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A Study of Microlithic Assemblage from Kalangapali Site, Middle Ong Valley, Odisha, Eastern India

Kshirasindhu Barik[1], Tosabanta Padhan[2], Sudam Jhankar, Biswaprakash Mishra and Sima Rani Nayak

[1]Dept. of History, Sambalpur University

[2]School of Historical Studies, Nalanda University

Contact E-mail: kshirasindhubarik2@gmail.com, tpadhan@gmail.com

Abstract: *Microliths are widely distributed throughout the various parts of Eastern India. The present paper tries to study microlithic assemblages of the western highlands of Odisha with special reference to the Kalangapali site, located in the Bargarh district of Odisha. This paper is focused on the detailed analysis of the lithic assemblage, stratigraphic contexts, raw material utilization, and site exposure pattern and other related areas of research. The microlithic sites in the area have been reported with the use of numerous varieties of raw materials like chert, quartz, and agate for microlithic tools production. In this context, one of the interesting findings of this site shows microliths associated with pebble tools also known as heavy-duty tools, in a stratigraphic context that is generally confined to limited sites in Odisha.*

Keywords: *Pleistocene, Microlith. Lithic analysis, Pebble tools, Ong River, Odisha, Eastern India*

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Introduction

Microliths are found commonly in various parts of the world during the late Pleistocene epoch in different geographical and temporal settings (Brown et al. 2012, Neely 2012). Microliths are generally associated with the emergence of modern humans characterized by the use of Microlithic tool kits, frequent use of heat treatment for making lithic artifacts, finding of both mobile and parietal art, large scale exploitation of both small game hunting and fishing, strong intercommunications, trade, exchange and the colonization of new geographical regions which successfully support the Microlithic technology (Padhan 2021).

These factors indicate the advanced cognitive abilities of modern humans. The recent dates of microliths from Africa have pushed back the timeline of microliths to 71,000 B.P. The findings from

Pinnacle Point Cave are dominated by bladelet tools and the use of heat-treated stone tools (Brown et al. 2012). In South Asia, microliths are widely distributed and the Mehtakheri site in Nimar District of Madhya Pradesh in central Narmada basin yielded an early date of 45,000 BP (Mishra et al. 2013). In Eastern India, new evidences of the early occupation of Microlithic population in Ayodhya hills in Kana and Mahadebbera in Purulia district of West Bengal has been dated to 42-25ka (Basak et al. 2023). Jureru valley in South India has been dated to 35,000 BP (Clarkson et al. 2009). Recent findings in Sri Lanka Microlithic industries are characterized by evidence of symbolic behaviour, long-distance contacts, advanced bone tool technology, and hominin fossils evidences are dated between 45,000-48000 BP (Lewis et al. 2014, Roberts & Petraglia 2015, Robert et al. 2015, Wedage et.al 2019). In relation to the Microlithic occurrences in Odisha, it finds a special mention as hundreds of sites have been reported from various geomorphological contexts with varied natures of lithic assemblages. The current paper aims to highlight the large density of microlithic sites in the hilly and riverine landscapes of Western Odisha. The Mahanadi, a major drainage pattern in the state with wide networks of tributaries, has been witnessed as the most preferred area for the occupation of early hunter-gatherers settlements. The availability of suitable stable plants, animal food sources along with water resources was a prime factor for the continuous colonization of the area. In this context, Kalangapali, a stratified Microlithic site located in the Bargarh district of Westen Odisha, has been considered for a detailed study. The analysis of the lithic assemblage aims to understand the site from various perspectives.

Previous Work in the Study Area

Prehistoric explorations conducted in Odisha have brought to light more than 400 microlithic sites in different parts of the state, specifically in the western highland of Odisha (Padhan 2017). The Mahanadi and its major tributaries in western Odisha, such as Ong, Jira, Jonk, Tel, and Suktel their tributary have brought to light several open-air sites in primary and semi-primary contexts. Microliths are widely distributed throughout the Bargarh upland and artefacts are made from various types of raw materials such as chert, quartz, quartzite, silicified, sandstone, chalcedony, agate, jasper, quartz crystal, etc. (Tripathy 1970, 1972, 1973, 1977, 1980, Panda 1996, 2016, Seth 1998, Patel 2002, Thakur 2015, Padhan 2014, Padhan 2017, Behera et al. 2015, Thakur & Behera 2015, Behera & Thakur 2018, Behera et al. 2020, Barik & Sabale 2021, Behera & Barik 2022, Barik 2022).

The exploration carried out by (Tripathy 1970; 1972) in the upper reaches of Ong river, was reported with microlithic without chopper and chopping lithic assemblages. Later work carried out by (Panda 1996) reported 17 microlithic sites without the association of chopper or chopping tools, which also popularly called as pebble tools or heavy-duty tools. The foothill and pediment regions of the Bargarh uplands, covered by the Jira River and its catchment area, as well as the middle and lower stretches of the Ong River, lack evidence of pebble tools (Behera et al. 2017). Although survey conducted by T. Padhan in the Middle Ong basin has reported pebble tools predominantly consist of two types: choppers and flakes. Further, he noted that pebble tools/heavy-duty tools were found in localities such as Dunguripali and Katapali sites with large numbers of cores and flake pebbles tools associated with Microliths (Padhan 2017). Earlier heavy-duty tool components have been known from the Middle Mahanadi Basin (Ota 1986, Behera 2006), the Tel River Basin (Tripathi 1980), and the Baitarini Basin in Keunjhar (Mohanty 1989). In Odisha, the variety of heavy-duty lithic tools includes choppers (both unifacial and bifacial), core scrapers, picks, knives, limaces, and flakes (Mohanty 1993: 207-232). It is suggested that these tools were likely utilized for the extensive exploitation of forest resources and woodworking activities (Mohanty 1989, 1993: 207-232, 2000: 114-152). During the author's survey in the southern Bargarh upland in the Middle Ong Valley the author came across a few sites where microliths are found associated with pebble tool components (Barik 2022). The pebble tools are mostly prepared on the quartzite pebble and cobble collected from the river bed.

Physical Setting of the Study Area

The Bargarh upland is divided into two parts, i.e., the Northern Bargarh upland and Southern Bargarh upland, which are dissected by the river Jira (Singh 1993). Jira River drains the Northern part and the Southern part is drained by the Ong River. The site of Kalangapali (hereafter, KLP) (Latitude: 20.991671 N, Longitude: 83.318275 & Elevation- 180 amsl) is located 3 km north of Gaisilat block of Bargarh district and lies 32 km east of sub-divisional headquarter, Padampur, and 66 km south of the district headquarter, Bargarh **(Figure-1)**. The site is situated between Latitude 20.9856, Longitude 83.3267, and approximately 157 meters above mean sea level. Accessible via a tar road from Gaisilat-Naogaon village, a right turn onto a mud road lead directly to the KLP site, located on the right bank of the Ong river **(Figure-2)**. The site is located 1.5 km north of the Kalangapali village and 800 meters downstream from the Ghuchepali dam on the right bank of the Ong river.

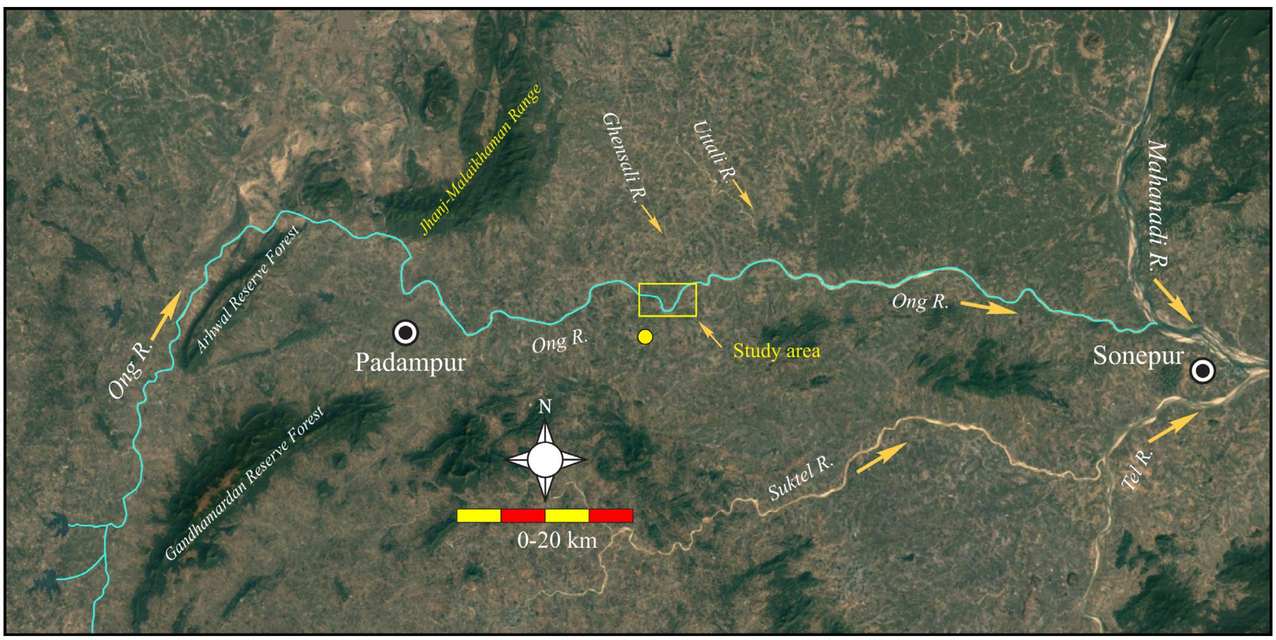

Figure 1: Satellite view and location of Kalangapali site.

The artifacts were collected from the freshly exposed/erosional rill and rain gully in the primary/semi-primary sedimentary context **(Figure-3)**. Artefacts are found in fresh mint conditions. The lithic remains are exposed on the surface, spanning an area of **800 square meters** and found concentrated in small clusters. For a detailed techno-typological analysis, artifacts were randomly sampled from a **200 square meters** area. A variety of artifacts; i.e. flakes, blades, bladelets, and pebble tool components, are recovered from the site.

Geology and Geomorphology

The investigated area can be found in the Survey of India toposheet no 64 P/5. The middle Ong valley geologically comprises of (i) cratonic segment in the north occupying a flat to slightly undulating terrain covered with soil, intercepted by small mounds and hillocks **(Figure-4)**. It is represented by granite gneiss intruded by dolerite dykes, (ii) Eastern Ghat granulites forming folded hills and intermittent valleys towards the southern part. The formation belong to Eastern Ghat Mobile Belt and are represented by khondalites, calc-silicate, amphibolites and granitoids. (iii) Gondwana formations occurring in between Eastern Ghat Mobile Belt and cratonic gneiss occupying a linear fault bounded basin, which include feldspathic sandstones and olive shale. (iv) Anorthosite pluton intruding the Granulites in the south eastern sector of the area covering flat to low-lying terrain (Rath & Sahoo 1999, Mishra & Patel 2001). Geomorphologically, the middle Ong basin can be divided into three physiographic units such as (i) the hill ranges comprising Chhatisgarh sedimentary formation in the northern part and Eastern ghat metamorphics in the southern part, (ii) flat, soil covered terrain composed of Bastarcraton gneisses and (iii) a narrow tract of mounds formed by Gondwana, occupy the central part of the area. The hilly area is generally covered with forest, which includes Mahul, Sal, Asan, Cher, Bija, Bamboo, etc. Besides, medicinal plants are in plentily available in the nearby hills. Mango, Mahul, Jack-fruit, Neem, Harida, Bakul, Amla, Bel and Berries etc., are found in the plain terrain. The fauna includes Jackles, Rabbits, Snakes, Leopards etc. The climate is extremely very dry, with mercury reaching 48° c during Summer and dropping to <10° c during Winter (Singh 1971).

Lithic Assemblage

A total number of 470 artifacts were collected from the site, out of which core comprises nos-40 (8.51%), flake nos-291 (61.91%), blade nos-26 (5.53%), bladelet nos-18 (3.83%), chopper nos-12

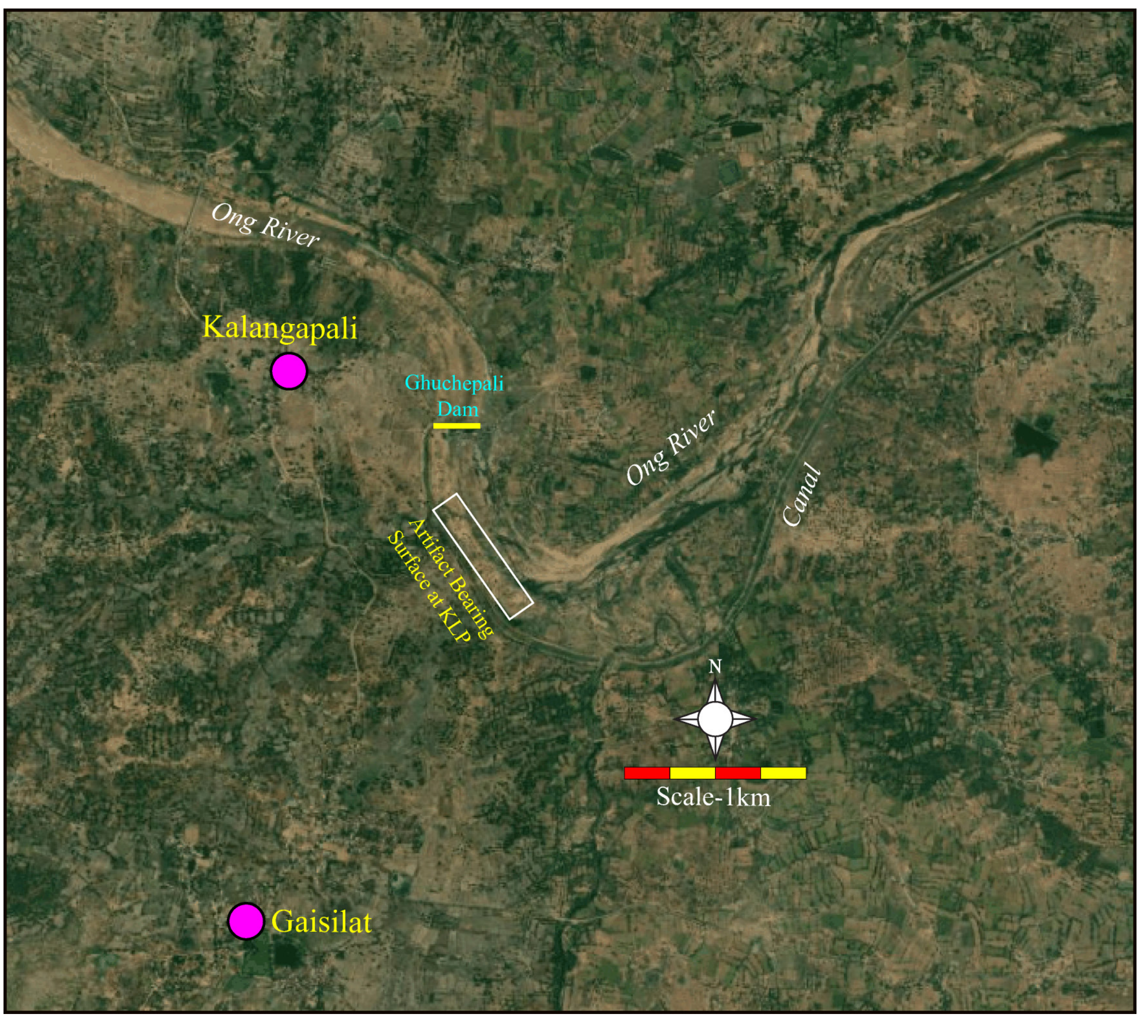

Figure 2: Closeup view of Kalangapali site and surrounding area.

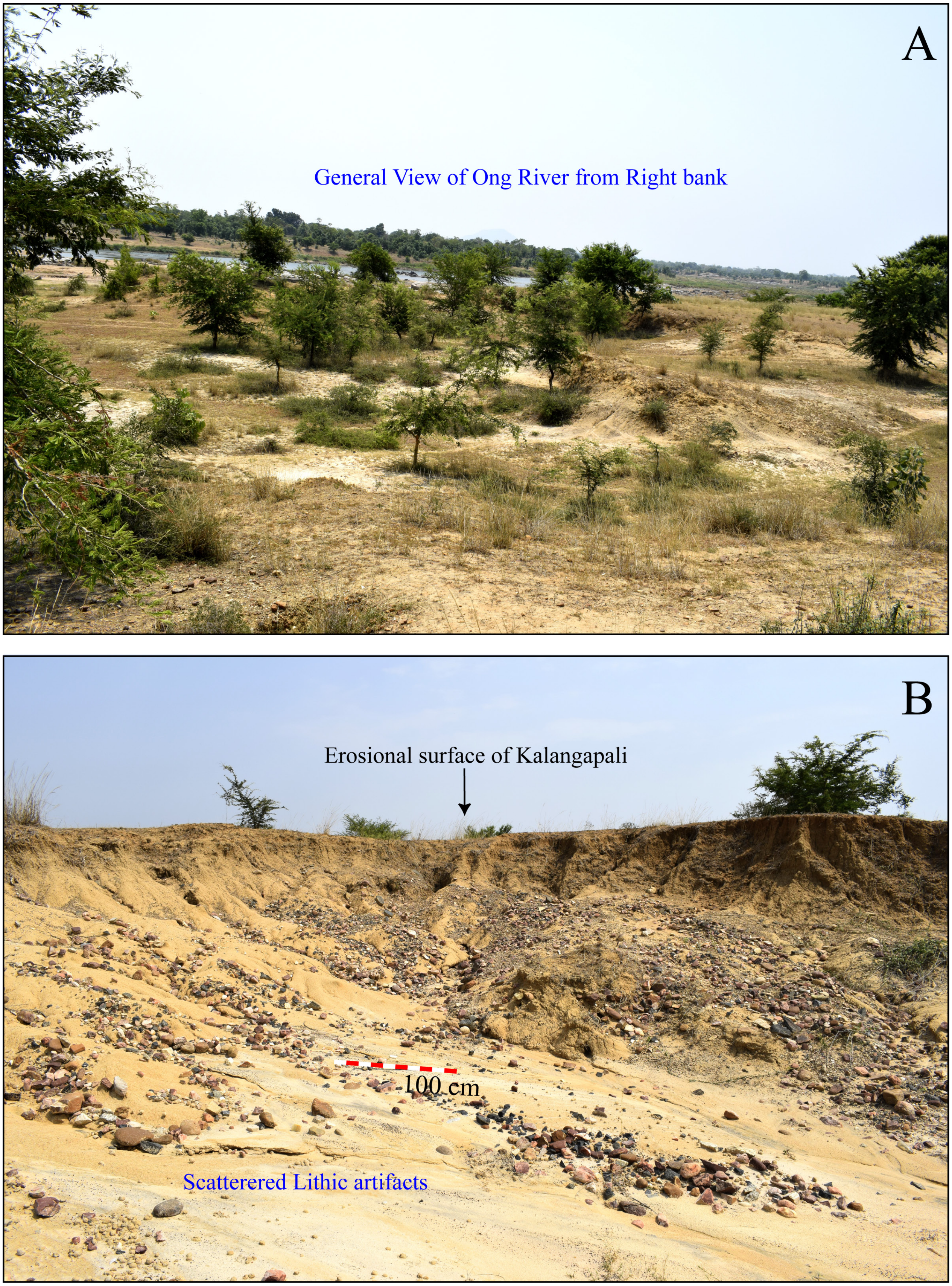

Figure 3: (A) General view of the Ong River from right bank, (B) Erosional surface along with scattered lithic remains.

(2.55%), ring stone nos-19 (4.04%) and hammer nor-4 (0.85%) of the lithic assemblage collected from the site. Flake is the dominant blank group in the assemblage, and the chip/chunks or waste product nos-60 comprises (12.77%) of the lithic assemblage sampled from the site (Table-1). The data suggest a predominance of the flakes and a higher number of blades and bladelets being retouched for use and reuse.

Table 1: Lithic assemblage composition

Artefact Category	*Total n*	*Percentage (%)*	*Unretouched n*	*Percentage (%)*	*Retouched n*	*Percentage (%)*	*Percentage Utilized*
Core	40	8.51	39	11.27	1	3.45	-
Flake	291	61.91	270	78.03	21	72.41	7.22
Blade	26	5.53	21	6.07	5	17.24	19.23
Bladelet	18	3.83	16	4.62	2	6.90	11.11
Chopper	12	2.55	-	-	-	-	-
Ring Stone	19	4.04	-	-	-	-	-
Hammer	4	0.85	-	-	-	-	-
Total	410	87.23	-	-	-	-	-
Waste	60	12.77	-	-	-	-	-
Grand Total	470	100.00	346	100.00	29	100.00	-

Gondwanas Olive Shale and Feldspathic sandstone

---Unconformity--

Basic dyke
(Chhatisgarh Group)

E G S G

Anorthosite
Garnetiferous granite gneiss
Khondallite/Garnet- sillimanite
Quartzite, calc granulite
Pyroxene granulite

---Unconformity--

Quartz vein
Dolerite Dyke
Quartz syenite/Monzonite/Monzodionite
Pink Granite
Gray Granite
Porphyroblastic granite gneiss
Biotite granite gneiss
Biotite granite grain
Banded veins

Figure 4: Litho-Stratigraphy of the Middle Ong Valley (after Rath & Sahu 1999).

Core Technology

There are different types of cores, such as flake, flake-blade, and flake-bladelet, found on the site. In order to understand the blank detaching process, the available cores and debitage were studied. Additionally, morphometric analysis of the blank forms, scar patterns, and blank removal techniques also applied **(Figure-5)**. It was observed that certain types of blade-bladelet cores were utilized for flake blank production, as is evident from a clear predominance of flake scars found

Figure 5: Core and unfinished Ring stone (1 and 6: Raw material for ring stone, 2, 4, and 5: unfinished ring stone, 3: Ring stone, 7-12: Core).

on the cores. During the process of reduction, rejuvenation of cores was carried out. During the study, 40 cores were collected and studies and it was observed that blank forms consist of angular nodules (12.5%), rounded nodules (17.5%), flakes (10%), chunks (30%), cobbles (7.5%) followed by undetermined (22.5%) artefacts in the collections **(Figure-6)**. The cores were found with single platform single face (SPSF 47.5%), opposite platform same face (OPSF 20%), opposite platform opposite face (OPOF 22.5%) followed by multiple platforms (10%). The majority of the core have observed with prepared platforms (71.11%), followed by cortical platforms (24.44%) and facetted platforms (4.44%). Close observation of the blank removal surface suggests that the majority of the cores have feathers (56.25%), followed by step (26.56%) and hinged termination (17.19%). The blanks (67.44%) were followed by bladelet (13.95%), blade (9.30%) and flake bladelet (9.30%). The core maximum (Length/Breadth/Thickness/Weight) varies between 12.82-123.53 mm, width 11.27-103.84 mm, thickness 9.89-111.99 mm, and weight 4-944 grams. The mean core length is 41.34 mm, width 37.83 mm, thickness 20.26 mm, and weight 118 grams **(Figure-6)**. The core lengths are larger than the flake, blade and bladelet blank. The detailed morphometric study of the cores provided in (Table-2) represents the artefact group's mean, standard deviation, and coefficient variation**.** The cores nodules are angular to sub-angular river pebbles were used, which were sourced locally in the river bed.

Table 2: Mass attributes of artifacts from Kalangapali site

	Artifact Type					
Variable	*Core*	*Flake*	*Blade*	*Bladelet*	*Chopper*	*Hammer*
Number of specimens	40	203	15	8	12	4
Length (mm)						
Maximum	123.53	98.32	72.43	33.65	136.50	65.17
Minimum	12.82	12.67	25.94	22.29	45.25	25.56
Mean	41.34	33.03	37.55	14.38	91.65	45.54
Standard deviation	23.50	15.61	11.05	28.60	26.25	19.39
Coefficient variation	56.83	47.26	29.43	4.11	28.64	42.57
	Width (mm)					
Maximum	103.84	103.49	30.29	11.91	116.00	86.66
Minimum	11.27	10.10	12.37	9.01	47.15	52.79
Mean	37.83	27.87	16.35	10.80	83.70	68.31
Standard deviation	23.29	14.77	4.79	0.92	20.08	17.35
Coefficient variation	61.57	52.99	29.28	8.37	24.00	25.40
	Thickness (mm)					
Maximum	111.99	55.64	19.80	7.83	56.23	51.68
Minimum	9.89	3.16	5.39	3.26	28.18	25.07
Mean	20.26	11.69	10.00	6.29	40.72	38.09
Standard deviation	23.91	6.87	4.31	1.60	9.74	12.05
Coefficient variation	79.00	58.83	43.05	25.45	23.92	31.63
	Weight (gm)					
Maximum	944.00	-	-	-	1148.00	215.00
Minimum	4.00	-	-	-	88.00	147.00
Mean	118.00	-	-	-	487.00	178.80
Standard deviation	228.60	-	-	-	339.50	32.10
Coefficient variation	193.69	-	-	-	69.72	17.96

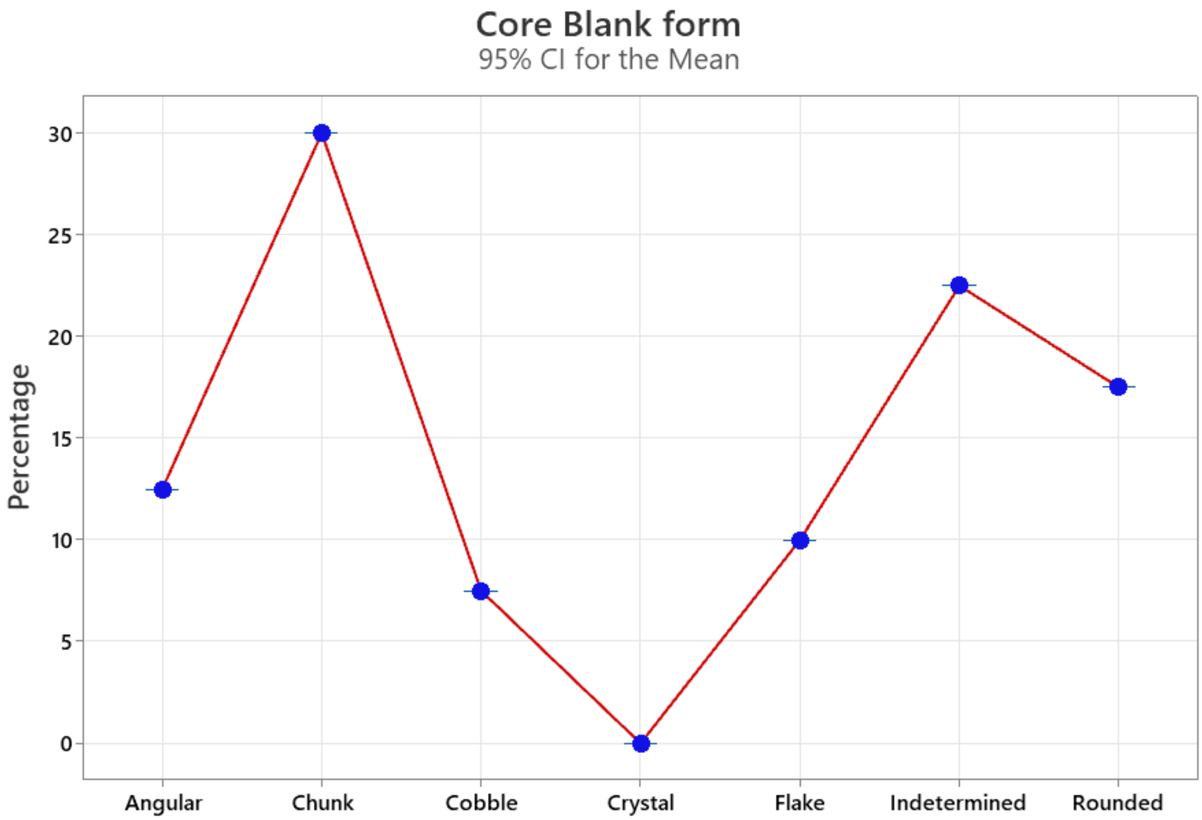

Figure 6: Distribution graph of core blank forms.

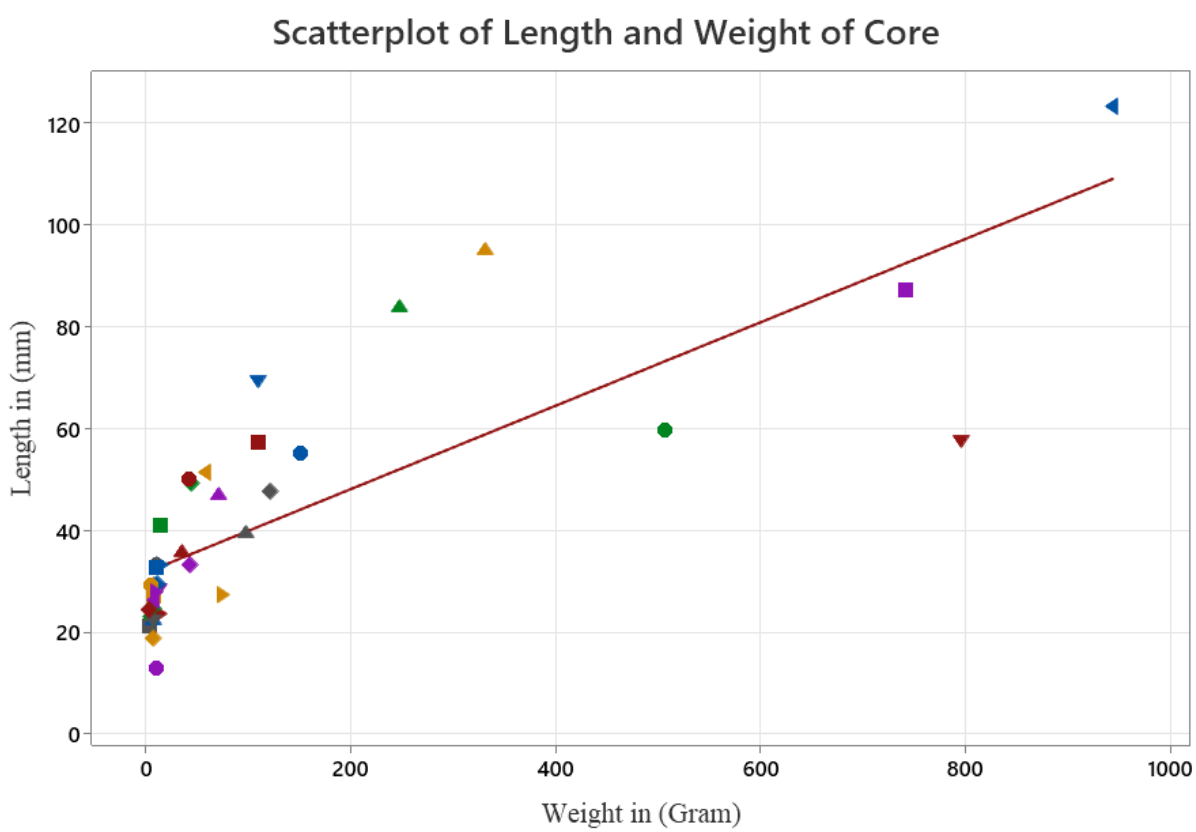

Figure 7: Scatterplot of core length and weight.

Blank Types

A number of blanks were observed in the study: flake blank (291) **(Figure-8)**, blade blank (26), and bladelets. Within the assemblages, some are unmodified blanks. The broken flake blank accounts for proximal breakage (2.41%), distal breakage (20.62%), and lateral breakage (7.22%). The blade category has proximal breakage (11.54%), distal breakage (30.77%), and absence of lateral breakage. The bladelet category has proximal breakage (11.14%), distal breakage (44.44%), and absence of lateral breakage. In general, from all total blanks (335), the breakage pattern is proximal breakage (3.58%), distal breakage (22.69%), and lateral breakage (6.27%) and complete blanks (67.46%) (Table-3). The maximum blanks appear to have been fractured during the removal procedure from the different cores or during the later post-depositional erosional phase, as fresh breaking is uncommon.

Table 3: Breakage pattern of different blank forms

Breakage pattern	***Flake***		***Blade***		***Bladelet***		***Total***	
	N	%	N	%	N	%	N	**%**
Proximal	7	2.41	3	11.54	2	11.11	12	3.58
Distal	60	20.62	8	30.77	8	44.44	76	22.69
Lateral	21	7.22	--	--	--	--	21	6.27
Complete	203	69.76	15	57.69	8	44.44	226	67.46
Total	291	100.00	26	100.00	18	100.00	335	100.00

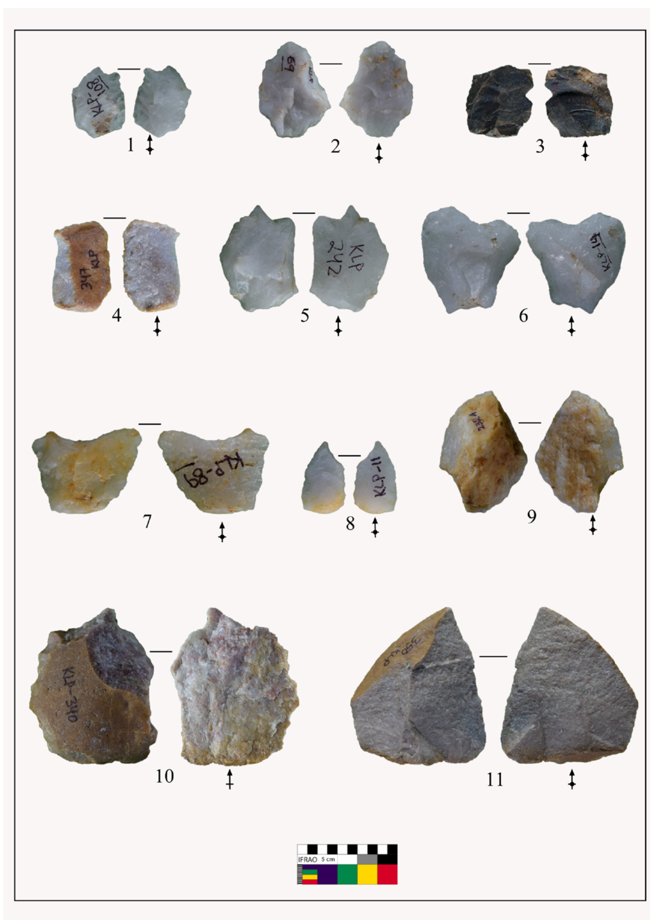

Figure 8: Lithic artefacts from the site of Kalangapali (1, 3, 5, 6, 7, 9: Notch, 2: convex end scrapper, 4: end scrapper, 8: straight backed point, 10: denticulate + borer, 11: atypical point).

Different types of platforms were observed in debitage groups i.e., cortical (23.84%), prepared (51.08%), facetted (0.93%), punctiform (2.79%), thinned (17.03%), dihedral (0.31%), lipped (0.31%) and modified platform (3.72%). Out of 335 blanks, including flake, blade & bladelet, nearly (59.13%) of the bulbs are pronounced exhibiting Irrailure fracture (4.64%), indicating the use of the hard hammer percussion method for blank production. The dorsal scar pattern on flakes is dominantly unidirectional, the majority from the proximal end (58.49%), followed by bidirectional scars originating from both ends (40.19%) and from mid-rib (0.32%) (Table-4). The flake blanks were classified according to cortical remains on the dorsal and platform into six groups from I to VI as prescribed by N. Toth (1987). The blanks with fully cortical dorsal surface and platform (first flakes/blades detached from unprepared core/raw material) are rarely represented (2.06%), and the large majority represents Toth's 'Flake Type-VI,' i.e., non-cortical dorsal and prepared platform (56.36%). Most of the other types of flakes, *i.e.,* those with cortical/non-cortical platform and partly cortical dorsal surface (Toth's Type II (16.84%), III (7.90%), IV (2.41%), V (14.43%) appear to have been detached while preparation of platform and blank removal surface of the cores **(Figure-9).** The majority of flake lengths range between 20-30 mm and 30-40 mm **(Figure-10).** The length and breadth of the flake are highly symmetrical and a majority of the range is between 50-60 mm **(Figure-11).**

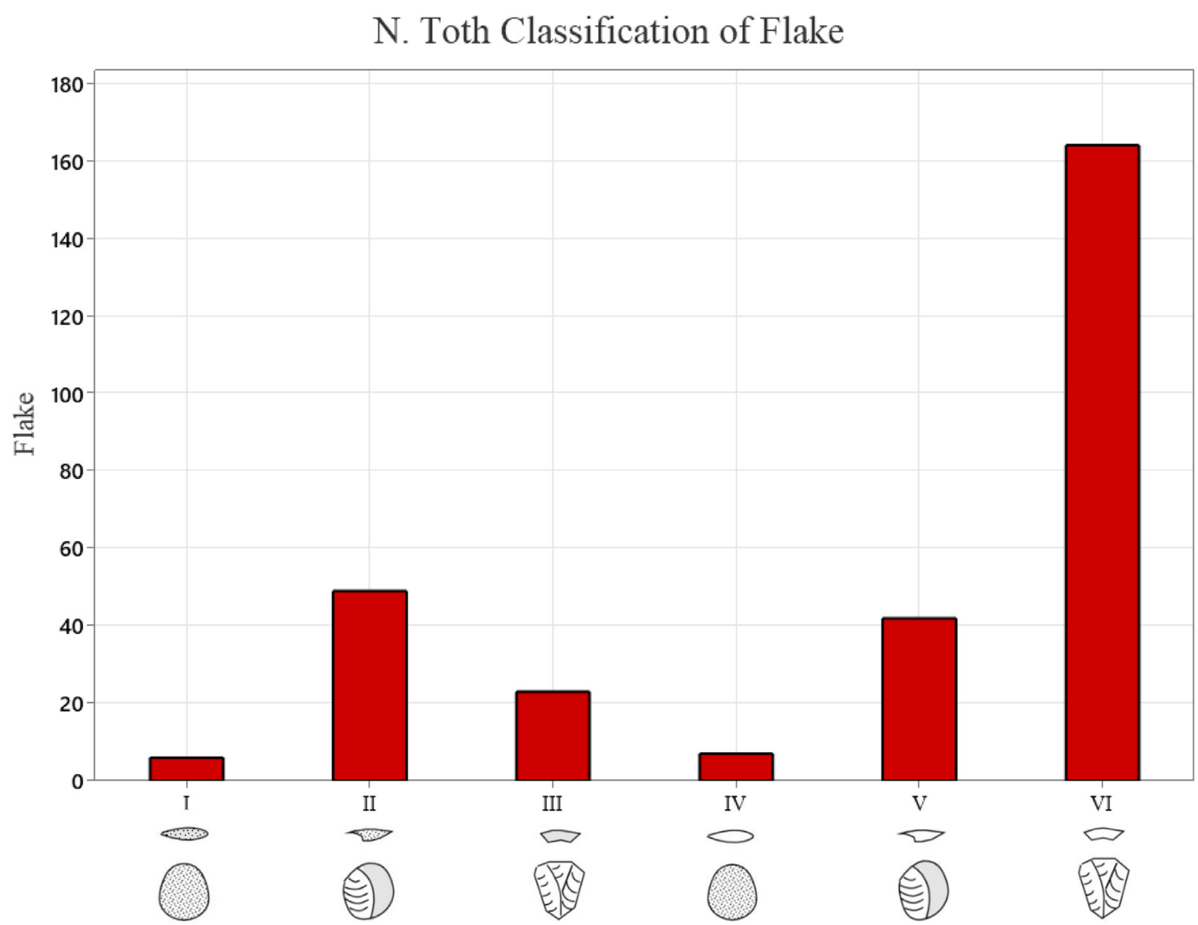

Figure 9: N. Toth classification of flake component.

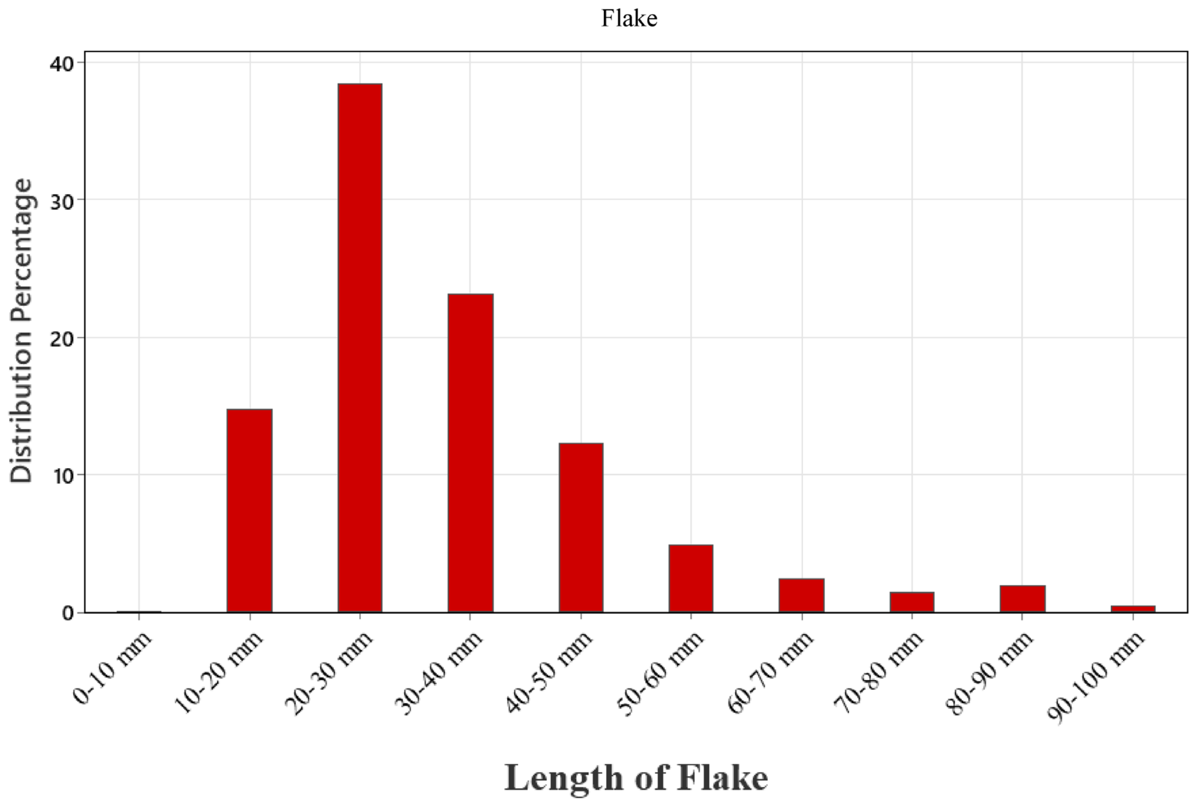

Figure 10: Flake length range of KLP site.

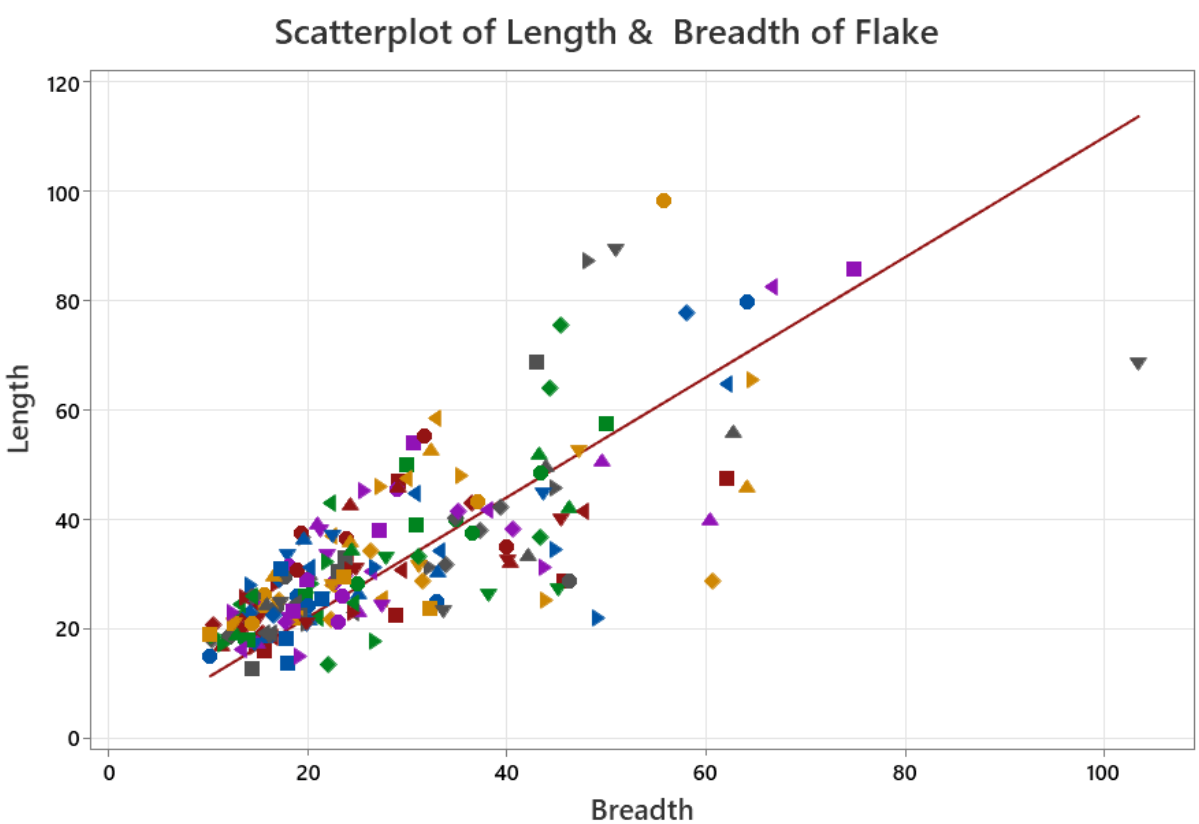

Figure 11: Scatter plot of flake length and breadth.

Table 4: Dorsal scar pattern of the blank forms

Scar Direction/Pattern		*Flake*		*Blade*		*Bladelet*		*Total*	
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Unidirectional	Proximal	142	45.66	7	41.18	10	52.63	159	45.82
	Distal	6	1.93	--	--	--	--	6	1.73
	Lateral	37	11.90	2	11.76	--	--	39	11.24
Mid Rib		1	0.32	--	--	--	--	1	0.29
Bidirectional	Distal-Proximal	124	39.87	8	47.06	8	42.11	140	40.35
	Lateral	--	--	--	--	1	5.26	1	0.29
Multiple Platform	Levallois	1	0.32	--	--	--	--	1	0.29
	Kombewa	--	--	--	--	--	--	--	--
	Indeterminate	--	--	--	--	--	--	--	--
	Total	311	100.00	17	100.00	19	100.00	347	100.00

Shaped Tools

The lithic assemblage consisted of wide variety of artefacts with secondary modifications of blanks and debitages. Out of 470 sampled artefacts 64 artefacts were modified/used as tools. Most of the artefacts collected from the sites are prepared on core, flake, blade and bladelet blank. The other associated artefacts found from the sites are pebble tools, ring stones, and quartzite hammers with battering marks. The study reveals that there was no specific size preference for blanks to be modified into different types of tools; rather, it appears blanks were probably randomly selected as per suitability and requirements. Retouch marks, in the case of scrapers, are mostly semi-invasive and appear on the dorsal surface of the blanks. The tools such as notch (12.50%), lunate (3.13%), denticulate (4.69%), chopper (18.75%), ring stone (29.69%), bipolar flake (1.56%). The assemblage includes several types of tools, such as side scrapers, end scrapers, straight-backed points, lunates, and notched pieces with micro-denticulation. Additionally, there are partially straight-backed points, convex-backed points, atypical points, and convex-backed bladelets, among others **(Figure 12).** For detailed information on the tools and their distribution (see Table 5).

Table 5: Tools prepared on different blanks at Kalangapali

Sl. No	*Tool type*	*Blank type*							*Total*	*Percentage %*
		Core	*Flake*	*Blade*	*Bladelet*	*Chopper*	*Ring Stone*	*Hammer*		
1	Atypical Point	-	2	-	-	-	-	-	2	3.13
2	Bipolar Flake	-	1	-	-	-	-	-	1	1.56
3	Convex End Scrapper	-	2	-	-	-	-	-	2	3.13
4	Denticulate	1	2	-	-	-	-	-	3	4.69
5	Denticulate + Borer	-	1	-	-	-	-	-	1	1.56
6	End Scrapper	-	3	-	-	-	-	-	3	4.69
7	Notch	-	8	-	-	-	-	-	8	12.50
8	Side Scrapper	-	1	-	-	-	-	-	1	1.56
9	Straight Baked Point	-	1	-	-	-	-	-	1	1.56
10	Lunate	-	-	2	-	-	-	-	2	3.13
11	Notch + Micro denticulate	-	-	1	-	-	-	-	1	1.56

Sl. No	*Tool type*		*Blank type*						*Total*	*Percentage %*
		Core	*Flake*	*Blade*	*Bladelet*	*Chopper*	*Ring Stone*	*Hammer*		
12	Partially straight Baked Point	-	-	2	-	-	-	-	2	3.13
13	Convex Baked Bladelet	-	-	-	1	-	-	-	1	1.56
14	Convex Baked point	-	-	-	1	-	-	-	1	1.56
15	Chopper	-	-	-	-	12	-	-	12	18.75
16	Ring Stone	-	-	-	-	-	19	-	19	29.69
17	Hammer	-	-	-	-	-	-	4	4	6.25
Total		**1**	**21**	**5**	**2**	**12**	**19**	**4**	**64**	100.00

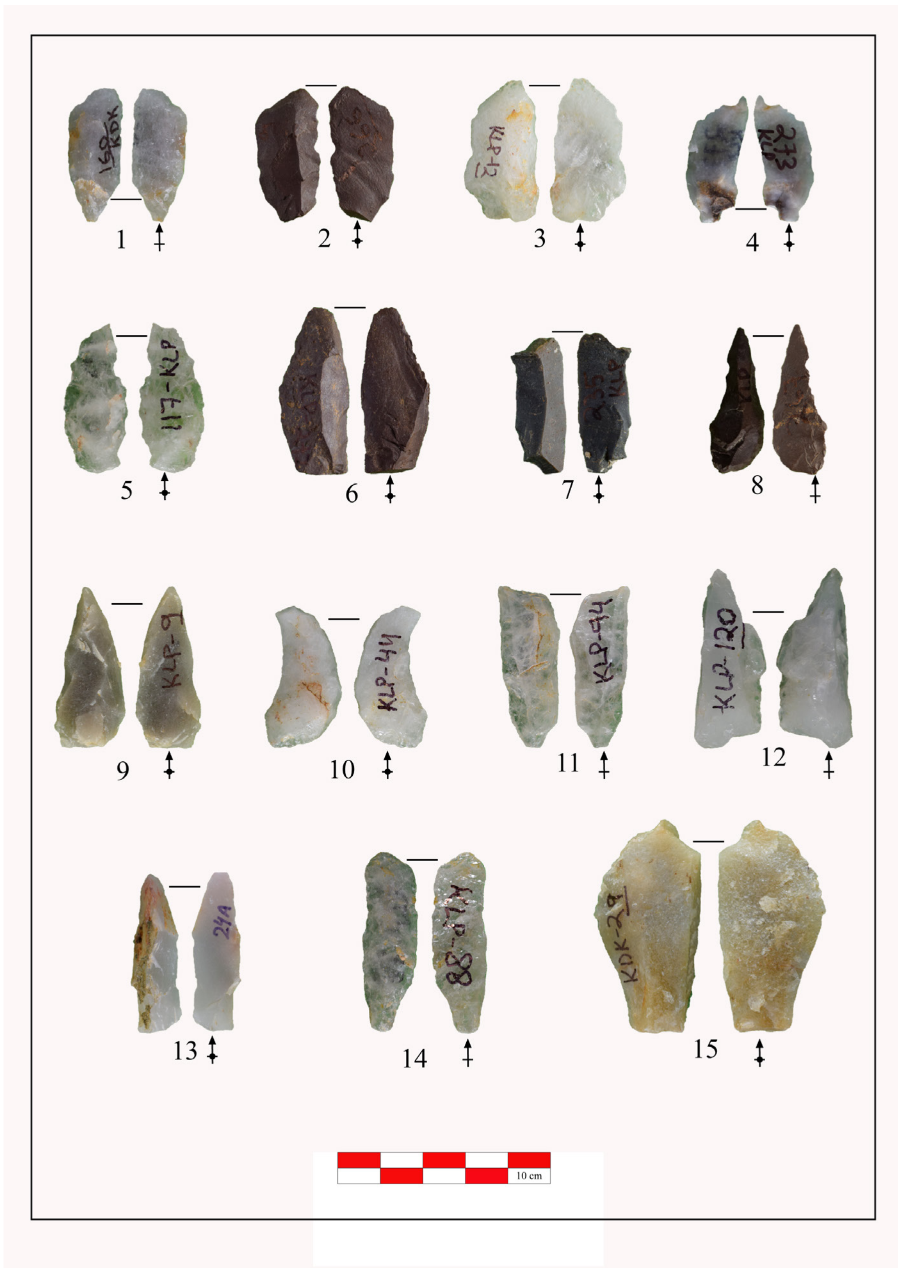

Figure 12: Lithic artefacts from the site of Kalangapali. (1, 4, 13, 14: bladelet, 5: notch + micro denticulate. 8: convex backed point 9, 12: partially straight-backed point, 10: lunate, 2, 3, 6, 7, 11, 15: Blade).

The (L/B/T/W) of the chopper ranges from 45.25-136.50 mm, 47.15-116 mm, 28.18-56.23 mm, 88-1148 grams. The (L/B/T) of flakes are measured 12.67-98.32 mm, 10.10-103.49 mm, and 33.16-55.64 mm. Similarly, the (L/B/T) of the blade is 25.94-72.43 mm, 12.37-20.29 mm, 5.39-19.80 mm. The (L/B/T) of the bladelet is 22.29-33.65 mm, 9.01-11.91 mm, 3.26-7.83 mm.

Heavy Duty/Chopper/ Pebble Tools

Total numbers of 12 pebble tools were yielded associated with microliths in the sedimentary context **(Figure-13).** The choppers were made of different types of raw materials and found in fresh condition, made of quartz (25%) and sandstone (75%). The (L/B/T/W) of the chopper is 45.25-136.50 mm, 47.15-116 mm, 28.18-56.23 mm, 88-1148 grams. The chopper cutting edge are generally broad. Cutting edge were observed distal end side (56.25%), right lateral (25%), left lateral (6.25%) and butt end (12.5%). The majority of the pebble tool base are flat (91.67%) and convex (8.33%) in nature. The cutting-edge shape of the pebble tools is convex (40%), concave (6.67%), straight (33.37%), oblique (6.67%), pointed (6.67%), denticulated (6.67%). The butt end shape of the pebble tools is rectangular (25%), pointed (8.33%), rounded (8.33%), elongated oval (8.33%), irregular shape (16.67%) and oval shape (33.33%). Large numbers of flat-based pebbles are available in the river bed, which were collected and turned into pebble tools.

Figure 13: Lithic artefacts from the site of Kalangapali. (1-6: chopper).

Raw Material Utilisation

The study of raw materials is most important in understanding the range of raw materials sources lithic analysis irrespective of the assemblages' age, provenance, and technology. The KLP site is observed to have seven types of raw materials utilized for manufacturing the artifacts. The core is dominated by quartz (65.00%), chert (10.00%), sandstone (10.00%), silicified (7.50%), and followed by quartzite chalcedony and agate (2.50%) raw materials. The flake assemblage is dominated by quartz (66.67%), chert (15.12%), sandstone (13.75%), quartzite (4.12%), chalcedony (0.34%) of the flake assemblage. The blade was preferred on two raw materials: Quartz (84.62%) and chert (15.38%). The bladelet was found to be dominated by quartz (83.33%) and chert (16.67%). Overall, the total assemblage collected from the site was dominated by quartz (68.53%), chert (14.67%), sandstone (11.73%), quartzite (3.47%), silicified (0.80%), chalcedony (0.53%), and agate (0.27%) (Table-6).

Table 6: Utilised Lithic Raw Materials

Raw Materials Types	*Core*		*Flake*		*Blade*		*Bladelet*		*Total*	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Chert	4	10.00	44	15.12	4	15.38	3	16.67	55	14.67
Quartzite	1	2.50	12	4.12	-	-	-	-	13	3.47
Quartz	26	65.00	194	66.67	22	84.62	15	83.33	257	68.53
Silicified	3	7.50	-	-	-	-	-	-	3	0.80
Sandstone	4	10.00	40	13.75	-	-	-	-	44	11.73
Chalcedony	1	2.50	1	0.34	-	-	-	-	2	0.53
Agate	1	2.50	-	-	-	-	-	-	1	0.27
Total	40	100.00	291	100.00	26	100.00	18	100.00	375	100.00

Section Scraping at Kalangapali

The site is located on the right bank of middle Ong valley and the artifacts were found in situ within the section **(Figure-14)**. During explorations in this region, large clusters artifacts were observed at the site and surrounding area **(Figure-15)**. The artifacts were recovered from the exposed river bank surface **(Figure-16)**. The artefacts were found in the fine loamy soil within the gently sloping upland area. The artefacts were found in the exposed erosional surface and artifacts were found in fresh conditions. Large number of artifacts were found 800m downstream of Ghuchepali Dam on the right bank of Ong river **(Figure-17)**. A trench was laid out in dimensions of (2 x 2.5m). A total number of 37 lithic artifacts were found during the section scraping. The lithic assemblage includes core (13.51%), flake (40.54%), blade (5.41%), bladelet (2.70%), hammer (13.51%), and a chopper found associated with microlith.

The stratigraphy at KLP consisted of 8 layers. Each layer shows a slightly different character than the others **(Figure-18)**. The topmost layer is thin, greyish-white in color and shows highly irregularities due to its surface weathering. The second layer is pale brown and made mainly of sandy silt sediment. The third layer is dark brown to moderate color and shows irregular deposition of differential-sized sediment. The fourth layer is a well stratified layer showing deposition of very coarse sediments in the loosely compacted layer. A number of cracks and vogues are spotted in the layer. The fifth layer is thick and dark brown in color, possibly due to a high concentration of lateritic pallet deposits. The sixth layer is largely composed of silty clay, shows greyish white in color. This could be due to a rapid decrease in lateritic pellets. The important feature of the layer is the presence of Microlithic tools prepared on quartz and sandstone. The seventh layer is sediment ranging from white to pink in color. The sediments are composed of sand and silt, as well as well-cemented lateritic pellets. At

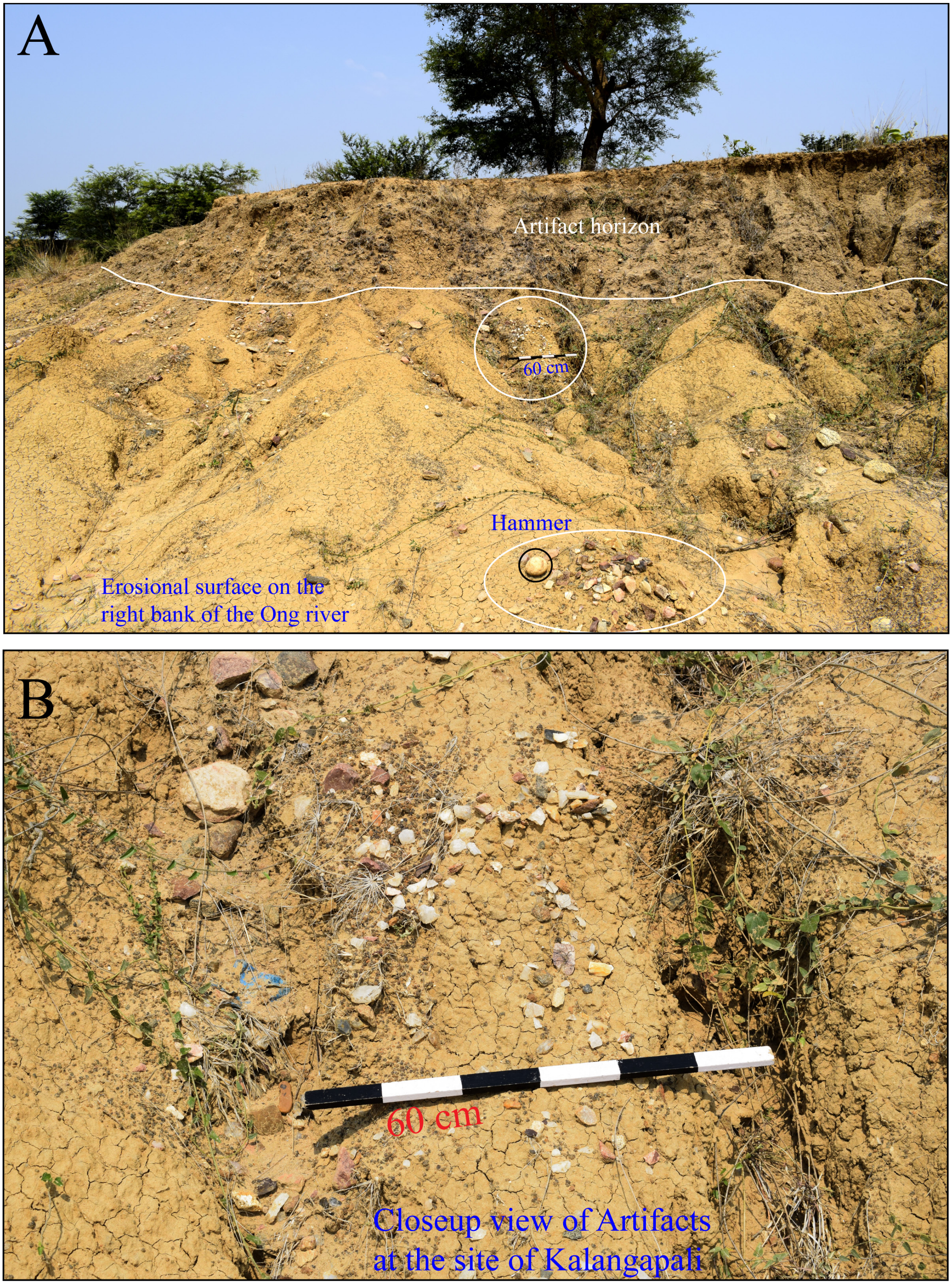

Figure 14: Exposed river section embedded with microlithic remains along with hammer stone.

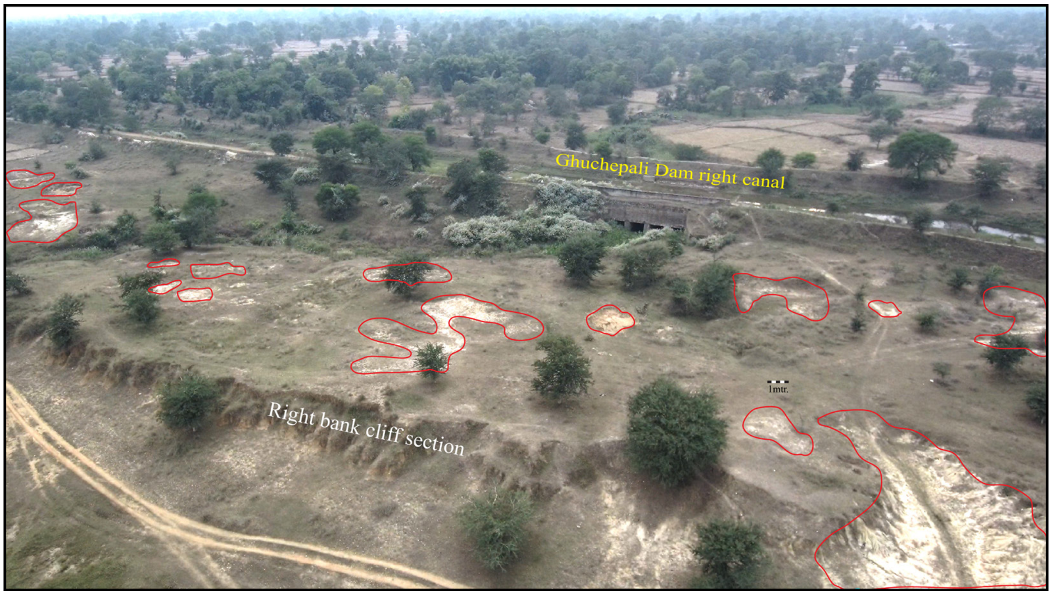

Figure 15: Distribution of Microlithic clusters close to the site (marked in red).

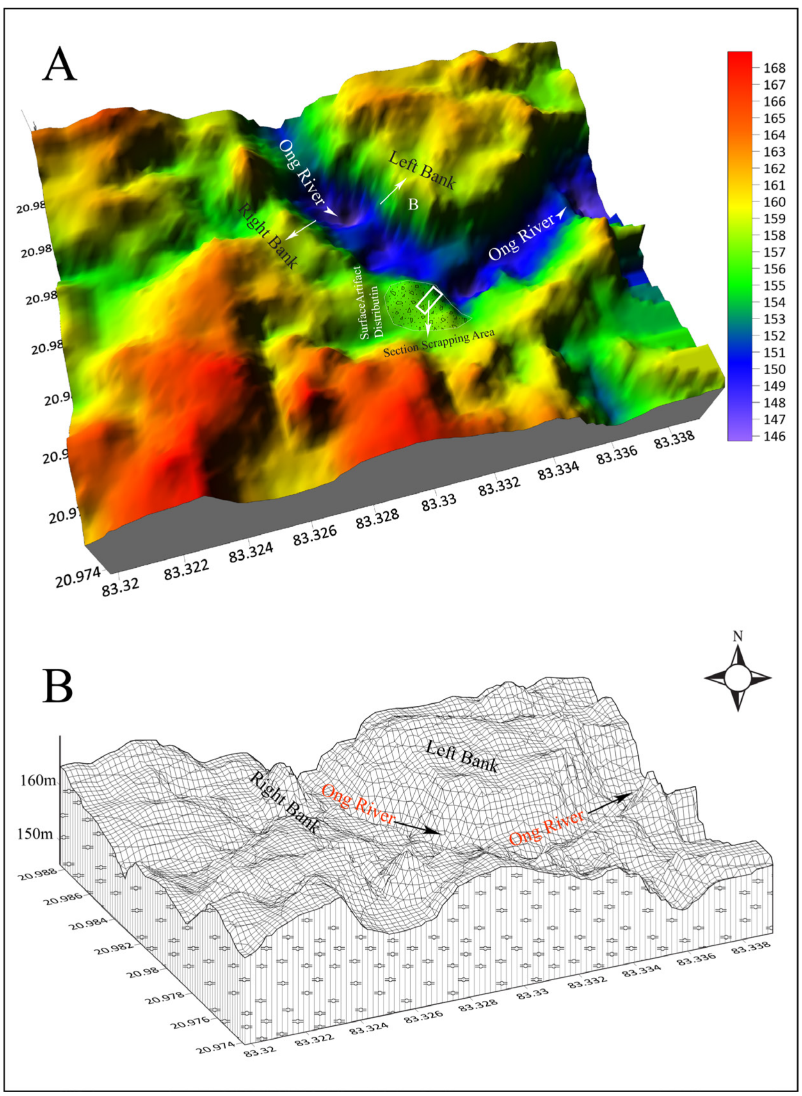

Figure 16: 3D representation and wireframe view of the study area.

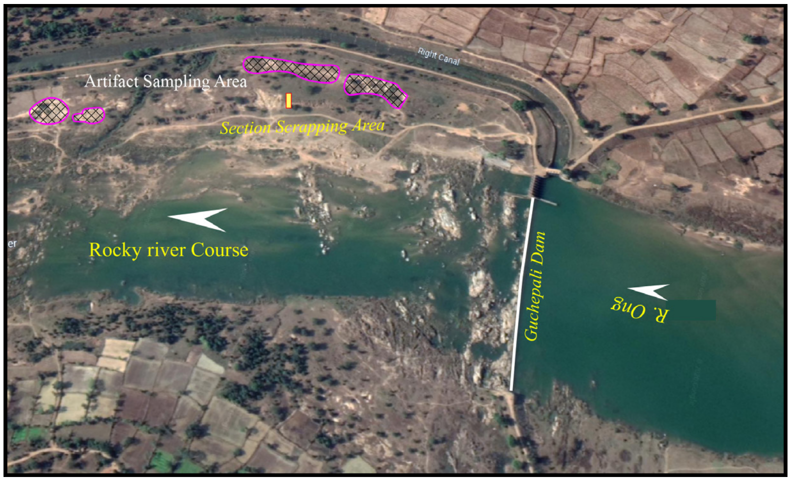

Figure 17: Satellite view of the section scrapping area and artifact sampling area.

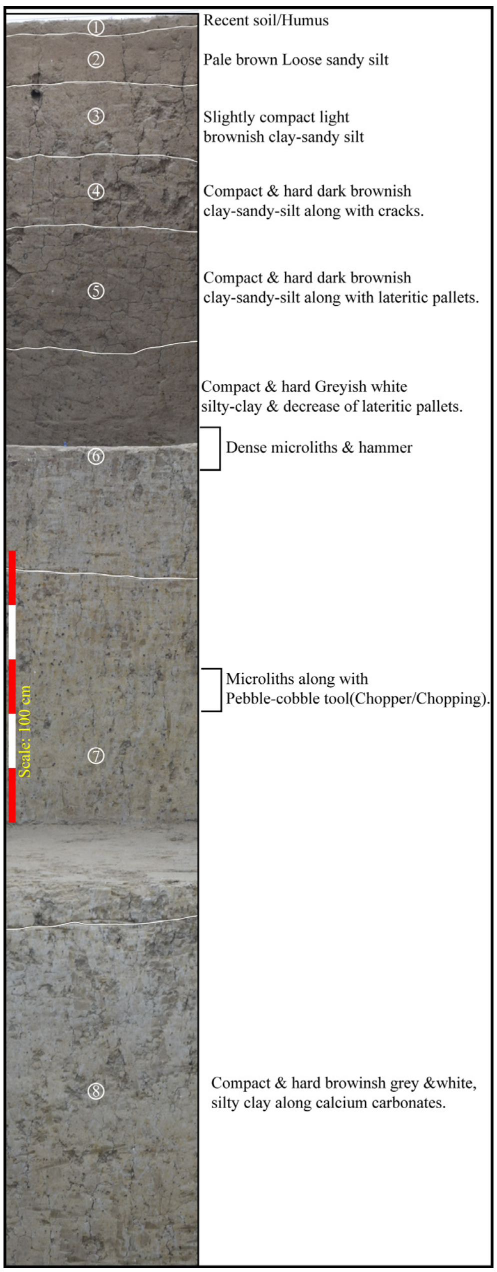

Figure 18: Stratigraphy of the Kalangapali site.

places, few ant holes were noticed. Microlithic tools are found associated with pebble tools made of quartzite pebbles. The eighth layer is the thickest and lowermost horizon layer and shows dual color tone i.e., greyish white at the top and pale brown at the bottom. This transition could be due to the calcium carbonate (caco3) rich clay alluvium formation during the dry season and ferro magnesium-rich material formation during the wet or high rainfall season.

Lithic Assemblage (section scrapping)

During the section scraping, a total number of 37 artifacts were collected. The points are observed with a thick patina (12.50%). Notch is a major tool type (37.50%), trapeze and transverse burin (12.50%) each, one lunate (12.50%) and one chopper (12.50%) are part of the lithic assemblage **(Figure-19)**. The general (L/B/T/W) of the core is 28.96-46.65 mm, 21.83-46.93 mm, 12.31-39.46 mm, 14-60 mm having mean 33.59 mm, 36.29 mm, 25.45 mm, 38.40 mm. the (L/B/T/W) of flake is 13.11-53.70 mm, 12.61-33.35 mm, 5.28-29.04 mm. with mean 29.68 mm, 22.14 mm and 11.22 mm. the length of the single chopper measured 69.23 mm, width 60.48 mm and thickness 33.9 mm prepared on a flat elongated pebble. (Table-7).

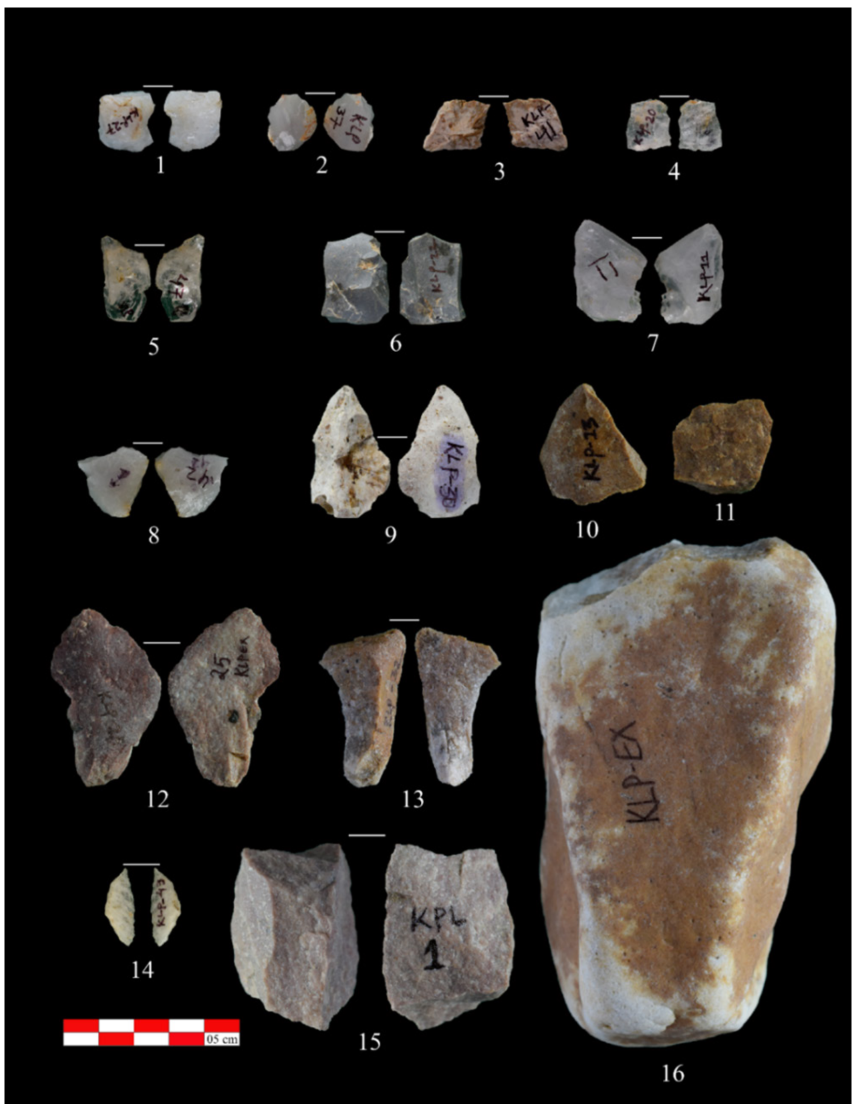

Figure 19: Tool types from recovered from the section scrapping (1, 5, 7- Notch, 3-Trapeze, 8- Transverse burin, 9- Point, 10-13, 15-Flake, 14- Lunate, 16- Chopper).

Table-7: Showing the length range of, Flake, Blade, Bladelets

Blank/length	*Flake*	*%*	*Blade*	*%*	*Bladelet*	*%*	*Total*	*%*
0-10 mm	--	--	--	--	--	--	--	--
10-20 mm	30	14.78	--	--	--	--	30	13.27
20-30 mm	78	38.42	3	20.0	5	62.50	86	38.05
30-40 mm	47	23.15	7	46.7	3	37.50	57	25.22
40-50 mm	25	12.32	4	26.7	--	--	29	12.83
50-60 mm	10	4.93	--	--	--	--	10	4.42
60-70 mm	5	2.46	--	--	--	--	5	2.21
70-80 mm	3	1.48	1	6.7	--	--	4	1.77
80-90 mm	4	1.97	--	--	--	--	4	1.77
90-100 mm	1	0.49	--	--	--	--	1	0.44
Total	**203**	**100.00**	**15**	**100**	8	100.00	226	100.00

The numbers of artefacts are few in the section scraping. Study of five cores recovered from the site suggests that the prehistoric knapper preferred angular pebbles, rounded pebbles and flake blanks readily available in the river bed. The cores were observed with the cortical platform (60%) and prepared platform (40%) and the platform flaking pattern of the core is single platform single face (60%), opposed platform same face (20%), and opposed platform opposite face (20%).

The blank removal surface of the core is mostly feather type (71.43%), followed by step and hinge type (14.29%) each. The cortical remains on the platform can be observed on (71.43%) of the core and butt and lateral part remains are seen (14.29%). A total number of 15 flakes were collected from the section scraping, out of which (46.67%) observed thin patina (40%) showed thick patination and (6.67%) flakes appeared with moderate patination. The flake blanks were measured and noted with a thickness at the medial (53.33%), proximal (33.33%), and distal (13.33%). The platform preparation in the case of the flake blanks was observed with a cortical surface (14.29%), prepared (57.14%), pointed, and thinned (14.29%).

The assemblage was classified based on N. Toth (1987) flake types, which are found in type II (16.67%), IV (8.33%), V (16.67%), VI (58.33%). The flake detachment profile were also considered in the parameters and included (53.33%) of flakes having a convex profile and (46.67%) having a flat profile. The blades and bladelets are few in number; therefore, statistical parameters could not be generated. The length ratio of the core between 21-30 cm (40%), 31-40 cm (40%) and from 41-50 cm (20%) and flake length between 11-20 cm (25%), 21-30 cm (33.33%), 31-40 cm (16.67%), 41-50 cm (16.67%) and from 54-60 cm (8.33%) **(Figure-20)**.

Discussion and Conclusion

The increasing numbers of Microlithic sites in Odisha suggests population growth and spread to wider geographical areas. However, the sites found in the Bargarh upland suggest a pattern of innovation, a changing subsistence strategy, or adaptation to a diverse environments. The use of various raw materials for microlithic tool-making indicates the range of wider choice of locally available materials. The Kalangapali site is an open-air site in stratified contexts that shows a single-period occupation. However, findings of abundant microliths at the site suggest that the site was inhabited for longer durations or with sizeable microlithic populations. The artifact count in the scraping section is limited,

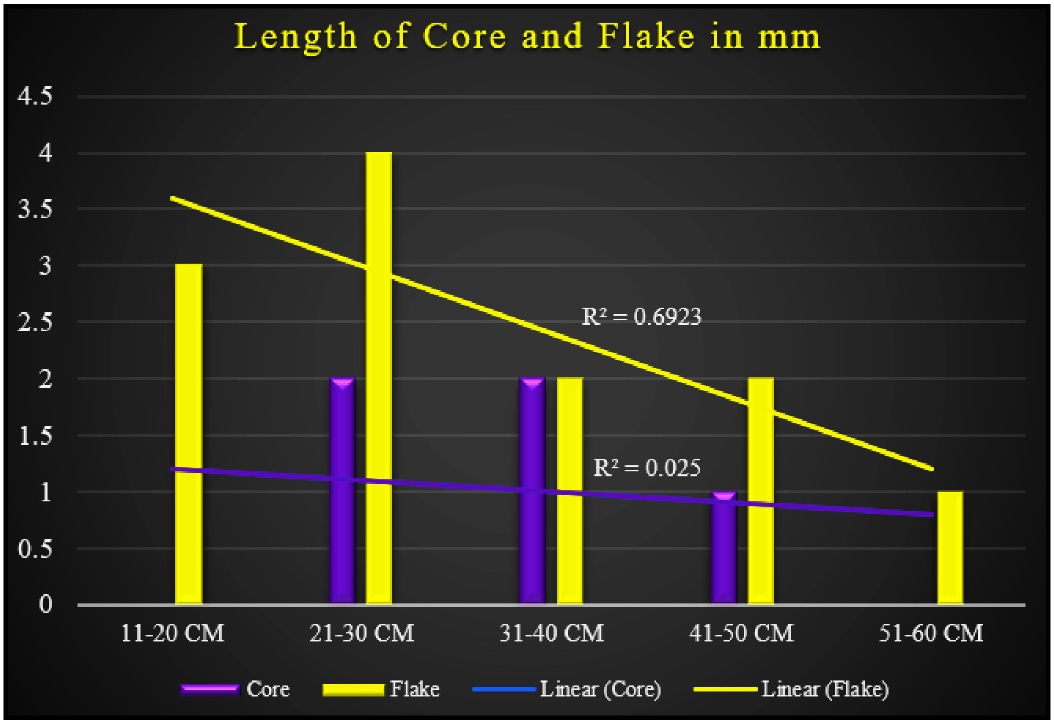

Figure 20: Length ratio of core and flake from Kalangapali section scrapping.

which constrains interpretation based on small collections. The findings of the numerous ring stones at the site, typically ranging from small to medium size and frequently featuring a central perforation or a small indentation, may have been utilized for fire-making. A comprehensive analysis of the ring stone could provide further insights into their functions. The association of microliths with pebble tools could be crucial for functions related to the usage of heavy-duty purposes where tiny microliths may not be feasible or suitable. The functions beyond the scope of microliths may be replaced with the usage of large quartzite, flake, choppers, cores, and scrapers. These changes in the lithic typology along with the microlithic, could be a subsistence-based innovation. It could also be an influence from the late Pleistocene lithic traditions of Southeast Asia or from the Soanian traditions which may require detailed further investigations and comparative studies. Currently there is no absolute date for the site and further work in this regard is promising to get precise dates of the site.

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