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Prehistoric Toolmaking in Meghalaya: An Analysis of Flake and Blade Cores from the Garo Hills

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Abstract:

This study presents a preliminary analysis of flake and blade core technology from the Garo Hills region of Meghalaya, shedding light on prehistoric toolmaking traditions in Northeast India. The Garo Hills, with their rich archaeological potential, offer a unique context for understanding lithic production techniques employed by early human populations. The analysis focuses on the typological and technological characteristics of cores recovered from surface explorations and excavations in selected sites across the region. Special attention is given to core morphology, reduction strategies, and raw material selection, aiming to reconstruct the technological behaviour of prehistoric toolmakers. The presence of both flake and blade cores suggests a transitional or diverse lithic tradition, indicative of adaptive strategies in response to ecological and functional needs. Comparative references are drawn with similar assemblages from other parts of India to place the Garo Hills material within a broader prehistoric framework. The findings contribute to our understanding of early human settlement patterns, technological innovation, and regional variability in lithic industries. This analysis underscores the importance of the Garo Hills in the study of prehistoric archaeology in Northeast India and calls for more systematic explorations and contextual excavations to build a comprehensive cultural sequence of the region.

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Study Area

The lithic materials analyzed in the present study originate from prehistoric sites located in the Selbalgre area of the West Garo Hills district, Meghalaya. This region is situated on the left bank of two rivers—Selbal and Rongram—which play a significant role in shaping the local topography and settlement patterns. The Selbal River, a tributary of the Rongram River, flows in a south-to-north direction and eventually merges with the Rongram near the village of Selbalgre. The source of the Selbal River lies in the Tura Range, close to the village of Misimagre, indicating the area's close ecological association with the upland terrain.

The archaeological site lies at an altitude of approximately 640 meters above mean sea level (amsl), offering a strategic and elevated landscape likely conducive to prehistoric habitation and tool production. Geographically, the site is positioned between latitude 25.45°N and longitude 90.15°E to 90.13°E, placing it within a region known for its rich cultural and ecological diversity. The location, characterized by hilly terrain, riverine systems, and natural resources, would have provided prehistoric communities with access to water, raw materials, and food sources, making it an ideal setting for early human occupation and lithic activities (see Fig. 1).

Fig. 1 Map of Selbalgre, West Garo Hills (Source: Google Map)

The River Selbal has carved three distinct depositional terraces into the Gawak Hills, situated at elevations of approximately 40 metres, 22 metres, and 2.5 metres, respectively. The highest of these terraces, notable for its rich assemblage of quartz pebbles, was once inhabited by Stone Age communities. Remarkably, the Rongram-Selbal Valley accounts for no less than 80% of all prehistoric sites discovered in Meghalaya to date, underscoring its archaeological significance in the region.

The solid geology of the region is predominantly composed of granite and gneiss, overlain by a substantial mantle of Tertiary sedimentary formations, including sandstone, claystone, and shale. Notably, other intermediate geological strata are largely absent in the area under investigation. The Archaean and Tertiary systems are, in certain locales, intruded by dykes—most prominently composed of dolerite, a fine-grained, compact igneous rock characterized by its conchoidal fracture. This dolerite was extensively utilized by prehistoric populations for the manufacture of stone tools across all cultural phases. Although chert is not naturally found in this particular region, its use in tool-making has been documented in the East Garo Hills and at Bibragre in the West Garo Hills (Sharma et al., 1985: 89–91).

Considering the geological, geomorphological, and geoarchaeological evidence, the stratigraphic layer from which these materials were recovered has been assigned to the Mid to Late Pleistocene period, as suggested by Rajaguru et al. (1978–79). However, it is important to note that no radiometric dating has yet been conducted in the area to substantiate this chronological attribution.

The region falls within a subtropical humid zone characterized by heavy rainfall and a dense, luxuriant cover of vegetation. A striking aspect of the area is its diverse geological and geomorphological features. In the piedmont zone, one encounters an extensive erosional plain, while the transitional zones preserve remarkable remnants of Quaternary fluvial formations, alongside evidence of human occupation in various contexts. Additionally, the landscape exhibits a truncated topography, suggestive of underlying tectonic activity.

The valley forests support a rich variety of shrubby, herbaceous, and bushy vegetation, and are home to diverse fauna including elephants, deer, bears, foxes, monkeys, snakes, and numerous bird species. Wild edible plants also grow in abundance and are extensively utilized by the local Garo community. Although the Garos are primarily agriculturalists, they also engage in limited hunting and gathering. From ethnographic, archaeological, and

ecological perspectives, their subsistence practices reflect a remarkable continuity from prehistoric times to the present.

Objectives of the Present Study

1. **To document and analyse the flake and blade core assemblages** recovered from the Selbalgre area of West Garo Hills, Meghalaya, with a focus on their typological and technological attributes.

2. **To understand the core reduction strategies** employed by prehistoric communities in the region, including methods of core preparation, platform management, and flake/blade detachment.

3. **To examine the raw material selection and procurement patterns** to assess the relationship between available geological resources and lithic production techniques.

4. **To interpret the technological behaviour and adaptive strategies** of early human populations based on core morphology and toolmaking techniques.

5. **To compare the lithic assemblage of Selbalgre** with other contemporary prehistoric sites in Northeast India and the broader Indian subcontinent, in order to place it within a wider archaeological and cultural context.

6. **To contribute to the understanding of prehistoric occupation and toolmaking traditions** in the Garo Hills and highlight the archaeological significance of the region for future research and exploration.

Methodology

The methodology adopted for this study involved a detailed typological and technological analysis of lithic cores collected from the Selbalgre area of the West Garo Hills, Meghalaya. Field investigations included systematic surface surveys and selective collection of lithic artefacts based on visibility, context, and concentration of cultural material. Each core was examined for its morphological attributes, including shape, size, and evidence of flake or blade removal patterns. The study also documented raw material types, core preparation techniques, and reduction strategies employed by prehistoric toolmakers. Standard analytical methods such as metric measurements, classification of core types (e.g., single platform, multi-platform, bipolar), and identification of use-wear traces were applied to understand the technological choices. Comparative analysis with similar lithic assemblages from other regions of Northeast India and the broader Indian subcontinent was conducted to contextualize the findings within existing archaeological frameworks. This methodological approach aimed to reconstruct the behavioural and technological aspects of prehistoric communities in the Garo Hills and to contribute to the broader discourse on lithic technology in South Asia.

Typological and Technological Assessment of the Artefacts

The archaeological sites at Selbalgre, first discovered in early 1967, have yielded substantial collections almost annually. These assemblages include an enormous quantity of flakes, blades, blanks, and cores. The primary objective of the present study is to examine the nature and characteristics of the cores in particular. To ensure a focused and systematic analysis, the study is confined exclusively to the cores from the Selbalgre site, which, in addition to cores, contains a vast array of stone artefacts representing all cultural phases. Given the sheer volume and variability of the cores, a comprehensive study of the entire collection would be impractical at this stage. To address this limitation, a case study approach has been adopted, focusing on 165 cores collected during the 2008–2009 field exploration. I must acknowledge that this endeavour is an experimental one, and if proven effective, it may serve as a foundation for a more exhaustive examination of the complete collection in the future.

It must be acknowledged that research specifically focused on this category of lithic analysis remains relatively rare. Nonetheless, two significant works—Johnson (1978) and Ghosh (1993)—have been instrumental in informing the present study. These earlier contributions provided valuable experimental frameworks and terminological insights, some of which have been adopted and appropriately modified to suit the specific context and material of the Selbalgre assemblage. Drawing from their methodologies while adapting them to local conditions, the present study employs a refined set of analytical parameters aimed at ensuring both consistency and relevance in interpreting the lithic cores. These parameters serve as the foundation for a systematic and comparative analysis of the technological attributes of the artefacts.

Analytical Attributes Employed in the Study

1. **Provenance**: Name of the site from which the artefact was recovered.

2. **Catalogue Number**: Unique identification number assigned to each artefact.

3. **Core Typology**: Classification of cores based on reduction strategies (e.g., unidirectional, bidirectional, multi-platform, bipolar, etc.).

4. **Core Morphology**: General shape of the core (e.g., conical, sub-spherical, irregular, etc.).

5. **Platform Characteristics**: Nature of the striking platform (e.g., plain, faceted, dihedral, crushed).

6. **Number of Platforms**: Total number of striking platforms present on a core.

7. **Raw Material Type**: Lithological classification of the material used (e.g., chert, quartzite, basalt, etc.).

8. **Degree of Weathering**: Assessment of surface alteration due to natural agents (e.g., patination, abrasion, or surface sheen).

9. **Core Blank Identification**: Determination of whether the core was prepared on a pebble, nodule, or flake blank.

10. **Metric Dimensions**: Measurement of length, breadth, and thickness of the core (in millimetres).

11. **Flake Scar Frequency**: Number of identifiable flake or blade scars present on each core.

12. **Maximum Scar Length**: Measurement of the longest flake/blade scar on the core.

13. **Cortical Coverage**: Estimated percentage of natural cortex remaining on the surface of the core.

14. **Technological Deficiencies**: Observed manufacturing defects such as hinge fractures, step terminations, or misaligned removals.

15. **Debitage Type**: Classification of removed products (e.g., flakes, blades, bladelets) indicating the nature of core reduction.

Core Typology and Raw Material Analysis

A total of 165 lithic cores were recovered and analyzed to understand the typological and technological attributes of core preparation and raw material selection strategies. Among these, **38 cores (23.03%)** have been identified as belonging to the *flake core* category, characterized by the removal of flakes from one or more platforms. These suggest a core reduction strategy primarily aimed at producing flakes for immediate or future use. In addition, **25 cores (15.15%)** fall under the *blade core* category, indicative of a more standardized and elongated flake production, often associated with advanced knapping techniques and greater planning in core exploitation.

The remaining **102 cores (61.82%)** consist of raw material nodules that were either unmodified or minimally modified. These have been further subdivided into two categories based on the extent of their modification. **40 nodules (24.24%)** are classified as *simple nodules*, exhibiting negligible or no traces of trimming or preparation. The remaining **62 nodules (37.57%)** are categorized as *trimmed nodules*, reflecting initial attempts at core preparation, albeit often incomplete.

A closer examination of the 102 nodules reveals that **approximately 37%** of these were discarded soon after the preliminary trimming stage. This high discard rate suggests a conscious decision by toolmakers to abandon the cores during the early stages of reduction, most likely due to the presence of *intrinsic flaws or inhomogeneities in the raw material*. These defects may include internal fractures, inconsistent grain structures, or inclusions that render the core unsuitable for further reduction.

The observed discard pattern highlights a crucial aspect of the raw material economy in the region. The lithic raw materials, predominantly dyke rocks, are known to contain a high frequency of natural defects. Dyke rocks, although often preferred for their durability and workability, tend to be unpredictable in quality, with many specimens proving unsatisfactory only after initial knapping attempts. Such a high rejection rate underscores the adaptive strategies employed by prehistoric knappers, who had to make rapid assessments of raw material viability during the early stages of core processing.

This analysis not only illuminates the technological choices and constraints faced by the knappers but also provides insights into the broader dynamics of resource procurement and lithic economy. The selective retention of cores based on their reduction potential, and the relatively high rate of early-stage discard, reflect a pragmatic approach to lithic production in an environment where raw material quality was variable and inconsistent.

The analysis of the lithic assemblage reveals that a significant proportion of cores exhibit a high frequency of flake scars, clearly indicating that flake production was the primary and intentional objective of the toolmakers. This strategic emphasis on flake detachment suggests a technological orientation geared more toward flake-based tool manufacture rather than sophisticated blade production. The relatively limited efficiency in blade production is further evidenced by the scarcity of blade cores within the assemblage, especially when compared to the substantial number of trimmed nodules, simple nodules, and flake cores (Fig. 2a). This disparity underscores a technological tradition that prioritized expedient flake removal over systematic blade production, possibly due to functional requirements or raw material constraints.

In terms of core morphology, the collection reveals a notable diversity, which can be systematically categorized into five distinct typological classes. These include polyhedric cores (n=9; 5.45%), flat cores (n=10; 6.06%), conical cores (n=31; 18.78%), round cores (n=63; 38.18%), block-type cores (n=41; 24.84%), and cylindrical cores (n=11; 6.66%) (Fig. 2b, 2c). This typological variability may reflect both the technological choices and the adaptive strategies employed by prehistoric knappers to exploit the raw material efficiently.

Blade cores are predominantly represented by polyhedric and cylindrical forms, indicating a more controlled and oriented core reduction strategy aimed at producing elongated flakes or blades. In contrast, among the flake cores, round and block-type morphologies are especially prevalent. These forms typically suggest a more expedient and less formal approach to core reduction, possibly aimed at rapid production of functional flakes for immediate use. The morphological characteristics of these cores, therefore, provide critical insights into the technological organization and reduction strategies of the lithic production system.

The raw material analysis unequivocally indicates a deliberate and exclusive selection of dolerite dyke (100%) for the production of both flakes and blades. This consistent

preference reflects not only the abundance and accessibility of this fine-grained igneous rock in the region but also the recognition of its superior fracture properties, making it particularly suitable for controlled flake detachment and blade production. The homogeneity in raw material selection underscores a focused technological tradition wherein toolmakers prioritized quality and predictability in lithic reduction.

Further, the assemblage includes several cylindrical, round, and oval-shaped battered quartz pebbles bearing distinct bruises and percussive marks, especially on their apical and distal ends. These use-wear patterns strongly suggest that these quartz pebbles functioned as hammerstones, employed in the hard-hammer percussion technique to detach flakes and blades from prepared cores (Fig.2d, 2e). The morphology and wear evidence point toward a utilitarian role for these implements in the primary stages of lithic production.

Moreover, the examination of core morphology reveals that river-worn pebbles were also utilized as raw material for core preparation. The sample distribution shows that 14.45% of the cores were fashioned from naturally rounded pebbles, while a dominant 81.21% were produced on nodular raw material. This suggests a preference for nodules, likely due to their larger, more manageable surfaces and volume, which facilitated better control during the reduction process.

Interestingly, a small subset of the assemblage (4.24%) comprises chunky flakes bearing distinctive flake scars—either long and shallow or broad and deep—indicating that these flakes were further utilized as makeshift or opportunistic blade or flake cores (Fig.2f). While minor in frequency, these instances highlight the adaptive strategies of the toolmakers, who occasionally maximized the utility of large flakes by reusing them as secondary cores when appropriate. Such practices reveal a nuanced understanding of raw material economy and reduction potential within the lithic production system.

With regard to the sources of raw materials, it has been observed that dolerite—the primary and sole raw material used for tool-making—occurs as exposed outcrops in the beds of streams and rivers, as well as in the form of dykes intruding through granite formations. In the beds of these water bodies, various types of dolerite pebbles and nodules are found scattered. These naturally occurring materials were selectively exploited by Stone Age communities for the manufacture of stone tools.

The availability of good-quality dolerite in the immediate vicinity made it a preferred and extensively used raw material by the prehistoric toolmakers, or stone knappers. However, selecting the right variety of dolerite posed certain challenges, as it required a careful assessment of the rock's texture and grain. Empirical observations reveal that dolerite occurs in multiple varieties—some being very fine-grained and fine-textured, which tend to fracture conchoidally, similar to cryptocrystalline rocks. These characteristics made such dolerite highly suitable for knapping.

Conversely, dolerite with coarse grains, rough textures, and numerous veins and cleavage planes was also present in the same landscape. This second variety was not conducive to tool-making, as it could not be fashioned into finely crafted artefacts. When stone knappers inadvertently collected such unsuitable dolerite, they would test its quality by detaching one or two flakes. Upon realizing its inadequacy, the material was immediately discarded.

Despite these challenges, the availability of raw materials did not pose a significant problem for the prehistoric inhabitants of the Garo Hills. The abundance of fine-quality dolerite ensured a steady supply for their lithic manufacturing activities.

The extent to which the cores were exploited can be approximately assessed through a detailed analysis of various factors such as the number, type, and orientation of striking platforms, the number and distribution of flake and blade scars, and the presence, extent,

and position of cortex on the cores. A significant observation is that the majority of blade cores (approximately 79.1%) possess a single striking platform. In contrast, flake cores typically have either two platforms (24%) or more than two platforms (76%).

In the case of blade cores, most of the blades appear to have been detached in a unidirectional manner from a single platform, indicating a relatively organized and planned reduction strategy. On the other hand, flake cores predominantly exhibit bidirectional or multidirectional flaking patterns, suggesting a more opportunistic approach to raw material utilization. These flaking patterns—unidirectional, bidirectional, and multidirectional—are illustrated in Figure Fig. 3a, 3b, 3c.

The average number of flake scars observed per core ranges between five and seven for flake cores, and between three and four for blade cores. Interestingly, all examined cores retain at least a small patch of cortex. This residual cortex suggests that the raw materials were not fully exploited, and optimal utilization of the cores was not achieved.

However, it must be noted that the accurate identification of cortex on artefacts requires great caution. Due to extensive weathering, certain highly eroded portions of the core surface may be mistakenly identified as cortex. Most of the cores collected from the region exhibit significant surface abrasion, which can be attributed to their prolonged exposure on hill and terrace surfaces.

Approximately 60% of the archaeological sites in the Garo Hills are located on hill or terrace slopes, as well as in areas formerly used for slash-and-burn agriculture (jhum cultivation) by the Garo people. During these jhumming operations, artefacts buried in the soil were brought to the surface and left exposed to natural weathering processes. This exposure subjected them to environmental factors that contributed to their abrasion and surface degradation.

Furthermore, a majority of the cores display a high degree of patination. The soil in the Garo Hills is known to be highly acidic and rich in ferruginous content, as is the water found in the region. When artefacts remain buried in such soil conditions for extended periods, a patina layer forms on their surfaces, concealing the actual rock beneath.

An experimental analysis was conducted to determine the thickness of this patina layer. The results indicate that the artefacts are covered with patina ranging from 0.5 mm to as much as 10 mm in thickness. This patination further complicates the identification of rock type and original surface features, emphasizing the need for careful examination during archaeological analysis.

As previously noted, the stone tool knappers did not make optimal use of the core blanks during the process of artefact production. This observation is substantiated by comparing the size of the utilized cores with that of the trimmed and subsequently discarded nodules or chunks. It has already been discussed that certain chunks or nodules were rejected after undergoing only preliminary trimming, without being subjected to further reduction. This pattern of early abandonment provides a useful reference for understanding the typical size of the original core blanks, nodules, or chunks that were selected for tool-making (Fig. 2h, 2i, 2j, 2k)

When these discarded nodules are compared to the final size of the cores from which flakes were actually detached, it becomes evident that there was minimal reduction in size during the knapping process. In other words, the dimensions of the worked cores remained relatively large, indicating that only a limited number of flakes had been removed. This reinforces the conclusion that the cores were underutilized, and that the full potential of the raw material was not realized by the knappers.

Such evidence suggests either a lack of necessity to maximize material use—perhaps due to abundant availability of raw material—or a preference for specific flake types, leading

to selective flake removal and early abandonment of the core. Regardless of the reason, the minimal decrease in core size clearly demonstrates that the knapping process involved only limited flake detachment from each core.

The flake cores exhibit considerable variability in all three dimensions. Their lengths range from 4.3 cm to 17.4 cm, with most specimens measuring between 4.3 cm and 13.0 cm. In contrast, blade cores are slightly shorter on average, with lengths varying from 6.5 cm to 16.3 cm and the majority falling between 6.5 cm and 14.0 cm. When considering breadth, flake cores span from 4.2 cm to 12.9 cm, though most lie within the 4.2 cm to 11.8 cm interval; blade cores range more narrowly from 3.1 cm to 10.7 cm, with most between 3.1 cm and 8.5 cm. Thickness measurements follow a similar pattern: flake cores vary from 3.2 cm to 9.7 cm, with the preponderance between 4.3 cm and 9.7 cm, while blade cores range from 3.2 cm to 8.6 cm, clustering predominantly within that full span. The average dimensions for each core type are summarized in Table 1 and Figure 4: flake cores have a mean length of 10.6 cm, mean breadth of 8.6 cm, and mean thickness of 6.9 cm, whereas blade cores average 9.5 cm in length, 7.07 cm in breadth, and 6.3 cm in thickness.

Table: 1: Mean Value of Cores

Core type	Mean Value		
	Length (cm)	Breadth (cm)	Thickness (cm)
Flake Core	10.6	8.6	6.9
Blade Core	9.5	7.07	6.3

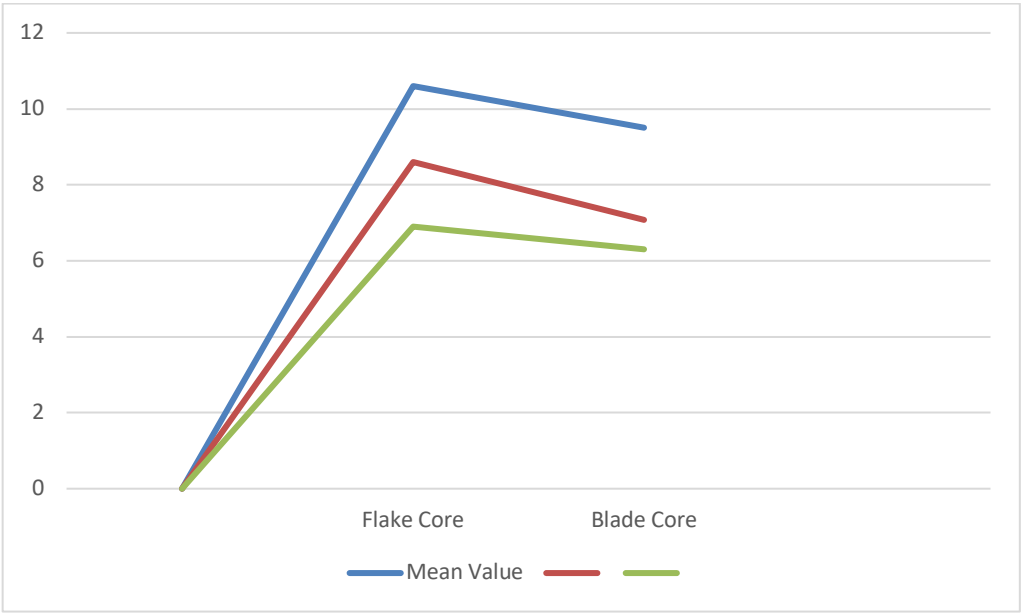

Fig. 4. Frequency distribution of mean value of Flake and Blade Core

The flake cores display a considerably broader range of variation in length, breadth, and thickness compared to the blade cores, whose dimensions are more narrowly constrained. This discrepancy likely reflects differences in intended function: blades and blanks were manufactured to serve specific, standardized purposes, whereas flakes served as the raw material for a far greater variety of tools. Indeed, the predominance of flake cores in the assemblage lends further credence to this interpretation, suggesting that flakes were in high demand as a versatile starting point for multiple tool types, while blades fulfilled more specialized roles.

In the case of blade cores, the angle of the striking platform typically measures around 90 degrees, or occasionally slightly less. This angular configuration is generally regarded as

suitable for the efficient detachment of blades. Similar observations have been made by Ghosh (1993:14) in his study of the blade cores from the Mehtakheri site in Madhya Pradesh, where comparable platform angles were noted.

In most of the blade cores examined, a significant portion of the striking platform has been left untouched. This suggests that the entire platform was not utilized in the flaking process. It is likely that this unutilized portion was deliberately retained to serve as a convenient handhold, allowing the knapper to maintain a secure grip on the core during blade detachment.

The occurrence of shallow, thin, long, and parallel-sided flakes further indicates a high level of control over the flaking technique. Such characteristics point to a refined and deliberate method of blade production. In these cases, knappers employed both naturally occurring homogeneous surfaces as well as intentionally prepared or trimmed platforms for detaching blades, demonstrating a flexible and skilled approach to core reduction.

The presence of shallow, relatively uniform flakes arranged in a regular pattern on the cores provides strong evidence that the toolmakers employed the direct percussion method. In this technique, the core was held securely in one hand while the other hand wielded the hammerstone to strike and detach flakes (Fig 2g, 2l). To facilitate a firm grip during this process, a portion of the cortex was deliberately left intact on the core, functioning as a natural handhold. This practice has also been documented by Ghosh (1993:15) at the Mehtakheri site in Madhya Pradesh, where similar use of cortical surfaces for grip enhancement was observed.

In contrast, Goerke (1983:243) noted that large, massive flakes with a pronounced, elevated striking surface often rendered the use of an anvil unnecessary. A similar phenomenon is evident at Selbalgre, where long, massive flakes with diffused bulbs of percussion—indicating a less sharply defined point of impact—are a recurring feature. This further supports the inference that direct percussion was the dominant technique employed by the toolmakers.

Additionally, hinge fractures, which are typically regarded as less common in other contexts, are frequently observed at Selbalgre. The prevalence of this flaking pattern, along with the physical characteristics of the flakes and cores, reinforces the conclusion that direct percussion was the principal method used in the production of both flakes and blades at the site.

Observation:

Based on the preliminary and experimental nature of the present study, the following observations can be made:

1. **Variation in Core Dimension**

There is a wider range of variation in the length, breadth, and thickness of flake cores compared to blade cores. This suggests that flake production allowed for more flexibility and versatility, possibly due to the broader range of tools that could be fashioned from flakes.

2. **Specialization in Blade Production**

Blade cores exhibit a narrower and more consistent range of measurements, indicating a more standardized production technique. This supports the idea that blades were manufactured for specific, possibly specialized purposes.

3. **Striking Platform Angles and Techniques**

The flake cores typically have striking platform angles of around or slightly more than 120°, whereas blade cores tend to have striking platform angles of approximately 90° or

slightly less. These differences point to distinct flaking techniques used for each core type, tailored to the desired flake or blade form.

4. **Use of Natural Surfaces as Platforms**

In both flake and blade production, naturally formed homogeneous surfaces were frequently used as striking platforms. This was particularly evident at Selbalgre, where the dolerite dykes' multidirectional cleavage planes provided flat, uniform surfaces, reducing the need for trimmed or prepared platforms.

5. **Retention of Cortex for Hand-Grip**

A portion of the cortex was intentionally left on many cores to serve as a handhold during flaking. This practical adaptation has been similarly observed at the Mehtakheri site by Ghosh (1993), and suggests ergonomic consideration in core handling.

6. **Evidence of Skilled Percussion Technique**

The presence of thin, parallel-sided, and well-controlled flakes, especially in blade cores, indicates a high level of skill and control in the direct percussion technique. This suggests that the toolmakers possessed a clear understanding of how to manipulate core angles and striking force to produce desired results.

7. **Massive Flakes and Diffused Bulbs of Percussion**

At Selbalgre, large, massive flakes with diffused bulbs of percussion are common, reinforcing the use of direct percussion without the need for anvils. This observation aligns with Goerke's (1983) findings and suggests a consistent pattern of flake detachment across different contexts.

8. **Frequent Occurrence of Hinge Fractures**

Hinge fractures, though generally considered uncommon, occur frequently at Selbalgre. This may indicate either the inherent characteristics of the raw material or a particular flaking strategy used by the toolmakers.

9. **Direct Percussion as the Primary Technique**

All available evidence—from core morphology and flake characteristics to platform angles and cortex retention—strongly supports the conclusion that direct percussion was the principal method employed for the production of both flakes and blades.

10. Environmental Context and Raw Material Availability

The local geology, particularly the presence of dolerite dykes with multidirectional cleavage planes, played a significant role in shaping the flaking technology. Dolerite, being abundant in the region and naturally breaking into flat, homogeneous surfaces, provided an ideal raw material for core and flake production. The availability of such suitable stone influenced both the choice of technique and the efficiency of tool manufacture. The environmental advantage of having readily accessible, high-quality raw material reduced the need for extensive preparation, allowing toolmakers to focus on production and utility.

These observations, though preliminary, offer important insights into the technological practices and environmental adaptations of the toolmakers at Selbalgre. Further systematic and detailed studies are needed to substantiate these interpretations and expand our understanding of lithic technology in the region.

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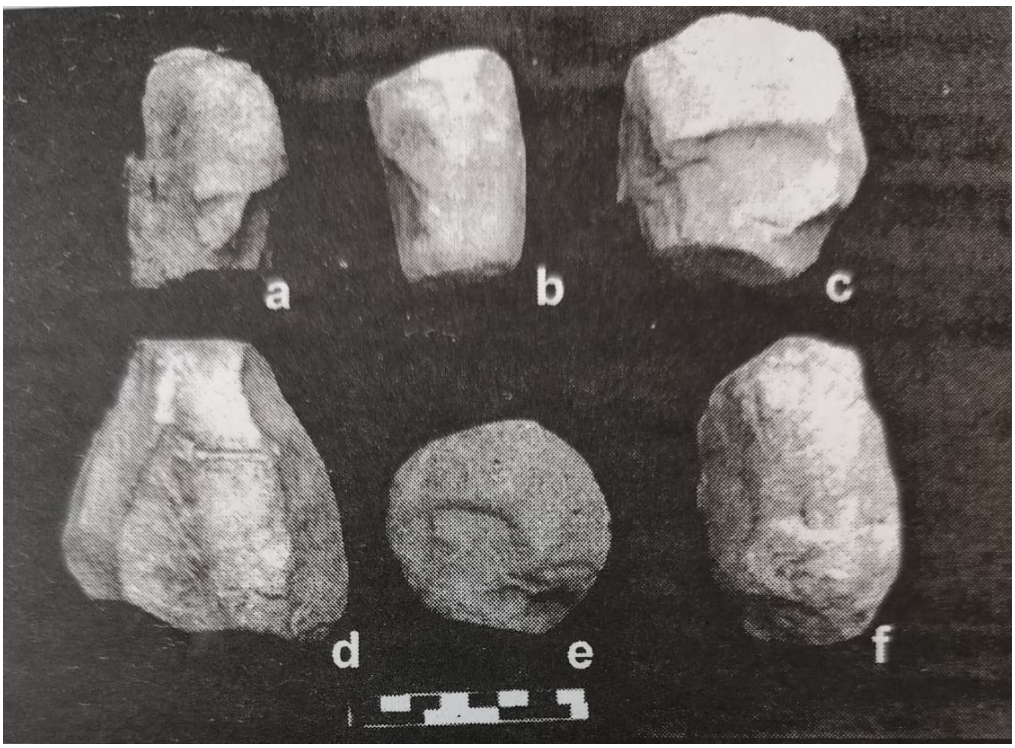

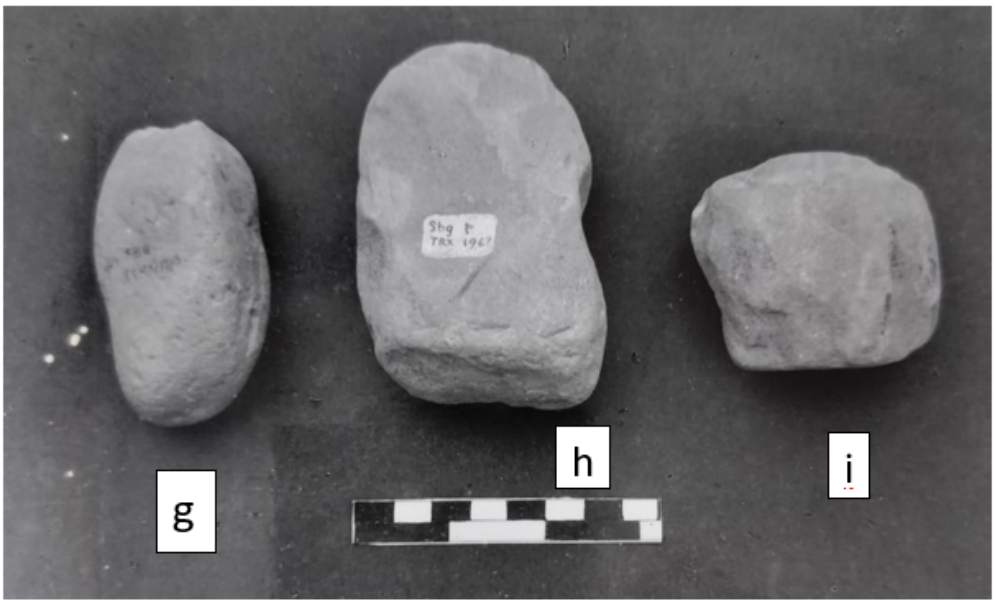

Fig. 2: a- Flake Core, b & d- Polyhedric blade core, c- Cylindrical flake core, e- Round flake core, f- Chunks, h- Blank, i, j, k- Nodules, g, l- Hammerstone.

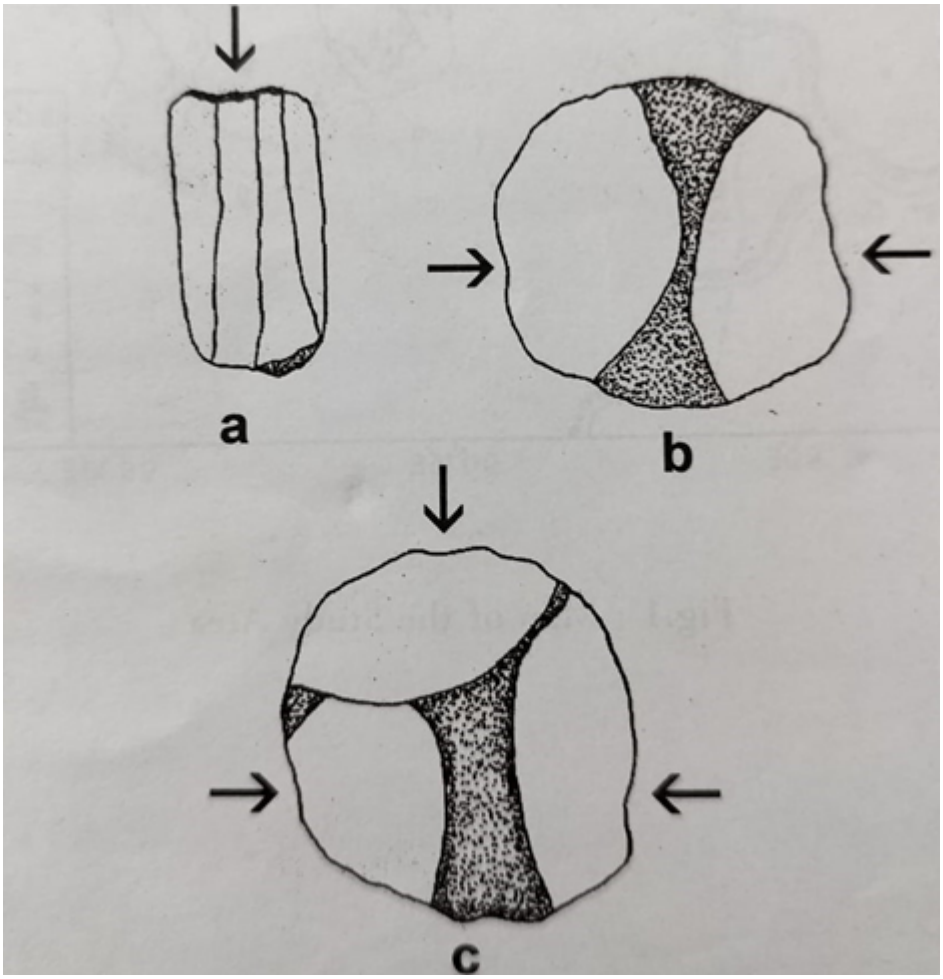

Fig. 3. a- Unidirectional Core, b- Bi-directional core, c- Multidirectional cores