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Lithic Materials Utilization for Microlithic Tool Production in the Ranj River Valley of West Odisha

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Abstract: *During the Stone Age availability of raw materials plays a significant role in stone tool production. Prehistoric tools and associated lithic materials provide us a lot of information regarding their movement, lithic utilization and behavioral pattern. An important aspect in the study of their manufacturing technology is that they had to expend a good amount of effort in the production of stone tools. Besides, they would have used better quality raw materials for achieving the desired shape of tools. The quality of raw materials determines the functions of tools. Availability of such qualitative lithic raw materials in the Bargarh upland had also attracted the prehistoric people. The ongoing paper emphasizes identifying the probable source of raw material in the study area. As this region had provided an abundance of qualitative raw materials since prehistoric time in its riverbank, hill slopes, and rocky outcrops, an attempt has been to discuss the raw-material utilization pattern in microlithic settlements of Ranj valley based on procured lithic artefacts from various sites.*

Keywords: *Microlith, Chert, Quartz, Agate, Burin, Scrapper, Denticulate, Mesolithic, Artefacts*

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Introduction

Lithic raw material plays a significant role in prehistoric lifeways. Procurement of raw materials was considered to be one of the economic activities of the Stone Age. Lithic materials procurement and use provide vital information about their subsistence pattern, land use, tool production and functions, changing mobility and regional variation (Bordes, F. 1950:23). The nature of lithics and inferred age may suggest that hominins other than modern humans could unintentionally modify their environment. The scale of debris also implies the significance of stone as a source for prehistoric people (Bicho, N. 1993:768). The use of stone tools by prehistoric man and the subsequent evolution of manufacturing technology signifies the exploitation of large quantities of rock. When hominins first adopted stone

tools as a significant element of their behavior, they use their local landscape through quarrying, breaking off huge boulders available nearby (Freeman, L. G.1991:89).

The visibility of lithic materials scattered in eroded landscapes in Ranj valley of Bargarh upland has demonstrated the extent of human impact in this area. As the importance of stone increased due to its excessive use in the microlithic period, the prehistoric hominin group followed various strategies to obtain it and use it. Further, to have a desired shape of artefacts, they preferred to obtain a sizeable and quality raw material from their living landscape. For effective functioning of tools, good quality of raw material and sophisticated production technology was always necessary. Thus, they exploited the raw material of varying sizes as per their need during the microlithic period. The research studies have tended to examine the way in which access to good quality stone influences human behavior and adaptation (Andrefsky, 1994:21-34). Where a good stone is very common, usage and production may be higher in that area. The activity area and extraction of raw material for lithic production have an impact on the environment also. During the exploration, some probable raw material sources have been noticed in the Ranj valley adjacent to the microlithic settlements. The microlithic assemblages explored in all 14 sites of Ranj valley are made from the raw materials which would have been obtained from the nearby Rocky outcrops, foothill nodules, or some are river pebbles. In this paper, an attempt has been to discuss the types of raw material used in various sites by prehistoric communities and their probable source of obtaining these close to their settlements.

Previous Work on Microlithic Study

Various researchers worked in Stone Age culture in different parts of Orissa from time to time since 1876. But the systematic Paleolithic research in Orissa started only after 1939 A.D. Later on, G.C. Mohapatra (1962) carried out his research in the regions of Mayurbhanj, Dhenkanal, Sambalpur, and Sundargarh and brought to light eight microlithic sites. The work of Tripathy during the early ’1970^{s} in southwestern Orissa has also made known several Stone Age sites from the Tel river basin. The total collection from all these sites consisted of 1781 artifacts. In these sites, chert is the most common raw material, followed by quartzite, chalcedony, jasper, and Opal. Besides the above-mentioned sites, the occurrence of Microlithic industries was also reported from the Jira valley, a tributary of the river Mahanadi, in the western part of Orissa. Late Stone Age Microlithic assemblages in Jira valley were first reported by K.C. Tripathy (1972). Besides the researchers as mentioned earlier, exploration has been conducted by P.K. Behera and S. Pradhan with the assistance of numbers of M.A. and M.Phil students in the Middle Mahanadi and its major and minor tributaries resulting in the discovery of hundreds of Mesolithic sites. The occurrence of a microlithic industry has also been reported from Ong valley by S. Panda (1996), in lower Ong and Suktel by S. Gadtia (2000), in middle Ong (Padhan, 2016) in lower Jira valley by K. Seth (1998), Upper Jira valley by S. Mishra (1998), in the middle Mahanadi valley by A.K. Sethi (1996), lower Bheden valley by J. Naik (2002), Raul valley by B. Patel (2002), Girisul valley by S. Mendaly (2012), Jonk valley by T. Padhan (2013) and Bargarh Upland by S. Deep (2016). These above mention people have been working in the Mesolithic culture of Western Orissa. The above discussion clearly shows that the highland of Orissa and its adjoining areas bear ample testimony of the existence of microlithic industries. The microlith assemblages reported from these above-mentioned sites are rich in a different type of raw material like chert of various colors, quartzite, chalcedony, agate, and quartz of milky and fine variety. The exploration by the author in Ranj valley (fig-1) has brought to light 14 microlithic bearing sites, which have also yielded the same raw materials as reported by previous scholars in the Jira valley and Mahanadi valley and its tributaries. The significant feature of the landscape of the western part of Odisha is that stone tools

occur ubiquitously and constitute a considerable portion of the landscape's surface. Ranj valley is a tributary of river Jira rich in lithic material in its adjacent areas over the vast landscape. However, the geological work in the valley is lacking. The Geological Survey of India (1966-67) classified the rocks as unclassified granite. Earlier, some work has been done on the Proterozoic formations of the western Orissa-Chhattisgarh region. (Das *et. al* 2001:243, Balakrishnan *et. al* 2011:1-14). Mahalik and Nanda (2006:47- 49), in their research, classified the granite and granitic genesis of the present area as undifferentiated granite and occurring at a geomorphic level of about 300m above mean sea level. According to them, the granitic genesis is the oldest and ranges from 3000 million years ago to 26000 million years ago. Thus, the area has a rich deposit of minerals and rocks and has created a prolific environment for settlements of primitive people.

Research Methodology

In the year 2013, systematic explorations were carried out in the Ranj valley. The river Ranj and its adjoining areas were surveyed for understanding geology, geomorphology, and geo-archaeology. For identifying the exposure and rocky outcrops, toposheets have been used during exploration. Microlithic settlements were located, and samples were collected from various sites. The adjacent microlithic survey was focused on the rock outcrops, rocky knobs, foothills, and pediment areas. During explorations, attempts were made to locate the raw material source found closed to the microlithic settlements. Thus, all eroded surface area and exposure present near the riverbank, small hillocks, rocky knobs, and pediment areas were explored thoroughly. The cultural materials collected from different sites of this valley have been analyzed, and their quality and color of each artefact were recorded.

Present Environment

The river Ranj is an important tributary of the river Jira in the Bargarh upland. It originates from an open scrub near the village Birhipali in the district Bargarh. The river receives water during the rainy season by many small seasonal streams such as Bargarh Nala, Nuagaon Nala, Baunsenmura Nala, Barpali Jhor, etc. The Ranj moves in a southeastern direction to join the river Jira at Samalaipadar. The study area covers a less than half portion of the Bargarh upland. The general relief of Bargarh upland is between 140m and 250m above mean sea level. It is bounded on the west by Raipur districts of Chhattisgarh, on the north-west by hill ranges of eastern Sarangagarh, and the north by the Barapahar hill ranges of Bargarh district. On the eastern side of the upland lie the uplands of Sambalpur, in south-east Subarnapur district and Balangir districts is bounded in the southern side.

The area lying towards the north and north-west of the upland mainly comprises meta-sedimentary rocks, viz. coarse, earthy, felspathic, and other varieties of quartzite, conglomerate, shale, and calcareous shale. The oldest rock formation of the upland is mainly represented by medium-grained biotitic granite, often referred to as Sambalpur Granite (Sahoo 2007:35) of the Precambrian age. Older meta-sedimentary rocks occur as enclaves within the granite, intruded at places by dolerite dykes and quartz veins (fig-2). The area had undergone intense tectonic deformations, as evident by numerous faults and joints in the granitic rocks. Most of the fault zones are silicified and filled with quartz veins. The silicified rocks are massive, fine-grained, and are of various colours, from dirty white, yellowish to brown. Overlying the weathered granite, there are found thin to thick quaternary deposits, which have undergone massive erosion at many places, particularly in the western part of the upland. The overall drainage pattern of the area is dendritic with high drainage density, which is characteristic of hard rock terrain with low relief. The river Ranj is also a branch of this dendritic river system. The Bargarh plain is not a flat alluvial tract but an expanse of undulating country sloping down from the Barapahar hill

in the north to the Mahanadi valley in the east. However, the land between River Jira and Ranj has formed a very vast plain. This plain contains a good portion of the cultivated land of the district. The soil is a mixture of sand and gravel as well as clay. Based on physical and chemical characteristics, mode of origin and occurrence, the area's soil is described as alfisols (Sahoo 2007:53). It includes red sandy soil, red loamy soil mixed with red and black soil. The soil of the upland is slightly alkaline. However, the soil types support the cultivation of rice and other crops like groundnut, black gram, horse gram, and various kind of vegetables. This upland is rich in vegetation having Mango groves in most of the villages of the district.

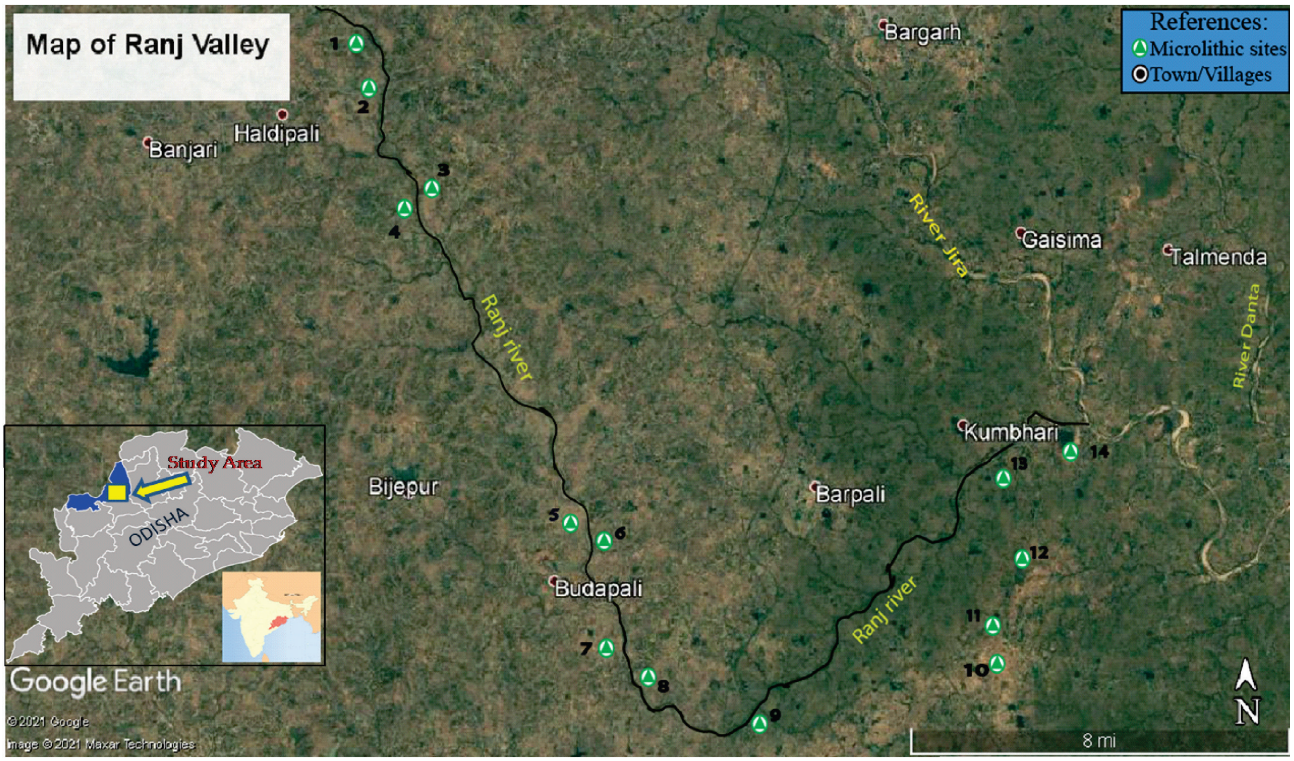

Figure 1: Location of Microlithic settlements in Ranj valley

Table 1: Lithology of Bargarh Upland

Age	*Geological unit*		*Lithology*
Pleistocene to Recent	-	-	Soil/ Alluvium
Cenozoic	-	-	Laterite
Carboniferous Permian	Gondwana super group	Talchir formation	Conglomerate, felspathy, sandstone and clay
Middle to upper Proterozoic	-	Raipur group	shale, calcareous shale, purple quartzite
	Chhatisgarh super group	Chandarpur group	Coarse quartzite, sandstone, shale, earthy sandstone, phyllite, quartzite, siltstone, coarse felspathic sandstone, grit and conglomerate, fine clay, fine clay shale/slate, arkoses
Proterozoic			Quartz vein, Dolerite, Grenophyre, pyroxenite, Anorthosite, medium-grained biotite, granite gneiss, augen gneiss, migmatite gneiss, garnetiferous granite gneiss, leptynite
Achaen	Eastern Ghat super group	Khondalite group	Calc-silicate, calc-ganulite, quartzite/silimanite-quartzite, quartz garnet-silimanite, graphite schist gneiss, amphibolites, meta-volcanics

Lithology of the Ranj valley

The striking feature of the landscape of the Ranj valley is that stone tools occur ubiquitously and constitute a significant portion of the surface of the landscape. Due to the availability of raw materials, the environment and area are dominated by prehistoric activity. There is the widespread use of local stone as raw material for tool production. The table below shows the lithic material available in the Bargarh upland in general and Ranj valley.

As the above table shows, the oldest rock formation of the area is composed of the rocks of the Achaean series succeeded by the Proterozoic and Cenozoic series. The rocks of lower Gondwana, represented by Talchirs, etc. may be observed towards the western fringe of the district, bordering Raigarh district of Chhattisgarh; some portions of the district is covered with deposits of varying thickness of laterite and lateritic iron-ore at various latitudes. The recent and sub-recent formations can be seen in the form of a thin deposit of primary laterite, alluvium and soil. The district exposes different litho-stratigraphic units having varied litho assemblages. The Eastern Ghat supergroup (Achaean) comprises the Khondalite group quartz-feldspar-garnet-sillimanite-graphite schist gneiss, quartzite/ sillimanite-quartzite, calc-granulite, and Charnokite group of rocks.

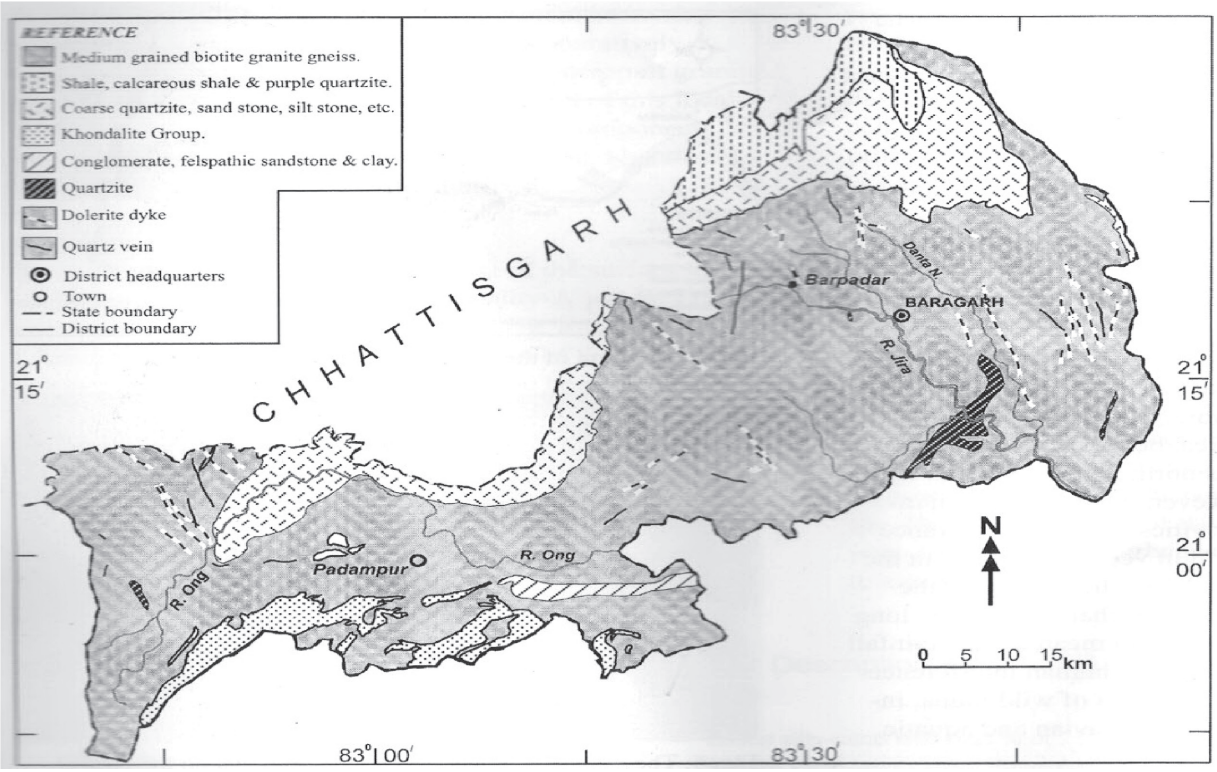

Figure 2: Geological map of Bargarh (after Behera *et.al*. 2015: 3)

The Anothosite bodies possibly an apophysis of Bolangir Granophyres, pyroxenite, Anorthosite, Quartz vein, Dolerite are intrusive into Eastern Ghat super group of rocks. The Chhatisgarh supergroup of rock of the Middle to upper proterozoic age are represented by conglomerate, grit, arkose, sandstone, shale belonging to Chandarpur group overlain by fine-grained siltstone shale, calcareous shale, purple quartzite of Raipur group. Talchir formation comprising pebbly sandstone, siltstone, and needle clay is the only representative of Gondwana rocks occurring in a narrow basin in the southern part of the district. The quaternary formation is represented by transported laterite, sandy clay and medium to fine sand. The Eastern Ghat supergroup of rocks shows a history of intricate polyphase folding.

Metaphorism had progressed up to granulite facies. Local partial melting and anatexis is frequently observed. The granite at the contact of the Eastern Ghat mobile belt is mylonitic, thereby indicating the tectonic nature of contact between the two rocks group. The Chhattisgarh sedimentary conformably overlie the cratonied Eastern Ghat super group.

Microlithic settlements discovered in Ranj Valley

During the surface exploration made by the author in the year 2013-14 in the Ranj River, a tributary of Jira river system in the Bargarh upland, a total of 14 sites have been discovered in different geographical contexts. The table below demonstrates the exact location, context of each site, and artefacts yielded. The microlithic settler in this valley inhabited in four geomorphologic contexts. Artifacts reported from these sites are very crucial to know the activities in which the prehistoric peoples were engaged.

Table 2: Microlithic sites located in the Ranj valley

Sl.no	*Name of the sites*	*Longitude/latitude*	*River system*	*Geomorphological context*	*Total no. of Artefacts*
1	Chichinda	N21^{0}17'21.5" E 83^{0}26' 51.9"	Ranj	Along with the River Bank	429
2	Hirapali	N 21^{0}17' 24.1" E 83^{0}26' 53.6"	Ranj	Along the River Bank	347
3	Bandala	N 21^{0}16' 26.1" E 83^{0}27' 44.5"	Ranj	Along the River Bank	373
4	Lebri	N 21^{0}16' 57.7" E 83^{0}27' 52.1"	Ranj	Along with the River Bank	345
5	Bandhpali	N 21^{0}12' 36.1" E 83^{0}31' 59.9"	Ranj	In an eroded rocky outcrop	441
6	Raksa	N 21^{0}08' 44.2" E 83^{0}31' 51.8"	Ranj	Along the River Bank	269
7	Rabanguda	N 21^{0}07' 34.2" E 83^{0}39' 49.8"	Ranj	Along the River Bank	218
8	Tentelpali	N 21^{0}07' 14.3" E 83^{0}32' 23.7"	Ranj	Along the River Bank	429
9	Dalaipali	N 21^{0}07'28.5" E 83^{0}32' 59.9"	Ranj	Along the River Bank	324
10	Bhatigaon	N 21^{0}07' 51.9" E 83^{0}35' 08.2"	Ranj	Along the River Bank	192
11	Bhubanpali	N 21^{0}09' 41.1" E 83^{0}39' 49.8"	Ranj	Foothill	452
12	Patkulunda	N 21^{0}11' 42.9" E 83^{0}40' 12.6"	Ranj	Pediment	288
13	Govindpur	N 21^{0}09' 49.7" E 83^{0}39' 55.9"	Ranj	Foothill	402
14	Barikel	N 21^{0}12' 03.7" E 83^{0}40''44.9"	Ranj	Rocky outcrop	356

Lithic Source over the Landscape and its Exploitation

Raw material over the landscape plays a very significant role in the living pattern of prehistoric people. Searching for raw material was considered to be the economic activity of early man (Jeske, 1989:39). After procuring these materials, they used to process these using technology and give them a final shape to make these tools as per their desire. However, in the tool manufacturing process, man

involved a lot of his behavioral operations such as procurement of raw materials, reduction sequences, and production by applying technology, further modifications, and abandonment of tools, etc. All the processes were part of their subsistence strategy too. Recently, studies on raw materials have focused on the importance of exotic raw materials and long-distance acquisition of lithic raw materials as well as the local raw materials (Jeske 1989:42). The characterisation of these raw materials has become more detailed and frequent since the 1950s by using classic petrological methodologies and increasing archaeologists' interest in new perspectives to understand prehistoric societies (Polanyi 1957:261). The excavation and exploration conducted in the Bargarh upland recently by Behera identified the source of raw material in the Danta valley. The river bed of Danta has abundant materials like quartz and chert in the form of nodule and pebble of varied shapes and sizes (Behera 2019:1-11).

Further, the work of Mendaly (2012:37) in the Girisul system, a tributary of river Jira also revealed the presence of a chert bed near Sulsulia (Badghat-A). Similarly, Ranj valley also had many locations where the source of chert and quartz is available. Prehistoric people might have access to these chert and quartz sources. Non-local raw materials are very rare since good quality rocks are ubiquitous and chert is abundant across the landscape. Core and flakes of local raw materials are represented in the assemblages of all explored sites. Availability of local chert and quartz suggests that local materials were used both during acquisition and excursion. Acquisition of raw material was one of the major activities of the people of this time. Archaeological studies of raw materials have tended to focus mostly at the regional level due to their connection to mobility or planning of prehistoric people (Andrefsky 1994:28, Kuhn 1989:36). The local raw material is defined as coming from a source within less than a 20 km radius (Mark *et al.* 1991:133). Such sources are likely to have been important in terms of the regional economy and in the acquisition of all resources. Five major types of raw materials are usually noticed in the microlithic sites of Ranj valley. They are Agate, Chalcedony, Quartzite, chert and quartz. The major rock formations of this area being granite, quartzite, Dolerite, quartz, sandstone, and chert and limestones; there is large scale availability of quartzite river pebbles, cobbles, foothill nodules and boulders, etc. in this part of Bargarh upland. The following graph (fig-3) shows the utilization of the raw materials in this valley.

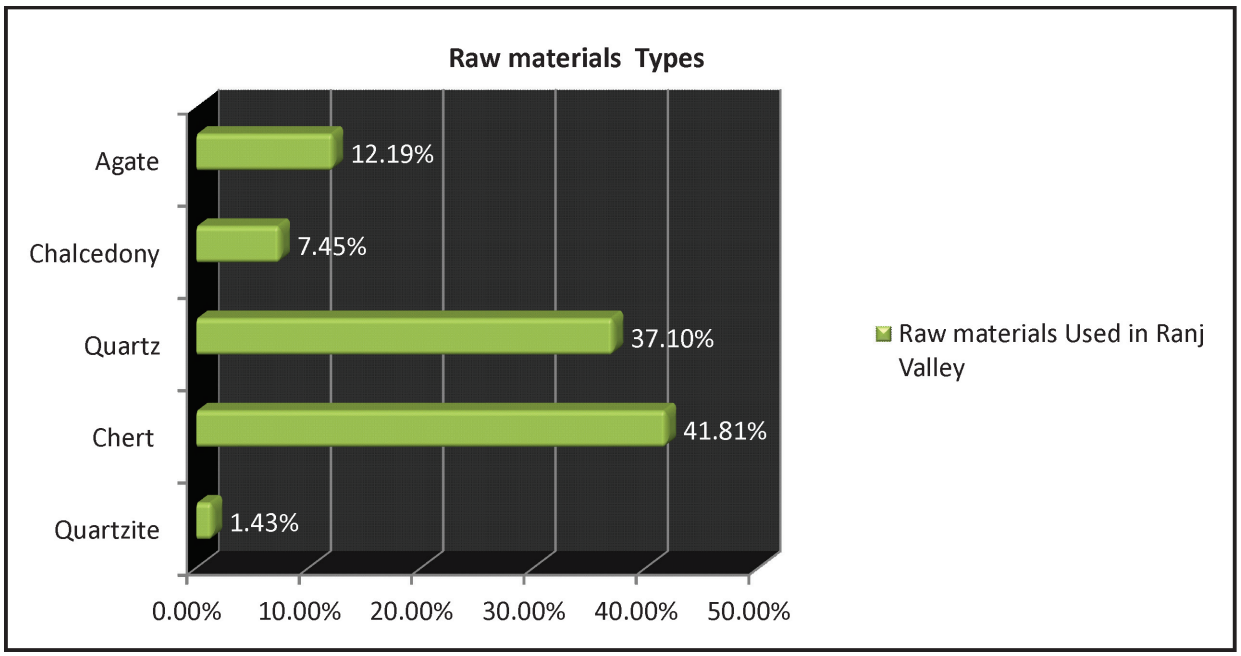

Figure 3: Percentage showing the Raw materials Utilisation

Chert Artefacts

Chert is a sedimentary rock composed of microcrystalline or cryptocrystalline quartz, the minerals form of silicon dioxide (SiO_2). It occurs as nodules, concretionary masses, and also as layered deposits. Chert is the raw material most common in the assemblages in the Ranj valley. The microlithic sites located in Ranj valley close to the river were dominated by chert (see Fig-3) as the main raw material due to its availability nearby. During the classification of artifacts, varieties of colours of chert components have been noticed, such as black chert (13.68%), grey chert (2.03%), green chert (8.34%), yellowish-grey chert (1.65%), brown chert(3.33%), banded reddish chert(3.35%), Blueish greyish chert (3.27%), coffee-colored chert (4.10%), Reddish off white chert (2.64%), Brownish greenish chert (0.74%), fine-grained chert (0.3%), etc. Chert breaks with a conchoidal fracture and produces very sharp edges. The edges of broken chert tend to retain their sharpness because chert is a hard and durable rock. During the Microlithic cultural phase, fine grain chert material is used to produce cutting and scraping tools. In the assemblage composition, most of the scrappers, baked Bladelet, notches are made of chert components (fig-10,11,12,13).

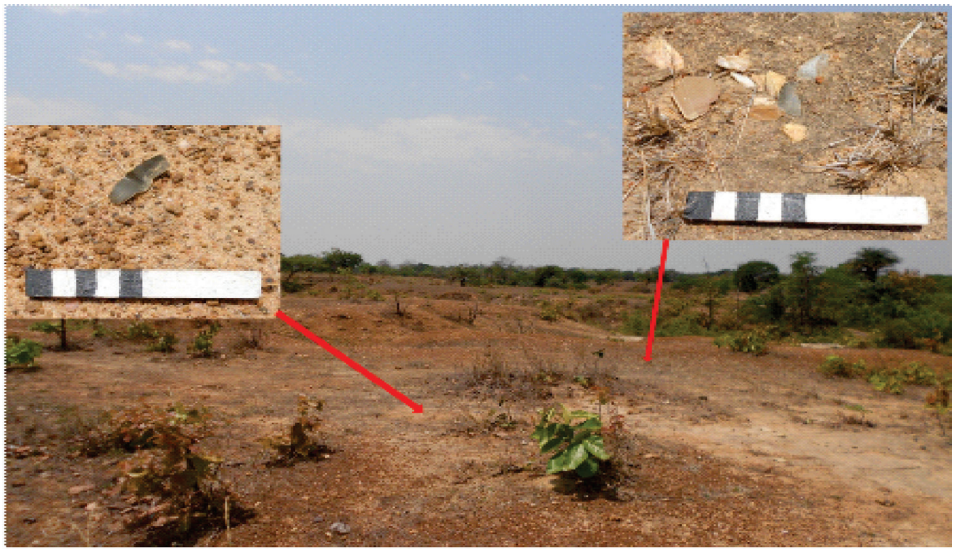

Figure 4: Chert Nodules scattered over the exposed surface at the foot hill near Hirapali

Figure 5: Chert Nodules lying at the foothill of Tulundi Reserve Forest

Three different forms of chert nodules have been utilised in the study area; the river pebble, hill slope nodules and outcrop chunks. Hirapali (Fig-4) is such a site where chert nodules are scattered near a foothill which is only 1 km away from the site. At the site, Bandhpali, Tentelpali and Dalaipali people seem to have utilised the river nodules lying in the river bed of Ranj. Here the river bed is highly concentrated with pebble deposit. Bhubanpali and Govindpur are located very close to the Tulundi (Fig-5) reserve forest, where small chert nodules are abundant. Among the chert components, black chert has occupied the predominant position having 13.68% of the total artefacts. Green chert is in the second position, having 8.34% of the total. Other types are of varying nature. In Bhubanpali site, grey chert (nos =18) and Banded reddish chert (nos=19) are in the majority, whereas in Govindpur site, blueish grayish chert (nos=34) is predominant. The site Dalaipali yielded black chert (nos=31) (fig-12) component and has got a significant position in tool production followed by coffee-colored chert (nos=23). The site Raksa (nos=31) (fig-7), Bandhpali (nos=27) (fig-10) and Lebri (nos=47) have also larger concentration of black chert as compare to other. Brown chert (nos=29) has dominated the site Bandala in its assemblages. The site Chichinda (fig-11) is a very rich microlithic site where the composition is dominated by Green chert (nos=40), Black chert (nos=71), Grey chert (nos=19). However, other varieties of chert are also present in the composition. Chert nodule in these sites ranges from small pebble size to large boulder. Probably, Prehistoric people brought these nodules to the sites from hill slopes or river bed and used for tool production.

Figure 6: Blades from Govindpur

Figure 7: Blades from Raksa

Quartz Components in Assemblages

Quartz is a widely distributed rock that consists primarily of silica. It occurs in nearly all acid igneous, metamorphic, and sedimentary rocks. Quartz as a raw material is very common in Ranj valley and has occupied the second position in assemblage composition. But the percentage of use of quartz is varying from site to site. A total of 37.84% of the total assemblages are quartz components (see Fig-3) in the microlithic settlements of Ranj valley. Three varieties of quartz have been observed in the study area; Such as Crystal quartz, Milky quartz, and oxidized quartz. These all are different in

their appearance. Milky quartz is 35.67%, and crystal is 2.17% of the total artefacts. Milky quartz is dominant in the sites like Barikel (nos=39), Tentelpali (nos=148), Rabanguda (nos=123), Lebri (nos=101) and Bhubanpali (nos=109). Other sites of Ranj valley have also yielded quartz artifacts. However, their number is low compared to chert and agate. Crystal Quartz has been used in limited sites. But in some time, the use of crystal variety of quartz is neglected.

Figure 8: Thick deposit of Quartz chunks near Barikel

Figure 9: Weathered Quartz near Hirapali

The people of the prehistoric period might have perceived these three raw materials with different functional values. Quartz was probably used most abundantly in the developed microlithic phase. In the Ranj valley, quartz dominates at the sites located away from the river and near the granitic rocks and foothills. Quartz occurs in the form of large chunks, fragments and pebbles. Quartz outcrop

occurs more commonly near the river and has also been found at an approachable distance from the site discovered. The source of quartz has been observed on the foothill of Tulundi Reserve forest and Barikel reserve forest (Fig-8). Besides, quartz occurrence has been found in the right bank of river Ranj near Hirapli village (Fig-9). It was very difficult to identify the retouching on quartz components of the artefacts. However, quartz was also occasionally utilized for making blades and bladelets, but flake components are very usual. The blades made on quartz show the advancement and efficiency of the technology as quartz is very difficult to produce. There was a common use of the bipolar technique in connection with the reduction of quartz material.

Agate

Agate is a rock consisting primarily of cryptocrystalline silica. It is a banded form of chalcedony, which is a microcrystalline variety of quartz. It is characterized by its fineness of grain and variety of colors. Agate is one of the raw materials used by prehistoric people during the microlithic phase. Agates are most commonly found as nodules within the cavities of volcanic rocks. It is difficult to identify because it also resembles red chert. Agate is found in all the sites of Bargarh upland. It has occupied the third position (see Fig-3) in the total assemblage of Ranj valley as the raw material. In some sites of the Ranj valley, it is neglected due to a lack of sources nearby. The highest number of agate (nos=29) components have been observed from the site Tentalpali. However, in other sites like Bhubanpali (nos=28)(fig-13), Chichinda (nos=28), agate has been used as raw material. Age is divided into three major categories such as agate, cherty agate and yellowish-grey agate. Among all types, cherty agate is dominant in Govindpur (nos=28) sites. But the use of yellowish-grey agate is limited in all sites and often neglected.

Quartzite

Quartzite is a rare raw material found in the microlithic settlements of Ranj valley. It was one of the most abundant raw materials during the Paleolithic period but not a preferable raw material during the late Stone Age. In chronological terms, the amount of quartzite gradually decreases from the Lower Paleolithic to the last phases of the Upper Paleolithic and the Neolithic (Straus 1991:185-190). So, very few numbers of quartzite artefacts have been noticed in the assemblages of Ranj valley. Quartzite found in these settlements classified into three categories based on their texture or grain size such as fine grain, medium grain, and coarse grain quartzite. Quartzite obtained in this region is usually grey in color. But in some sites like Bandala and Lebri, yellow and brown quartzites have also been observed. Other natural impurities might have caused quartzite to be yellow and brown. The majority of the artefacts are of medium-grained quartzite. The coarse texture of this raw material made it less suitable for producing tools with fine edges, so it was not preferred during the microlithic cultural phase. The source of these quartzite materials are found near Baunsenmura rocky outcrop area. Sometimes large-sized boulders of quartzite are also found in the river channels. As it was a less preferred material in tool production, only 1.43% of the total assemblages are quartzite (see Fig-3). However, no tools have been identified in this category. Quartzite as a raw material has been noticed in the site like Barikel (nos=8), Chichinda (nos=7), Lebri (nos=6), and Tentelpali (nos=5).

Chalcedony

Chalcedony occurs in the Bargarh Upland within the basalt and limestone area. It contains a mixture of crystal and silica. Chalcedony is found in the Ranj valley, and its occurrence and use are limited in nature. Chalcedony is a dominating raw material at Govindpur and Patkulunda. However, in certain

sites use of chalcedony as a raw material is completely absent. The primary source of chalcedony raw material is found in a small mound near Barikel hill. The use of chalcedony gradually decreases as one comes to the sites found upstream. The highest number of chalcedony is found in the sites like Govindpur (nos=73), Patkulunda (nos=35), and Dalaipali (nos=34) (fig-12). The use of chalcedony is maximum in these sites in comparison to other chert raw materials.

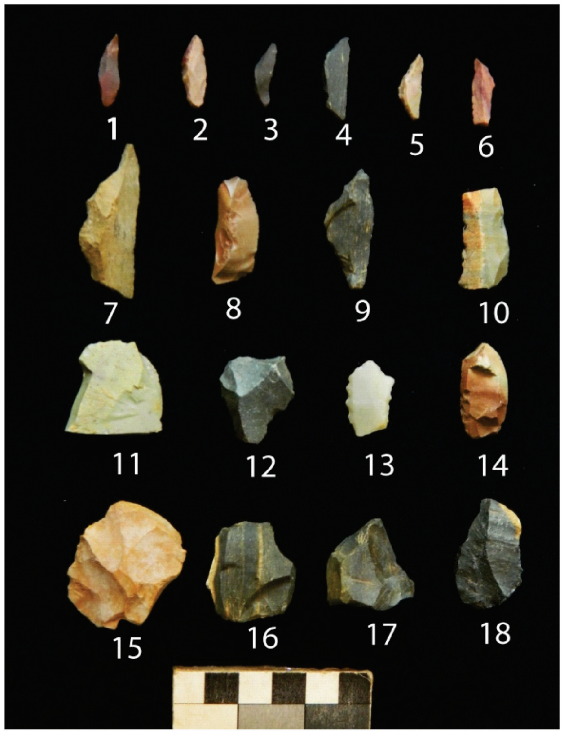

Figure 10: Microliths from Bandhpali

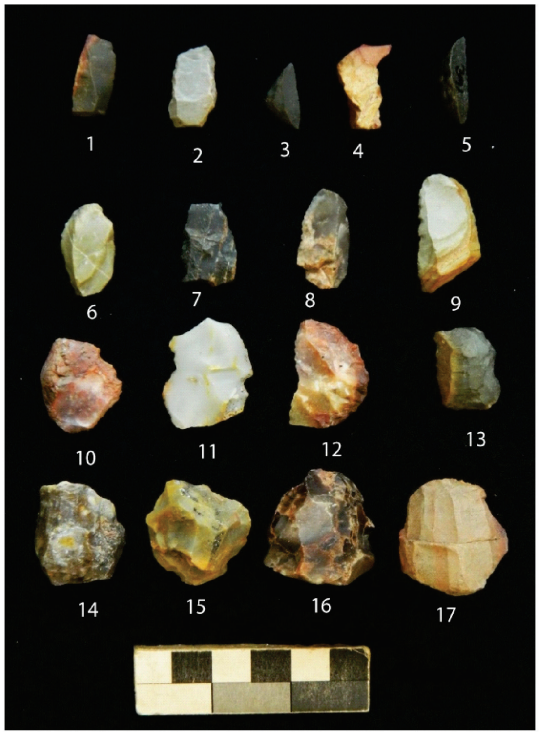

Figure 11: Microliths from Chichinda

Figure 12: Microliths from Dalaipali

Figure 13: Microliths from Bhubanpali

General Observation on Raw Materials

The environment has produced an abundance and variety of lithic raw materials that can be used by prehistoric man for tools manufacturing in the Bargarh upland in general and Ranj valley in particular. Raw materials occur in localized settings, such as river streams, river deposits, bedrock outcrops and hill slopes, etc. However, two observations can be made in relation to the extraction process. One is that there are inter-site variations in raw material exploitation and the second is that the extraction process also affects local ecology. Sometimes large boulders may have been used, or large flakes would have been removed for tool manufacturing (Mirazon *et al.* 2008:276). The extraction of stone material may also have enhanced the productivity of the area and might have attracted the mobile community to settle in this upland area. If the microlithic community's survival became dependent upon lithic-based technology, they would become tethered to areas where such raw materials are available. The hunter-gatherer groups of this region had mobility over a large area for resource acquisition. However, they might have chosen different areas for their base camps. As shown in (Fig.1), chert is the most dominant raw material in the microlithic settlements of Ranj valley, followed by Quartz and Agate. As these raw materials produce sharp edges, they are used to extract it and used in tool reduction. The most common reduction sequence used in the production of baked microlith involved the removal of blades and bladelets from the pyramidical core with the single or opposed platform; the micro burin technique was used for the production of geometric tools (Bamforth 1991:223-225). Primary preparation of large boulders to create the cores from which artefacts are made can increase the volume of stone extracted massively. Then they reduced cores to their final products. It is noticed that there was a casual use of quartz for the manufacturing of tools as the quartz debitage fragments are large in number in the assemblages. This can be due to the abundance of quartz in the surrounding areas. The same can be noticed in the case of chert. The sites with limited chert artefacts show many blade scars on chert cores compared to chert-dominated sites. The use of chalcedony gradually decreases as one comes to the sites found upstream. Quartzite is occasionally used at some sites, but its number is negligible in comparison to the chert and quartz. Chalcedony blades were found narrow and thinnest breadth-wise compared to other raw materials. However, chert blades were found to belong, wide and thick blades. However, certain variation is found in the lithic assemblages of different sites during the analysis of raw materials. It exists primarily either the adequate availability of a resource or acute scarcity of lithic raw materials. The quality of lithic raw materials also plays a role in structuring tool production. Very-fine-grained homogeneous raw materials tend to be more easily shaped and reduced than coarse-grained and flawed raw materials and thus represent better-quality stone (Andrefsky 1991:132; Henry 1989:186). Thus, man during prehistoric times made use of existing qualitative local resources in this area. The procurement of raw material and lithic reduction strategy of the prehistoric man in Ranj valley suggest that large flake blanks were brought to the site from the nearby areas where raw materials were available and produced their tool for various purposes.

Concluding Remarks

The exploration conducted in the Ranj River in the Bargarh upland reveals that the study area is rich in stone age sites and holds tremendous potentiality archaeologically. The area inhabited by prehistoric people for a long period as testified by the existence of many microlithic settlements. The available natural resources must have fulfilled all the needs of prehistoric man. The discovery of a large number of prehistoric sites in the Ranj valley proves that the area was densely populated during the time of late Pleistocene period. The microlithic settlements found in this region is characterized by both geometric and non-geometric tools. The lithic artifacts reported are often found in fresh condition, except a few

which have light patination. Most of the sites discovered recently are found along the river banks. The microlithic using community seems to have exploited river pebble and nodule for tool production as these are close to the bank. However, the above-discussed site is neither associated with heavy-duty tools nor with ceramics. So far, geomorphology of the region is concerned; the study area is lacking the availability of rock shelters and caves. Hence no cave site is reported so far rather, and all are open-air sites. In some locations, it has been brought to notice that heavy erosion has taken place near the site because of some natural and anthropogenic factors, which have left the stone artifacts exposed in clusters. The analysis of the collected artifacts and their techno-typological features demonstrate that the microliths of Ranj valley bear resemblance with the microliths of Mahanadi valley as well as microliths reported from various sites of Eastern India. It is difficult to say how the prehistoric man of this area chose and used the raw materials. In this regard, we have to understand the characterization of the massive primary outcrops present in this region. The reasons for the choice and transport of the raw material are also other criteria that are yet to be understood. Finally, it is necessary to analyse and quantify the lithological variety of Quaternary deposits in the form of river terraces, landscapes and river beaches. Further scientific and systematic research with a multidisciplinary approach may provide us more information regarding prehistoric subsistence strategy, raw material exploitation and site distribution pattern of the prehistoric community of Ranj valley in the Bargarh upland.

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