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Palaeoecological Insights and Techno-Typological Characteristics of Microlithic Assemblages in the Barapahad Hill and Jhaun River Valley of Bargarh Upland, Odisha

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Abstract

The principal concern of the present treatise is to methodically concentrate upon the newly identified Microlithic sites situated along the banks of the Jhaun river and the adjoining foothill precincts of the Barapahad hill, located within the Bargarh district of Odisha. The Jhaun river, widely regarded as a paramount tributary of the Mahanadi River system, appears to have functioned as a vital geographical and ecological corridor for sustained human occupation. This occupation seemingly extended across a broad cultural continuum, encompassing prehistoric phases from the Paleolithic through to the Neolithic epochs. Within the framework of a systematic archaeological inquiry, scholars have discerned six significant Microlithic locales strategically distributed throughout the surveyed terrain. These sites exhibit a rich concentration of lithic artefacts and material culture, reflective of the technological and adaptive strategies employed by early hominin populations. The artefactual assemblages retrieved from both the Jhaun riverine system and the Barapahad hill disseminate invaluable empirical data, particularly in relation to settlement dynamics, mobility patterns, and resource utilization among prehistoric communities inhabiting this region. These findings underscore the importance of this landscape as a favorable ecological niche that potentially supported seasonal or long-term habitation. The ongoing research encapsulates a meticulous and exhaustive analysis of the Microlithic deposits recently unearthed from this area, aiming to reconstruct cultural processes through stratigraphic, typological, and spatial studies. This investigation further contributes to a broader understanding of early human occupation and technological evolution in eastern-central India.

Keywords: Barapahad Foothills, Bargarh District, Jhaun River, Microlithic.

Introduction

In light of the pervasive paucity of material evidence, our comprehension of Prehistoric human life ways remains partially obscured. Nevertheless, through assiduous efforts, erudite archaeologists and historians have managed to reconstruct a relatively authentic depiction of this era, facilitated by the discovery and exploration of prehistoric sites across the globe. Over successive epochs, humanity evolved methodologies of subsistence centered on hunting and food gathering, evidenced by the fabrication and utilization of prehistoric stone tools (1, 2). Persistent and methodical archaeological investigations within the Bargarh region have revealed a profusion of sites representing Acheulian, Middle Paleolithic, Microlithic, and Neolithic cultural manifestations area (3-13).

In contemporary archaeological discourse, the term 'Microlithic' is intrinsically associated with Mesolithic antiquities found in the different parts of the ancient world after the last Pleistocene in the form of geographical and temporal setting (14), characterized by diminutive geometric lithic fragments generally measuring less than 40 mm in length and 4 mm in thickness (15). The extensive employment of Microliths during the Mesolithic has been authenticated through the discovery of composite tools, frequently fashioned from organic materials such as bone, antler, or wood, embedded with lithic inserts. These artefacts, when preserved within conducive environmental matrices, provide profound insight into the technological ingenuity of Mesolithic populations.

The fecund terrain of Bargarh eloquently narrates its illustrious antiquity, with archaeological investigations tracing human occupancy back to the Stone Age. For the past triennium, the authors have endeavored to unearth the archaeological patrimony of the Bargarh region and the Barapahad foothills.

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This paper endeavors to illuminate the results of extensive field research conducted along the Jhaun river, an influential tributary of the Mahanadi, and the associated Barapahad highlands. Six pivotal archaeological sites such as Junani, Belbahali, Gangei, Runipali, Aapkhol, and Nalichuan have emerged as critical loci elucidating the prehistoric settlement dynamics of this watershed. The lithic assemblages collected from these sites furnish a coherent narrative of human adaptation, development, and cultural progression within the prehistoric milieus of the region (Figure 1).

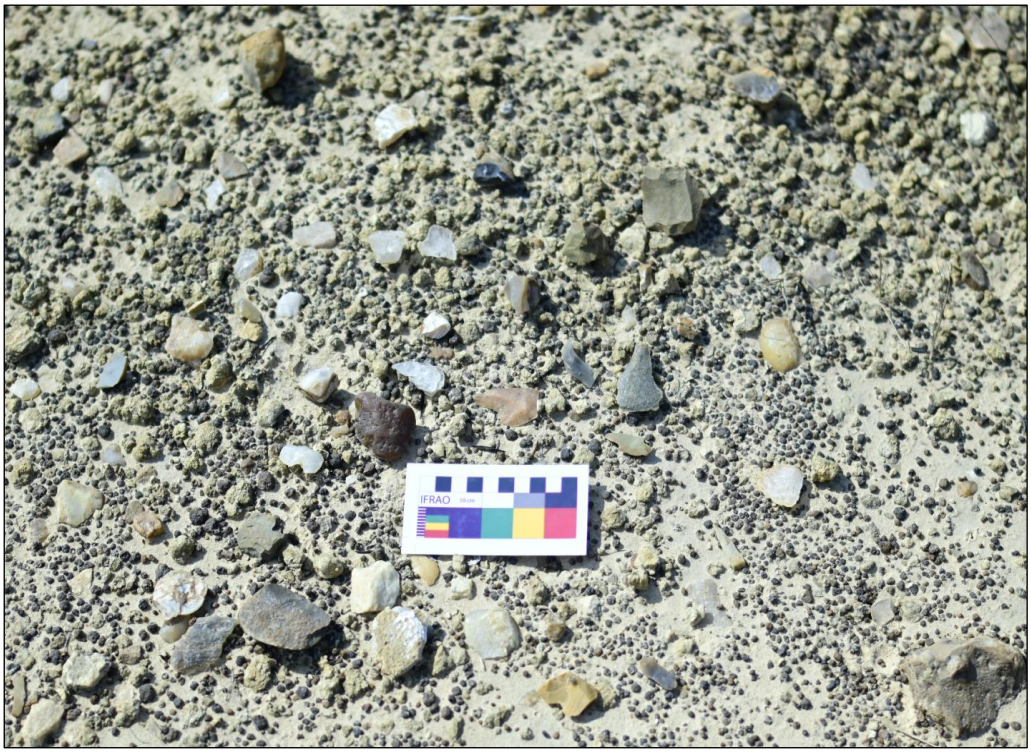

Figure 1: Scattered Lithic Artifact from Junani Site

The present century has witnessed the systematic unveiling of archaeological wealth through pioneering excavations and extensive explorations, culminating in the documentation of myriad sites dispersed across foothill tracts, riparian margins, upland fluvial sections, cavernous formations, and piedmont zones. Despite these strides, vast expanses of the region remain archaeologically inscrutable, perpetuating lacunae in the historical consciousness of Odisha's antiquity (16). Episodic Prehistoric investigations conducted intermittently by diverse scholars have illuminated facets of Microlithic cultural transitions manifesting across variegated geomorphological settings. Scholarly inquiry into the Bargarh Upland underscores that the Prehistoric lithic assemblages of the Jira River basin were first reported by Mishra, who identified Microlithic loci proximal to Bargarh township. Seth's systematic reconnaissance along the Jira River, from its emergence near Bargarh town to its confluence with the Mahanadi, revealed seven discrete Microlithic-bearing locales. Subsequent contributions include S. Panda's documentation of the Ong valley lithic industries (17), Seth's studies along the lower Jira (18), Mishra's explorations of the upper Jira, and J. Naik's surveys in the lower Bheden valley (19). The intensive campaigns undertaken by P.K. Behera and Neena Thakur between 2011 and 2015 considerably expanded the corpus of known archaeological sites in the district. Additional seminal works encompass Mendaly's reconnaissance of the Girsul Valley (20) and S. Deep's analyses of the lower Jira Valley (21) and its resources such as Ranj and Danta (22) and southern Bargarh upland by K. Barik.

The present study undertakes a meticulous examination of artefactual material procured from the Jhaun River system and the basal slopes of the Barapahad Hill, employing a technological and typological analytical framework. The artefacts are comparatively evaluated other Microlithic assemblages extant within the Bargarh Upland and the broader fluvial context of the Mahanadi basin.

Materials and Methodology

Area of Present Study

The archaeological endeavor under consideration furnishes an intricate and holistic analysis of the expansive terrain adjoining the Jhaun river, extending from its nascence to its intersection with National Highway 6, across a landscape exhibiting altitudinal variation between 150 and 200 meters above mean sea level. Recognized as a consequential hydrological artery, the Jhaun river has played a seminal role in sustaining Paleolithic cultural landscapes across Bargarh. Originating in the Barapahad hills, the river meanders through numerous settlements including Junani, Belbahali, Kaantal, Amjhar, and Batimunda; it traverses Attabira, intersects NH6, and ultimately confluences with the Mahanadi River. Numerous Prehistoric sites punctuate the foothills of this riverine system Ghanghati and Runipali being notable in the Attabira sector, with Nalichuan positioned within the Bhatli block and Gangei proximal to the Ambabhona block. The elevated plateau of Bargarh, nourished by the Jhaun river, has historically facilitated the sustenance and continuity of early human habitation.

Geographical and Physical Setting

The Bargarh district, geographically ensconced within the South-Western Hill Region of Odisha's highlands, exhibits a physiographic duality. Central to its topographical identity is the Bargarh Plain a vast, open expanse irrigated by the minor rivers Danta, Ong, and Jira. The Barapahad hill range fortifies its northern boundary, while the Ong River valley defines its southwestern reaches; the Mahanadi valley dominates the eastern periphery. This region, characterized by its perennial agricultural fecundity, is a bastion of verdancy in Odisha's geomorphic tapestry.

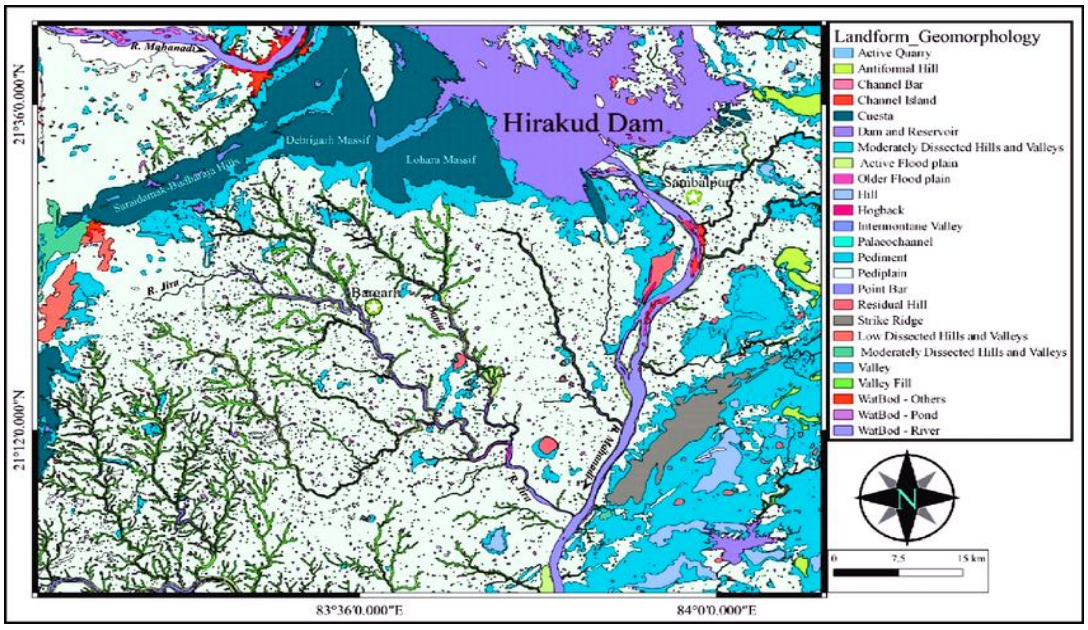

Figure 2: Geological Map of the Bargarh District

Morphologically, the district is divisible into two principal geomorphic units: the undulating highlands of the southern and southwestern tracts, and the surging plains, punctuated by residual hills and mounds, of the northern and western sectors (Figure 2). The central plain is typified by a gently undulating terrain, expansively arable and spanning altitudes from 285 meters to 120 meters above mean sea level. Bargarh, as part of the peninsular highland mosaic, is studded with sporadic hillocks and modest ranges the Gandhamardan Hills, Barapahad Hills, and Jhanjpahad Hills constituting its dominant relief features. Besides these, isolated forested and non-forested upland pockets persist. The Barapahad massif, sprawling across approximately 777 square kilometers, asserts its prominence along the district's southwestern frontier, serving as a critical physiographic and ecological anchor.

Assemblage Composition

Table 1 (i.e., Figure 3 and 4) presents the lithic assemblage data from six archaeological sites—Junani, Belbahali, Gangei, Runipali, Aapkhol, and Nalichuan—highlighting various types of stone

artifacts recovered during explorations conducted at both the principal and subsidiary springs of the Jhaun River, as well as across the Barapahad hill. The artifacts are categorized into cores, flakes, blades, bladelets, hammer stones, and chips/chunks. Among these, flakes are the most abundant (561), followed by cores (237), indicating a focus on primary tool production across the sites. Junani contributes the highest number of artifacts (231 or 20.19%) and is the only site with hammer stones (2), suggesting a complete tool-making process. Belbahali closely follows with 225 artifacts (19.66%) and records the highest number of blades [32], while Nalichuan has the most bladelets [24], indicating a more refined lithic technology. The remaining sites—Gangei, Runipali, and Aapkhol—also show a diverse but lesser assemblage, with Runipali contributing the least (148 artifacts or 12.93%). Overall, the total artifact count from all sites is 1,144, offering valuable insight into the prehistoric lithic technology and tool-making practices in the study area.

Table 1. Lithic Assemblage of the Study Area

Sl. No	Name of the sites	Core	Flake	Blade	Bladelet	Hammer Stone	Chip/ Chunk	Total	Percentage
1	Junani	53	117	19	16	2	24	231	20.19
2	Belbahali	48	105	32	22	---	18	225	19.66
3	Gangei	31	86	21	13	---	11	162	14.16
4	Runipali	27	76	18	15	---	12	148	12.93
5	Aapkhol	36	82	22	18	---	21	179	15.64
6	Nalichuan	42	95	21	24	---	17	199	17.39
Total	6 sites	237	561	133	108	2	103	1144	99.97

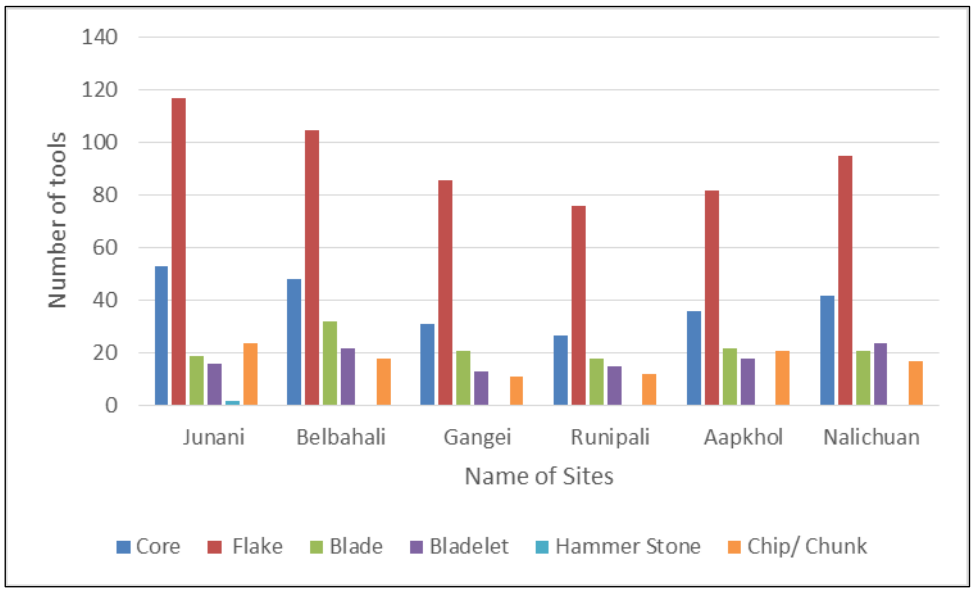

Figure 3: Bar graph of Lithic Assemblage of the Study Area in Numbers

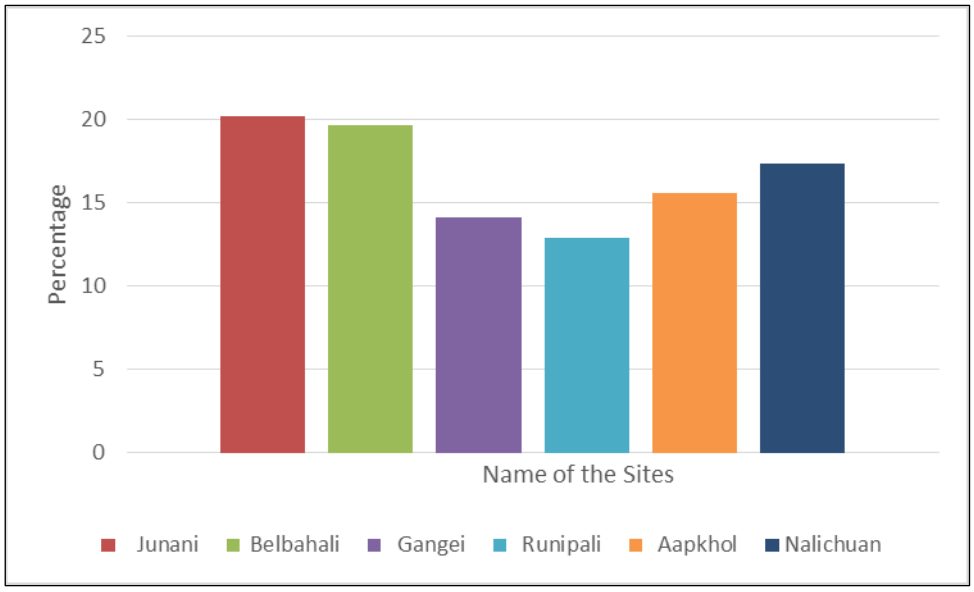

Figure 4: Bar graph of Lithic Assemblage of the Study Area in Percentage

Utilization of Raw Materials

Archaeological materials are inherently derived from organic and inorganic constituents of the natural environment, often appropriated in their native state without significant alteration (23). The Barapahad hill massif itself served as a prolific lithic resource zone for these prehistoric populations. It is plausible that hominins exploited the indigenous lithologies to fabricate utilitarian implements, thereby catalyzing cognitive and technological advancements. Geomorphologically, the region is characterized by Archean formations, subsequently overlain by Dharwar, Cuddapah, Lower Gondwana, Tertiary, and Quaternary stratigraphic sequences. Extensive exposures of quartzite and silicified lithologies are conspicuously evident. Furthermore, an occurrence of dolerite dykes, quartz reefs, and chert beds have been documented. These geological resources were harnessed extensively for tool manufacture by Pleistocene hominins and continued to be exploited into the post-Pleistocene epochs.

Chert, owing to its localized abundance and advantageous Properties namely its fine-grained texture and ease of knapping emerged as the predominant raw material, particularly in the context of a microlithic technological tradition that flourished during the onset of the Holocene. The ready accessibility of chert nodules likely facilitated the proliferation of sophisticated chert-based microlithic assemblages.

Table 2: Raw Materials of the Study Area

Raw Material type	Core	Flake	Blade	Bladelet	Chip/ Chunk	Total in nos.	Percentage
Chert	186	459	82	66	50	843	73.68
Quartz	3	72	17	34	31	157	13.72
Quartzite	31	13	6	---	14	66	5.76
Agate	13	11	---	3	8	35	3.05
Chalcedony	4	6	28	5	---	43	3.75
Grand Total	237	561	133	108	103	1144	99.96

Table 2 (i.e. Figure 5) provides an overview of the raw materials used in the lithic assemblage of the study area, detailing the quantities of cores, flakes, blades, bladelets, and chips/chunks made from five material types: chert, quartz, quartzite, agate, and chalcedony. Chert emerges as the most extensively used material, comprising 843 out of 1,144 total artifacts (73.68%), suggesting it was favored for its availability or suitability for tool-making. Quartz ranks second, with 157 artifacts (13.72%), commonly used for flakes and bladelets. Quartzite, though less frequently employed (66 artifacts or 5.76%), is mainly linked to cores and debris. Agate and chalcedony are the least represented,

contributing 3.05% and 3.75% respectively; however, chalcedony stands out for its relatively high number of blades (28), implying its selective use for crafting finer tools. In summary, the data indicate a clear preference for chert, while other materials were likely chosen based on specific functional or situational needs.

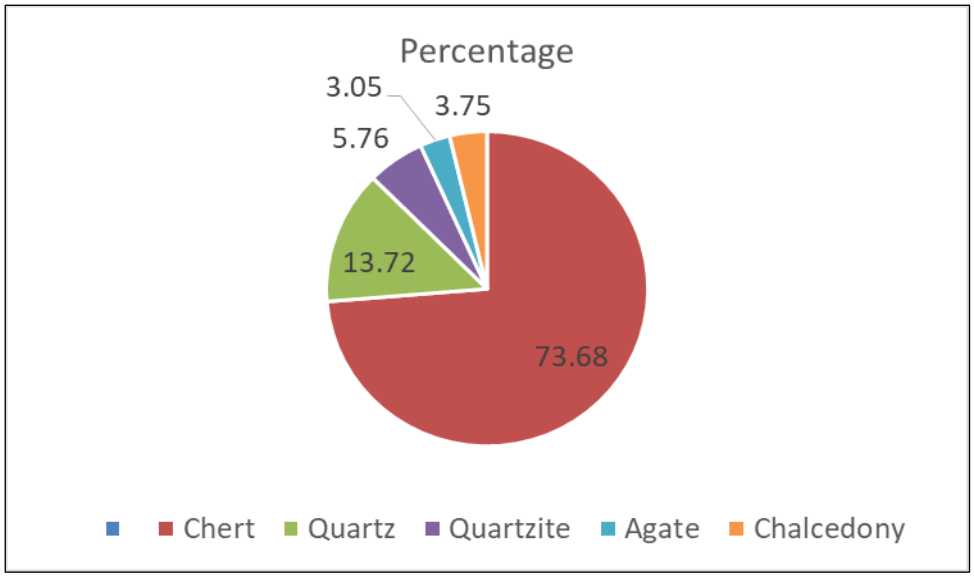

Figure 5: Pie Chart of the Percentage of Raw Materials

Results

The technological trajectory discernible within the assemblage illustrates a discernible shift from a core biface/chopper-chopping tool tradition towards a flake-centric technological paradigm, underpinned by the application of Levallois techniques. Within the corpus of stone tool typology, diagnostic forms such as choppers, chopping tools, and side scrapers have been identified, indicating a nuanced and evolving lithic industry.

There is the silhouette of a core biface/chopper chopping instruments transformation to a flake based technology using the Levallois methodology in the landmass. When we talk regarding the stone instruments technology concerned, we discovered chopper, chopping, side scrapper etc.

Core

The core in Figure 6 represents a principal artifact, extensively utilized as a source of raw material, available in diverse forms and dimensions. It constitutes the culmination of a sequence involving the strategic extraction, reduction, and sequential exploitation of detached lithic fragments.

In the lithic assemblages from the surveyed regions, 237 cores were recorded. A multitude of core types were identified during the examination of lithic artifacts, including Flake Cores, Blade Cores, Bladelet Cores, and Flake-Blade Cores. An array of lithological resources such as Quartzite, Quartz, Chert, and Chalcedony were employed in their production.

Flake

Flakes are considered pivotal constituents of Middle Paleolithic technological traditions, playing a critical role in lithic reduction sequences characterized by considerable consistency across both temporal and spatial dimensions. This cultural phenomenon exhibits remarkable homogeneity in artifact typologies and production strategies, wherein flake tools occupied a central and indispensable function.

The present study documents 561 flakes retrieved from the Jhaun River basin and the foothills of the Barapahad (Figure 7). The production of these lithics incorporated raw materials including Quartzite, Quartz, Chert, Chalcedony, and Agate.

Blade

In archaeological nomenclature, a blade denotes an elongated, slender, sharp-edged lithic flake detached from a specially prepared core, typically through percussive techniques utilizing a hammer stone. The defining criterion stipulates that its length must at least double its width. Blades served either directly as tools or as blanks for manufacturing instruments such as bifacial knives, burins, or perforators.

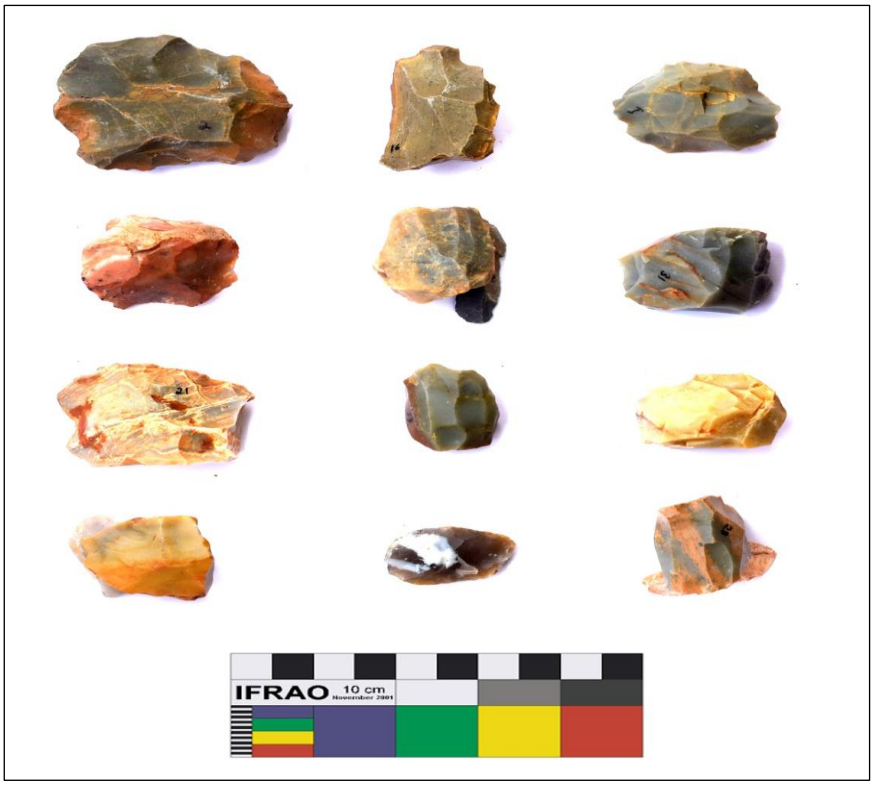

Figure 6: Core of the Study Area

Figure 7: Flakes of the Study Area

Figure 8: Blades of the Study Area

Blades in Figure 8 are classified based on metrics (length: width ratio of 2:1; minimal dorsal cortex coverage below 20%; presence of longitudinal dorsal ridges aligned parallel to the axis of percussion (24). Morphologically, blades exhibit either parallel or sub-parallel lateral edges, with systematic dorsal scar patterns.

The current field investigations recorded 133 blades from the Barapahad region. The material culture indicates that these blades were predominantly crafted from locally sourced Chert especially variants of black, green, and brown hues which appeared largely unweathered at the time of recovery.

Bladelet

The term bladelet refers to diminutive blade fragments, typically measuring less than 50 mm in length and under 12 mm in width. A total of 108 bladelets were documented, predominantly fashioned from Chert and Chalcedony (Figure 9).

Hammer Stone

Hammer stones, typically composed of exceptionally resilient lithic materials such as dolerite, quartzite, and other durable substrates, were meticulously selected for their minimal attrition rates during extensive utilization. The granular texture, often a requisite characteristic, facilitated the continuous abrasion and refinement of the pecked surfaces as the lithic reduction process advanced. It is scarcely questionable that prehistoric populations, existing within a lithic technological framework, possessed an intimate familiarity not only with optimal lithological sources but also with the specific suitability of materials for designated functional roles (25). Sites like the Junani Hammer Stone locality attest to the deliberate selection of such tools (Figure 10). Rather than merely serving as implements for direct production, these hammer stones were likely instrumental in the detachment of substantial lithic fragments from parent boulders, foundational to subsequent tool fabrication.

Chips/Chunks

Detrital lithic fragments, characterized by their detachment during core reduction yet neither utilized nor further modified into formal tools, are systematically categorized as debitage. Intensive field investigations along the Jhaun River corridor and at the foothill complex of Barapahad have yielded an assemblage comprising 103 discrete instances of chips and chunks, evidencing extensive lithic production activity in these zones.

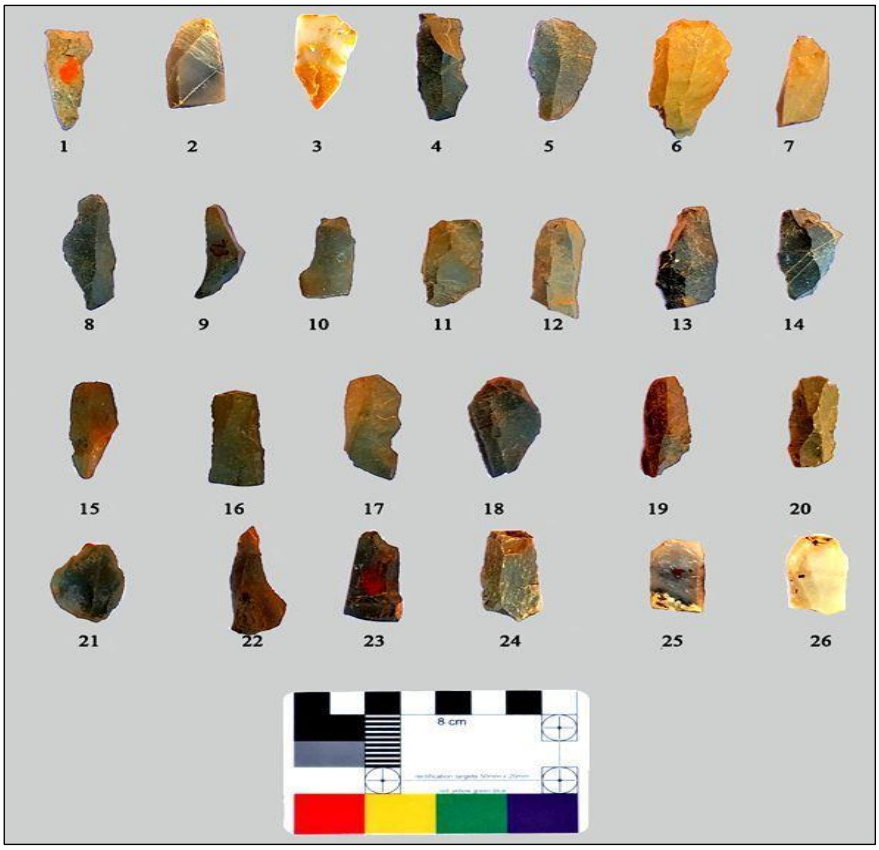

Figure 9: Bladelets of the Study Area

Figure 10: Hammer Stone of the Study Area

Table 3: Techno – Typological Analysis of Microlithic

Sl. No	Tool type	Debitage Type				Total	Percentage
		Core	Flake	Blade	Bladelet		
1	Alternately Retouched Flake	---	2	---	---	2	2.24
2	Awl	---	2	---	---	2	2.24

3	Backed Bladelet	---	---	---	4	4	4.49
4	Bilaterally Retouched	---	---	---	2	2	2.24
5	Borer	---	3	2	---	5	5.61
6	Concave Side Scrapper	2	---	---	---	2	2.24
7	Convex Backed Blade Point	---	---	2	---	2	2.24
8	Bipolar Blade and offset Burin	---	---	---	2	2	2.24
9	Convex Backed/Point	---	2	---	---	2	2.24
10	Convex End Scrapper	---	2	---	---	2	2.24
11	Convex Side Scrapper	---	2	---	---	2	2.24
12	Denticulate	---	4	2	---	6	6.74
13	Denticulate + Transverse Burin	---	2	---	---	2	2.24
14	End Scrapper	---	2	2	---	4	4.49
15	Levallois Core	4	---	---	---	4	4.49
16	Levallois Flake	---	2	---	---	2	2.24
17	Levallois Point	---	2	---	---	2	2.24
18	Lunate	---	---	---	3	3	3.37
19	Marginally Retouched	---	2	---	---	2	2.24
20	Micro Burin	---	2	---	---	2	2.24
21	Micro Denticulate	---	---	---	2	2	2.24
22	Notch	---	6	---	---	6	6.74
23	Partially Retouched	---	6	2	2	10	11.23
24	Partially Retouched + Notch	---	2	---	---	2	2.24
25	Retouched Point	---	---	4	---	4	4.49
26	Side Scrapper	---	---	9	---	9	10.11
27	Transverse Burin	---	2	---	---	2	2.24
	Total	6	45	23	15	89	99.84

A detailed classification of 27 different microlithic tool types based on their debitage type (i.e., the technique or method used to shape them: Core, Flake, Blade, Bladelet) along with their total count and relative percentage has described in the Table 3. Among the tools analyzed, a majority are made on flakes (45 tools), followed by blades (23), bladelets (15), and a small number from cores (6), indicating a technological preference towards flake-based production.

The most frequently occurring tool type is Partially Retouched (10 pieces, 11.23%), followed by Side Scrapers (9 tools, 10.11%) and Notches (6 tools, 6.74%). Tools such as Denticulate, End Scrapers, and Retouched Points are also well-represented. Most tools exhibit specific retouching or morphological features, such as backing, bilateral retouching, or denticulation, which highlight their functional specialization. Some rare tools include Levallois Cores and Lunates, reflecting a mix of prepared core technologies and geometric forms.

Overall, the assemblage demonstrates a diversified microlithic industry with an emphasis on secondary retouching and flake-based production, likely representing a flexible toolkit adapted to varied functional needs.

Discussion

The discovery of six Microlithic sites along the Jhaun river and the foothill zones of Barapahad hill represents a significant advancement in our understanding of prehistoric human settlement in the Bargarh district of Odisha. The spatial clustering of these sites near a major tributary of the Mahanadi River suggests that early hominin groups strategically selected ecologically favorable zones for habitation, resource procurement, and possibly seasonal mobility.

The Jhaun river valley, acting as a natural corridor, appears to have facilitated continuous occupation or recurrent use across multiple cultural periods, particularly from the Paleolithic to the Neolithic. This riverine alignment supports broader archaeological patterns where proximity to water bodies played a vital role in the settlement choices of prehistoric communities. The artefactual assemblages, comprising diagnostic microliths such as blades, scrapers, and points, highlight a technologically adept lithic tradition. These tools suggest a subsistence economy possibly based on hunting and foraging, with evidence of technological continuity and adaptation. The presence of these artefacts in both open-air contexts along the river and in hill-based locales like Barapahad further indicates a diverse usage of the landscape, possibly tied to different functional or seasonal activities.

Moreover, the newly documented sites bridge a critical gap in the prehistoric archaeological map of Western Odisha, an area previously underrepresented in microlithic research. These findings not only extend the known geographical range of Microlithic cultures in Eastern India but also contribute to understanding regional variability in tool typology and settlement behavior. Further comparative analysis with adjacent cultural zones—such as the Chhattisgarh and Central Indian plateau regions—may illuminate broader patterns of cultural interaction, diffusion, or parallel development. Continued excavation and multidisciplinary studies, including paleoenvironmental reconstruction, could shed light on how climatic and ecological factors shaped human adaptation strategies in this region.

Conclusion

The principal objective underpinning this inquiry was the delineation of the cultural complexion of the Microlithic phase within the geomorphological contexts of the Jhaun River and Barapahad hillocks in Bargarh district. The artifact assemblages recovered from these locales, typified by the presence of diversified cores, blades, bladelets, and formalized geometric implements, substantiate their cultural affiliation with the Microlithic techno-complex. Settlement dynamics of the microlith using groups display both regional diversity and spatial ubiquity across this landscape. A notable density of prehistoric loci was identified along riverine margins and foothill settings, with erosional processes along the Jhaun River exposing stratified paleo-surfaces and pediments strata invaluable for the retrieval of microlithic vestiges. The confluence of advantageous environmental parameters likely rendered this locality an attractive niche for prehistoric groups engaging in seasonal foraging and hunting pursuits.

The mobility patterns of these prehistoric groups seemingly transitioned across the landscape in response to resource distribution dynamics, ranging from lithic raw material procurement to

subsistence gathering activities. Although the breadth of microlithic site distribution is considerable, it is salient that many assemblages derive from secondary depositional contexts. A comprehensive program of systematic exploration and stratigraphic excavation remains imperative to accurately date the microlithic phenomena in this region. Despite the typological heterogeneity within the assemblage, a significant degree of formal and technological coherence is discernible. Ongoing investigations aim toward the identification of stratified, primary-context sites, the establishment of a robust chronological framework, and the elucidation of the subsistence economies and settlement mobility strategies of Holocene era hunter-gatherers occupying the Bargarh landscape.

Abbreviation

None.

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Author Contributions

All the authors contributed equally.

Conflict of Interest

The authors declare that they have no conflict of interest to report regarding the present study.

Ethics Approval

Not Applicable.

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