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Prehistoric Occupation and Lithic Assemblages in the Khadga River Valley: Insights from Recent Field Investigations in Odisha

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Abstract:

This research focuses on prehistoric investigations in the Khadga River Valley, located in the north-western region of Kandhamal and extending into the south-eastern part of Balangir district. The study identifies 21 prehistoric sites in both primary and semi-primary contexts, with artifacts recovered from various elevations, suggesting possible seasonal occupations. The abundant availability of raw materials along the riverbank likely attracted prehistoric communities, particularly those using microlithic tools, to settle in the area. A detailed analysis of the lithic assemblages from each site reveals a predominance of microlithic components and a diversity of raw materials. The region's diverse geomorphological features, including riverbanks, foothills, and rocky outcrops, enhance its potential for understanding human adaptation from the Pleistocene to the Holocene epochs. Previously unexplored in terms of archaeological significance, the study area offers important insights into the cultural evolution and long-term human occupation of the Khadga River Valley.

Key words: *Kondha, Khadga, Khadang, Microlithic, Hematite*

Introduction

The study of prehistoric Odisha has progressively uncovered a rich and varied cultural heritage, revealing human activity dating back to the earliest stages of human evolution. Odisha's unique geographical setting, with its diverse landscapes, ranging from coastal plains to rugged hill terrains has provided a fertile ground for prehistoric communities to thrive. Over the years, significant research has focused on identifying and documenting prehistoric artifacts, settlement patterns, and technological advancements that characterize the region's

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ancient past. Following these early pioneers, a number of archaeologists began exploring prehistoric sites across India, with a particular focus on major river valleys, which often served as crucial areas of human settlement during prehistoric times. In Odisha, prehistoric research gradually gained momentum through the efforts of numerous scholars. Early works were spearheaded by Ball (1876), Acharya (1923), and Banarjee (1930), followed by significant contributions from researchers like Bosh (1948), Mohapatra (1959), Tripathy (1972), and Dash (1987). This lineage of scholarly inquiry continued with later works by Mohanty (1989), Behera (1989), Pradhan (1991), Tripathy (1996), Padhan (2013), Thakur (2015), Rana (2017), Mendaly (2019), Barik (2022), and others. Collectively, these scholars explored the prehistoric potential of Odisha, mapping out the distribution of sites and offering critical insights into the technological advancements, settlement patterns, and subsistence strategies employed by early humans in the region.

Despite the richness of their contributions, a significant gap remains in understanding the technological progress that shaped subsistence patterns and settlement structures in prehistoric Odisha. Although many prehistoric sites have been documented, there is still a lack of systematic research that focuses on how these technological innovations influenced broader behavioral changes, particularly from the Paleolithic to the Mesolithic periods. To fully grasp the long-term evolution of human societies in Odisha, more detailed investigations into these aspects are needed.

In the regions of Boudh and Kandhamal, isolated discoveries of prehistoric artifacts were made by S.B. Ota during the 1980s (Ota 1982–83; 1986). His surveys focused on the areas between the Bagh and Khadang rivers, both tributaries of the Mahanadi and Tel rivers, respectively. Ota's work led to the discovery of several Lower Paleolithic open-air sites in locations such as Barapadar, Gurvelipadar, Kankalidunguri, Kantamal, Sunadei Hill, and Rangoli Hill. These sites, associated with the pebble-tool industry, offered important early insights into prehistoric life in the region.

In the upper reaches of the Khadga River, located in Kandhamal, the river is fed by a network of streams that traverse a dense forest, creating a challenging yet resource-rich environment. Villages in this region are typically small hamlets nestled among hills and foothills, home to indigenous communities such as the Kondha people (Ratha 2007; 2010). These hills and

wooded areas offer diverse resources that likely shaped early human subsistence strategies and settlement choices.

In contrast, the lower Khadga River in the Balangir district presents a low-relief pediment landscape. Here, artifacts are scattered across the riverbed, and the area is characterized by rocky outcrops, eroded hill slopes, and connected streams. This region has been largely overlooked in previous archaeological research, despite the evidence of prehistoric activity. The distinct geomorphological zones of the upper and lower Khadga River Valley suggest varied human experiences and adaptations, making this area ripe for further exploration.

Study Area

The research area covers the entire Khadga River and its major tributaries, offering a comprehensive view of prehistoric human settlement in the valley. The Khadga River originates from Katasingi Hill in the K. Nuagaon subdivision of Kandhamal district and flows through the Boudh district before joining the Tel River in Mahajanpada village of Gudvela block, located in the southeastern part of Balangir district. The geographic coordinates of the river are between 20°22'35.6"N latitude and 83°47'13.8"E longitude (Fig. 1). Several sub-tributaries and nullahs flow into the river, enhancing its significance as a water source for both prehistoric and modern communities.

Many of the newly discovered prehistoric sites are located in the middle and lower portions of the Khadga River Valley. The study area is situated in a region of high elevation, featuring several hill ranges and narrow valleys. This unique topography, combined with the socio-economic conditions of the local tribes and the fact that approximately 66% of the Kandhamal district is covered by forest, highlights the importance of the Khadga River Valley as a center of prehistoric human activity. Understanding the prehistoric past of this area offers valuable insights into the long-term cultural evolution and adaptation strategies of early humans in Odisha.

Fig-1: Satellite image of the Study Area

Methodology

The investigation into prehistoric settlements within the Khadga River Valley was executed through a rigorous and multifaceted methodology, integrating extensive fieldwork with advanced archaeological techniques to explore and document early human activities in this distinctive geomorphological setting. This approach aimed to uncover and analyze new archaeological sites across the upper, middle, and lower sections of the valley.

The research began with a thorough review of existing literature to establish a robust theoretical framework. Foundational texts on prehistoric archaeology, such as those by Movius (1968), Bordes (1969), Andrefsky (1998), Inizan (1999), and Shea (2015), were consulted. This literature provided critical insights into lithic technology, typology, and prehistoric human behavior, laying the groundwork for the analysis and interpretation of the archaeological findings.

Field investigations were systematically conducted across various zones of the Khadga River Valley. The identification of potential archaeological sites was guided by a combination of traditional methods and modern technological tools, including Google Earth imagery and Survey of India Toposheets. These tools enabled the researchers to assess geological, geomorphological, and landscape features, leading to the discovery of 21 new sites. The sites

were primarily located on eroded surfaces, foothills, and rocky outcrops, which were identified as likely areas of prehistoric activity due to their strategic location and raw material availability.

Artifacts were found in clusters that suggested locations where prehistoric peoples engaged in tool manufacturing. Each artifact was meticulously documented, focusing on the accessibility and use of raw materials. The artifacts were categorized based on their texture, with careful recording of the selection process for fine, medium, and coarse materials. Digital tools such as Mitutoyo calipers, digital weighing scales, and Canon DSLR cameras were employed to ensure precise measurements and high-resolution documentation.

Stratigraphic analysis was conducted to understand the vertical distribution of artifacts and their chronological context. Sections near the riverbed were cut and examined to reveal stratification patterns. This stratigraphic work was crucial for assessing the sedimentary history and understanding the processes affecting the preservation and erosion of sites within the valley.

The lithic artifacts were analyzed using over 40 measurement parameters, including length, width, thickness, and weight. Classification followed established systems, such as the Toth (1987) classification and Bordes typology (1961). The analysis focused on core types, flakes, blades, and bladelets, documenting variability in shape, size, and technique. Detailed attention was given to debitage conditions, core forms, and raw material associations, as well as breakage patterns like hinge, plunge, and feather fractures, to elucidate knapping techniques.

Statistical methods were utilized to analyze lithic variability and technological evolution across the sites. Software tools, including Photoshop and Illustrator, facilitated the creation of high-quality images and visual representations of artifacts and sites. MS Excel and Excel STAT were used for statistical analysis, providing quantitative insights into the technological aspects of tool production and usage. This comprehensive data analysis was essential for understanding the behavioral patterns of prehistoric communities in the Khadga River Valley.

The methodology employed in this study, combining thorough fieldwork, detailed artifact documentation, and advanced data analysis, enabled a comprehensive examination of prehistoric settlements in the Khadga River Valley. The approach facilitated the discovery

and detailed analysis of new archaeological sites, offering valuable insights into the technological developments, raw material preferences, and settlement patterns of early human communities in the region.

Newly Discovered Prehistoric Sites

In the past thirty years, extensive field surveys have been meticulously carried out in the study area, leading to the identification of 21 significant archaeological sites across various contexts and cultural phases. These sites span a range of elevations, with the highest situated at 543 meters above mean sea level (AMSL) and the lowest at 152 meters, averaging around 338 meters AMSL. The variation in elevation is notable, and it is hypothesized that the higher elevation sites, due to their strategic positions and the range of lithic tools and raw materials found, were likely used seasonally, aligning with findings from similar studies (Reckin and Todd 2020).

The survey efforts extended beyond the primary discovery sites to include surrounding areas, which led to the identification of additional prehistoric sites from various cultural periods. Among the 21 sites, two are particularly significant as they date back to the late Middle Paleolithic cultural phase, providing crucial insights into this era. The remaining nineteen sites are characterized by microlithic artifacts, which are distributed in clusters ranging from dense to sparse. This distribution and the presence of microlithic tools offer a way into the technological and cultural practices of the prehistoric communities that once inhabited this region (Fig. 2).

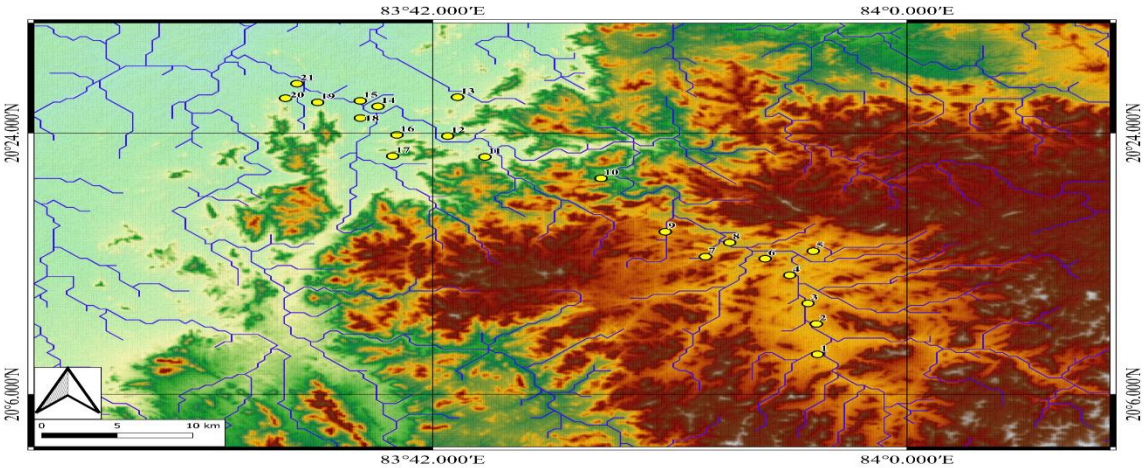

Fig-2: Distribution of prehistoric sites in the study area

Table-1: Distribution of Prehistoric sites in the Khadga River Valley

Sl. No	Site Name	Latitude	Longitude	Elevation	Geo-morphological Context	Cultural Phase	Riverbank	Total number of artefacts
1	Mahasingha	20.145906	83.943339	541	Riverbank	Microlithic	Left	186
2	Daugarh	20.180875	83.942644	539	Riverbank	Microlithic	Right	129
3	Indiraj	20.204436	83.937303	534	Riverbank	Microlithic	Right	82
4	Budrikia	20.236736	83.925833	535	Riverbank	Microlithic	Left	119
5	Sindrigaon	20.264406	83.940614	535	Foothill	microlithic	Right	143
6	Madinad	20.255681	83.910225	526	Foothill	Microlithic	Left	172
7	Sundru	20.258056	83.872561	534	Foothill	Microlithic	Left	165
8	Kutikia	20.274278	83.887831	510	Foothill	Microlithic	Right	131
9	Kudukelkia	20.286592	83.847125	543	Foothill	Microlithic	Left	183
10	Daka	20.347956	83.806525	333	Foothill	Microlithic	Left	109
11	Khamnakhol	20.372536	83.733097	213	Foothill	Microlithic	Left	135
12	Hardapadar	20.39645	83.709614	186	Foothill	Microlithic	Right	97
13	Tentulimunda	20.4411	83.715775	189	Foothill	Microlithic	Right	90
14	Bandhugora	20.430514	83.665522	171	Rocky outcrop	Microlithic	Right	250
15	Kachharpali	20.436872	83.654283	167	Foothill	Microlithic	Right	181
16	Karnibera	20.397789	83.677494	186	Foothill	Microlithic /Middle.p	Left	106
17	Pandapadar	20.373428	83.674764	197	Foothill	Microlithic	Left	108

18	Kanersingha	20.417114	83.654411	169	Foothill	Microlithic	Left	153
19	Tilkamal	20.435164	83.627358	166	Foothill	Microlithic	Left	153
20	Jamut-A	20.439925	83.607072	172	Foothill	Microlithic/ Middle.p	Left	82
21	Jamut-B	20.456597	83.614292	152	Rocky outcrop	Microlithic	Left	195

Typological Study of the Lithic Assemblage

William Henry Holmes (1894) highlighted the significance of lithic analysis, emphasizing how stone tools serve as chronological markers to unravel prehistoric evolution. This foundational approach remains crucial for archaeologists studying lithic technology and typology. In this study, we adopted this methodology to classify lithic artifacts from the Khadga River Valley based on contemporary techno-typological principles and to compare our findings with those from other notable sites. Our aim was to draw insights into the development of stone tool technology within this region.

Lithic artifacts were categorized according to size, shape, material, and the nature of the cutting edge, which also aids in determining their functional use. The primary categories include cores, flakes, blades, bladelets, choppers, and handaxes.

A detailed analysis of the lithic assemblage from the Khadga Valley revealed several interesting patterns. The collection includes 489 cores, which make up 16.47% of the artifacts and are predominantly crafted from chert and quartz (Fig. 3). Flakes emerged as the most common type, comprising 41.97% of the assemblage with a total of 1,246 flakes found (Fig. 4). These flakes were primarily sourced from the Khadga River basin. Additionally, 200 blades were recovered, with chert being the main material used. Of particular note is the presence of 273 bladelets (Fig. 5), constituting 9.20% of the artifacts. Choppers, found in minimal quantities (0.67% of the total artifacts), were exclusively made from pebbles collected from the nearby riverbed (Fig. 6).

Fig. 3: Core from the Khadga river valley

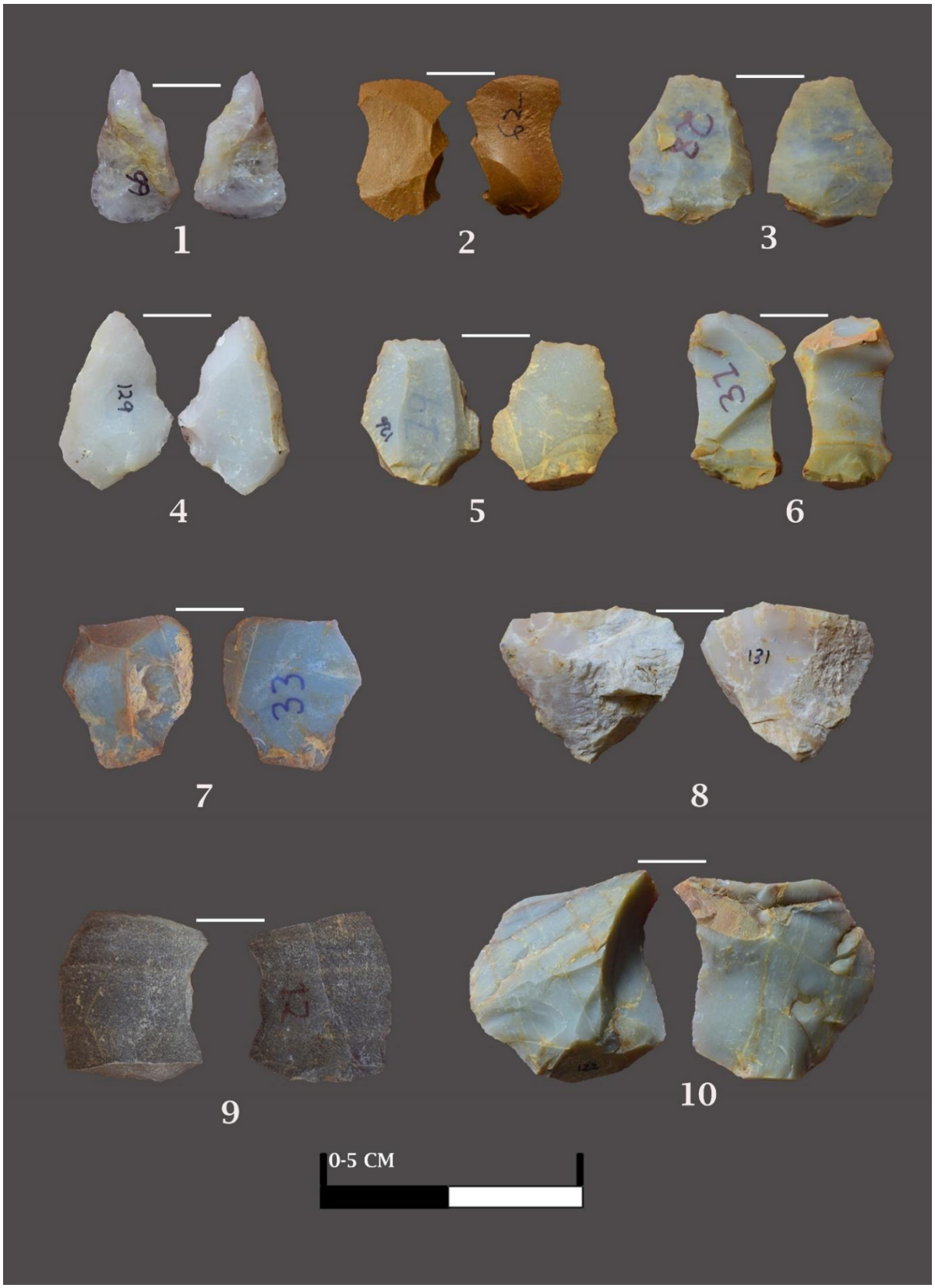

Fig-4: Flake from the Khadga river valle

Fig-5: Blade and Bladelet from the Khadga River valley

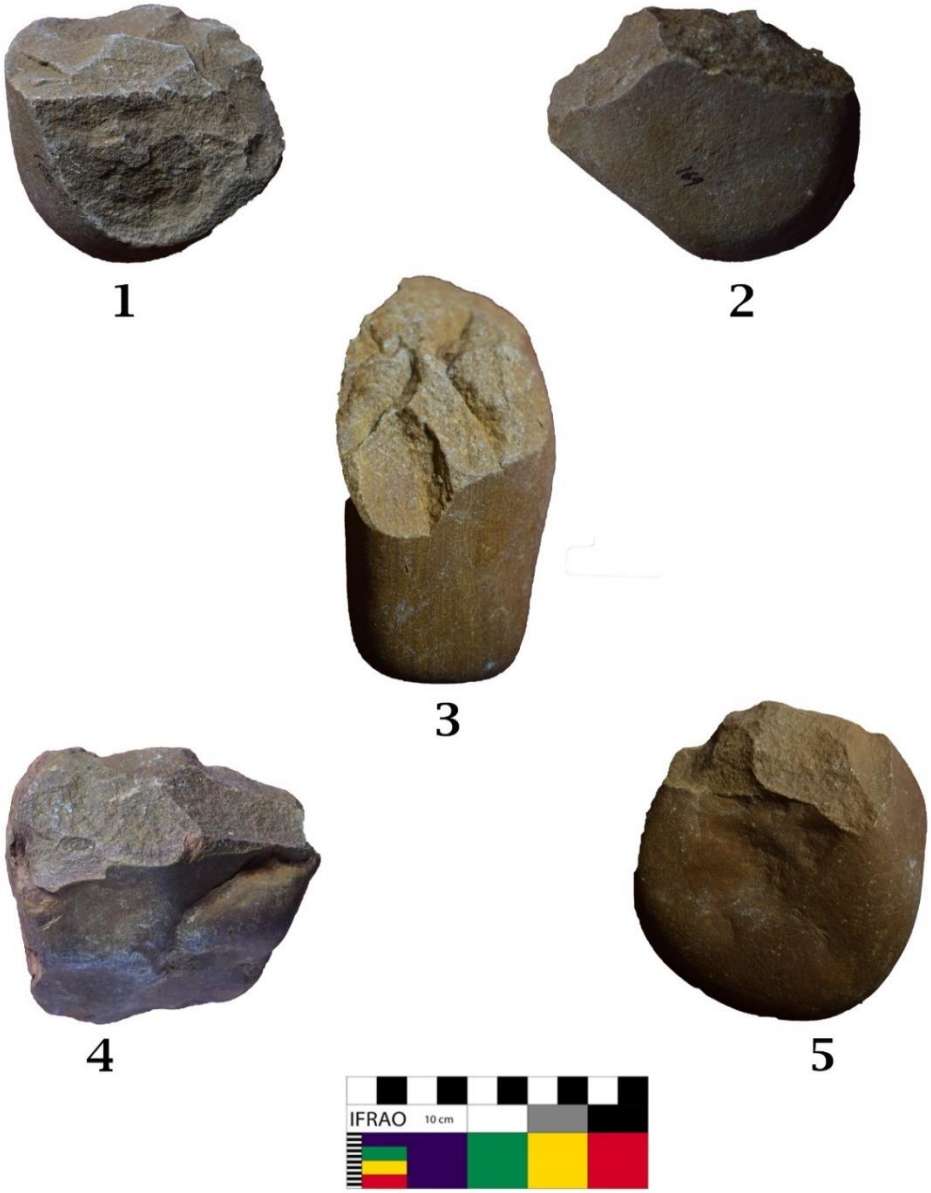

Fig-6: Choppers from the Khadga River valley

The distribution of bladelets showed a significant concentration in foothill areas, while they were notably scarce along the riverbank and rocky outcrops. Microliths were categorized into geometric and non-geometric types, exhibiting a range of shapes including triangles,

obliquely blunted blades, backing pieces, lunates, notches, denticulates, micro-burins, trapezes, and crescents (Hikade 2010).

A noteworthy finding was a single handaxe collected from the site at Karnibera (Fig. 8). This bifacial tool, made from silicified rock, measures 105.73 mm in length, 87.80 mm in width, 40.08 mm in thickness, and weighs approximately 350.00 grams. As the only bifacial artifact discovered at the site, it is of considerable significance. However, the solitary nature of this handaxe suggests it may be a manuport rather than a tool used within the local context. Chert and quartz were identified as the primary materials for most of the bladelets discovered during this survey. Detailed categories of the artifacts are provided in Table 2.

Table-2 Site wise Lithic Artefact Category

Lithic Artefact Category							
Sites name	**Core**	**Flake**	**Blade**	**Bladelet**	**Chopper**	**Chip/ Chunks**	**Total**
Mahasingha	50	80	11	13	-	32	186
Daugarh	18	42	17	9	-	43	129
Indiraj	4	15	13	9	-	41	82
Budrikia	13	41	10	5	-	50	119
Sindrigaon	40	43	7	11	-	42	143
Madinad	31	71	18	26	-	26	172
Sundru	13	104	5	25	-	18	165
Kutikia	20	50	12	18	-	31	131
Kudukelkia	26	64	27	40	-	26	183
Daka	23	44	7	2	-	33	109
Khamnakhol	19	63	11	9	-	33	135
Hardapadar	19	23	7	2	2	44	97
Tentulimunda	8	30	6	10	-	36	90
Bandhugora	44	144	9	8	-	45	250
Kachharpali	43	54	5	27	4	48	181
Karnibera	6	65	2	2	-	30	105
Pandapadar	18	38	3	5	9	35	108

Kanersingha	31	70	13	6	-	33	153
Tilkamal	22	89	4	8	-	30	153
Jamut-A	15	31	-	5	5	26	82
Jamut-B	26	85	13	33	-	38	195
Grand total	**489**	**1246**	**200**	**273**	**20**	**740**	**2968**

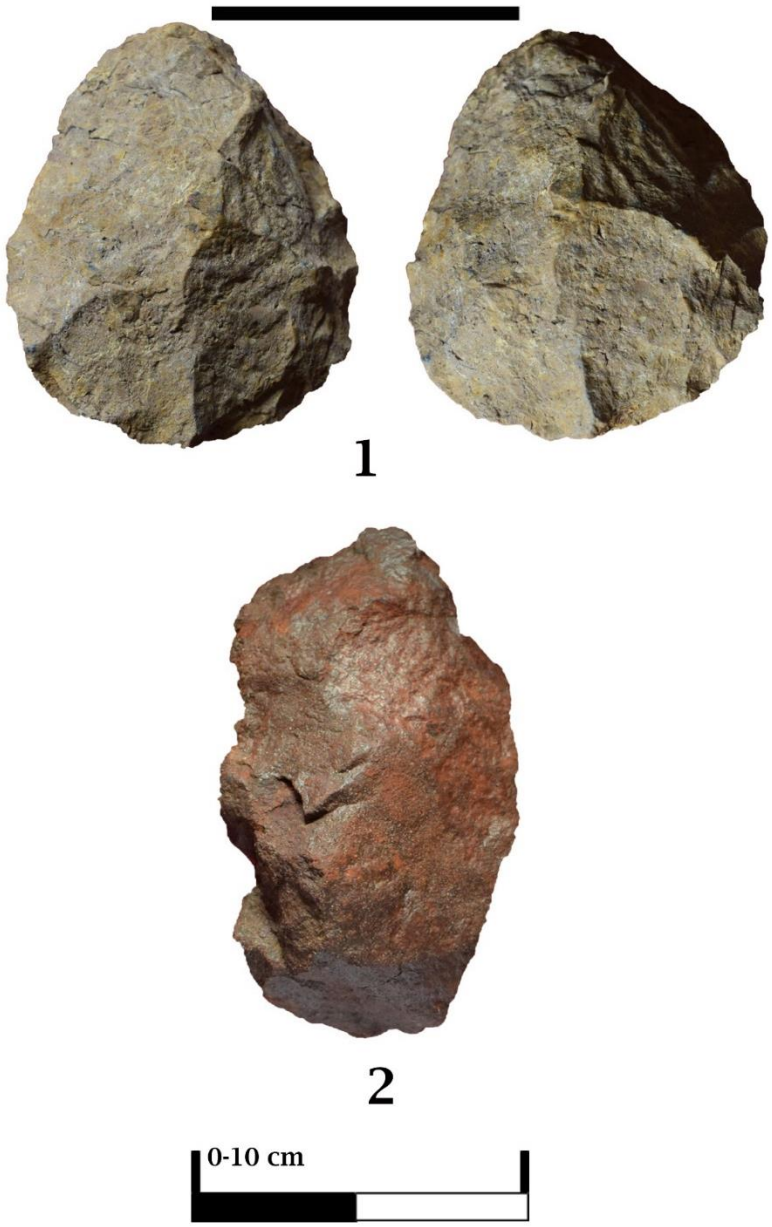

Fig-7: Hand axe and hematite nodules from the Khadga river valley

Raw Materials

The initial stages of lithic technology involve the selection, acquisition, and transport of raw materials to the site of tool manufacture. Understanding these processes provides insights into the movement patterns of early hominins and their adaptation strategies. The availability and quality of lithic raw materials are crucial factors influencing stone tool technology and settlement patterns (Andrefsky 1994). The physical properties of raw materials have long been recognized for their impact on the form and function of lithic artifacts (Goodman 1944; Eren et al., 2014). Additionally, environmental factors, mobility, and procurement methods, as well as socio-cultural elements like color preferences, symbolic value, and stylistic choices, play significant roles in raw material selection (Binford and Stone 1985; Gould and Saggers 1985; Clark 1980; Stout 2002; Wurz 1999; Berleant 2007).

This study evaluates a range of raw materials including chert, quartz, quartzite, sandstone, crystal, silicified rock, jasper, agate, chalcedony, and hematite. These materials are found in various forms such as nodules, cobbles, and slabs. Chert, available locally as angular nodules, is preferred for its conchoidal fracture properties, though its utility warrants further scientific analysis. Quartz and crystals are present in reef and vein forms, while chalcedony nodules are relatively rare. Quartzites appear as blocks, cobbles, nodules, and slabs across multiple sites (Fig. 8).

At the Jamut-A site, quartzite was identified as a locally sourced material, evidenced by hammer marks and negative scars on the parent rock (Fig. 9 and 10). The study involved the collection of 102 natural pieces from various sites to assess the characteristics and distribution of these raw materials. Investigations covered three geomorphological contexts-foothills, riverbanks, and rocky outcrops, where the artifacts were documented, shedding light on the utilization patterns of these materials.

Hematite nodules, including those from the Kachharpali and Sindrigaon sites, were notably discovered. These nodules, which may have been previously overlooked, were highlighted in recent surveys at sites such as Torajunga and GPR in Bargarh (Behera et al. 2020). Their consistent presence suggests significant uses, potentially for grinding activities as indicated by shallow grooves found in Middle Palaeolithic and Microlithic sites in western Odisha.

The use of red ochre or hydrated iron oxide by early humans, documented since the Middle Palaeolithic and Mesolithic periods, is a well-established indicator of cognitive and symbolic behavior. Hematite, often associated with rock paintings and microliths in Odisha, likely

played roles in rituals, body art, camouflage, and burial practices. Its application in Chalcolithic rural cultures of western India includes use in rock paintings and as an adhesive. The Mesolithic era's reliance on composite tools suggests hematite's use as an adhesive for attaching tools to wooden shafts, bone pieces, or antlers. Notably, one hematite nodule exhibits knapping marks (Fig. 7), indicating its potential use in producing a core scraper (Jhankar and Thakur 2022).

Fig-8: Source of Quartz from the site of Jamut-A

Fig-9: Source of Quartzite from the site of Jamut-A

Fig-10: Modern query site from Jamut-A

Conclusion

The recent field investigations in the Khadga River Valley have substantially advanced our understanding of prehistoric human activities in Odisha, highlighting its role as a crucial center of human settlement and technological development from the Paleolithic era onward. The valley's varied geomorphological features, including high hill ranges, foothills, and low-relief pediments, have influenced settlement patterns and subsistence strategies throughout prehistory. The discovery of 21 new archaeological sites, spanning elevations from 152 to 543 meters above mean sea level, underscores the valley's importance in early human behavior studies. High-elevation sites, marked by well-preserved artifacts and erosional surfaces, likely functioned as seasonal or strategic locations due to their proximity to raw material sources and water bodies.

The lithic assemblages from these sites offer valuable insights into technological and cultural advancements of prehistoric communities. The diversity of lithic artifacts, including cores, flakes, blades, bladelets, and a solitary handaxe, reflects the evolution of tool-making strategies. The predominance of flakes and bladelets, alongside the presence of microlithic tools, indicates significant technological progress. The handaxe found at Karnibera, though isolated, hints at varied tool usage, raising questions about its contextual significance.

Raw material analysis reveals a sophisticated approach to material procurement and utilization. The study highlights the use of chert, quartz, quartzite, and hematite in different forms, such as nodules, cobbles, and slabs. The locally sourced quartzite and evidence of grinding activities associated with hematite nodules suggest advanced material use, with hematite potentially serving symbolic and practical purposes, including rituals and body art.

This research fills a significant gap in the Khadga River Valley's archaeological record, expanding the understanding of lithic technology and settlement patterns. Future research should explore the origins of materials like chalcedony, jasper, and agate, and refine the chronological context of the artifacts through detailed stratigraphic analyses. The Khadga River Valley thus emerges as a pivotal area for studying prehistoric Odisha, offering new insights into the technological, cultural, and environmental dynamics of early human societies in the region.

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