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RESEARCH ARTICLE

Sketch Consciousness Observed in the Chiseled Rock Art of Longmenka, Rutog, Xizang

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ABSTRACT

Previous rock art research has focused primarily on the images themselves, and this study aims to supplement this gap by systematically investigating *sketch consciousness* in the production process of chiseled rock art at Longmenka, Rutog, Xizang. Employing field observation, simulation experiments, and spatial analysis, the study reveals the step-by-step creation process of Longmenka rock art (outlining contours first, then filling in details), which are manifested as preliminary positioning, line direction planning, and key part marking before image creation. The sketches are mainly in outline or line form with fine, shallow, and sparse chisel marks, and are more readily identifiable in unfinished rock art. Further analysis clarifies that this sketch consciousness serves to standardize image order and reduce production errors, and that it is not isolated but shares commonalities with rock art from multiple global sites (e.g., Mandela Mountain in Inner Mongolia, China; Alta, Norway; and the Black Desert in Jordan), reflecting similar cognitive patterns and compositional concepts in ancient human artistic creation. This study offers a new perspective for understanding the cognitive logic behind ancient rock art.

KEYWORDS

Xizang Rock Art, Chiseled Rock Art, Sketch Consciousness, Production Techniques

1. INTRODUCTION

Sketches represent the initial phase of an artist's creative process, serving as a conceptual expression of their inner thoughts and the forms they wish to depict. The imagery at this stage brims with passion and uncertainty, establishing rough proportions of objects. During the actual painting process, modifications can be made to the objects being depicted to achieve the desired effect, allowing for further refinement. The application of sketch consciousness in rock art creation manifests specifically through the step-by-step process of its production. In brief, it serves as preparatory groundwork before creating the final rock art images, encompassing the rough positioning of each image component and planning the direction of lines. As one of the most crucial concepts in rock art production, the sketch consciousness transcends a mere procedural step. Unfinished images, simplified lines, or repeatedly revised sections within rock art may reveal the original creator's conceptual process, trial strokes, or discarded ideas.

Previous studies on rock art have largely focused on the images themselves, overlooking the psychological processes and creative thinking of creators implicit in the image-making process. Consequently, research related to the sketch consciousness has been scarce. In analyzing the production techniques of the DunDebulake rock paintings in Xinjiang, China, Wang Qian, based on the state of pigment adhesion, usage, and color depth, concluded that the rock art makers employed a process of outlining contour first and then filling in color, with particular emphasis on outlining the contour. She validated this understanding through simulation experiments. In similar studies on painted rock art, many scholars observed the evidence of step-by-step production processes in European painted rock art, yet specialized research on chiseled rock art remains scarce. Park Jun-cheol, through experimental reconstruction of the production sequence of the chiseled rock art at Bangudae, South Korea, inferred a rough drawing stage (i.e., a sketch) prior to rock art production, upon which different techniques were applied to different parts based on the sketch. Nathalie Østerled Brusgaard cited examples to analyze the production steps of rock art images in the Black Desert region of Jordan, in which the initial steps followed the same principles as sketching.

A sketch is an abstraction of the characteristic features of an objective entity, selecting and expressing its most distinctive and unique traits. Regarding animal horns, the shapes of ox horns, sheep horns, and deer antlers are entirely different. This requires rock art creators to grasp the subject's characteristics and proportional relationships when roughly positioning the image's contour. The sketch consciousness manifests primarily in the integration of *point, line, and plane* during the carving process. These are fundamental geometric elements. In visual art, a point can serve as a turning point for a line or as a focal point within the composition. Lines are used to represent edges, contours, direction, or movement. Planes are expansions of points and lines. Points can form lines, and both points and lines are fundamental elements in constructing planes. Overall, the application of points, lines, and planes

in creation is highly flexible; they can appear in various forms and ways according to the creator's intent and the demands of the work. In the actual creative process, points may physically exist or be imagined. From an artistic perspective, before formal drawing begins, artists typically create sketches or outline drawings. This process helps establish the composition and forms of the work, laying a solid foundation for subsequent refinement and coloring. In rock art, this corresponds primarily to pigment coating for planes or chisel marks. However, some artists may adopt more improvised or intuitive approaches, bypassing or blurring the conventional sketching stage. This tendency is often observed in rock art characterized by disordered lines and chisel marks. Within complete rock art images, points arising from sketch consciousness are typically obscured by lines or planes. This is more of a creative idea rather than the final artistic objective.

2. RESEARCH ON SKETCHES IN LONGMENKA ROCK ART

The Longmenka rock art is located in Longmenka Village, Rutog County, Ngari Prefecture, Xizang (Figure 1). It is a large-scale ancient rock art complex, first formally discovered during a cultural relic survey in the early 1990s. American Tibetologist John Vincent Bellezza also conducted fieldwork in western and northern Xizang during the late 1990s and visited this area. Since 2013, the Shaanxi Academy of Archaeology, in collaboration with a number of institutions, has conducted surveys in the Longmenka Village area, discovering more than 6,000 sets of rock art in total. The Longmenka rock art site is located in a plateau lake basin, with the rock art distributed around the lake, seasonal lake basins, and lake terrace areas. Through on-site observation and image processing of the rock art, it was found that the sketch consciousness was relatively common at Longmenka. Longmenka rock art is predominantly chiseled, with only a small number of painted rock art. Due to the considerable depth of the chisel marks, the sketch consciousness of the chiseled rock art images may be more readily detectable.

2.1 On-Site Observation

Based on field observations and photographs, the rock art details were meticulously examined. Particularly, unfinished rock art preserves more traces of its creation, which is highly beneficial for discerning whether a sketch consciousness exists. Figure 2 depicts three yak images carved from left to right in sequence. The overall proportions, style, and traces of production techniques are highly similar across all three, and they appear consistent with the rock varnish color, indicating they belong to the same composition. The rear half of the left yak's body features only an outline, with no interior filling of chisel marks. The chisel marks along this rear outline differ in size and direction of force application compared to those in the front half of the image. The middle yak is the most fully rendered. The right yak shows a clear gap between its outline and filling, indicating it was not chiseled simultaneously. Based on the above analysis, the yak images in the scene were likely created in two stages: outlining the general contours, followed by filling the chisel marks inside the contour by tapping. Comparing completed rock art with unfinished ones reveals that sketch consciousness is extremely difficult to discern in finished works, as a production technique adopted in the process is typically overlaid during subsequent stages.

Similarly, we discovered more similar images in the Longmenka rock art. The chisel marks outlining the image's external contour appear in two distinct patterns: in some cases, they form a continuous but sparsely spaced line, while in others, the marks are discontinuous or broken (Figure 3 (1), (2)), with chisel marks applied only at key parts—such as the back, haunch, and legs of a yak where contour lines turn (Figure 3 (3)). This demonstrates that sketches serve to position and outline, with only a few points having a very small distance from or even overlapping with each other.

2.2 Simulation Experiments

To further validate the accuracy of on-site observations and understand the specific manifestations of the sketch consciousness of the Longmenka rock art, simulation experiments were conducted for verification. These experiments were carried out once each in the outdoor area and indoors at Longmenka. The materials of the rock carrier (chiseled planes of rock art) used in the simulation experiments were sandstone and granite, which is the same material as the rock carriers of Longmenka rock art. At Longmenka, only one site features carvings on the surfaces of granite, while all others are carved into sandstone. Tools used in the simulation

Note: This map is drawn based on the standard map of the Ministry of Natural Resources of China (Map review No.GS (2019) 1720). The national boundaries of the base map remain unchanged, and only the study area and sampling points are overlaid.

Figure 1 Geographical Location of Longmenka Rock Art

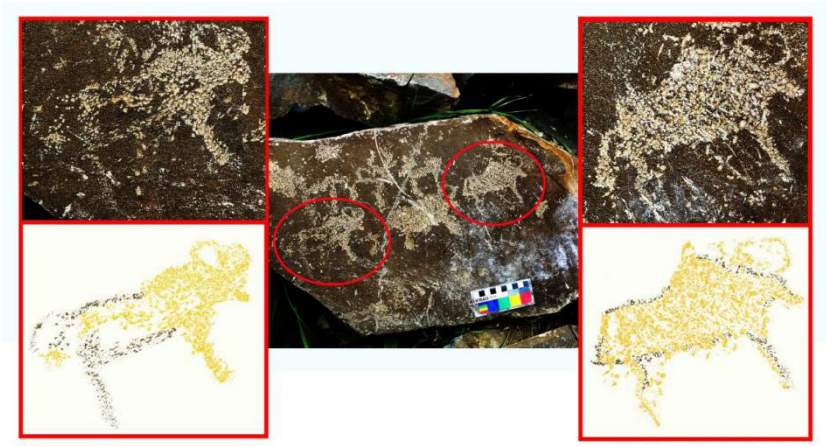


Figure 2 Longmenka Yak Rock Art (Guore Rock Art)

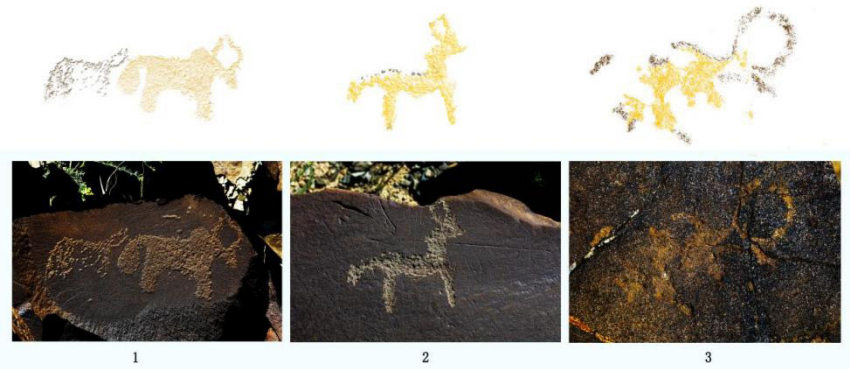


Figure 3 Detailed View of Longmenka Sketch Rock Art

Figure 4 Tools Used in Simulation Experiments

experiments were natural rocks collected around the Longmenka rock art site—non-artificial artifacts showing no signs of processing. The materials comprised sandstone, micrite, mudstone, and marble (Figure 4). Based on material type, they were designated as Category A, Category B, Category C, and Category D (Table 1).

During the simulation experiments, both single-tool production and multi-tool combination production were employed, with differing production methods (Table 2 and 3). Experimental results indicate that tools of different weights, different shapes of the production surfaces of the same tool, and production methods all significantly influence chisel marks. However, this paper focuses primarily on the observation of sketches and thus omits discussion of these aspects.

Results related to the production of contour-style (including line-style) rock art images are as follows: The process of creating such images inherently involves outlining contours. Some experiments adopted a combined technique of engraving and chiseling, while others used a single technique. When the combined technique was applied, the resulting rock art images were more regular. When engraved lines were used as auxiliary guides, they left shallow traces that were later covered by chisel marks, making the original sketch difficult to discern.

Results related to the production of silhouette-style rock art images are as follows: When only a single production technique was used, sketch traces were nearly indistinguishable, mainly due to two reasons: First, the chisel marks were consistent in size and depth, making it impossible to distinguish sketch marks from formal chisel marks. Second, formal chisel marks directly overlapped with sketch marks, leading to indistinguishable traces. When formal chisel marks were not strictly confined to the sketch outline, even if sketch consciousness was applied during the production process, the final image still presented disordered chisel marks, as shown in the second image in Table 2. In the simulation experiments of silhouette-style images, if subsequent formal chisel marks did not cover the sketch marks or maintained a certain distance from them, the continuous traces of the sketch remained clearly visible, as illustrated in the first two images in Table 3. In contrast, when the two overlapped, the location and specific form of the sketch chisel marks became indistinguishable, which was consistent with the characteristics of contour-style (line-style) rock art images.

Based on the above experimental results, the following conclusions are drawn regarding sketch awareness: When creating contour-style (including line-style) rock art images, the act of outlining contours is inherently dominated by sketch consciousness. The combined technique of engraving and chiseling is a concrete manifestation of this sketch consciousness, and the application of this technique contributes to more regular rock art images. In the production of silhouette-style images, the presence of sketch consciousness cannot be judged solely by the regularity of chisel mark images. Even with sketch consciousness, if formal chisel marks deviate from the sketch outline, the image will still show disordered chisel marks. The visibility of sketch traces depends primarily on the spatial relationship between formal chisel marks and sketch marks—when they do not overlap and maintain a gap, sketch traces are clear; when they overlap, sketch traces are covered and indistinguishable, a rule that applies to both contour-style (line-style)

Table 1 Simulated Tools for Rock Art Production

Tool	A:1	A:2	A:3	B:1	B:2	B:3	C:1	C:2	C:3	D:1	D:2	D:3
Category	Category A			Category B			Category C			Category D		
Material	Sandstone			Micrite			Mudstone			Marble Rock		
Weight (kg)	0.32	0.27	0.11	0.62	0.20	0.08	0.43	0.24	0.08	0.25	0.17	0.05

Table 2 Contour-Style/Line-Style Rock Art Simulation

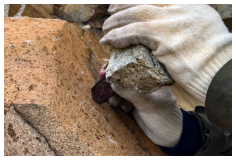
Production Process				
Simulated Result				
Production Tool	C:3	D:2	C:3	C:1
Production Technique	Indirect Chiseling (Oblique Chiseling)	Direct Chiseling	Indirect Chiseling (Oblique Chiseling)	Direct Chiseling
Rock Art Carrier	Sandstone	Sandstone	Granite	Granite

Table 3 Silhouette-Style Rock Art Simulation

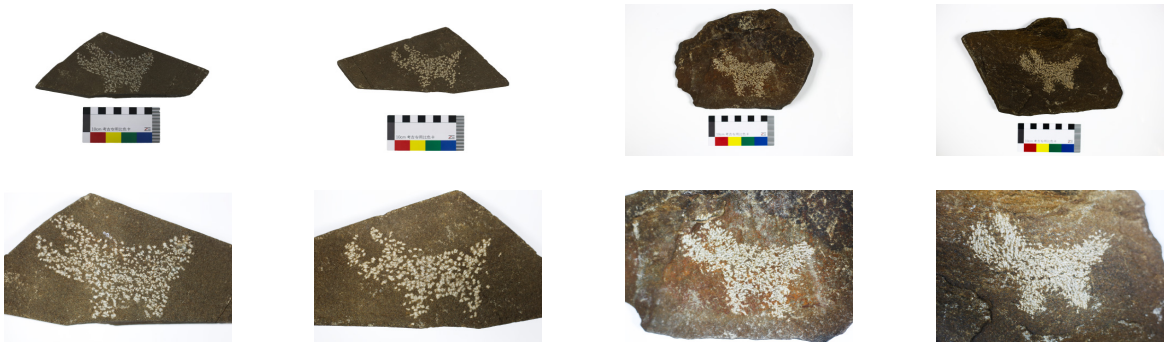
Simulated Result				
Production Tool	B:1+B:2	C:2	D:2	B:2
Production Technique	Direct Chiseling	Direct Chiseling	Direct Chiseling	Direct Chiseling
Rock Art Carrier	Sandstone	Sandstone	Sandstone	Sandstone

Table 4 Differences Between Sketch Chisel Marks and Formal Chisel Marks

Classification	Width	Depth	Regularity
Sketch Chisel Marks	Narrow	Shallow (Used only for Positioning)	Moderate regularity, yet slight disarray relative to standard formal chisel marks
Formal Chisel Marks	Wide (Covers the Sketch Chisel Marks)	Deeper (Serves as the Final Effect for Pattern Formation)	More Neat and Orderly

and silhouette-style rock art images.

In summary, sketches exhibit the following characteristics: First, compared to final images, most sketch chisel marks are finer, shallower, and sparser. Second, sketches predominantly employ contour-style techniques, though it should be noted that silhouette-style techniques are not excluded (e.g., in painted rock art). Third, sketches are more readily observable in unfinished rock art images. Once the rock art image is fully completed, they become difficult to discern. Fourth, employing sketch consciousness enhances controllability in rock art production, yielding more orderly and aesthetically pleasing results. Fifth, stone tools are feasible for sketch production (Table 4).

2.3 Spatial Analysis

Regarding the reasons for the appearance of the sketches, beyond objective technical constraints such as tool damage or failure, the breakage or wear of rock art tools during production—coupled with the absence of suitable replacements on-site—may have rendered continuation impossible. For instance, certain unfinished animal images exhibit abrupt, shallower, or more disordered lines, speculating that the tools had worn out and were unable to engrave deeper marks, leading to abandonment. However, it's conjectured that the predominant cause may have been urgent intervention from the external environment. In ancient societies with low productive capacity, humanity possessed limited resilience against natural and social risks. The process of creating rock art could be abruptly halted by unforeseen circumstances. Environmental shifts, including inclement weather such as rain, snow, or thunderstorms, would compel the creators to cease work; the appearance or attack of wild beasts could also lead to work suspension as creators prioritized self-preservation; if the creators were engaged in social productive activities like herding, they might have paused their work to focus on production resources, with no guarantee of returning to continue later. The reason why these rock art images with sketch consciousness observed in the Longmenka's Rock Art present an unfinished form can be discussed by combining spatial analysis. Given the mobility of large rock art, to ensure the objectivity of the results, this summary only selected unfinished rock art samples with observable sketch consciousness, located on mountain bedrock and exceptionally large rock blocks (where movement is difficult). Among the 77 rock art sites in Longmenka, such sketch-style rock paintings have been identified at 35 sites, exhibiting a relatively wide distribution.

First, consider their distribution density. Observing the distribution of sketch rock art localities across the four images (Figure 5) reveals a pattern of random dispersion with localized gaps, yet an overall pronounced clustering tendency. The western lakeside area is concentrated along the lake, and the eastern seasonal lake basin area also shows a relatively high concentration. This clustering may reflect frequent ancient human activity in specific areas, which may have held significant resource or social importance. Conversely, low-density zones could represent marginal areas less frequented by ancient humans, or areas where human activity was constrained by terrain limitations or scarcity of resources.

Second, analyze the topographical conditions. Building upon this foundation, further analysis should be conducted in conjunction with topographical conditions. Consider whether the incomplete nature of the images stems from objective constraints imposed by the terrain environment, such as elevated altitudes, steep gradients, or complex topography, rendering certain locations difficult to locate. The contour

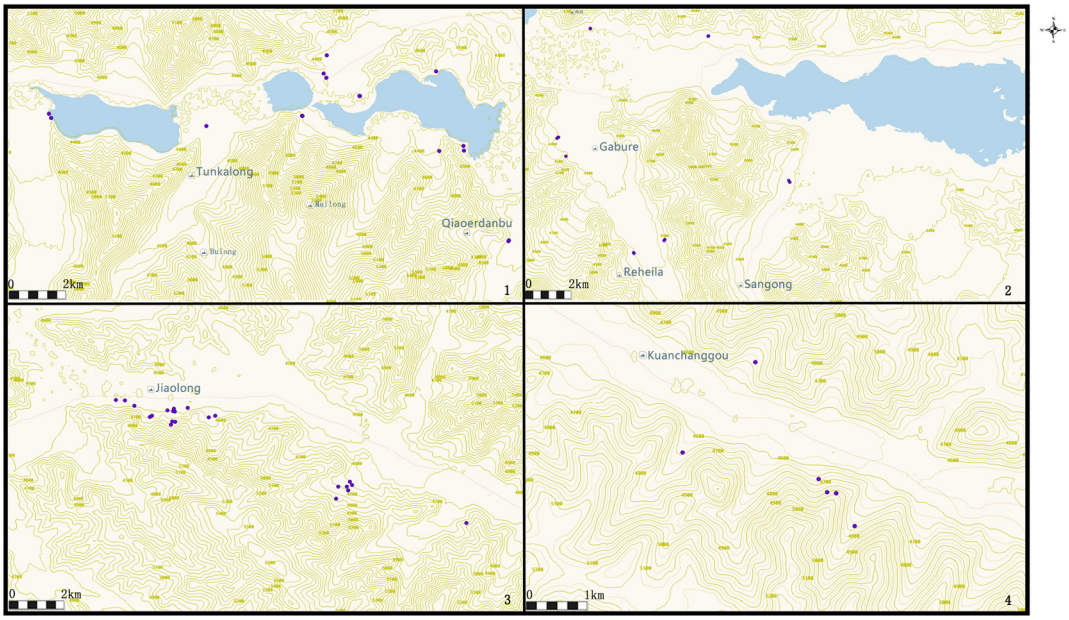


Figure 5 Distribution of Sketch Rock Art Locations within Longmenka Site: (1)–(2) Western Lakeside Area; (3)–(4) Eastern Seasonal Lake Basin Area.

lines in Figure 5 reveal that the altitudinal range of rock art sites is extensive. By reading and statistically analyzing the contour line values at each location of rock art points, it can be roughly determined that the sketch rock art in the western lakeside area primarily occurs within the 4,400–4,500 meter altitude range, representing a relatively low elevation. In contrast, the eastern region spans the 4,500–4,800 meter altitude range. Simultaneous analysis of slope gradient and aspect (Figures 6, 7) reveals that unfinished rock art in the western lakeside area predominantly occurs on slopes below 15°, whereas that in the eastern seasonal lake basin ranges from 10° to 60°, presenting greater climbing difficulty than the western lakeside sites. Slope aspects include southeast, northeast, east, north, and west, with a predominance of east-facing slopes. This distribution is closely linked to the region's topography. Longmenka is situated along a narrow, string-of-pearls pattern of rivers and lakes, flanked by mountain ranges to the north and south. Rock art predominantly occurs on the eastern and western slopes of these mountains, as well as on the lake-facing sides. Furthermore, this arrangement reflects adaptation to climatic conditions. Located between 32° and 33° north latitude, Longmenka lies at the southern edge of the mid-latitude westerlies, where prevailing northwesterly winds dominate during winter. Winter brings frequent blizzards, and the eastern and northeastern mountain hollows or foothills offer shelter from strong winds and low temperatures, creating warmer conditions conducive to human activity. The unfinished rock art slopes are generally gentler and face east, potentially reflecting the habitation height, mobility, and environmental adaptation level of ancient humans. Given the site's location and topographical characteristics, it is hypothesized that the unfinished rock art in the western lakeside area is not primarily due to higher elevation or steeper slopes, indicating a lesser relationship with terrain conditions. Conversely, the eastern seasonal lake basin shows a stronger correlation with elevation and slope. It should be noted, however, that the association with slope aspect reflects an overall

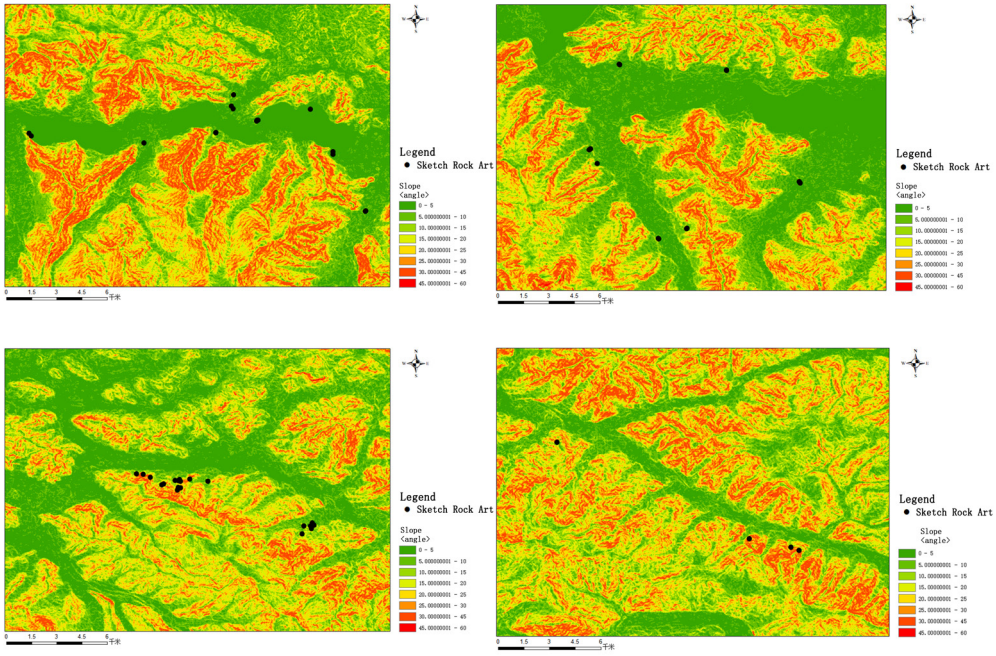


Figure 6 Slope Map of Locations of the Longmenka Sketch Rock Art: (1)–(2) Western Lakeside Area; (3)–(4) Eastern Seasonal Lake Basin Area.

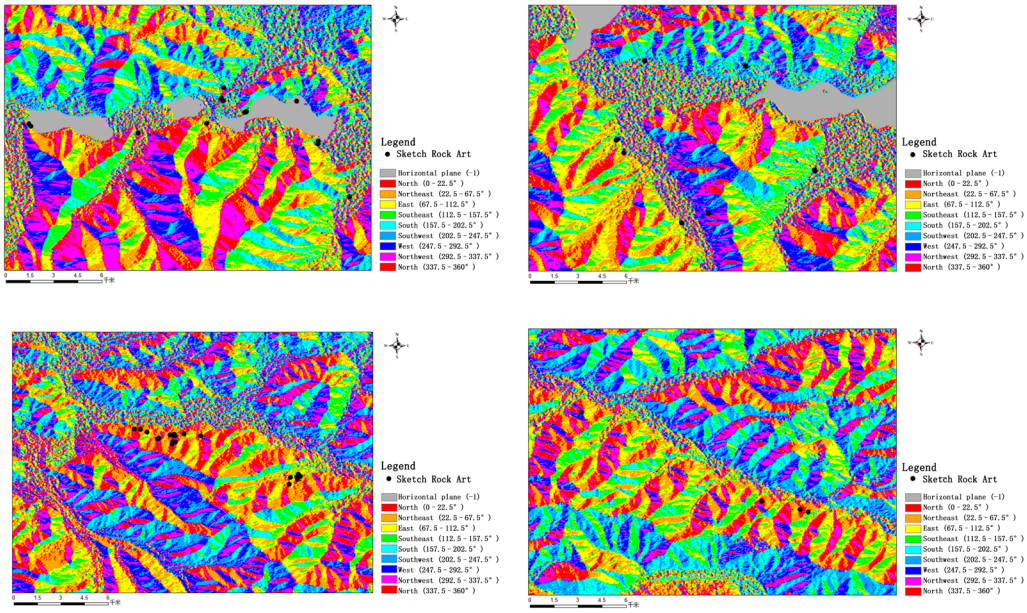


Figure 7 Slope Aspect Map of Locations of the Longmenka Sketch Rock Art: (1)–(2) Western Lakeside Area; (3)–(4) Eastern Seasonal Lake Basin Area.

characteristic of rock art production rather than a unique feature of unfinished works.

3. CHARACTERISTICS OF THE SKETCH ROCK ART AT LONGMENKA

The emergence of sketch rock art resulted from multiple contributing factors, with environmental conditions likely being the primary reason for its preservation. Regarding its state of preservation, by combining conclusions drawn from on-site observations and simulated experiments, and re-examining all the sketch rock art at Longmenka, it can be recognized that the distinctive features exhibited by this art are closely linked to its expressive form and production techniques.

3.1 Expressive Forms of the Rock Art

3.1.1 Silhouette Style

The silhouette style refers to the fullfilling of the negative space of the rock art image by chisel marks, so that the image presents a shadow-like form, which is not conducive to depicting fine details and textures. Sketch consciousness manifests in silhouette-style images through discrepancies between the outer contours and internal fillings (Figure 8), while chisel rock art primarily reflects this in its technique. The characteristics of silhouette-style sketch rock art can be summarized as follows: First, it serves a positioning function. In the step-by-step creation of rock art, the initial outline aids in determining the image's form and placement. Second, distinctions exist between sketch chisel marks and final chisel marks, specifically in density, depth, and size. Sketch chisel marks are sparser, shallower, and unrestricted in size. Third, the formal image typically obscures the sketch, rendering it invisible.

3.1.2 Contour Style

The term "contour-style" originally denotes the lines forming the outer edge of a figure or object; thus, such rock art inherently reflects a sketch consciousness. In the vast majority of cases, contour-style rock art manifests as the external contour of an image, representing a refined expression of the subject's external characteristics. As long as the image's prominent features are depicted, the viewer can swiftly recognize it. However, even in painted rock art, these line contours are not created in a single stroke. A close examination of the image

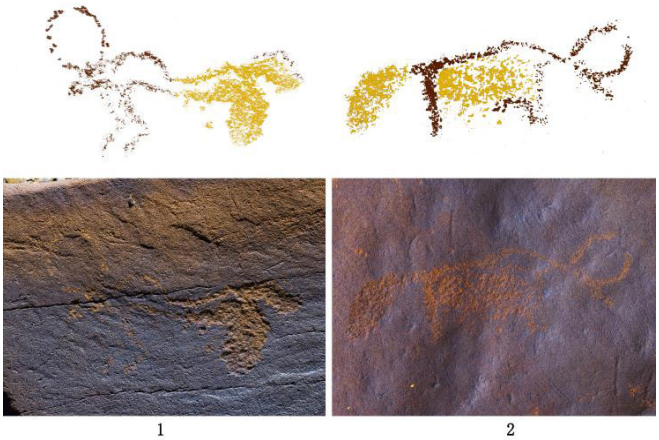


Figure 8 Silhouette-Style Rock Art at Longmenka: (1) Yagra 2022RLYRY128; (2) Yagra 2022RLYRY128.

details reveals discontinuities, turns, and modifications in the lines, as well as repeated engravings at the same location (Figure 9). Like some silhouette-style rock art, contour-style rock art also involves a step-by-step process. Specifically, the rough outline of the image is first engraved, then deepened upon this foundation.

The characteristics of the contour-style rock art sketches are largely consistent with those of the silhouette-style sketches. The chisel marks in the sketches are finer, sparser, shallower, and more disordered, yet they similarly serve to position and outline the form.

3.2 Rock Art Production Techniques

Rock art production techniques refer to the techniques, skills, and manipulations employed during the creation process with the aid of tools. Currently known techniques include chiseling, engraving, grinding, pounding, tracing, smearing, spraying, and impressing. Different techniques combined with varying tools can produce distinctly different marks on rock surfaces. For instance, chiseling often generates more regular and precise lines, as the artist can meticulously control and align each chisel mark, whereas engraving generally forms narrow grooves, from shallow to deep, requiring direct application of sharp tools upon the rock. As established in the preceding discussion, examining the production technique is paramount when analyzing whether sketching consciousness was employed in a rock art image.

Sketch consciousness may be achieved through a single technique or a combination of different techniques. When employing a single technique to create rock art, chiseling and engraving are most commonly employed. The engraving technique has been mentioned above, and engraving-dominated rock art exhibits relatively consistent lines, achieved through repeated engraving to attain the desired effect.

As the primary rock art technique, chiseling produces distinct differences in form between sketch chisel marks and formal chisel marks, chiefly in the following aspects: First, the thickness of chisel marks varies. Most traces from the sketch step are generally finer, whereas those from the formal step are coarser. Second, the density of chisel marks differs. Sketches establish the image's general form, requiring only sparse placement at key points; formal production, however, determines the image's final presentation, with chisel marks typically densely connected and overlapping. Third, the depth of chisel marks varies. Sketch chisel marks are shallower, while formal chisel marks are comparatively deeper. Fourth, the regularity of the chisel marks differs. Two cases exist: First, when the sketch forms part of the formal image, the thickness, density, and depth of the sketch chisel marks are generally identical to the formal chisel marks. However, their positioning is more precise, coherent, and aesthetically pleasing. This is common in silhouette-style rock art, where subsequent formal chisel marks appear more haphazardly distributed due to the clearly defined outline. Second, the contrast in neatness is stark: the sketch resembles a traditional rough draft, with hastily executed, disorderly chisel marks. Conversely, the formal chisel marks receive the artist's full attention, resulting in a meticulously crafted image. In the latter case, the chisel marks of the sketch are entirely obscured by the formal chisel marks composing the image, becoming virtually invisible once the work is complete. Only in some unfinished rock art can traces of the sketch be discerned.

Combined techniques refer to the creation of rock art using two or

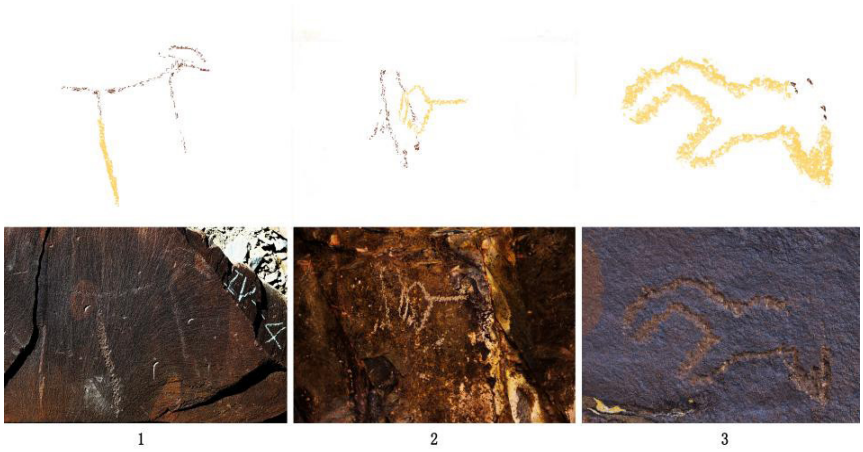


Figure 9 Contour-Style Sketch Rock Art at Longmenka: (1) Guore 2013RLGIVY4; (2) Guore 2013RLGIIY32; (3) Jielangqiongma 2021RLJLY267.

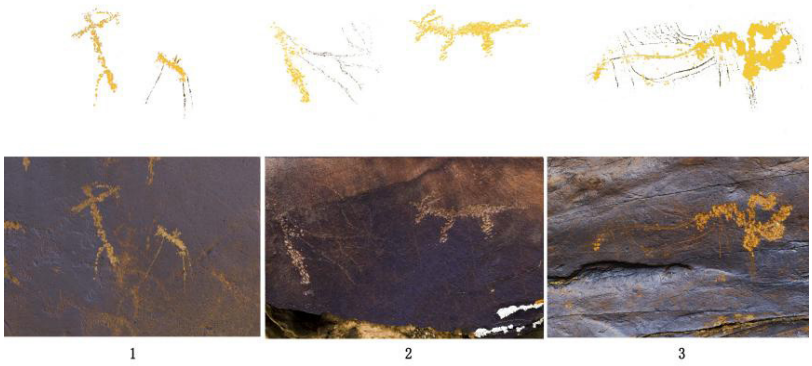


Figure 10 Application of Combined Techniques in Longmenka Sketch Rock Art: (1) Mazhu 2022RLMZY69; (2) Jielangqiongma 2022RLJLY492; (3) Yagra 2022RLYRY464.

more distinct techniques. In chiseled rock art, combined techniques are primarily a fusion of engraving and chiseling. Typically, engraving serves as the technique for creating the sketch, while chiseling is employed as the formal production technique of the image (Figure 10). Engraving traces are fine and sharp, clearly defining the image's boundaries; chiseling traces are coarser. There is no absolute standard for the depth of either type of trace.

4. THE GLOBAL NATURE OF SKETCH ROCK ART

The characteristics exhibited by sketch rock art are relatively distinct and readily identifiable. The camel images engraved into the rock art of Mandela Mountain on the Alashan Plateau in Inner Mongolia, China, offer insight into the sketch consciousness inherent in chiseled silhouette-style rock art (Figure 11). Following processing with Adobe Photoshop, it is evident that the camel's head, neck, and forelimbs are entirely covered by chisel marks. Minimal gaps remain between the interior filling marks on the dorsal part and its outer contour lines, while the hind limbs retain only their outer outlines. Notably, the chisel marks currently exhibit two distinct shades of yellow. The brighter hue corresponds to later-stage chiseling, while the duller yellow represents earlier work, with the later layer superimposed over the earlier. Upon removing the later chisel marks (Figure 12), the image's original form becomes visible. The illustration reveals that the rock art creator employed a two-step process: Engraving the camel's outer outline, and then filling the interior with chisel marks.

Some unfinished silhouette-style rock art images have also been preserved in the Ḥimā Cultural Area in Saudi Arabia (Figure 13). In the lower left section, a smaller figure is depicted with chiseled marks filling the animal's head and neck, while the remainder remains unfilled. The overall form of this image shares identical stylistic, technical, and chromatic characteristics with the larger figures surrounding it. Moreover, distinct line traces persist at the necks of the larger figures on both the left and right sides, indicating an approach akin to that observed in the Mandela rock art. Additionally, the above two examples demonstrate that the presence of sketch consciousness becomes

Figure 11 Silhouette-Style Camel Image in the Mandela Mountain Rock Art of China, Retaining Late-Period Chisel Marks (After: TREASURES IN THE DESERT: SELECTED BADAIN JARAN PETROGLYPHS, 2014. The original image has been digitally edited using Adobe Photoshop by the author).

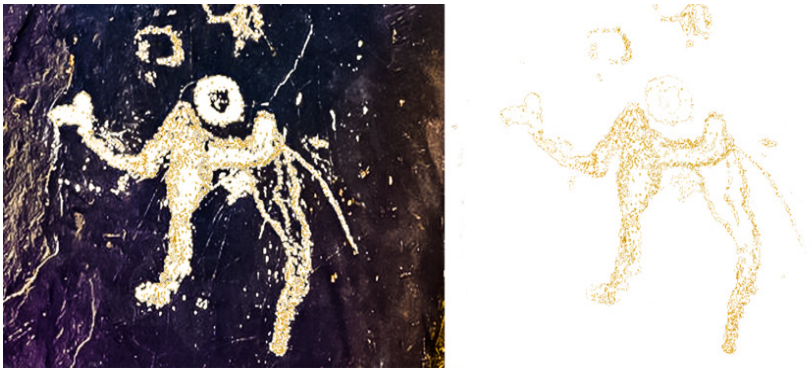


Figure 12 Silhouette-Style Camel Image with Late-Period Chisel Marks Removed

Figure 13 Silhouette-Style Image of Human Riding Animal from the Ḥimā Cultural Area in Saudi Arabia (After: Stories in the Rocks: Exploring Saudi Arabian Rock Art, 2013. The original image has been digitally edited using Adobe Photoshop by the author).

imperceptible once the final image is completed. As noted earlier, the sketches are, in most cases covered by the final rock art images, since they inherently serve to facilitate the creation of the image itself.

As previously noted, the contour lines in contour-style rock art are not created in a single stroke; repeated engravings may be present, a feature also observed in Spanish rock art (Figure 14).

Neither single production techniques nor combination production techniques are unique to the Longmenka rock art. The semi-finished rock art at Alta, Norway, clearly demonstrates the distinction between preliminary sketches and formal chiseling (Figure 15). Animal rock art from the Khomeyn Region in central Iran reveals another form of sketch (Figure 16 (left)). Analysis of the image in the upper right corner suggests the rock art may have used silhouette-style outlines as sketches, with a relatively sparse distribution of chisel marks. Referencing the animal image in the lower left corner, it is inferred that partial chisel marks coverage was subsequently applied over the sketch. A similar image appears on a rock surface of the Alashan rock art in Inner Mongolia, China (Figure 16 (right)). Additionally, the same rock surface features a small deer rendered in an incomplete silhouette style, intermediate between contour style and silhouette style. This suggests two potential sketch types: *either silhouette-style preliminary chiseling followed by full silhouette-style coverage or contour-style preliminary chiseling followed by full silhouette-style coverage*.

Figure 14 Rock Art from the Parpalló-Cave, Spain (Modified from: Making Scenes-Global Perspectives on Scenes in Rock Art, 2021).

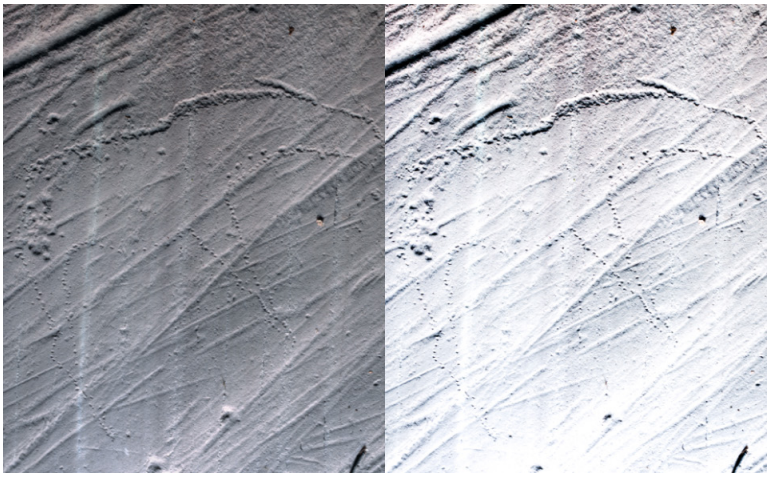


Figure 15 Rock Art at Alta, Norway (Modified from: *Communicating with the World of Beings: The World Heritage Rock Art Sites in Alta, Arctic Norway*, 2014. The right image is Photoshop-edited by the author based on the left one).

Figure 16 Rock Art in the Khomeeen Region of Central Iran (left) (After: https://www.arabnews.com/node/1022511/art-culture) and Rock art in Inner Mongolia, China (After: TREASURES IN THE DESERT: SELECTED BADAIN JARAN PETROGLYPHS, 2014. Both original figures have been digitally processed by the author using Adobe Photoshop).

The distinctive characteristics of combination production techniques become even more pronounced in detailed observation, as evidenced in the Mandela Mountain rock art (Figure 17). Beyond the conspicuous chisel marks, the rock art retains a significant number of engraved lines. Their thickness aligns closely with the width of the diamond-patterned lines in the horse's body, and the chisel marks can be clearly seen overlaying the engraved lines in the horse image at the upper-right corner of the rock art. This technique is even more pronounced in the rock art of Jordan's Black Desert region (Figure 18). An engraved line remains on the right side of the camel image, clearly representing the creator's initial attempt to engrave the animal's foreleg and neck. The discovery of numerous such rock art examples in Jordan's Black Desert further corroborates the significant role of sketch consciousness in rock art production. Among these, Nathalie Østerled Brusgaard has proposed multiple speculations regarding the steps of rock art production based on rock art images from the Black Desert region of Jordan (Figure 19). These include simulations

Figure 17 Image of Human Riding Animal from the Rock Art at Mandela Mountain, China (After: TREASURES IN THE DESERT: SELECTED BADAIN JARAN PETROGLYPHS, 2014. The original image has been digitally edited using Adobe Photoshop by the author).

Figure 18 Rock Art from the Black Desert Region of Jordan (Modified from: *Carving Interactions Rock Art in the Nomadic Landscape of the Black Desert, North-Eastern Jordan*, 2019).

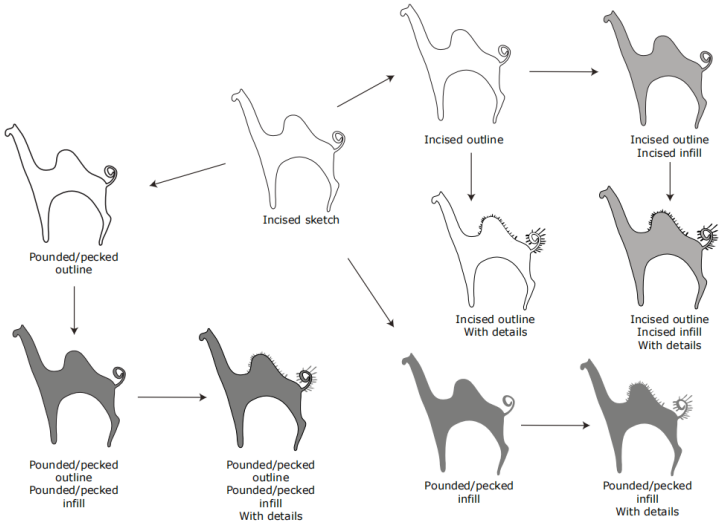


Figure 19 Nathalie Østerled Brusgaard's Simulation of the Rock Art Production Process (Modified from: *Carving Interactions Rock Art in the Nomadic Landscape of the Black Desert, North-Eastern Jordan*, 2019).

ranging from initial sketch to detailed engraving, as well as beginning-to-end processes under varying production scenarios. Such simulations demonstrate diverse possibilities for the formation of rock art images, a process inherently involving the separation and sequential relationship between the two stages: the delineation of outlines and the subsequent filling of interior areas.

In summary, the thickness, density, depth, and regularity of lines are all key factors in determining whether a rock art image possesses a sketch consciousness. Additionally, attention must be paid to the integrity and disruption of the marks' shapes. Although this sketch consciousness is concealed within these details, it is important to note that the differences in marks are not solely attributable to this sketch consciousness; they may also be related to multiple factors such as the type of tool used by the rock art creator, the direction of application, and the force exerted.

Regarding the relationship between the sketches formed by points, lines, and planes and the rock art images mentioned earlier, we may explain this from the perspective of production techniques. Firstly, the combination of points and lines is more commonly applied in chisel rock art. The most prevalent technique, chiseling, involves striking and hammering to create chisel marks. These points connect closely to form lines, and when connected in silhouette-style patterns, they form planes. Secondly, engraving and smearing techniques exemplify the integration of line and plane. The smearing technique, frequently employed in painted rock art, alongside the grinding technique used in chiseled rock art, has even bypassed the stages of *point* and *line* (here referring to the actual production effect rather than the theoretical concept of points forming lines and lines forming planes), achieving a direct fusion of plane with plane.

The sketch consciousness has appeared across global rock art, indicating that ancient humans shared similar modes of expression and creative principles for perceiving the external world. The emergence of this sketch consciousness signifies progress in compositional consciousness within individual rock art images, demonstrating that creators already considered the aesthetic appeal of the final image when creating the rock art. For instance, at the Longmenka rock art site, there exist some rock art images characterized by scattered chisel marks, inconsistent sizes, indistinguishable subject types, and even inaccurate depictions of animal body shapes; yet the sketch-making process could avoid such outcomes. While the application of sketches may not represent an epochal advancement in rock art production, it constitutes a progress and enhancement at the level of production techniques. This consciousness not only lends images greater regularity and order but also reduces the error rate during production. Rock art creation falls within the irreversible category. Direct production may lead to the need for constant corrections and adjustments due to improper technique, thereby compromising the final presentation of the rock art. Subsequent *second-stage* and *third-stage* processes must be applied over the base layer, making the sketch consciousness a prerequisite for most rock art images. However, this sketch consciousness does not apply universally to all rock art images. It is reasonable to infer that creators with modest image requirements or those possessing advanced technical proficiency may opt to dispense with this practice. When the creator possesses a clear morphological understanding of the subject, even a haphazardly executed image may remain broadly recognizable.

Based on prior chronological periodization research on the Longmenka rock art, the corpus can be categorized into four distinct phases, spanning from 1,000 BCE to the 7th century CE. Throughout the four chronological phases, clear traces of sketch consciousness can be identified in the production of this rock art, while no distinct phase-specific characteristics are observed among them. The persistent presence of sketch rock art across all phases of Longmenka's rock art tradition indicates that this technique is not a period-specific feature but a consistent practice spanning eras. This reflects a diachronically consistent cognitive logic in the creation of Longmenka's ancient rock art. A global survey of the historical contexts in which sketch rock art emerged reveals that such art is not a product of a single era.

REFERENCE

Arnheim, R. (1954). *Art and Visual Perception: A Psychology of the Creative Eye*. Berkeley, Los Angeles, London: University of California Press.

Bellezza, J.V. (2001). *Antiquities of Northern Tibet: Pre-Buddhist Archaeological Discoveries on the High Plateau (Findings of Changthang Circuit Expedition, 1999)*. Delhi: Adroit Publishers, 140–145.

Brusgaard, N.O. (2019). *Carving Interactions Rock Art in the Nomadic Landscape of the Black Desert, North-Eastern Jordan*. Oxford: Archaeopress Publishing Ltd.

Davidson, I., & Nowell, A. (2021). *Making Scenes-Global Perspectives on Scenes in Rock Art*. New York: Berghahn.

Dewey, J. (1934). *Art as Experience*. New York: G. P. Putnam's Sons.

Helskog, K. (2014). *Communicating with the World of Beings: The World Heritage Rock Art sites in Alta, Arctic Norway.* Oxford: Oxbow Books.

Li, Z.H. (2016). Research and Practice on the sketch of oil painting creation. Hunan Normal University.

Park, J.C. (2020). Examination of the Production Chronology of the Bangudae Petroglyphs through Production Experiments and Overlapping Patterns. *Yeongnam Archaeology*, *87*, 5–34.

Wang, Q. (2019). Analysis on the cultural characteristics and drawing technology of cattle in dundebulake painting surface. Northwest University.