

## New Perspectives on the Microlithic Assemblages from the Upper Baitarani River Valley, Odisha, Eastern India

NISHIKANTA DWIBEDI<sup>1</sup> AND RAJASHREE PUHAN<sup>2</sup>

<sup>1</sup>Faculty in History, Department of History, Ravenshaw University, Cuttack, Odisha

E-mail: [nishikantadwibedi2014@gmail.com](mailto:nishikantadwibedi2014@gmail.com)

<sup>2</sup>Ph. D. Research Scholar, School of History, G. M. University, Sambalpur, Odisha

E-mail: [rajashreepuhan1994@gmail.com](mailto:rajashreepuhan1994@gmail.com)

**Abstract:** The present paper is a preliminary report based on the surface exploration carried out between 2019 and 2023 in and around the Upper Baitarani River valley in the Keonjhar District of Odisha. The field investigations have brought to light 62 prehistoric sites in both primary and semi-primary contexts. The exploration of the upper Baitarani River valley has yielded a total of 53 microlithic sites. Among them, 32 sites yielded only Microlithic artefacts, and 21 sites had microliths associated with Middle Palaeolithic, Upper Palaeolithic and Neolithic artefacts. The cultural remains of this region exhibit several characteristic features, which are usually noticed in other river valleys of Odisha. The abundant availability of raw materials along the riverbank has attracted prehistoric communities that utilised microliths to establish settlements in this region. This area possesses significant potential for advancing our understanding of human adaptation from the Pleistocene epoch to the Holocene epoch. The river valley is characterized by a diverse and picturesque landscape of hills, rock shelters, and a chain of hillocks, which are conducive to fostering a rich cultural heritage. Consequently, the Baitarani River valley has served as a cradle of human activity, as evidenced by the discovery of numerous and varied lithic tool types.

**Keywords:** Pleistocene, Holocene, lithic, Geomorphologic, Microlithic, flake, fluted core, cryptocrystalline rock and percussion etc.

**Received :** 28 April 2025

**Revised :** 24 May 2025

**Accepted :** 09 June 2025

**Published :** 29 June 2025

### TO CITE THIS ARTICLE:

Dwibedi, N., & Puhan, R. (2025). New Perspectives on the Microlithic Assemblages from the Upper Baitarani River Valley, Odisha, Eastern India. *Journal of History, Archaeology and Architecture*, 4: 1, pp. 69-90.

## INTRODUCTION

Microliths are small retouched stone tools, usually considered to be hafted as part of composite tools (Lewis and Petraglia, 2015). These small retouched stone tools are often backed and generally considered to have been hafted as part of composite tools, particularly projectile-hunting weapons (Elston and Kuhn, 2002). The emergence of microlithic technology plays a significant role in enhancing our understanding of the origins of modern humans and their dispersal across various regions of the globe. Furthermore, it contributes to the development of human capacities for complex behaviours and symbolic thought processes (Clark 1969, Neeley & Barton 1994, 275-288, Bar-Yosef & Kuhn

1999: 322-38, Kuhn & Stiner 1999: 505-17, Klein 2000: 17-36, Hiscock 2002: 163-77, Foley & Lahr 2004: 108-22, James & Petraglia 2005: 23-27, Mellars 2006: 796-800, Anikovitch *et al.* 2007: 223-25, Seong 2008: 871-83, Pradhan 2013 & 2021, Mendaly and Hussain 2015). Several scholars argued that microliths are related to many 'archaeological signatures of modern human behaviour' (McBrearty and Brooks, 2000), including the hafting and standardisation of composite tools, the use of projectile weaponry, increased dietary breadth and/or specialized hunting, complex manufacturing sequences including the procurement of raw materials and the control of fire for the production and use of mastics, exchange networks, and even symbolism in the form of regional artefact styles (Lewis *et al.* 2014).

Microliths are commonly discovered in numerous regions across the globe during the late Pleistocene epoch, occurring in diverse geographical and chronological contexts (Brown *et al.* 2012, Neely and Barton 1994). The continuous Prehistoric archaeological studies reveal that the earliest microlithic tool-making industries reported high production rates from three continents: Howiesons Poort in southern Africa, Bondaian in eastern Australia, and the microlithic period in India (Hiscock *et al.* 2011: 653-664). 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 the central Narmada basin yielded an early date of 45,000 BP (Mishra *et al.* 2013). In Eastern India, new evidence of the early occupation of the 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). Jwalapuram Locality- 9 is a rock shelter in the Jureru Valley in South India that has been dated to 35,000 BP (Clarkson *et al.* 2009). Recent findings in Sri Lanka, the Microlithic industries reported from Batadoma-lena are characterized by evidence of symbolic behaviour, long-distance contacts, advanced bone tool technology, and hominin fossils evidence are dated between 45,000-48000 BP (Perera *et al.*, 2011: 254-69, Lewis *et al.* 2014, Roberts & Petraglia 2015, Robert *et al.* 2015, Wedage *et al.* 2019). Odisha has revealed a significant number of Microlithic sites located in various geomorphological contexts, including rock shelters, foothills, piedmont areas, and the cliff surfaces of rivers and their numerous tributaries. Most of these sites are associated with microlithic industries, with or without the presence of heavy-duty pebble and cobble tools (Ota 1986: 79-85, Mohanty 1993: 85-104, Behera 1989, 2006: 1-62, Mendaly and Hussain 2015). This study aims to highlight the notable concentration of microlithic sites found in the hilly and riverine terrains of northern Odisha. The Baitarani River, a vital drainage system in the region with an extensive network of tributaries, has been identified as a preferred habitat for early hunter-gatherer communities. The availability of stable plant varieties, accessible animal food sources, and reliable water supplies has been instrumental in the sustained human colonization of the upper Baitarani River valley.

## **HISTORY OF MICROLITHIC RESEARCH IN ODISHA**

Prehistoric explorations conducted in Odisha have brought to light more than 500 microlithic sites in different parts of the state, specifically in the northern and western highlands of Odisha. The rivers Mahanadi, Brahmani, and Baitarani and their major tributaries, have brought to light several open-air sites in primary and semi-primary contexts. Microliths are found in association with both heavy-duty tools and independently throughout the state. These artefacts are made from a variety of raw materials, including chert, quartz, quartzite, silicified sandstone, chalcedony, agate, jasper, and quartz

crystal. Several scholars have studied Stone Age culture in various regions of Odisha since 1876. However, systematic prehistoric research in Odisha only began after 1939 A.D. From the early 20th century onward, extensive and focused prehistoric studies have been conducted throughout different regions of Odisha. The scholars like Acharya (1923-24) and Banerji (1930: 38-39) played significant roles in highlighting the rich Stone Age heritage of northeastern Orissa. Following Independence, G.C. Mohapatra (1962) initiated his research in Mayurbhanj, Keonjhar, Dhenkanal, Sambalpur, and Sundargarh, uncovering eight microlithic sites. Subsequently, Tripathy (1972), Nanda (1984, 1985), and Mohanty (1989) made important contributions in this field. The work of Mohapatra holds considerable significance as it was the first to elucidate a succession of Stone Age cultures in Orissa, demonstrating that the Palaeolithic industry extended beyond the confines of the Mayurbhanj district and thrived over a substantially larger geographical area. In the late 1950s and early 1960s, numerous isolated discoveries of Stone Age sites were reported, including microliths from Kaniha in the Talcher sub-division, documented by Ghosh (1958: 29-36), and from Baramandar, Bonaikala, and Danguaposi within Keonjhar district, explored by Mitra (1961-62: 32-37). Additionally, findings from the Tel River and its tributaries as well as from the Balangir, Ganjam, and Kalahandi districts were contributed by Raghunath (1963-64: 27). During the early 1970s, Tripathy's research in Southwestern Orissa revealed several Stone Age sites along the Tel River basin, including three sites indicative of a pebble tool industry, sixteen sites associated with flake tool industries of Middle Paleolithic cultures, and twenty-seven sites representing flake-blade industries attributed to Mesolithic culture, spanning the districts of Phulbani, Balangir, Kalahandi, and Sambalpur. Furthermore, extensive exploration conducted by P.K. Behera (1983-1984:64-67, 1984-85: 60-61) unearthed multiple sites from the Lower, Middle, Upper Palaeolithic, Mesolithic, and Neolithic periods in the upper Brahmani valley and its tributaries located in the Sundergarh district of Odisha. Reports from S.B. Ota (1982-83, 1986) also indicated the occurrence of Late Stone Age assemblages in the Tel River valley. The presence of a microlithic industry in Western Odisha has been documented by several scholars, including S. Panda (1998) in the Ong Valley, S. Gadia (2000) in the lower Ong and Suktel regions, K. Seth (1998) in the lower Jira Valley, S. Mishra (1998) in the Upper Jira Valley, A.K. Sethi (1996) in the middle Mahanadi Valley, J. Naik (2002) in the lower Bheden Valley, S. Mendaly (2012) in the Girisul Valley, B. Patel (2002) in the Raul Valley, T. Pradhan in the context of Jonk and middle Ong valley (Pradhan 2013, 2014 & 2016, Barik 2022) and S. Deep (2016) in the Jira Valley. In the context of the Northern part of Odisha, particularly in the contexts of Keonjhar and Mayurbhanj districts, a few microlithic sites have been documented by Mohapatra (1962), Mohanty (1989), Mohanta (2002) and Dehuri (2013). The author's survey in the upper Baitarani River valley has yielded a total of 56 microlithic sites. Among them, 32 sites yielded only Microlithic artefacts, and 24 sites had microliths associated with Middle Palaeolithic, Upper Palaeolithic and Neolithic artefacts.

## **GEOLOGY AND GEOMORPHOLOGY OF THE STUDY AREA**

The Baitarani River, a prominent river in Odisha, originates from the Guptaganga hills near Gonasika village in the Kendujhar district. The river travels a distance of 360 kilometres to drain into the Bay of Bengal after joining the Brahmani at Dhamra mouth near Chandabali (Senapati 1986). The upper Baitarani valley spans a latitude of 20°35' to 22°15' N and a longitude of 85°10' to 87°03' E. The present study area consists of the north-eastern parts up to the south-eastern parts of the Keonjhar district. The study area covers the area in and around the upper Baitarani River valley from the

Bansapal block up to the Hatadihi block of the Keonjhar district. It covers the Champua, Keonjhar Sadar and Anandapur sub-divisions and the Bansapal, Champua, Jhumpura, Patna, Saharpada, Ghatagaon, Anandapur, Ghasipura and Hatadihi blocks of Keonjhar district (Fig. 1). Geographically, the area is an extension of the Chhota-Nagpur region, and it is drained by the Baitarani River and its numerous tributaries, such as the Kalinjari, Ordai, Kukurkutia, Sita, Musala and other small Nullahs. The average annual precipitation is 900 mm. The vegetation is of the tropical deciduous type, and the climate is characterized by hot during the summers, high humidity, and well-distributed rainfall. The Keonjhar is situated at the convergence of the Gondwana formation, the Chhotanagpur plateau, and the Eastern Ghats, providing an advantageous climate and topography for creating residential and cultural environments for the populace.

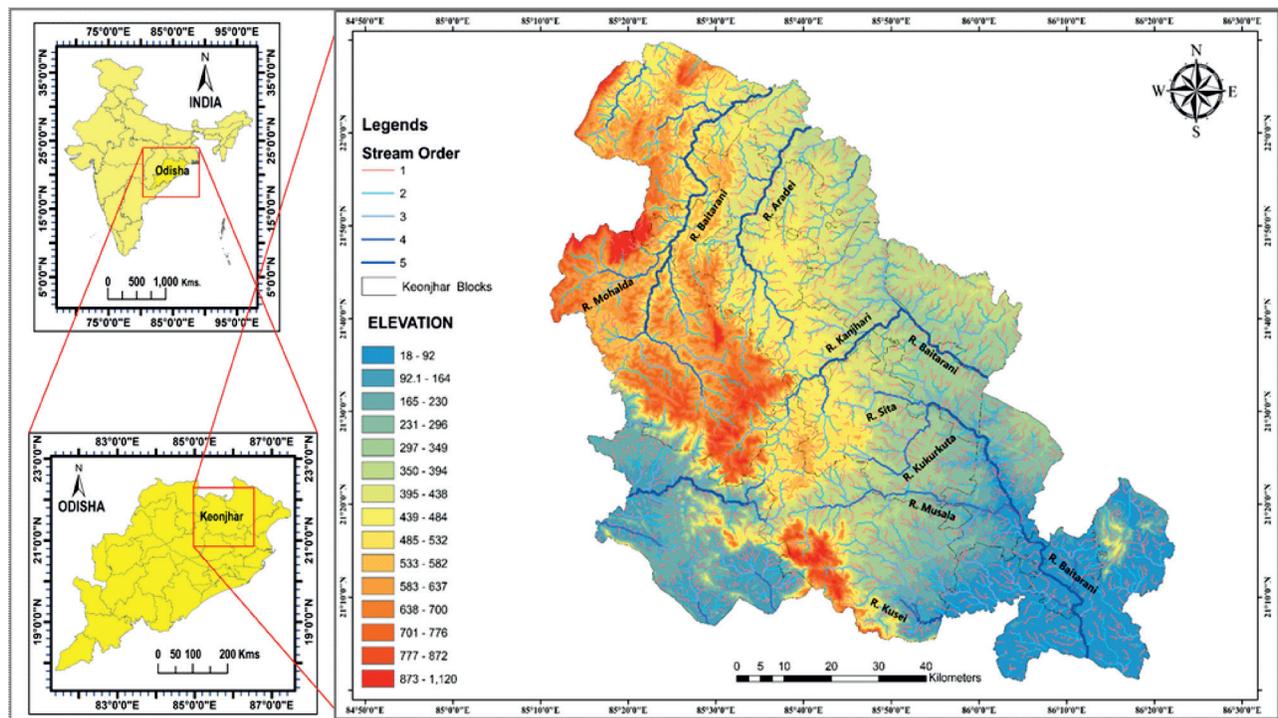


Fig. 1: Location and Digital Elevation Model of the Baitarani River Basin in the Keonjhar district of Odisha.

Geologically, Keonjhar district is abundant in various rock types and mineral resources. The geological formations in the district are highly diverse and mostly consist of Precambrian rocks. The Baitarani River Basin contains Quaternary and Recent unconsolidated alluvium (Fig. 3). Geomorphologically, the district predominantly consists of dense forests and extensive hilly terrain. The landscape is characterized by undulating topography, featuring numerous fertile valleys and a variety of soils ranging from rich loam to the gravelly detritus of the hill slopes. Keonjhar district encompasses valleys, lowlands, and mountainous highlands, with a prevailing slope from north to south (Fig. 2). The river Baitarani and its catchment areas must have formed an equally important region in the past due to its strategic location, geography and suitable geology for the rise of ancient settlements. Raw materials such as quartzite, limestone, quartz, chert, chalcedony, dolerite, dolomite and others are easily available in the form of river pebbles and cobbles and also in the adjoining hill slopes in the form of blocks and slabs. These must have provided adequate raw materials for the prehistoric settlers in the Baitarani River valley throughout the Pleistocene period.

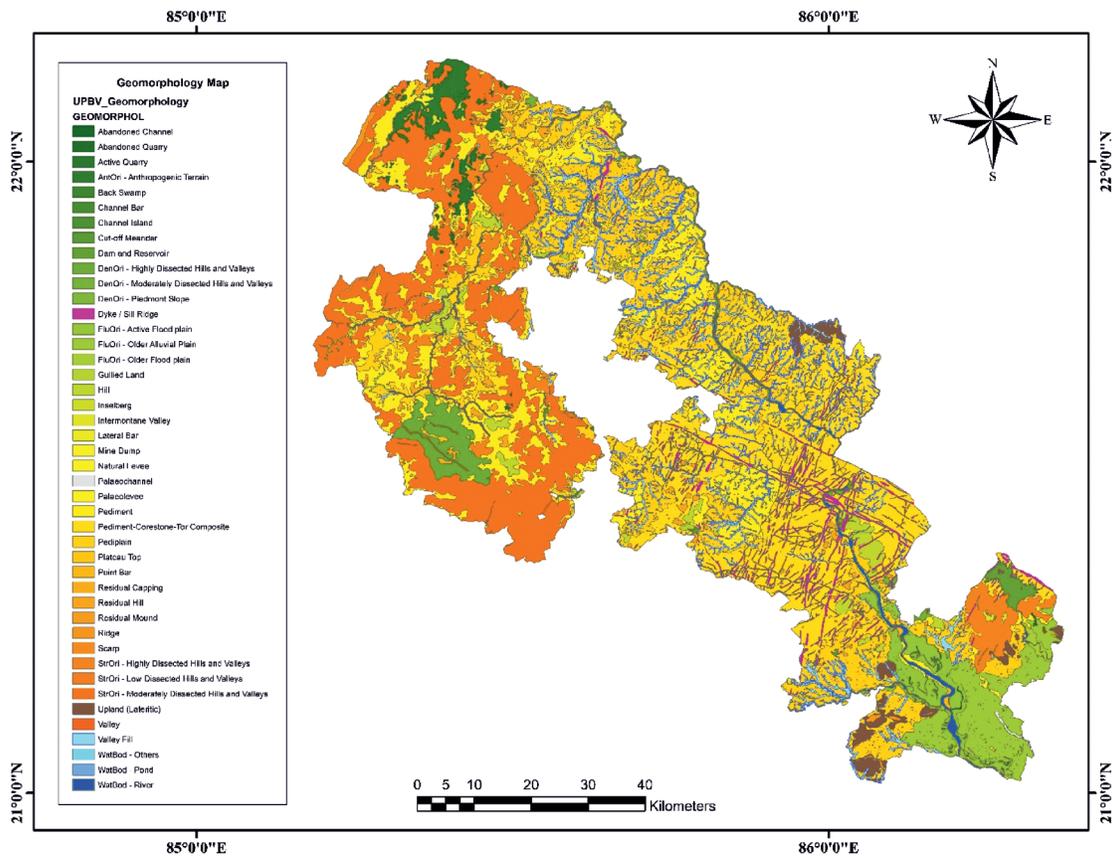


Fig. 2: Map showing the Geomorphological units of the Upper Baitarani River valley, Keonjhar district, Odisha.

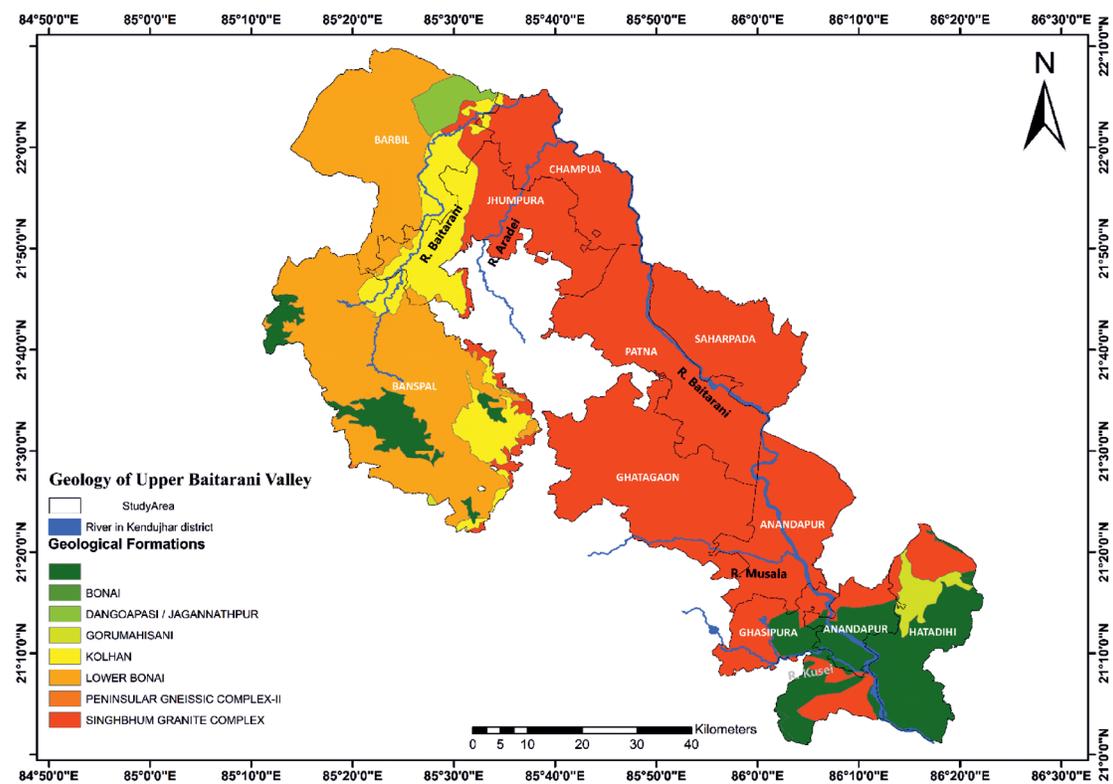


Fig. 3: Map showing the geological formations in the Upper Baitarani Valley.

## RESULT OF THE FIELD SURVEY

A recent field investigation in the Upper Baitarani Valley was carried out between 2019 and 2023 as part of the doctoral research. The field investigations have brought to light a total number of 62 prehistoric sites reported in both primary and semi-primary contexts, of 53 sites that have yielded microlithic tools (Fig. 4). Among the 53 microlithic sites, 32 sites yielded only Microlithic artefacts, and 21 sites had microliths associated with Middle Palaeolithic, Upper Palaeolithic and Neolithic artefacts (Table 1). A total of 3038 microlithic artefacts were collected from the 53 specified sites. A large number of microlithic artefacts of different shapes and sizes were collected through the random sampling method of the site-grid pattern from different sites. The cultural remains of this region exhibit several characteristic features, which are usually noticed in other river valleys of Odisha.

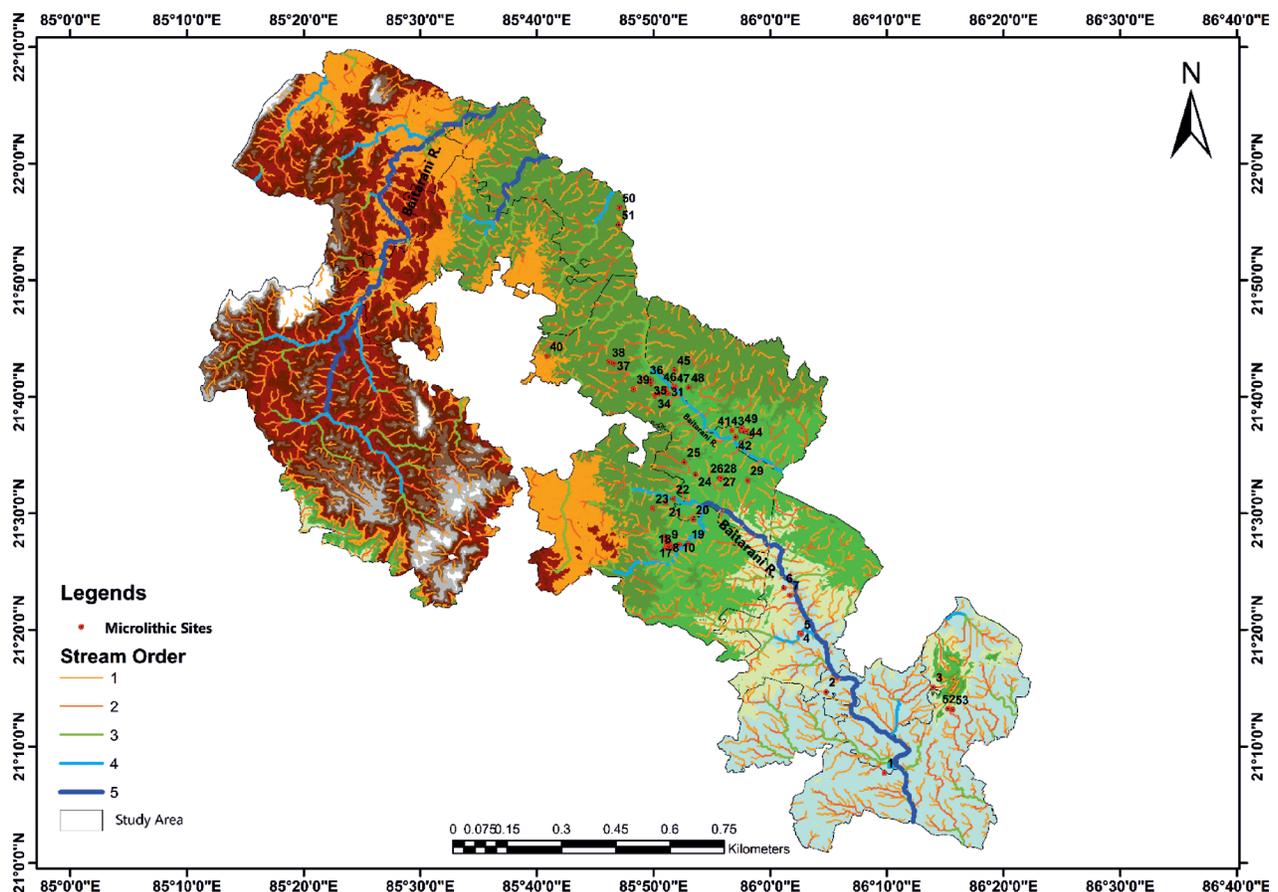


Fig. 4: Location of newly explored microlithic sites in the Upper Baitarani Valley, Keonjhar district, Odisha

## THE MICROLITHIC LITHIC INDUSTRY OF UPPER BAITARANI VALLEY

Arguably, the lithic evidence is the most abundant feature to reveal the prehistoric past because it doesn't degrade easily (Andrefsky 2005:1). South Asia is very rich in hominid occupational evidence, which extends back to the early Pleistocene (Haslam *et al.* 2012: 670). This microlithic industry of the Upper Baitarani valley comprised 3038 artefacts. All the recovered artefacts are analysed, and details are systematically recorded in the customized field database. This entire microlithic assemblage is defined as a microlithic industry due to the production of microblades and/ or backed artefacts (Clarkson *et al.* 2009: 326). The Microlithic industry (n=3038) consists of cores (n=500, 16.5%),

**Table 1: List of Recently Explored Prehistoric Sites in the Upper Baitarani River Valley, Keonjhar District**

<i>Sl No.</i>	<i>Name of the Site</i>	<i>Block</i>	<i>Context</i>	<i>Associated Materials</i>	<i>River Bank</i>	<i>Latitude</i>	<i>Longitude</i>
1	Batoo	GHASIPURA	Erosional surface on the river bank	Microlithic	Right Bank of Kusei River	21° 7'45.31"N	86° 9'47.38"E
2	Ostapur	GHASIPURA	Erosional surface	Microlithic	Right bank of Baitarani River	21°14'41" N	86°04'47"E
3	Sujanapal (Chakratritha)	Anandapur	Erosional Surface on Foothill	Microlithic	Bank of Perennial Stream	21°15'5.06"N	86°13'57.93"E
4	Kolimati (VSKM SAHI)-I	Anandapur	Erosional surface on the river bank	Microlithic	Left bank of Musala River	21°19'44" N	86°02'35" E
5	Karadabani	Anandapur	Erosional surface on the river bank	Upper Palaeolithic with Microliths	Right bank of Musala River	21°19'39"N	86°02'39" E
6	Kadabahali-II	Anandapur	Foothill	Middle Palaeolithic, Upper Palaeolithic, Microlithic & Neolithic	Right bank of Baitarani River	21°23'36" N	86°01'09" E
7	Kadabahali-III	Anandapur	Foothill	Upper Palaeolithic with Microliths	Right bank of Baitarani River	21°22'59" N	86°01'42" E
8	Dhanurjayapur	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°45'39" N	85°85'69" E
9	Haladharpur	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°44'15" N	85°85'55" E
10	Gadadharpur	Ghatagaon	Erosional surface	Microlithic	Left Bank of Kukurkuta River	21°27'20" N	85°52'11" E
11	Hatibari	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°27'22" N	85°51'22" E
12	Khunta	Ghatagaon	Erosional Surface on the Rock outcrops	Microlithic	Right Bank of Kukurkuta River	21°26'64" N	85°51'38" E
13	Sanamasinabila	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°27'48" N	85°51'06" E
14	Nuagaon	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°27'59"N	85°51'01"E
15	Sagadia-I	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°27'13" N	85°51'09" E
16	Sagadia-II	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°27'20" N	85°51'12" E
17	Sagadia-III	Ghatagaon	Erosional surface	Microlithic	Left bank of Sagadia Nala	21°27'25"N	85°51'06" E
18	Sagadia-IV	Ghatagaon	Erosional surface	Microlithic	Right bank of Sagadia Nala	21°27'00" N	85°51'00" E
19	Dehuripasi	Ghatagaon	Erosional Surface on the Rock outcrops	Microlithic	Right Bank of Kukurkuta River	21°27'24"N	85°52'59"E
20	Panupasi	Ghatagaon	Erosional Surface on the Rock outcrops	Microlithic	Left Bank of Kukurkuta River	21°29'28"N	85°53'23" E
21	Kaspada-I	Ghatagaon	Foothill	Neolithic & Microlithic	Right bank of Sita River	21°30'54"N	85°51'03" E
22	Kaspada-II	Ghatagaon	Erosional Surface on the Rock outcrops	Microlithic	Right bank of Sita River	21°31'15"N	85°51'41" E
23	Dhinkikot	Ghatagaon	Erosional Surface on the Rock outcrops	Upper Palaeolithic & Microlithic	Right bank of Sita River	21°50'55"N	85°82'79"E
24	Musakhari-I	Patana	Erosional Surface on the Rock outcrops	Upper Palaeolithic & Microlithic	Left bank of Kasia Nala	21°33'19"N	85°53'35"E

<i>Sl No.</i>	<i>Name of the Site</i>	<i>Block</i>	<i>Context</i>	<i>Associated Materials</i>	<i>River Bank</i>	<i>Latitude</i>	<i>Longitude</i>
25	Musakhari-II	Patana	Erosional Surface on the Rock outcrops	Middle Palaeolithic, Upper Palaeolithic & Microlithic	Left bank of Kasia Nala	21°34'23"N	85°52'38" E
26	Kumudabadi-I	Patana	Erosional Surface on the Rock outcrops	Microlithic	Right Bank of Perennial Streamlet	21°33'02"N	85°55'40"E
27	Kumudabadi-II	Patana	Erosional Surface on the Rock outcrops	Microlithic	Right Bank of Perennial Streamlet	21°32'57"N	85°55'42"E
28	Kumudabadi-III	Patana	Erosional Surface on the Rock outcrops	Microlithic	Left Bank of Perennial Streamlet	21°33'02"N	85°55'46"E
29	Pichilabada-II	Patana	Erosional surface	Microlithic	Right bank of Baitarani River	21°32'50"N	85°58'03"E
30	Kenduapada	Patana	Erosional Surface on the Rock outcrops	Microlithic	Left bank of Kanjhari river	21°40'15"N	85°50'29"E
31	Ankura-I	Patana	Erosional Surface on the Rock outcrops	Microlithic	Right Bank of Kanjhari river	21°40'15"N	85°51'15"E
32	Ankura-II	Patana	Erosional Surface on the Rock outcrops	Microlithic	Right Bank of Kanjhari river	21°40'35"N	85°50'55"E
33	Ankura-III	Patana	Erosional Surface on the Rock outcrops	Microlithic	Right Bank of Kanjhari river	21°40'42"N	85°51'03"E
34	Mushapada	Patana	Erosional Surface on the Rock outcrops	Microlithic tools	Left bank of Kanjhari river	21°40'05"N	85°50'06"E
35	Sildia-I	Patana	Erosional Surface on the Rock outcrops	Middle, Upper Palaeolithic & Microlithic	Left bank of Kanjhari river	21°41'11"N	85°49'46"E
36	Sildia-II	Patana	Erosional Surface on the Rock outcrops	Middle, Upper Palaeolithic & Microlithic	Left bank of Kanjhari river	21°41'28" N	85°49'44"E
37	Padmapur-I	Patana	Rocky Outcrop	Microlithic	Right bank of Baitarani River	21°42'52" N	85°46'37"E
38	Padmapur-III	Patana	Erosional Surface Rocky Outcrop	Microlithic	Right bank of Baitarani River	21°42'59" N	85°46'11"E
39	Kashipur	Patana	Erosional Surface Rocky Outcrop	Upper Palaeolithic & Microlithic	Left bank of Kanjhari River	21°40'38.81"N	85°48'17.37"E
40	Bhuluda	Patana	Erosional Surface on the Piedmont area	Middle & Upper Palaeolithic, Microlithic	Nullah Bank	21°43'28.39"N	85°40'51.54"E
41	Katabeda	Patana	Erosional Surface on Rocky Outcrop	Microlithic	Right bank of Bhirala River	21°37'6.28"N	85°56'43.02"E
42	Barachela	Patana	Erosional Surface on Rocky Outcrop	Microlithic	Left bank of Bhirala River	21°36'32.24"N	85°57'1.55"E
43	Mirigikhoji	Patana	Erosional Surface on Rocky Outcrop	Microlithic	left bank of Bhirala River	21°37'6.87"N	85°57'32.26"E
44	Talapada	Saharapada	Erosional Surface Rocky Outcrop	Microlithic	left bank of Bhirala River	21°37'2.41"N	85°57'57.40"E
45	Udayapur	Saharapada	Erosional Surface on Rocky Outcrop	Microlithic	Left bank of Baitarani River	21°42'17.19"N	85°51'46.61"E
46	Silipada-I	Saharapada	Erosional Surface on Rocky Outcrop	Microlithic	Left bank of Baitarani River	21°40'52.94"N	85°51'51.39"E
47	Silipada-II	Saharapada	Erosional Surface on Rocky Outcrop	Middle Palaeolithic & Microlithic	Left bank of Baitarani River	21°40'45.86"N	85°51'44.73"E

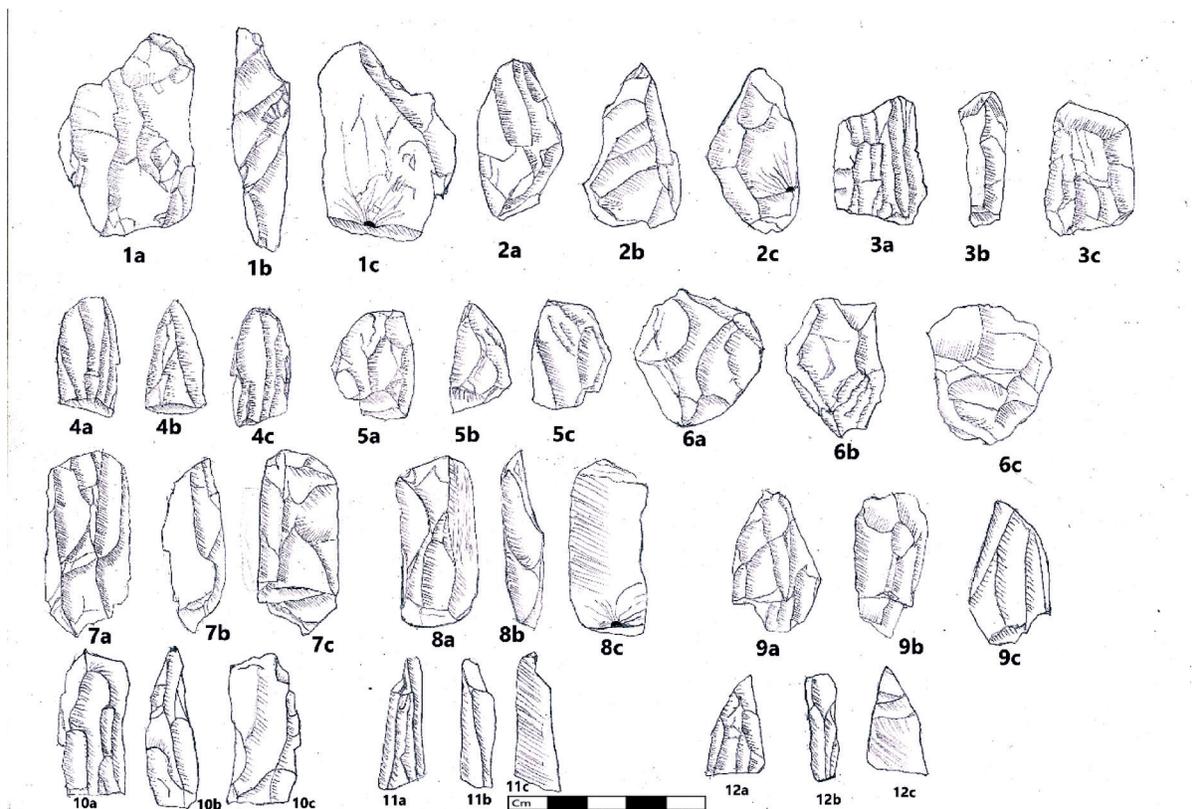


**Table 3: Position of breakage on the Microlithic artefacts**

<i>Position of breakage</i>	<i>In numbers</i>	<i>In percentage</i>
Both proximal and distal ends Broken	132	23.44 %
Distal end broken	88	15.63 %
Proximal and mesial ends Broken	58	10.30 %
Proximal end broken	145	25.75 %
Retouched	140	24.86 %
Total	563	100.00%

## CORE TECHNOLOGY

The Microlithic technology observed in the Upper Baitarani Valley encompasses a variety of core types (Fig. 5), including single and multiple platform flake cores, as well as blade core, flake-blade, and bladelet cores found on the sites (Plate 1). 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 was also applied. 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 on the cores. During the process of reduction, rejuvenation of cores was carried out. At most of the sites, there are different shapes of cores found, such as pyramidal cores (7.6%), sub-pyramidal cores (7.8%), rectangular cores (8.4%), cylindrical cores (9.6%), sub-cylindrical cores (10.6%), round cores (6.4%), triangular cores (10.4%), sub-triangular cores (15.8%) and irregular cores (23.4%) types of cores were more identical than other types in the core assemblages. The prepared cores have conical, chisel-ended, cylindrical, flat-based, elliptical, etc., shapes.



**Fig. 5: Types of Microlithic cores: Flake Cores (No. 1, 5, 6 & 9), Blade cores (No. 2, 3, 4, 7, 8, 10, 11 and 12).**

The shape depends more or less on the original shape of the nodule. Normally, conical and chisel-ended type cores have only one striking platform, respectively. Blades taken out from chisel-ended cylindrical cores are always parallel-sided; similarly, flakes taken out from a conical core shall always have one end narrow (Verma 2002). The flake cores have a cortex ranging from 25%-75% on the nodules. These cores have flake scars from 1- 4, and the flake scars dimensions range from 15.90 to 8.20mm in length and 9.83 to 4.67mm in breadth. The organization of the striking platform in flake cores consists of a 90° core (n=25), unidirectional core (n=19), and multidirectional cores (n=265). Blade cores were found in the sites, which contained blade scars from a range of 1- 8 scars with an average scar, so 2-3 scars were common, with 3 scars being more frequent. The blade scar dimensions range from 22.1 to 12.6mm in length to 9.2 to 4.7mm in breadth. The striking platform in blade cores



Pl. 1: Different types of Microlithic flake and blade cores found from Upper Baitarani Valley

is organised into unidirectional cores (n=155) and multidirectional cores (n=25). The cores used for removing both flakes and blades can be referred to as multi-functional cores. It has been noted on numerous occasions that the flakes (end product) were removed before detached blades could be used as tools, although such evidence is scarce. The organization of the striking platform in flake-blade cores consists of a 90° core (n=6) and multidirectional cores (n=15). A total of 105 cores that had traces of cortex from all the sites were considered for cortex analysis. This shows an interesting result, as only 14.28% of cores have 0-10% cortex, 33.33% of cores were found with 10-25% cortex, 27.61% cores were found with 25-50% cortex, 50-75% cortex was found on 11.42% cores, and 75-100% cortex was noticed on 13.33% of cores. The detailed morphometric study of the cores provided in (Table 2) represents the artefact group's maximum, minimum, mean and standard deviation. The core nodules are angular to sub-angular pebbles and cobbles, which were sourced locally in the river bed as well as on the hill slopes.

## DEBITAGE/WASTE PRODUCTS

In the overall tool assemblage, a total of 1634 waste products/debitage were collected. These form the largest portion of the Microlithic assemblage. The debitage includes blade debitage (n=112, 6.85%), core debitage (n=768, 47.00%), cortical flake (n=114, 6.98%), flake < 2cm (n=360, 22.03%) and non-cortical flake (n=280, 17.14%). Cortex is present in 114 artefacts and is absent in the majority of artefacts (Plate 2). The debitage is dominated by flakes with less than 2cm cortex coverage, and the percentage of cortex coverage is not recorded due to its size. The cortex coverage of the other artefacts is 0-25% and sometimes 25-50% on the surface. The waste products or debitage have different types of striking platforms; the plain type of platform (n=656) dominates in the assemblage, while others are faceted (n=102), cortical (n=71) and punctiform (n=20). In the majority of flakes, the striking platform is unclear (n=215) and blank (n=215). The striking platform is absent (n=245) in a good number of debitage. The bulb is present on 226 artefacts; among these, the diffused types of bulbs dominate (n=168).

## FINISHED/SHAPED TOOLS

A total of 904 finished Microlithic tools were collected from all fifty-six sites. The Microlithic assemblage is dominated by retouched blades (n=233, 25.77%) and bladelets (n=219, 24.23%), among the others burins (n=6, 0.66%), borers (n=28, 3.10%), backed blades (n=41, 4.54%), micro-blade (n=114, 12.61%), single side scraper (n=111, 12.28%), points (n=70, 7.74%), double side scrapers (n=1, 0.11%), notch (n=9, 1.00%), broken blade (n=23, 2.54%), micro scrapers (n=19, 2.10%), point cum borer (n=23, 2.54%), tringle (n=3, 0.33%) and crescents (n=4, 0.44%) (Table 2). These tools are dominated by non-geometric microliths, but a few geometric tools were also identified within the tool assemblage (Plates 3, 4 & 5). Most of the finished tools are complete in condition, whereas retouched bladelets (n=219), retouched blades (n=233), micro blades (n=114) and single-side scrapers (n=111) are found in fresh condition, whereas a few micro-blades (n=23) are found broken at the distal end (Fig. 6). The overall Microlithic assemblage has more complete tools than broken ones. The Microlithic tool assemblage is dominated by non-cortical tools. The cortex ranges from 0-25% to 25-50%; most of the tools have cortex ranges between 0-25% (n=181, 81.53%) and others have cortex >25%. Only 13 tools have a range of 25-50% in the cortex. There are different kinds of striking platforms, including broken, faceted, plain and punctiform types. Most of the flake tools have Punctiform platforms (n=525, 58.7%),



**Pl. 2: Microlithic flakes and debitage found from the Upper Baitarani Valley.**

while others have faceted ( $n=140$ , 15.48%) and plain ( $n=208$ , 23.00%). There are 31 finished tools on which the platform is absent due to the breakage in the proximal end. In the overall Microlithic assemblage, the bulb is present on the finished tools ( $n=881$ ) and absent on a few ( $n=23$ ). Most of the finished tools have prominent bulbs ( $n=569$ , 62.94%), 224 tools have diffused bulbs, and 88 have broken bulbs. Retouchings are observed on different positions of the artefacts with different types of retouches; these include nibbling ( $n=186$ , 20.57%), irregular ( $n=440$ , 48.67%), regular ( $n=238$ , 26.32%) and scalar ( $n=10$ , 4.42%) types. Most of the tools are retouched on both the right and left sides ( $n=285$ , 31.32%); others are on the left side ( $n=136$ , 15.4%) and on the right side ( $n=88$ , 9.73%). A large number of finished tools were retouched on the distal, left and distal, left proximal, and right and distal ends (Table 4). Different types of flake terminations were observed in the assemblage; among the feathered terminations ( $n=400$ , 44.24%) dominate, while others have plunging ( $n=200$ , 22.12%), hinged ( $n=259$ , 28.65%) and step termination ( $n=45$ , 4.97%). There are 13 finished tools with unclear flake terminations due to breakage of the terminals. Finished tools with fresh preservation ( $n=640$ , 70.79%) dominate among the assemblage, while others rolled ( $n=156$ , 17.25%) and weathered ( $n=108$ , 11.94%).



Pl. 3: Microlithic Bladelets from the Upper Baitarani Valley.

Table 4: Location and various types of retouching on the finished Microlithic tools

<i>Location of retouch</i>	<i>Irregular</i>	<i>Nibbling</i>	<i>Regular</i>	<i>Scalar</i>	<i>Total in Numbers</i>	<i>In Percentage</i>
Distal	45	38	20		103	11.39
Left	42	52	42		136	15.04
Left and distal	58		45		103	11.39
Left proximal	62		36		98	10.84
Right	48	25		15	88	9.73
Right and distal		71	20		91	10.06
Right and left	185		75	25	285	31.32
Total in Numbers	440	186	238	40	904	100.00
In Percentage	48.67	20.57	26.32	4.42		100.00



Pl. 4: Various types of Microlithic blades found from the Upper Baitarani River Valley.



Pl. 5: Microlithic Crescent, Points and Burins from Upper Baitarani Valley.

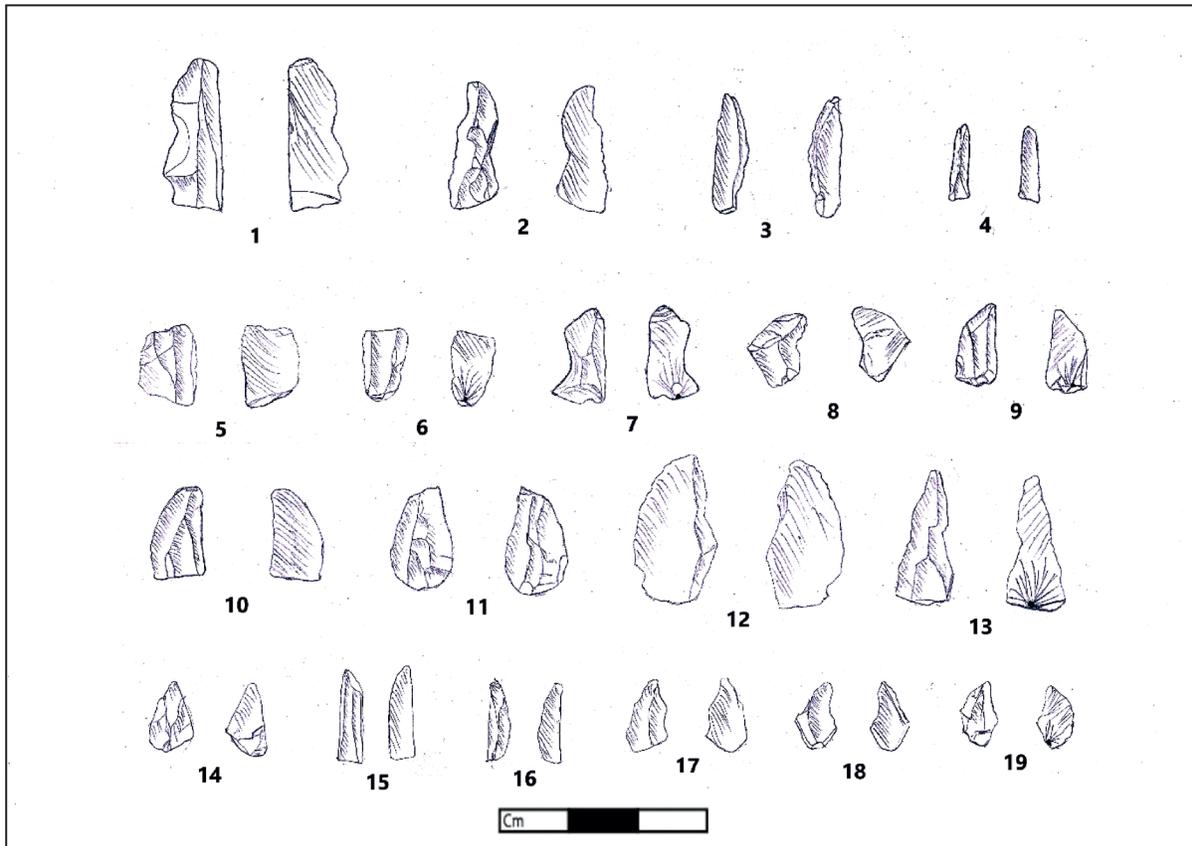


Fig. 6: Varieties of Microlithic tool assemblage, Bladelets (no. 1,2 & 5), Points (no. 3,9,13,14,15, 18 & 19), micro blades (no. 4 & 6), notches (no.7 & 8) and micro-scrapers (no. 10, 11 & 12).

## RAW MATERIALS USED

The Microlithic artefacts were flaked on different types of raw materials. Chert is predominantly used as a raw material (n=2732, 89.92%), other Chalcedony (n=1, 0.03%), Agate (n=1, 0.03%), Quartz (n=259, 8.52%), Jasper (n=35, 1.15%) and Dolerite (n=10, 0.32%). The source of siliceous raw material found at the sites located in the northern highland region is the exposures, which occur in the form of cobbles, pebbles, nodules and tablets. The exploitation of raw materials varies from site to site. Notably, a huge number of cores, finished tools, and debitage flakes on chert. Among all the raw material types, black chert is the dominant raw material used for the production of Microlithic tools in the upper Baitarani River valley. Quartz of various types, such as fine, milky, and banded varieties, was used in a good number of microliths. A few dolerites, jasper, chalcedony, and agate were also used to manufacture Microlithic artefacts (Fig. 7).

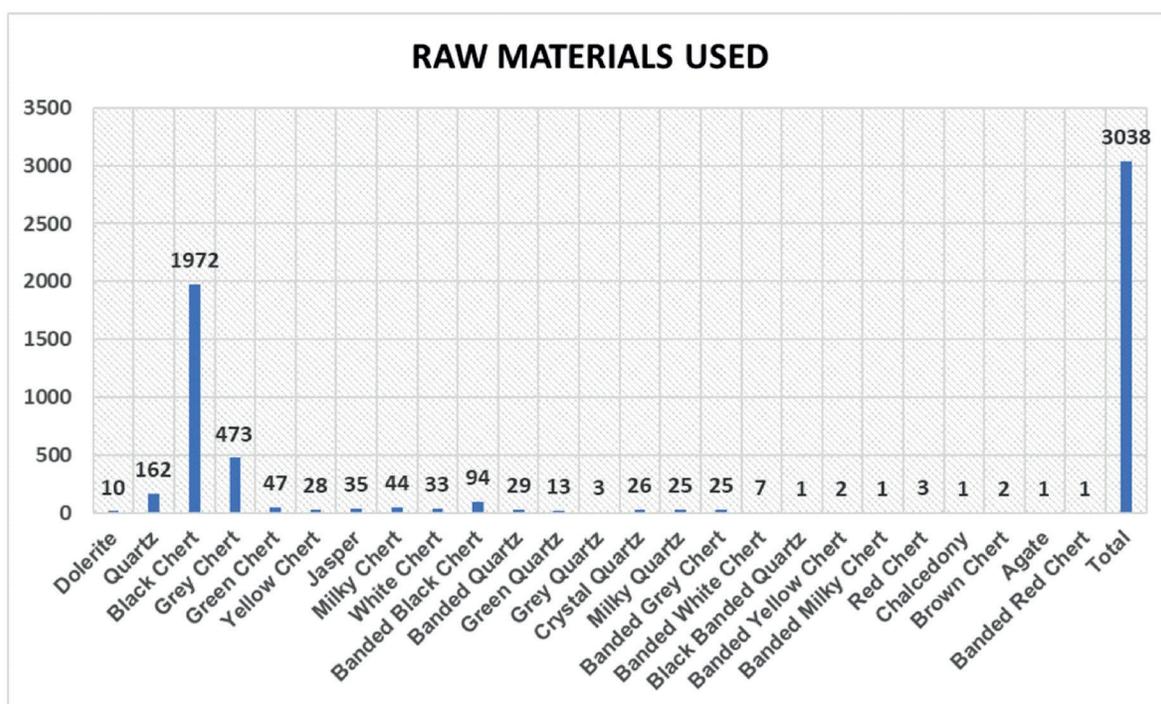


Fig. 7: The number and percentage of raw materials of the recovered microlithic assemblages in the Upper Baitarani Valley.

## DISCUSSION AND CONCLUSION

The Keonjhar district is important from an archaeological perspective. This region of Odisha, like many other parts of India, showcases a rich history of continuous human habitation, spanning from the Pleistocene to the Holocene epoch. All the recovered sites in the study area were mainly located in four geomorphological contexts: sites on the major river bank and its tributaries, on the bank of large and small perennial streamlets, on the foothill regions and both the flat and highly elevated granitic rock outcrops. All the recovered sites are mainly open-air sites, and they were predominantly situated near small streams. The nearby presence of forests likely facilitated access to various game animals and plant-based food sources. These sites were evidently utilized for habitation purposes (Issac 1960; Clark 1975; Paddayya 2006). The sites found in this region have occurred in the foothill context, river banks and on both low and high-elevated granitic rock outcrops areas always one of the major

centres of attraction for the prehistoric people for settlement. There are some good reasons to settle in a semi-high land area; the hill slopes provide the source of the raw materials for tool production and are used as a manufacturing centre. Andrefsky (1998: 21-34) argued that the availability of lithic raw materials might be the most important factor in the organization of technology that influenced the settlement configurations. Again, many flat and high elevated granitic rock outcrops situated on the major river bank and along the Nullah banks provide a platform as a watchtower or strategic location to understand the animal movements of this region for hunting-gathering. The abundance of artefacts present on the exposed surface of the rock outcrops indicates that this area served as a tool manufacturing site. Additionally, our research indicates that this platform frequently provided shelter for small game animals, allowing prehistoric people access to both plants and small game. Moreover, it likely served as a secure location suitable for long-term habitation. Besides, as we know, the river has always played a great role in prehistoric human settlement because it provided the basic needs of man for subsistence (Binford 1980).

In relation to the geological stratification of the study area, these Microlithic artefacts have been discovered in association with erosional surfaces covered by loose silty-sandy-clay of reddish-brown and yellowish hues. These surfaces are also connected with ferruginous lateritic pellets or calcrete nodules. The easy accessibility to the abundance of raw materials for tool production and suitable environmental conditions attracted the attention of the prehistoric people who inhabited the riverside for a long period. The Reddish-Yellowish mottled silts, sands, and clay with calcrete nodules having Microliths with or without heavy-duty tool components show a dry climatic condition in the later part of the Late Pleistocene period (Rajaguru 1983). The Pleistocene-Holocene transition phase was climatically very sensitive almost all over peninsular India due to the strengthening of the Indian monsoon (Kale and Rajaguru 1987). The climate was humid, favoured high water discharge in rivers, and strengthened the erosive force of water. More or less similar humid climatic conditions prevailed in Odisha and West Bengal in general and also in the context of the Baitarani basin in particular. Despite some disturbances occurring in the sites through natural processes, most of the investigated sites appear to be in their respective original sedimentary contexts.

The Microlithic industry of Upper Baitarani Valley comprises scrapers, scraper-cum-borers, blades, bladelets, backed blades, burins, borers, tringles, crescents, points, awls and notches made from different raw materials. Scrapers, blades and bladelets were the prominent tools in the overall Microlithic assemblage of upper Baitarani Valley. These Microlithic artefacts are found in association with many heavy-duty tools; the basis of the typo-technological and morphological analysis of these tools indicates they belong to both preceding and succeeding cultures such as the lower, middle and Upper Palaeolithic, and few are from the Neolithic period. Chert is the most common raw material used to manufacture artefacts. Chert occurs in secondary form as veins and in the form of pebbles from river beds. Among the use of chert raw material, black chert is used as the dominant. Except chert, quartz, agate, and jasper have been used to prepare these tools. On the basis of typo-technological comparison and the use of raw material employed for manufacturing the Microlithic tools, soft hammers of bone or wood, pressure flaking, and direct techniques have been used for preparing these tools.

However, due to the occurrence of long elongated flake scars on the blade core along with the micro-blade, backed-blade artefacts with a predominance of scrapers, it seems to be the microlithic tool industry of upper Baitarani Valley belongs to the transitional phases of the Upper palaeolithic to the Mesolithic as similar assemblage has been reported from the Bansloi River of Jharkhand named

as Damin Industry (Akhilesh 2008). In most sites, the microliths discovered alongside the tools were produced using the prepared core and discoidal cores characteristic of the Middle Palaeolithic. These were also found in conjunction with the long, parallel-sided elongated blades, bladelets, and burins from the Upper Palaeolithic period, as well as with the ground and polished tools from the Neolithic period. Despite this, the previous exploration of the Middle and Upper Suvernarekha Valley in the Jharkhand and West Bengal, the North Koel River Valley of the Palamou district and the South Koel River Valley of the Ranchi district provided upper Palaeolithic blades, including geometric and non-geometric-artefacts-from the open air surface site (IAR 1959-60:12). Moreover, artefacts on flakes and presence of blade, even, flake with fluted core further attract the attention towards the Indravati valley in Odisha where similar reduction sequence has been noticed (Nanda 1985 and 2000). Although the size ratio of the fluted core and blade disclosed the similarity of the recently dated site Mehtakheri, Kana and Mahadebbera (Mishra *et al.* 2013, Basak *et al.* 2014). So, this region has enough potential to secure its position in the late Pleistocene chronological context.

## ACKNOWLEDGEMENTS

I sincerely express my gratitude to my teacher, Prof. Subrata Kumar Acharya, for his continuous support, guidance and encouragement. I express my gratitude towards all my teachers in the Department of History, Ravenshaw University, Cuttack, for their support towards my research work. I am also thankful to Rajashree Puhana, one of the co-authors of this paper, for her help in the preparation of this research paper.

## REFERENCES

- Acharya, P. 1925-43. *Administration Report of Mayurbhanj (ARM)* for the years 1925-26.
- Akhilesh, K. 2008. The Upper Palaeolithic 'Damin Industries' of the Bansloi River Basin, Jharkhand. *Man and Environment* XXXIII (2): 15-31.
- Andrefsky, W. Jr. 1998. *Lithics: Macroscopic Approaches to Analysis*. Cambridge: Cambridge University Press.
- Andrefsky, William Jr. (Eds.) 2005. *Lithics: Macroscopic Approaches to Analysis*, (2nd. Edition). Cambridge: Cambridge University Press.
- Anikovitch, M.V. *et al.* 2007. Early Upper Palaeolithic in Eastern Europe and Implications for the Dispersal of Modern Humans. *Science*, 315:223-25.
- Banerjee, R. D. 1930. *History of Orissa*, vol. I, Calcutta, R. Chatterjee.
- Barik, K. 2022. *Prehistoric investigation in southern Bargarh upland with special reference to the Meddle Ong valley, Odisha*. Unpublished Ph.D. Dissertation, Pune: Deccan College.
- Bar-Yosef, O. and S. L. Kuhn 1999. The Big Deal about Blades: Laminar Technologies and Human Evolution. *American Anthropologist*, 101: 322-338.
- Basak, B., P. Srivastava, S. Dasgupta, A. Kumar and S. N. Rajaguru 2014. Earliest dates and implications of Microlithic industries of Late Pleistocene from Mahadebbera and Kana, Purulia district, West Bengal. *Current Science*, 1167-1171.
- Basak, B., S. Dasgupta and A. K. Paul 2023. Late Pleistocene microlithic industries in the Ayodhya Hills, Purulia, West Bengal: insights from geoarchaeological exploration. *Geological Society London Special Publications*, 515 (1).
- Behera, P. K. 2006. Investigations into the Mesolithic and Post-Mesolithic Settlements in the Middle Mahanadi Valley Orissa, in *Art and Archaeology of Orissa: Recent Perspectives* (S. Pradhan Ed.) pp. 1-62. New Delhi: Aryan Books International.

- Behera, P. K. 1989. *Archaeology of Sundargarh District with Special Reference to Brahmani Valley; Orissa*. Ph.D. Dissertation. Varanasi: Banaras Hindu University.
- Binford, L. R. 1980. Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45 (1): 4–20.
- Brown, K. S., C. W. Marean, Z. Jacobs, B. J. Schoville, S. Oestmo, E. C. Fisher, J. Bernatchez, P. Karkanas, and T. Matthews 2012. An early and enduring advanced technology originating 71,000 years ago in South Africa. *Nature*, 491(7425), 590-593.
- Clark, J. D. 1969. *World Prehistory: A New Outline*. Cambridge: Cambridge University Press.
- Clark, J. D. 1975. A Comparison of the Late Acheulian Industries of Africa and the Middle East, *After the Australopithecines*. Hauge, Mouton the Hauge Publishers: 605-659.
- Clarkson, C. M. D. Petraglia, R. Korisettar, M. Haslam, N. L. Boivin, A. Crowther, P. W. Ditchfield, D. Q. Fuller, P. Miracle, C. Harris, K. Connell, H. V. A. James and J. Koshy 2009. The oldest and Longest Enduring Microlithic Sequence in India: 35,000 years of Modern Human Occupation and Change at the Jwalapuram Locality 9 Rock Shelter. *Antiquity* 83: 326-348.
- Deep, S. 2016. *A Study of Microlithic Industries in the Bargarh Upland, District Bargarh, Orissa: with Special Reference to River Jira*. Ph.D. Dissertation. Sambalpur: Sambalpur University.
- Dehuri, R. 2013. *Archaeology of Kakharua Valley, North-Central Orissa*, Ph.D. Dissertation. Bhubaneswar: Utkal University.
- Elston, R. and S. Kuhn (Eds.). 2002. *Thinking Small: Global Perspectives on Microlithization*. Arlington: American Anthropological Association.
- Foley, R. and M.M. Lahr. 2004. On Stony Ground: Lithic Technology, Human Evolution and Emergence of Culture. *Evolutionary Anthropology* 12: 108-22.
- Gadta, S. 2000. *A study of Archaeological Remains in the Lower Ong and Suktel valleys Orissa*. Unpublished M. Phil. Dissertation. Sambalpur: Sambalpur University.
- Haslam, M., C. Harris, C. Clarkson, J. N. Pal, C. Shipton, A. Crowther, J. Koshy *et al.* 2012. Dhaba: an initial report on an Acheulean, Middle Palaeolithic and microlithic locality in the Middle Son Valley, north-central India. *Quaternary International* 258: 191-199.
- Hiscock, P., C. Clarkson and A. Mackay 2011. Big Debates Over Little Tools: Ongoing Disputes Over Microliths on Three Continents, *World Archaeology* 43(4): 653-664.
- Hiscock, P.D. 2002. Pattern and Context in the Holocene Proliferation of Backed Artefacts in Australia, in *Thinking Small: Global Perspectives on Microlithization* (R.G. Elston & S.L. Kuhn Eds.) pp. 163-77. Arlington (VA): American Anthropological Association.
- IAR: *Indian Archaeological Review* 1961-62. New Delhi: Archaeological Survey of India.
- IAR: *Indian Archaeology - A Review*. 1958-59. New Delhi: Archaeological Survey of India.
- IAR: *Indian Archaeology A Review* 1963-64. New Delhi: Archaeological Survey of India.
- Indian Archaeology: A Review. 1959-60. New Delhi: Archaeological Survey of India.
- IAR: *Indian Archaeological Review* 1982-83. New Delhi: Archaeological Survey of India.
- IAR: *Indian Archaeological Review* 1983-84. New Delhi: Archaeological Survey of India.
- IAR: *Indian Archaeological Review* 1984-85. New Delhi: Archaeological Survey of India.
- Isaac, N, 1960. *The Stone Age Cultures of Karnool*, Ph.D. Dissertation. Poona: Deccan College Post Graduate and Research Institute.

- James, H.V.A. and M.D. Petraglia 2005. Modern Human Origins and the Evolution of Behaviour in the Later Pleistocene Record of South Asia. *Current Anthropology* 46: 23-27.
- Kale, V. S. and S.N. Rajaguru 1987. Late Quaternary History of the NW Deccan Upland Region. *Nature* 325: 612-14.
- Klein, R.G. 2000. Archaeology and the Evolution of Human Behaviour. *Evolutionary Anthropology*, 9: 17-36.
- Kuhn, S. and M. Stiner 1999. Initial Upper Palaeolithic in South Central Turkey and its Regional Context: A Preliminary Report. *Antiquity*, 73: 505-17.
- Lewis, L. & M. Petraglia 2015. *Early microlithic technologies and behavioural variability in Southern Africa and South Asia*. Doctoral dissertation. Oxford: University of Oxford.
- Lewis, L., N. Perera & M. Petraglia 2014. First technological comparison of Southern African Howiesons Poort and South Asian Microlithic industries: An exploration of inter-regional variability in microlithic assemblages. *Quaternary International* 350 (2014) 7-25.
- McBrearty, S. and A. S. Brooks 2000. The revolution that wasn't: a new interpretation of the origin of modern human behaviour. *Journal of Human Evolution* 39 (5), 453-563.
- Mellars, P. 2006. Going east: new genetic and archaeological perspectives on the modern human colonization of Eurasia. *Science*, 313: 796-800.
- Mendaly, S. 2012. *A Study of Microlithic Assemblages in The Bargarh Upland: With Particular Reference to the Girisul River*, Orissa, unpublished M.Phil. Dissertation. Sambalpur: Sambalpur University
- Mendaly, S. and S. Hussain 2015. Microlithic Industry of Odisha with Particular Reference to Bhalugarh, District- Jharsuguda, Odisha: A Preliminary Report. *Heritage: Journal of Multidisciplinary Studies in Archaeology* 3: 346-369
- Mishra, S. 1998. *Archaeological investigation in the upper Jira valley, Orissa*. M.Phil. Dissertation. Sambalpur: Sambalpur University.
- Mishra, S., N. Chouhan and A. Singhvi 2013. Continuity of Microblade Technology In The Indian Subcontinent Since 45 ka: Implications For The Dispersal of Modern Humans, *PLoSOne* 8 (7): 1-14.
- Mohanta, B. K. 2002. *Neolithic and Post-Neolithic Cultures of Northern Orissa (With Special Reference to Mayurbhanj and Keonjhar Districts)*. Ph. D. Dissertation. Bhubaneswar: Utkal University.
- Mohanty, P. 1993. Mesolithic hunter-gatherers of Keonjhar, Orissa, India. *Asian Perspective*, 32 (1):87-104.
- Mohanty, P. K. 1989. *Mesolithic Settlement System of Keonjhar District Orissa*, Unpublished Ph.D. Dissertation. Poona: University of Poona.
- Mohapatra., G. C. 1962. *The Stone Age cultures of Orissa*, Deccan college. Pune.
- Naik, J. 2002. *The Mesolithic Industries of Lower Bheden Valley, Orissa A study of site distribution and assemblage composition*. Unpublished M. Phil. Dissertation. Sambalpur: Sambalpur University.
- Nanda, S. C. 1984. *Stone Age Culture of Indravati Basin, Koraput District, Orissa*, Ph. D. Dissertation. Poona: University of Poona.
- Nanda, S.C. 1985. The Mesolithic Culture of the Indravati Valley, District Koraput, Orissa in *Recent Advances in Indo-Pacific Prehistory* (V. N. Misra and P. Bellwood Eds.) pp. 159-163. New Delhi: Oxford and IBH.
- Neeley, M.P. and C.M. Barton 1994. A New Approach to Interpreting Late Pleistocene Microlithic Industries in Southwest Asia. *Antiquity*, 68: 275-88.
- Ota. S. B. 1986. Mesolithic Culture of Phulbani district, Orissa with Special Reference to Heavy Tool Components. *Bulletin of the Deccan College* 45: 79-85

- Paddayya, K. 2006. Water sources and lower Palaeolithic Settlement Patterns in the Hunsgi and Baichbal Valleys, Lower Deccan. *Journal of Indian Anthropological Society* 41: 55-65.
- Padhan, T. 2014. Stone Age Archaeology of Jonk River Basin in Western Odisha and Eastern Chhattisgarh. *Heritage: Journal of Multidisciplinary Studies in Archaeology* 2: 405-420.
- Padhan, T. 2016. Archaeological Exploration in Ong River Basin, Western Odisha. *Puratattva* 46: 69-75.
- Padhan, T. 2021. Modern Human Lithic Technology: Changing Subsistence Strategies during Late Pleistocene-Early Holocene in India. In *Cultural Heritage of India* (V. K. Rajpal Ed.). New Delhi: Research India Press.
- Panda, S. 1996. A study of *Archaeological Remains of the Ong Valley Orissa, particular Reference to Microlithic industries*. Unpublished M. Phil Dissertation. Sambalpur: Sambalpur University.
- Patel, B. 2002. *Archaeological Sites and Remains of the Raul Valley, Orissa*. Unpublished M. Phil dissertation. Sambalpur: Sambalpur University.
- Perera, N. 2011. People of the Ancient Rainforest: Late Pleistocene Foragers at the Batadomba-lena rock-shelter, Sri Lanka. *Journal of Human Evolution*, 61: 254-269.
- Pradhan, T. 2013. *Prehistoric Archaeology of the Jonk River in Odisha and Chhattisgarh*. Ph.D. Dissertation. Pune: Deccan College Post Graduate & Research Institute.
- Rajaguru, S.N. 1983. Problem of the Late Pleistocene Aridity in India. *Man and Environment* 7: 127-9.
- Roberts, P. and M. Petraglia 2015. Pleistocene rainforests: barriers or attractive environments for early human foragers. *World Archaeology* 47 (5): 718-739.
- Roberts, P., N. Perera, O. Wedage, S. Deraniyagala, J. Perera, S. Eregama & J. A. Lee-Thorp 2015. Direct evidence for human reliance on rainforest resources in late Pleistocene Sri Lanka. *Science*, 347 (6227): 1246-1249.
- Senapati, N. 1986 *Orissa District Gazetteers: Keonjhar*. Cuttack: Orissa Government Press.
- Seong, C. 2008. Tanged Points, Microblades and Late Palaeolithic Hunting in Korea. *Antiquity* 82: 871-83.
- Seth, K. 1998. *The Mesolithic sites of middle Jira valley, A study of pebble cobble Choppers form Mahanadi valley, Orissa*. Unpublished M. Phil Dissertation. Sambalpur: Sambalpur University.
- Sethi, K. 1995-96. *A Study of Mesolithic Sites Of High Land Odisha, With Particular Reference To Lower Jira Valley*. M.Phil. Dissertation. Sambalpur: Sambalpur University.
- Tripathi, K. C. 1972. *Lithic Industries of South-western Orissa*. Unpublished Ph.D. Dissertation. Bhubaneswar: Utkal University. Inter India Publication.
- Wedage, O., A. Picin, J. Blinkhorn, K. Douka, S. Deraniyagala, N. Kourampas, N. Perera, I. Simpson, N. Boivin, M. Petraglia and P. Roberts 2019. Microliths in the South Asian rainforest~ 45-4 ka: New insights from Fa-Hien Lena Cave, Sri Lanka. *Plos One*, 14 (10): e0222606.