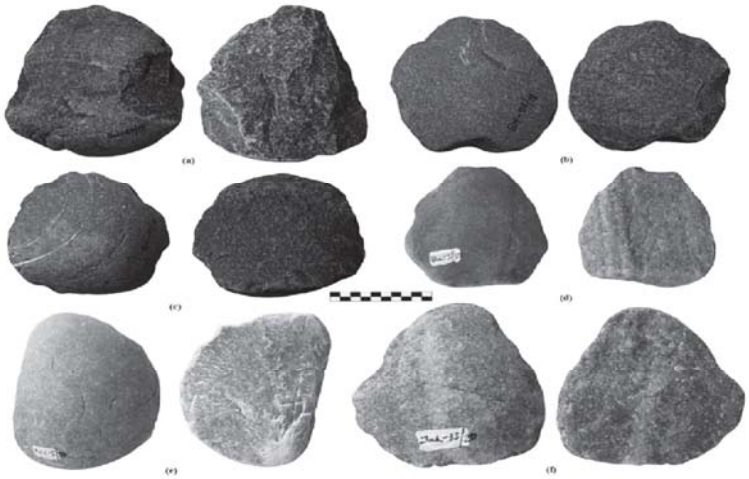


Figure 15 : Split cobbles from Kasohal.

Broken artefacts

It is worth mentioning that the notable feature in the Kasohal assemblages is the broken artefacts (n= 8), which is indicative of high-energy river activity. Due to ongoing developmental work in the study area, some of the artefacts broke, even though they are fresh (Figure 16).



Figure 16 : Occurrence of broken artefact from the surface in the study area.

Unidentified piece

Occurrence of geological clasts that look like lithic implements (n= 16)are a critical observation made during the field study. These clasts were most likely formed by high-energy contexts or the exfoliation process. High fluvial energy can lead to natural flaking that rolls, cores, and flakes in the gravel context (Chauhan, 2009: 100-103).

Comparison of the dimensional attributes of the recovered artefacts of Kasohal with other reported sites of Indian Siwalik Hills

To explore the variations in dimensional attributes of Kasohal tool types with other lithic sites in the Indian Siwalik Hills, the investigators compared their data with other earlier reported sites, which have yielded similar tool types. These are Baddi, Marhanwala, Dhang (Karir, 1985); Atbarapur (Gaillard et al., 2008: 5-7); Toka (Chauhan, 2007: 222-229); Masol (Gaillard et al., 2016: 345); Bhapral (Bain & Bezbaruah, 2020); Bam (Bain & Bezbaruah, 2021: 9-11) and Ghumarwin (Bain & Bezbaruah, 2022: 17-18). Three variables are considered, namely, range, average, and SD of artefacts' length, width, and thickness. The authors have found that the dimensional attributes of the tool types of Kasohal progressively vary in length, width, and thickness with the above mentioned sites. The authors have also found that the dimensional attributes of the irregular discoids of Kasohal differ gradually in length, width, and thickness when compared with the Bhapral, Bam, and Ghumarwin sites of the Siwalik Frontal Range. Regarding chopper and scraper, the authors discovered an intriguing contrast between the Kasohal tool types and the sites mentioned above. The average length, width, and thickness of the Kasohal picks are greater than those found at Bam and Bhapral. The average length and thickness of the unretouched flake of Kasohal are less than those of Bam, Bhapral, and Ghumarwin but greater than those of Baddi, Marhanwala, and Dhang. The retouched flakes of Kasohal is less than Bam and higher than other sites in terms of its average length. The average thickness of retouched flake of Kasohal is less than Bam, Bhapral, and Ghumarwin but greater than that of Baddi, Marhanwala, and Dhang.

Conclusion

The paper highlights a new Palaeolithic site in the Indian Siwalik Hills. Kasohal lithic assemblages comprise core, flake, discoid, chopper, and scraper elements, which are diagnostic of North-West India's core and flake lithic traditions. The Kasohal assemblages, like other Palaeolithic sites in the Indian Siwalik Hills, are associated with the same surface occurrences. Kasohal has a single cultural horizon, which may imply a temporally constrained occupation, although this must be proved by sedimentary and geochronological studies. The preliminary results here highlight lithic occurrence at Kasohal as an evidence of Palaeolithic culture in the Seer Khad River Basin. The Kasohal lithic assemblages replicate the general Palaeolithic occupational behaviour observed elsewhere, in which Palaeolithic hominines preferred permanent sources of water in the form Seer Khad River and its small streams; and raw material for stone tool making from the post-Siwalik depositions present in the study area. The typo- technological analysis of the Kasohal artefacts and their comparative study with other Palaeolithic sites of the Siwalik Frontal Range presented in this paper would aid in further refinement of regional comparative studies in orderto determine the nature of change that took place in the Siwalik Frontal Range during the post-Siwalik period. In future,

multidisciplinary research and excavations at Kasohal will be required to learn more about the technology and behaviour of the hominines of this region.

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