



MICROLITHIC ASSEMBLAGES OF THE UPPARMAL PLATEAU, HADOTI REGION, RAJASTHAN: A GEOARCHAEOLOGICAL STUDY

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ABSTRACT The Upparmal Plateau of the Hadoti region, southeastern Rajasthan, represents an important geoarchaeological landscape characterized by abundant prehistoric remains, including stone tools, rock shelters, pictographs, and microlithic assemblages. The present study investigates the microlithic assemblages of the Upparmal Plateau with special emphasis on typology, raw material utilization, geological context, and prehistoric human adaptation. Systematic field surveys were conducted at five sites, resulting in the documentation and collection of 271 microlithic artifacts. The assemblage comprises both geometric and non-geometric microliths, although non-geometric forms dominate significantly. Raw material analysis shows that chert and agate were the most preferred lithic materials, followed by quartz and jasper. Most artifacts were recovered from surface contexts and exhibit varying degrees of weathering, rolling, patination, and fragmentation caused by fluvial activity and other post-depositional processes. Typological and techno-morphological characteristics of the assemblage suggest that the microlithic industry of the Upparmal Plateau belongs predominantly to the Mesolithic period, although certain features indicate continuity from the Upper Palaeolithic phase.

KEYWORDS : Geoarchaeology, Microliths, Upparmal Plateau**INTRODUCTION**

Microliths are very small, deliberately shaped stone tools, generally less than 5 cm in length, characterized by standardized forms and retouched edges (Bordes, 1968). These tools represent a significant technological and cultural advancement in prehistoric human societies, particularly during the Mesolithic period (Middle Stone Age).

Microliths were extensively used for a variety of activities in prehistoric societies. They were commonly hafted onto wooden or bone shafts to produce composite tools such as arrowheads, spear tips, and barbs, thereby improving hunting efficiency (Allchin and Allchin, 1997). In addition to hunting, microliths functioned as cutting implements for processing meat, plants, and other organic materials (Clark, 1958). They also served as scraping tools for cleaning animal hides and working wood, activities essential for the preparation of clothing and shelters (Bordes, 1968). Certain forms, including points and borers, were employed in drilling and piercing operations such as perforating leather or wood (Sankalia, 1974). On the basis of morphology and presumed function, microliths may be classified into several functional categories such as cores, flakes, blades, scrapers, points, burins, and borers.

Microliths also possess considerable geological significance because they provide important information regarding raw material selection, source areas, and human interaction with geological environments. Although primarily archaeological artifacts, their study contributes substantially to geoarchaeological and geological interpretations.

Microliths were generally manufactured from fine-grained, homogeneous, and easily flakable lithic materials that permitted controlled shaping and the production of sharp edges. The parent piece of raw material from which flakes or blades are detached is termed a "core." The naturally occurring lithic raw material prior to reduction is referred to as an "unworked nodule" (Andrefsky, 2005; Inizan et al., 1999).

The Study Area: Upparmal Plateau

The Upparmal Plateau (also spelled *Upparmal*) is an elevated stony upland situated in the southeastern part of Rajasthan (Figure 1). It forms an important sub-division of the larger Hadoti Plateau of southeastern Rajasthan. Geographically, the plateau extends between Bhainsrorgarh in Chittorgarh district and Bijolia in Bhilwara district. The geomorphological evolution of the plateau was strongly influenced by tectonic movements associated with the Great Boundary Fault, a major tectonic boundary separating the plateau from the Aravalli Range in the northwest. The plateau presently lies at an average elevation of about 350–550 m above mean sea level.

The Hadoti region, including the Upparmal Plateau, provided favourable conditions for prehistoric human occupation owing to the

availability of abundant water resources from the Chambal River and its tributaries. The region supported rich vegetation and diverse food resources, while the surrounding rocky terrain offered natural shelters to prehistoric communities. Numerous rock shelters occurring within the area provided protection to Palaeolithic and Mesolithic populations. Situated between the Aravalli Range and the Malwa Plateau, the region occupied a strategic geographical position and experienced comparatively higher rainfall (80–120 cm), making it one of the more humid and hospitable zones during prehistoric times.

The Upparmal Plateau and its adjoining areas contain a rich archaeological heritage comprising stone tools, microliths, menhirs, rock shelters, and rock paintings. Many such remains have already been discovered, while several areas still remain unexplored. Archaeological investigations suggest that these remains belong to various prehistoric cultural phases, including the Upper Palaeolithic and Mesolithic periods, although precise chronological determination remains uncertain. These archaeological evidences clearly demonstrate that the Hadoti region sustained early human occupation (Sharma, 1998; Kumar, 1981, 1992; Wakankar, 1992; Saleem, 2020; Abbas, 2021; Pandey et al., 2024).

Geomorphology and Geology of Area

Geomorphologically, the study area comprises several significant landforms including dissected plateaus, escarpments, river terraces, pediplains, pediments, and various depositional and erosional features of fluvial and aeolian origin such as rock pedestals, rock shelters, potholes, and pen holes. These geomorphic units play a crucial role in the distribution, exposure, and preservation of microlithic sites, particularly in areas where erosional processes expose lithic materials (Sharma et al., 1980).

Geologically, the area is predominantly composed of sandstone and shale horizons belonging to the Lower Bhander Group (Bundi Hill Sandstone) of the Vindhyan Supergroup (Coulson, 1927; Prasad, 1984; Nagar et al., 2017).

METHODOLOGY

The present study adopts an integrated geoarchaeological methodology involving field survey, typological and technological analysis, raw material characterization, and comparative and chronological studies to understand prehistoric human behaviour and cultural development.

The investigation commenced with systematic field surveys aimed at identifying potential microlithic sites, particularly within favourable geomorphological settings such as river terraces and open surfaces. Microlithic artifacts were subsequently collected, and precise locational and contextual information was recorded to maintain spatial accuracy and archaeological integrity.

The collected specimens were subjected to detailed typological analysis based on shape, morphology, and tool categories. Raw material analysis was also undertaken to identify lithological types and infer possible geological source areas, thereby providing insights into prehistoric resource procurement strategies. Comparative and chronological analyses were further carried out to understand the cultural and technological significance of the assemblages.

Description of Microlith Sites and Assemblages

During field exploration and systematic survey, a total of 271 microliths were recovered from five locations within the Upparmal Plateau region. Mr. Om Prakash Kukki, an amateur archaeologist from Bundi, initially identified and reported these potential sites. Therefore, the sites cannot be regarded as new discoveries. However, the present work represents the first detailed geoarchaeological investigation of microlithic assemblages from this area. The study is based on microliths collected and documented by the authors during field investigations (Table 1).

Table 1: GPS Locations and Number of Microliths Recovered from Different Sites

S.No.	Site	GPS Coordinates	Number of Microliths collected
1	Sita Ka Kund	Latitude: 25.256340° N; Longitude: 75.340298° E	117
2	Banganga	Latitude: 25.202921° N; Longitude: 75.384004° E	70
3	Biswamil Ka Pathar	Latitude: 25.283349° N; Longitude: 75.427898° E	43
4	Gararda	Latitude: 25.202921° N; Longitude: 75.486179° E	29
5	Bhimlat	Latitude: 25.303107° N; Longitude: 75.412441° E	12
Total			271

The majority of the microlithic artifacts were recovered from surface contexts, indicating open-air site conditions (Figure 2). Most specimens exhibit clear evidence of weathering and erosion, suggesting prolonged exposure to natural geomorphic processes. Several artifacts occur in rolled condition, indicating transportation and redeposition by fluvial activity. The assemblage comprises both geometric and non-geometric microliths, reflecting a well-developed microlithic tradition and indicating repeated or sustained prehistoric occupation in the region (Figure 3).

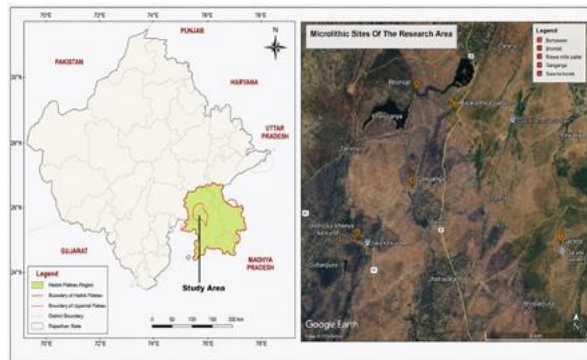


Figure 1: Location Map of Study Area and Microlith Sites



Figure 2: In-situ Microliths at Sita Ka Kund Site



Sita Ka Kund Site



Banganga Site

Biswamil Ka Pathar Site



Gararda Site

Bhimlat Site

Figure 3: Microlith Assemblages Recovered at Different Sites

Table 2: Description of Number of Microliths and Raw Material Used at Different Sites

S. No.	Location	Number Recovered	Raw Material of Microliths						
			Quartz	Agate	Jasper	Flint	Chalcedony	Sandstone	Chert
1	Sita Ka Kund	117	26	30	18	03	03	03	34
2	Banganga	70	14	18	02	02	00	01	33
3	Biswamil Ka Pathar	43	15	09	02	01	00	00	16
4	Gararda	29	00	27	00	00	01	00	01
5	Bhimlat	12	05	04	01	00	00	00	02
TOTAL		271	60	88	23	06	04	04	86

From the Table 2 it can be observed that the microlithic assemblage from the Upparmal Plateau validates the use of a wide variety of raw materials, indicating selective procurement strategies adopted by prehistoric communities. Among the identified lithic materials, agate (88 specimens) and chert (86 specimens) constitute the dominant raw materials, followed by quartz (60 specimens). Jasper, flint, chalcedony, and sandstone occur in comparatively smaller numbers.

The predominance of agate and chert suggests a preference for fine-grained, homogeneous, and easily flakable materials suitable for the production of sharp-edged tools. Quartz was also extensively utilized, probably due to its local availability within the geological formations of the region. The occurrence of flint, chalcedony, and jasper indicates deliberate selection of high-quality lithic resources for specialized tool production.

Site-wise variation in raw material composition is also significant. Sita

Ka Kund yielded the highest number of microliths (117), showing considerable diversity in lithic materials. Gararda is characterized by an overwhelming dominance of agate, whereas Banganga and Biswamil Ka Pathar show substantial use of chert.

Table 3: Typological Classification of Microliths of Different Sites

Location and Number of Microliths	Points	Borers	Burins	Flakes	Scrapers	Blades	Debitage	Core	Unworked Nodule	Broken Blades
Sita Ka Kund (117)	03	03	04	24	23	00	32	19	01	08
Banganga (70)	03	00	03	07	10	07	29	07	04	00
Biswamil Ka Pathar (43)	12	00	00	09	09	03	05	04	00	01
Gararda (29)	02	00	02	04	06	00	14	00	01	00
Bhimlat (12)	01	00	00	08	01	00	01	00	01	00
TOTAL (271)	21	03	09	52	49	10	81	30	07	09

The typological composition (Table 3) of the microlithic assemblage from the Upparmal Plateau reflects a well-developed lithic technology characterized by both tool production and reduction activities. Among the recovered artifacts,debitage constitutes the largest category (81 specimens), followed by flakes (52 specimens) and scrapers (49 specimens). The high proportion ofdebitage and flakes indicates intensive lithic manufacturing and reduction processes at the studied sites.

Scrapers form an important component of the assemblage and were likely used for hide processing, woodworking, and other domestic activities. Points (21 specimens) suggest hunting-related functions, particularly as projectile tips or piercing tools. Blades, though comparatively fewer in number (10 specimens), indicate the presence of blade-based microlithic technology.

The occurrence of cores (30 specimens) and unworked nodules (07 specimens) demonstrates that primary stages of tool production were carried out within the study area itself. Broken blades and other fragmentary artifacts further support evidence of on-site tool manufacturing and usage.

Site-wise analysis reveals notable variation in tool assemblages. Sita Ka Kund yielded the highest number of artifacts and shows a diverse range of tool categories, suggesting prolonged or repeated occupation. Biswamil Ka Pathar is characterized by a comparatively high number of points, whereas Banganga exhibits a significant concentration of blades anddebitage. Gararda and Bhimlat yielded relatively smaller assemblages but still preserve evidence of lithic reduction and tool utilization.

Table 4: Tool type Raw material in Microliths of Different Sites

Raw Material	Points	Borers	Burins	Flakes	Scrapers	Blades	Debitage	Core	Unworked Nodule	Broken Blades	Total
Quartz	12	00	06	16	12	00	05	01	01	08	61
Agate	07	00	03	17	13	00	41	02	02	02	87
Jasper	00	00	00	02	06	00	04	11	00	00	23
Flint	00	00	00	03	01	00	00	02	00	00	06
Chalcedony	00	00	00	01	00	00	02	01	00	00	04
Sandstone	00	00	00	00	02	00	00	01	00	01	04
Chert	02	03	00	13	15	03	29	12	04	05	86
TOTAL	21	03	09	52	49	10	81	30	07	16	271

The distribution of tool types according to raw material demonstrates clear patterns in prehistoric raw material selection and technological preferences (Table 4). Agate (87 specimens) and chert (86 specimens) constitute the most extensively utilized lithic materials, followed by quartz (61 specimens). Jasper, flint, chalcedony, and sandstone occur in comparatively smaller quantities.

Agate is predominantly represented bydebitage (41 specimens), flakes, and scrapers, indicating intensive lithic reduction and manufacturing activities. Its fine-grained texture and predictable flaking properties made it highly suitable for microlith production. Chert also shows a wide variety of tool categories including scrapers, flakes, cores, anddebitage, reflecting its importance as a preferred raw material for tool manufacture.

Quartz is mainly represented by points, flakes, scrapers, and burins. The comparatively high number of points and burins made from quartz suggests its selective utilization for specific tool forms despite the difficulties associated with controlled flaking of quartz. Jasper is notable for the occurrence of a relatively high number of cores, indicating its use during early stages of lithic reduction.

Flint, chalcedony, and sandstone occur in limited numbers, suggesting occasional or opportunistic utilization. Sandstone appears to have been used only rarely, probably because of its coarse-grained nature and poor flaking quality compared to siliceous rocks such as agate and chert.

The dominance ofdebitage, flakes, and cores across different raw materials strongly indicates that the Upparmal Plateau functioned not only as a habitation zone but also as an important lithic manufacturing area where prehistoric communities carried out on-site tool production and reduction activities.

DISCUSSION AND CONCLUSION

The Upparmal Plateau of Rajasthan is well known for its prehistoric significance, particularly for the occurrence of stone tools, rock paintings, and microlithic assemblages associated with favourable geological formations and geomorphic settings. The area represents an important zone for prehistoric investigations because microlithic assemblages occur in association with earlier Palaeolithic industries, indicating cultural continuity and repeated phases of human occupation.

During the present investigation, a total of 271 microlithic artifacts were documented and collected from five different sites within the Upparmal Plateau region. The assemblage is predominantly composed of non-geometric microliths, including flakes, scrapers, points, blades, borers, burins, cores, anddebitage (Figure 4). Geometric forms such as triangles and rectangles are comparatively rare. Among the total assemblage,debitage constitutes about 29.9%, flakes 19.2%, scrapers 18.1%, cores 11.1%, points 7.7%, blades 3.7%, burins 3.3%, broken blades 3.3%, unworked nodules 2.6%, and borers 1.1%. The predominance of non-geometric forms indicates a technomorphological tradition characteristic of Late Upper Palaeolithic to Mesolithic cultural phases.

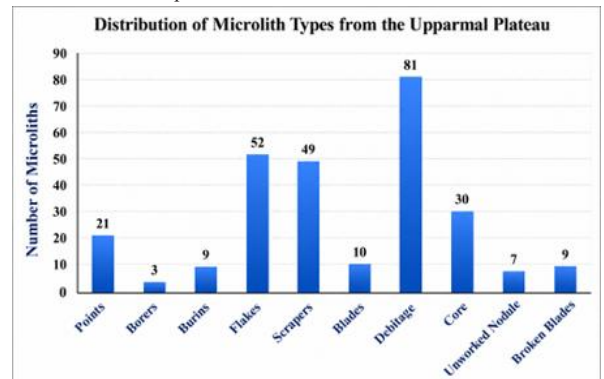


Figure 4: Microlith Types from the Upparmal Plateau

A significant number of blades and other artifacts are fragmented or exhibit considerable surface modification, resulting in the loss of their original morphology and sharp cutting edges. Prolonged exposure to natural agents such as sun, wind, and rain has caused surface alteration through edge rounding, patination, and cracking. Fluvial processes associated with streams and rivers have further contributed to rolling, abrasion, and displacement of artifacts, producing rounded and polished surfaces. Additionally, trampling and movement by humans and animals have resulted in breakage and fragmentation of the assemblage. These post-depositional processes significantly affect the preservation, visibility, and identification of microlithic artifacts (Schiffer, 1987; Waters, 1992; Goldberg and Macphail, 2006).

Field investigations also resulted in the recovery of several cores and unworked nodules. Two major categories of cores were identified within the assemblage:

- flake cores, representing generalized reduction strategies, and
- blade cores, indicating a more specialized and controlled technique intended for the production of standardized blades and bladelets (Figure 5).

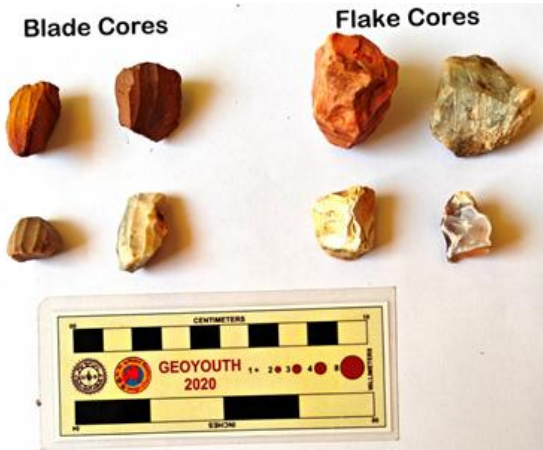


Figure 5: Core Samples Recovered from the Upparmal Area

The occurrence of substantial quantities of unworked nodules and debitage strongly suggests intensive on-site lithic reduction and tool-manufacturing activities. Many nodules display rounded to sub-rounded morphology, indicating derivation from secondary deposits such as river gravels and seasonal stream channels. This suggests transportation and reworking through fluvial processes prior to their utilization by prehistoric communities.

The microlithic assemblage is predominantly composed of chert and agate, which together account for nearly 64% of the total raw material used in tool production (Figure 6). Quartz constitutes approximately 22%, jasper about 9%, while flint and chalcedony each contribute nearly 2%, and sandstone about 1% of the assemblage. The predominance of chert and agate reflects deliberate selection of fine-grained siliceous materials possessing favourable flaking properties suitable for the manufacture of sharp and durable microlithic tools.

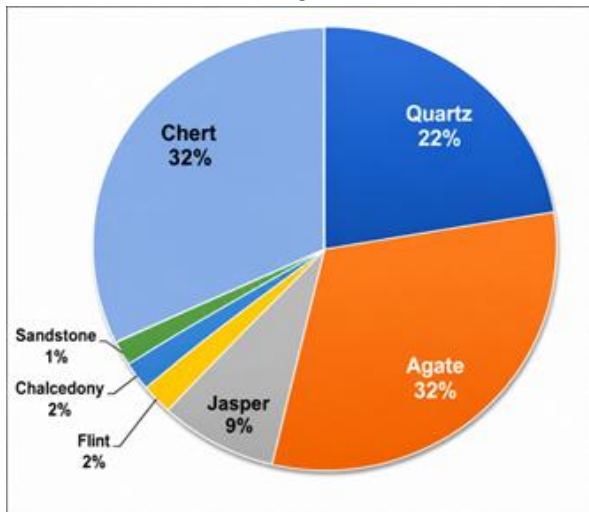


Figure 6: Raw Material Used in Microliths

The raw materials utilized for microlith production were primarily derived from locally available geological formations and secondary deposits, indicating a close relationship between prehistoric technology and regional geology. Two principal sources of raw materials may be identified in the Upparmal Plateau and adjoining Hadoti region. The Vindhyan formations, composed predominantly of sandstone, shale, and limestone, commonly contain veins and nodules of chert, chalcedony, and jasper either embedded within sedimentary strata or concentrated along lithological contact zones. These formations served as an important primary source of siliceous raw materials for prehistoric toolmakers.

Agate, on the other hand, was most likely derived from the Deccan Trap formations exposed along the southern margins of the plateau. Agate typically occurs as secondary mineralization within vesicles of basaltic rocks forming amygdaloidal structures. These agate nodules were subsequently transported by fluvial systems into rivers and

seasonal streams such as the Chambal and its tributaries, where they accumulated within gravel beds and river terraces. Such secondary deposits provided easily accessible and abundant sources of high-quality raw material that were selectively exploited for microlith production.

Quartz occurs abundantly within the Pre-Aravalli and Aravalli meta-sedimentary formations extensively exposed in the Bhilwara district, of which the Upparmal Plateau forms a part. Hard sandstone is locally exposed throughout the study area and, although comparatively less suitable for controlled flaking than siliceous rocks, appears to have been occasionally utilized as a readily available raw material.

Microlithic assemblages are generally attributed to the Mesolithic period (Middle Holocene). However, considering the typological and techno-morphological characteristics of the assemblage, particularly the predominance of non-geometric forms, the microlithic industry of the Upparmal Plateau may represent a cultural phase extending from the Upper Palaeolithic to the Mesolithic period (Late Pleistocene to Middle Holocene). Furthermore, the occurrence of Lower Palaeolithic tools, including Acheulean-type hand axes, together with pictographs reported from the region (Pandey et al., 2024), suggests prolonged prehistoric occupation and cultural continuity within the Upparmal Plateau area.

Overall, the present geoarchaeological investigation demonstrates that the Upparmal Plateau constituted an important prehistoric activity zone where favourable geomorphology, availability of water resources, suitable raw materials, and natural shelters collectively supported repeated human occupation and lithic technological development over an extended period of prehistoric time.

ACKNOWLEDGMENT

The authors gratefully acknowledge the assistance of Mr. Om Prakash Sharma (Kukki) in identifying the study sites and supporting field investigations. They also express their sincere thanks to B. N. University, Udaipur, for providing essential academic support and institutional facilities.

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