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RESEARCH ARTICLE

EXPLORING THE CULTURAL HUB SIGNIFICANCE OF THE TANGBALETASI CAVE PAINTINGS FROM ICONOGRAPHIC AND GIS PERSPECTIVES

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ABSTRACT

Rock art, as a vital legacy of early human spiritual culture, holds distinctive value in archaeological and religious studies. The Altay region of Xinjiang, China, preserves a rich corpus of rock art with diverse forms, among which anthropomorphic figures are particularly prominent. This paper focuses on the Tangbaletasi Cave Paintings and employs an integrated approach combining iconographic interpretation with GIS-based spatial analysis. Iconographic analysis reveals the shamanistic features embodied in these anthropomorphic figures and systematically demonstrates the site's central role in regional shamanistic interactions. The GIS analysis further underscores the significance of the southern foothills of the Altai Mountains in the early religious and cultural networks of Eurasia. The findings not only provide new empirical evidence for understanding the spatial distribution and regional dynamics of shamanistic culture in this area, but also contribute methodological insights into exploring early religious interactions and cultural exchanges across Eurasia.

KEYWORDS

Shamanism, Rock Art, Iconography, GIS Spatial Analysis, *Tangbaletasi* Cave Paintings

1. INTRODUCTION

As one of the earliest forms of religion, Shamanism has long played a central role in the spiritual beliefs and social life of many northern Eurasian peoples. The Altay region is widely regarded as one of the major centers of shamanistic traditions, and the *Tangbaletasi* Cave Paintings (Figure 1) in Xinjiang, China, are of particular significance for understanding regional religious interactions and civilizational exchanges due to their unique geographical setting and cultural attributes. The southern foothills of the Altai Mountains connect South Siberia, Central Asia, and western China, forming a crucial corridor for the multidirectional flow of early religions and cultures. This underscores the pivotal role of the region in shaping the early religious networks of Eurasia.

As one of the key regions where shamanistic traditions were distributed, the Altay region of Xinjiang, China, preserves a rich body of rock art that includes numerous anthropomorphic figures with shamanistic features. These figures are typically depicted with horned or feathered head adornments, ritual robes, and tail ornaments (Han, 2018), providing crucial evidence for tracing and studying the cultural exchanges of Shamanism. From a phenomenological perspective, Roger et al. noted that Shamanism, as a religious practice, independently originated and spread in multiple centers worldwide (Walsh, 1989). Laufer et al. suggested that the term "Shaman" derives from the Northeast Asia Turkic-Manchu region (Laufer, 1917). Okuniev further proposed that, around a certain period BCE, Shamanism first appeared as a complex

magical-religious practice in the Lake Baikal region and gradually expanded to the Ural and Ob River basins before the Common Era (Hoppál, 1992).

However, studies on the spatial distribution patterns and regional interactions of Shamanic culture in this area have largely relied on stylistic comparisons of imagery or historical textual inferences, while empirical and quantitative analyses from a spatial behavioral perspective remain relatively limited. For example, Song et al. claim that Shamanism spread southeastward along the Eurasian steppe slab burial culture is based solely on indirect analyses of megalithic grave types in Siberia, the Hulunbuir steppe, and the Liaodong Peninsula in China, without fully incorporating spatial analysis of the sites or direct examination of Shamanic relics (Song, 2023). Liu et al. treated Shamanism as part of *Tungusic Culture*, using linguistic and textual evidence and historical comparisons of cultural traits to infer its gradual diffusion from the center to peripheral areas, yet lacked systematic analysis of physical evidence. Overall, current research on the transmission pathways of shamanistic culture remains insufficiently supported by spatial analysis.

To address the current gap in research concerning the relationship between shamanistic transmission pathways and the geographic environment, this study focuses on the *Tangbaletasi* Cave Paintings as a case study. By integrating iconographic analysis with GIS-based spatial analysis, it systematically demonstrates the site's pivotal role as a hub in regional shamanistic interactions and identifies the southern foothills of the Altai Mountains as a crucial corridor facilitating cultural

connectivity and exchanges across the area. Specifically, iconographic analysis establishes the cultural attributes of Shamanic elements in the *Tangbaletasi Cave Paintings* and demonstrates potential connections between this site, the cultures of the Russian Altay region, and rock paintings along the Yellow River basin. Kernel density analysis reveals the macroscopic distribution patterns of the rock art sites, while buffer analysis highlights the spatial relationship between rock art distribution and rivers. Combined with terrain factors such as elevation, slope, and aspect, the study explores the environmental motivations behind the selection of these locations for creating Shamanic rock art. Ultimately, this study offers an important empirical case for understanding the cross-regional interactions of shamanistic culture from both “cultural traits” and “spatial behavior” perspectives, grounded in evidence-based and spatially-informed analysis.

The remainder of this paper is organized as follows: Section Two presents iconographic analysis; Section Three details spatial analysis; Section Four discusses and interprets the rock art sites; and the final section provides a summary of the study.

2. ICONOGRAPHIC ANALYSIS OF SHAMANIC ELEMENTS IN THE TANGBALETASI CAVE PAINTINGS AND THEIR CULTURAL ORIGINS

The anthropomorphic figures in the *Tangbaletasi Cave Paintings* can be roughly classified into three types.

2.1 Sun-Headed Figure

The *Sun-headed Figure* is a relatively common type of anthropomorphic representation in southern Siberia, Central Asia, and Northeast Asia. In relevant literature, such images are also referred to as “sun-headed” human faces and are considered Shamanic figures (Han, 2018; Yesin, 2009; Gou, 2018; Wang, 2018). Their typical characteristic is the radiating rays extending outward from the head contour. Some images have rays encircling the entire head, while others are limited to the top of the head or one side of the face (Gai, 1988). Figure 3 (a)-(g) illustrates *Sun-headed Figures* from rock art in different cultural contexts within the Altay region and various areas along the Yellow River basin.

In the *Tangbaletasi Cave Paintings*, one three-eyed human face (Figure 2 (c)) is identified as a *Sun-headed Figure*. The image is located on the middle-lower section of the right wall of the rock shelter, measuring 1.7 m in height and 1.2 m in width, and is painted in a light ochre-red color. The overall composition is relatively well-preserved, and the motifs are clearly discernible. The facial contour is distinct, with a pair of ears and a notably pointed chin. The two eyes and the central third eye on the

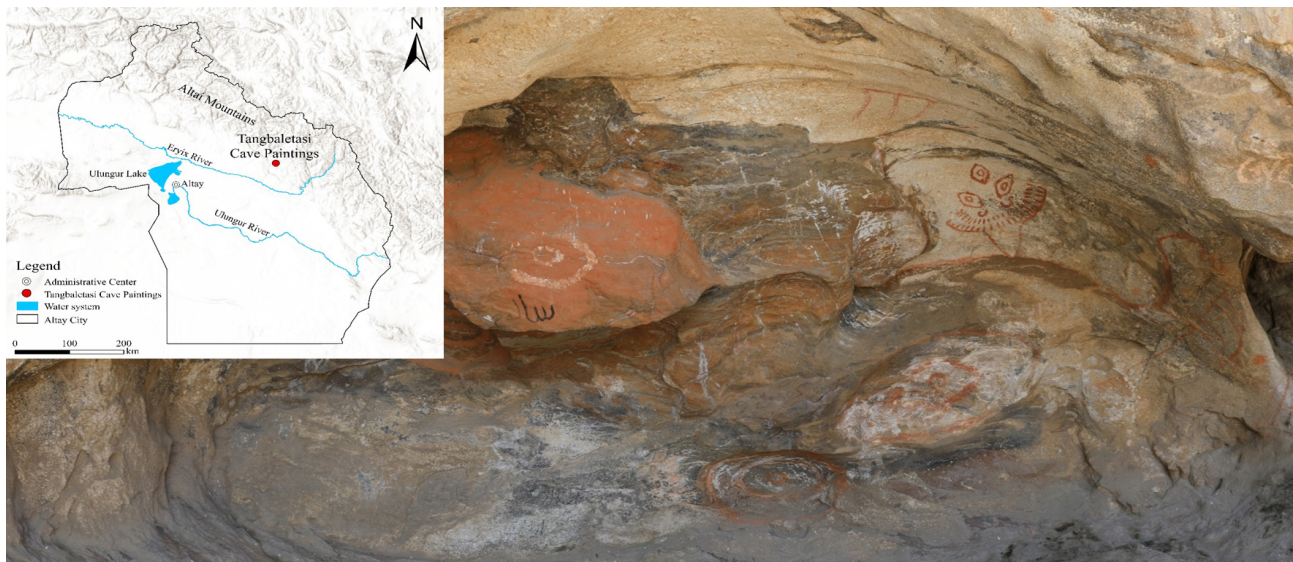


Figure 1 Geographic Location Map and Frontal Photographs of the Tangbaletasi Cave Paintings

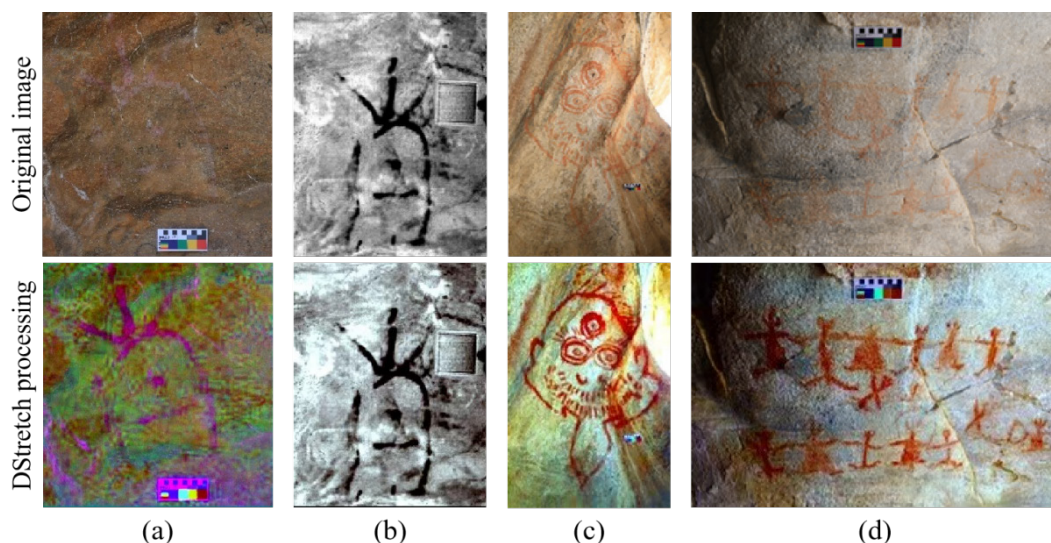


Figure 2 Anthropomorphic Figures from the Tangbaletasi Cave Paintings: (a) “Chemurchek” Anthropomorphic Figure; (b) Result of ICA Processing on the Hyperspectral Data of (a); (c) Sun-headed Figure; (d) Horned Anthropomorphic Figure, the First Row: Original Images, the Second Row: DStretch-Processed Images.

forehead are depicted using three concentric circles. Above the eyes, the eyebrows are represented by six and five short lines, respectively, while two short arcs indicate the nostrils. A beard is drawn below the lips, composed of 42 short lines arranged in two curved groups extending upward. Seventeen short radiating lines on the top of the head simulate sunlight, classifying this image as a *Sun-headed Figure*.

In the *Okuniev Culture* (Figure 3 (c)), *Sun-headed Figures* are mostly carved on stelae, though some appear on pottery surfaces. Some images feature fan-shaped short lines on the head to simulate sunlight. Facial patterns from the forehead to the nose are represented by several horizontal lines, and a third eye, or "heavenly eye," is typically depicted on the forehead.

The *Karakol Culture*, mainly distributed in the southern Altay Republic along the upper Ob River and roughly contemporaneous with the *Okuniev Culture* (Parzinger, 2022), presents *Sun-headed Figures* (Figure 3 (b)) that differ from those of the *Okuniev Culture* and the *Tangbaletasi Cave Paintings*. These figures have elongated limbs, with upper limbs either hanging or raised, sometimes holding branches or rod-like objects. Radiating lines around the head simulate sunlight. Similar figures are also found in the *Samus Culture*, located between the middle reaches of the Ob and Irtysh Rivers (Figure 3 (a)) (Yesin, 2009). These figures often have trapezoidal torsos, slender limbs, and radiating sun rays atop the head.

Additionally, similar *Sun-headed Figures* have been identified in the *Helan Mountain*, *Zhuozi Mountain*, and *Yinshan* rock art (Figure 3 (f), (g)). In these instances, only the face is depicted, while the limbs are either abstracted or omitted. Facial shapes include droplet, oval, or heart-like forms. The eyes are mostly circular, though some are almond-shaped, and certain images feature a pair of downward-curving eyebrows.

2.2 Horned Anthropomorphic Figure

Horned Anthropomorphic Figures are widely distributed in rock arts across the Altay region and the Yellow River basin, and have been identified in the *Samus Culture*, *Karakol Culture*, *Okuniev Culture*, as well as in the *Helan Mountain* and *Yinshan* rock arts (Figure 3 (h)-(m)). These figures are typically characterized by two short lines, straight or curved, drawn on the head of the anthropomorphic image to resemble animal horns.

In the *Tangbaletasi Cave Paintings*, a group of anthropomorphic figures was identified (Figure 2 (d)), exhibiting the following characteristics: the head is not depicted, the torso is rounded and resembles a "ritual robe", the arms are extended horizontally and connected, and the legs are separated and bent. On the head, two or three short lines depict horn-like adornments, and some figures also feature tail ornaments. The features of this group are highly consistent with those of *Horned Anthropomorphic Figures*. Okladnikov et al. believes that "side-facing figures with tails and figures with horns on the head are closely associated with Shamanism" (Xiao, 2016), further supporting the Shamanic attributes of these images.

2.3 "Chemurchek" Anthropomorphic Figure

Figure 3 illustrates anthropomorphic figures discovered at different sites in the Altay region. These figures typically represent Shamanic priests wearing "ritual robes", often depicted in trapezoidal or bell-shaped forms and decorated with geometric patterns such as dots, triangles, or line segments. The head is adorned with fan-shaped ornaments composed of two or more short lines, possibly representing horn or feather decorations worn during rituals. Some figures depict feet (Figure 4 (b), (e)), while others omit them; these are referred to as

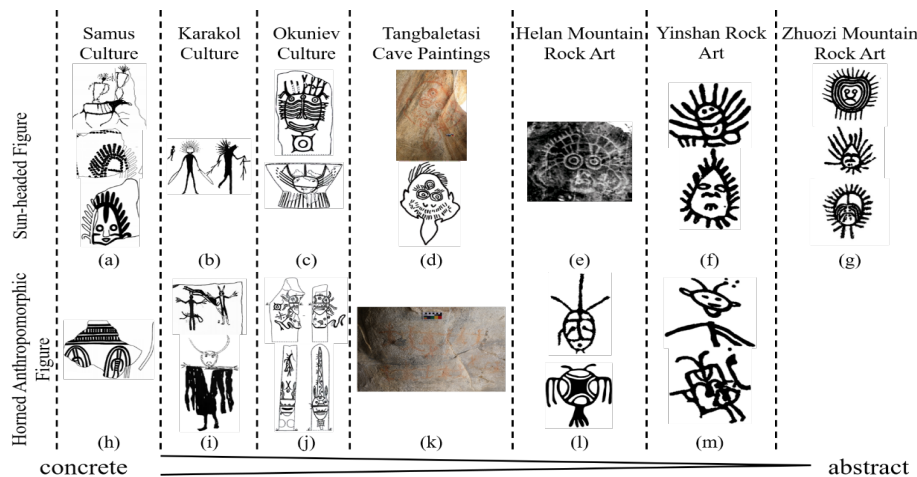


Figure 3 Sun-headed Figure and Horned Anthropomorphic Figure Images: (a) Rock Arts in the Lower Reaches of the Tom River, *Samus Culture* (Yesin, 2009) , *Samus Culture-Settlement 4* (Поселение Самусь-4) (Yesin, 2009); (h) *Samus Culture-Settlement 4* (Поселение Самусь-4): Jar-Shaped and Pottery Vessels (Yesin, 2009); (b, i) *Karakol Culture* (Han, 2018); (c, j) *Okuniev Culture* (Leontiev, 2006; Polyakov, 2017); (d, k) *Tangbaletasi Cave Paintings*; (e, l) *Helan Mountain* Rock Arts (Gou, 2018); (f, m) *Yinshan* Rock Arts (Wang, 2018); (g) *Zhuozi Mountain* Rock Arts.

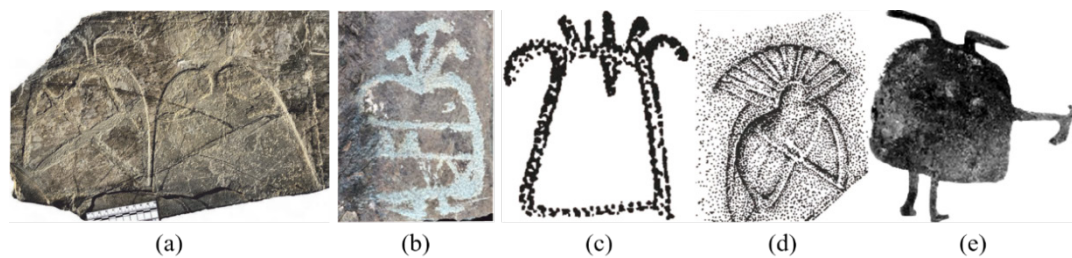


Figure 4 Chemurchek Anthropomorphic Figures: (a) and (b) Anthropomorphic Motifs Carved on Stelae at Harherut 1 Ceremonial Enclosure Site, Ulantkhes County, Bayan-Ulgii Province (Kovalev, 2022); (c) Carved on the Bezo Stone Shelter at a Late Neolithic Megalithic Tomb Site in the Eure-et-Loir Department, France (Li, 2019); (d) Carved on the Alapabrak 1 Statue Stele; (e) Painted on Rock Art 1 at Dunde Brak, Altay Region (Yihao, 2024).

“Chemurchek Anthropomorphic Figures” (Molodin, 2022).

In the *Tangbaletasi* Cave Paintings, bell-shaped figures of a similar type were also identified (Figure 2 (a)). This figure is located on the middle section of the rear wall of the rock shelter, with three concentric circular patterns on both sides. The overall image is dark red and relatively faint. The research team conducted component analysis using hyperspectral imaging, and the results are shown in Figure 2 (b). The bell-shaped figure features three radiating short lines at the top, and the middle section is decorated from top to bottom with a dot and a short horizontal line.

A comparison between the bell-shaped anthropomorphic figure in the *Tangbaletasi* Cave Paintings (Figure 2 (a)) and the *Chemurchek* Anthropomorphic Figures shows that the overall contour is bell-shaped, with geometric decorations on the upper part and horn-like short lines at the top. Its overall form is similar to the anthropomorphic motif on the stelae from the Harherut 1 ceremonial enclosure site in Ulanthkes County, Bayan-Ülgii Province, Mongolia (Figure 4 (b)). Therefore, the bell-shaped figure in the *Tangbaletasi* Cave Paintings is classified as a *Chemurchek* Anthropomorphic Figure.

3. SPATIAL ANALYSIS OF SHAMANIC ELEMENT ROCK ARTS IN THE ALTAY REGION

3.1 Data Sources

The foundational data used in this study are vector data, obtained from the 1 : 4,000,000-scale Basic Geographic Information of China published by the National Geomatics Center of China. A digital elevation model (DEM) with a resolution of 90 m was acquired from the Geospatial Data Cloud. Rock art data from the Altay region were sourced from *Rock Arts of Xinjiang*, compiled by the Xinjiang Uygur Autonomous Region, as well as from the third national cultural relics census conducted by the Altay Cultural Relics and Archaeology Research Institute. After data collation, a total of 14 rock art sites depicting Shamanic anthropomorphic figures were selected as analysis samples. It should be noted that for rock art complexes containing multiple sites, only one set of coordinates was chosen for spatial analysis.

3.2 Research Methods

To investigate the spatial relationships of rock art sites, this study employs three analytical methods to examine the spatial distribution system of rock art in the Altay region of Xinjiang: kernel density analysis, buffer analysis, and terrain analysis. Kernel density analysis is applied to reveal the macro-level distribution patterns of the rock art sites. Buffer analysis involves extracting hydrological information for the region and overlaying it with the rock art locations to examine the spatial relationships between rock art and rivers, thereby exploring distribution patterns and potential influencing factors. Terrain analysis,

based on DEM data, extracts elevation, slope, and aspect information for each rock art site, followed by statistical analysis, with the aim of inferring the spatial behavior logic of ancient people from micro-level site selection preferences.

3.3 Kernel Density Analysis

Kernel density analysis was conducted on 14 rock art sites in the Altay region using ArcGIS 10.8, and the results are shown in Figure 5. The analysis indicates that Shamanic-themed rock arts in the Altay region are widely distributed but spatially uneven, exhibiting a pattern of concentration in the northwest and northern areas. From an administrative perspective, the Altay city area forms a high-density cluster of rock art sites, whereas Habahe County, Burqin County, and Jimunai County constitute medium-density clusters, showing a point-like distribution pattern.

3.4 Buffer Analysis

Buffer analysis of Shamanic element rock art sites in the Altay region was conducted using ArcGIS. First, based on the river vector map of the Altay region, buffers were created at distances of 3 km, 5 km, 7 km, and 9 km. Then, each buffer was overlaid with the rock art sites within the study area for spatial overlay analysis. The results are shown in Figure 6: Four rock art sites (28.6%) are located within the 3 km buffer; 5 sites (35.7%) within the 5 km buffer; 6 sites (42.9%) within the 7 km buffer; and 11 sites (78.6%) within the 9 km buffer.

Regarding river distribution, rock art sites are primarily concentrated along the Keren, Burqin, Haba, and Irtysh river basins, while the number of sites located outside the 9 km buffer is significantly lower.

3.5 Terrain Factor Analysis

Using the spatial analysis functionality of ArcGIS, a DEM was employed to generate elevation (Figure 7 (a)), slope (Figure 8 (a)), and aspect maps (Figure 9 (a)) of the Altay region, with rock art site layers overlaid to extract corresponding attribute values. Figure 7 (b) shows that 7 rock art sites (approximately 50%) are located within the elevation range of 750–1000 m; 4 sites (28.6%) within 1000–1250 m; 1 site (7.1%) within 1250–1500 m; and 2 sites (14.2%) above 1500 m. Overall, the rock art sites are mainly distributed along the southern foothills of the Altai Mountains.

Figure 8 (b) shows that 4 rock art sites (28.6%) are located in areas with slopes of 2.5°–5°; 6 sites (42.9%) in slopes of 5.1°–7.6°; 3 sites (21.4%) in slopes of 7.7°–10.2°; and 1 site (7.1%) in areas with slopes greater than 10.2°.

Figure 9 (b) presents the distribution of rock art sites across different

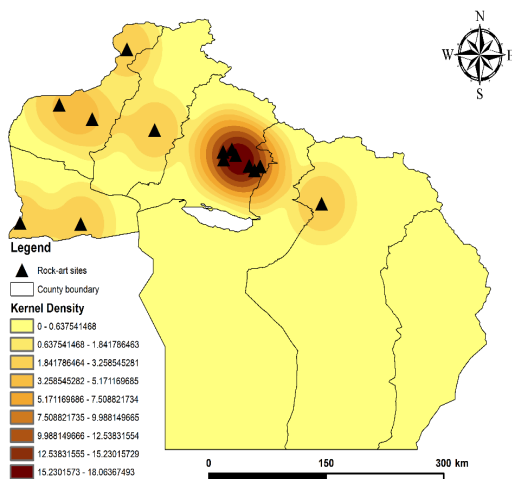


Figure 5 Spatial Density Distribution of Rock Art Sites

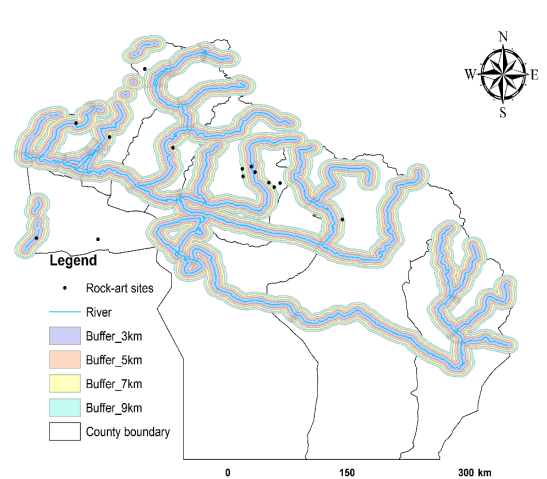


Figure 6 Buffer Analysis of Rock Art Sites

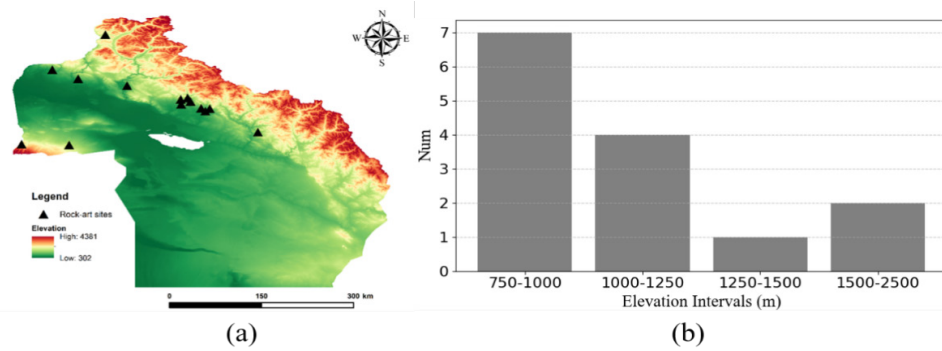


Figure 7 Elevation Map of Rock Art Sites and Statistics: (a) Elevation Map; (b) Number of Rock Art Sites within Different Elevation Ranges.

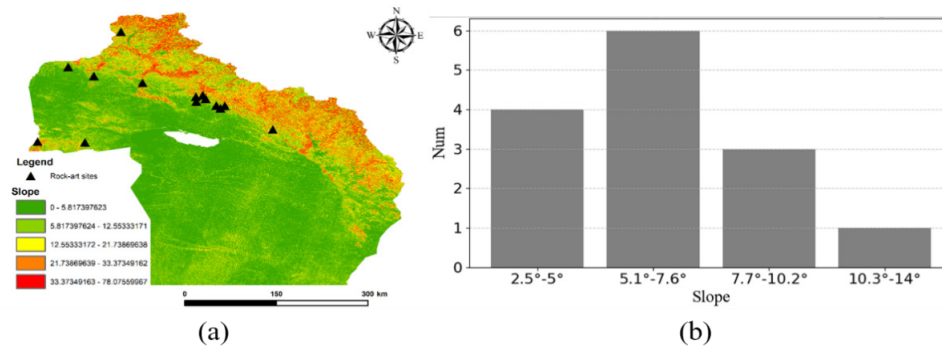


Figure 8 Slope Map of Rock Art Sites and Statistics: (a) Slope Map; (b) Number of Rock Art Sites within Different Slope Ranges.

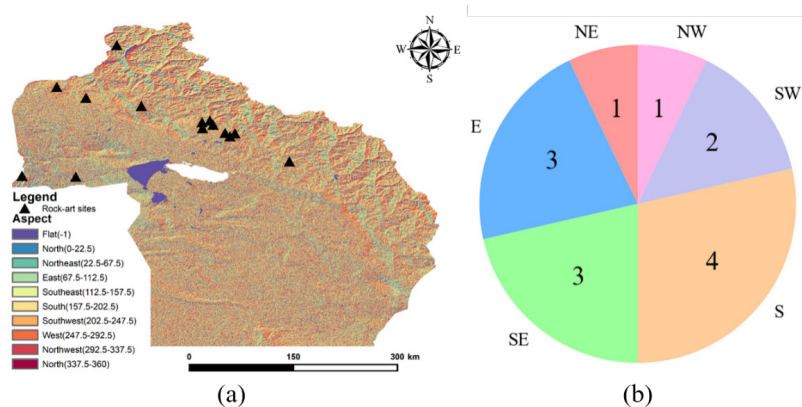


Figure 9 Aspect Map of Rock Art Sites and Statistics: (a) Aspect Map; (b) Number of Rock Art sites within Different Aspect Ranges.

slope aspects. One site (7.1%) is located on northeast-facing slopes; 3 sites (21.4%) on east-facing slopes; 3 sites (21.4%) on southeast-facing slopes; 4 sites (28.6%) on south-facing slopes; 2 sites (14.2%) on southwest-facing slopes; and 1 site (7.1%) on west-facing slopes. No rock art sites were found on north- or northwest-facing slopes.

4. DISCUSSION

4.1 Iconographic Discussion

The *Tangbaletasi* Cave Paintings exhibit significant transitional and integrative features in the style of Shamanic anthropomorphic figures. First, in terms of trunk and limb representation, the *Tangbaletasi* paintings reflect an intermediate evolutionary stage. In the Altay region, Shamanic anthropomorphic figures of the *Karakol Culture* and *Samus Culture* emphasize structural integrity and realism (Figure 4 (a), (b), (h), (i)), with clearly delineated trunks and limbs, distinguishable dynamic details, and sometimes depicted holding objects. In contrast, although the *Tangbaletasi* Cave Paintings retain the trunk structure, a noticeable

trend of simplification emerges (Figure 2 (d)), with trunks represented by geometric shapes such as triangles, circles, or straight lines instead of realistic depiction, and limbs often outlined with simple lines, reflecting a transition from figurative to symbolic representation. In the *Helan Mountain*, *Zhuozi Mountain*, and *Yinshan* rock arts of the Yellow River Basin, the images further evolve into geometric abstraction or structural omission (Figure 4 (f), (j), (l), (m)), forming a highly symbolic visual language. *Tangbaletasi* paintings thus occupy a key intermediate position in the “figurative–simplified–abstract” evolutionary chain.

Second, the “*Sun-headed Figure*” in the *Tangbaletasi* Cave Paintings closely resembles similar figures in the *Okuniev Culture*, characterized by concentric-circle eyes and a third “heavenly eye,” suggesting that the *Tangbaletasi* Cave Paintings may have been influenced by *Okuniev Culture*. The stylistic evolution of the facial features of the “*Sun-headed Figure*” further supports this iconographic transition. In the Altay region of Russia, facial features are rendered realistically, retaining strong naturalistic traits, whereas in the Yellow River Basin, the figures display highly abstracted, and even ornamental, characteristics. This gradient

sequence highlights the transitional role of the *Tangbaletasi Cave Paintings* in the regional evolution of iconographic styles.

From the perspective of cultural transmission and geographic space, the “*Sun-headed Figure*” exhibits a multidirectional dispersal pattern radiating from a central core. The *Okuniev Culture* in southern Siberia and the *Karakol Culture* in the Altay region established key iconographic traditions, which continued northward in the *Samus Culture*, westward at the Tamgale site, and eastward to the *Tangbaletasi Cave Paintings* in Xinjiang, China. Further southeast, these paintings correspond with highly abstracted motifs found in the *Helan, Yinshan*, and *Zhuozi Mountains* (Figure 10). Positioned between the northwest and southeast iconographic systems, the *Tangbaletasi Cave Paintings* retain the fundamental compositional tradition of depicting the trunk characteristic of northwest Shamanic cultures, while also exhibiting tendencies toward simplification and symbolic representation. This coexistence of inheritance and stylistic evolution underscores its pivotal intermediary role in the regional development of iconography, providing critical evidence for its function as a node in cultural interactions.

Moreover, similar motifs, known as the “divine-human animal-faced patterns,” have been identified in the *Liangzhu Culture* in the lower reaches of the Yangtze River in eastern China. These motifs feature head crowns represented by radiating lines, depicting a solar priest performing ritual worship (Jiang, 1994). The *Liangzhu Culture* dates to approximately 2890 BCE (Zhang, 2015), earlier than the *Okuniev* and *Karakol* cultures. However, due to gaps in the intermediate chain, whether there is a direct connection with the aforementioned iconography remains to be established.

In summary, the *Tangbaletasi Cave Paintings* combine the realistic legacy of northwest Altay cultures with the emerging abstract style of rock art in the southeast Yellow River Basin. Positioned within the transitional stage of the stylistic evolution sequence, they effectively reflect the integrative and adaptive changes associated with the cross-regional transmission of Shamanic culture, providing iconographic evidence for *Tangbaletasi* as a key hub in Shamanic cross-regional interactions.

4.2 Discussion of Spatial Analysis

The river buffer analysis indicates that Shamanic rock art sites in the Altay region are mostly concentrated within 9 km of rivers, exhibiting a clear riparian distribution pattern. Elevation analysis shows that these sites are primarily located within the 750-1,250 m range, where rock

formations and caves are abundant, providing natural shelters for ancient inhabitants against harsh weather and rainfall. The Altai Mountains descend in a stepped pattern from northwest to southeast, showing distinct vertical zonation. Within the 750-1,250 m range, the terrain includes alluvial plains, piedmont hill valleys, alternating mountains and faulted valleys, and trough-shaped valleys. Under climatic influences, these areas are typically covered by grassland vegetation, making them ideal for seasonal grazing and subsistence activities.

Slope analysis reveals that most rock art sites are situated on gentle to moderately steep slopes of 2.5°-10.2°, whereas sheer cliffs and steep slopes lack any rock art. Slope conditions affect rock art creation: gentle slopes provide flat rock surfaces suitable for carving and painting, while steep cliffs increase both difficulty and risk.

Aspect analysis shows a preference for south-facing slopes. In the Northern Hemisphere, south-facing slopes receive the most solar radiation, followed by southeast and southwest slopes, whereas north-facing slopes receive minimal sunlight. South-facing rock walls and cave entrances enjoy the longest daylight exposure during winter, aligning with the solar worship practices in Shamanism. The sun, regarded as a deity that nourishes the world and governs fate, makes placement of rock art on sunlit south-facing walls an expression of reverence and dependence on the solar deity.

In summary, the buffer, elevation, and slope analyses indicate that ancient inhabitants consciously selected “near-water” and “mid-elevation” areas as activity cores. This choice not only satisfied basic survival needs but also provided stable conditions for social and religious activities, such as rock art creation. Furthermore, during relatively humid climatic periods, the Altai Mountains did not impede migration but served as an important transit corridor (Li, 2019). The distribution of various cultural types illustrated in Figure 10 extends linearly from northwest to southeast, with the *Tangbaletasi Cave Paintings* occupying an intermediate position, providing spatial evidence that the southern Altai foothills function as a pivotal node in the pathways of Shamanic cultural interactions.

5. CONCLUSION

This study presents a systematic investigation of the *Tangbaletasi Cave Paintings* in the Altay region of Xinjiang based on iconographic and GIS spatial analyses. Through iconographic analysis, the bell-shaped anthropomorphic figures in the *Tangbaletasi Cave Paintings* were

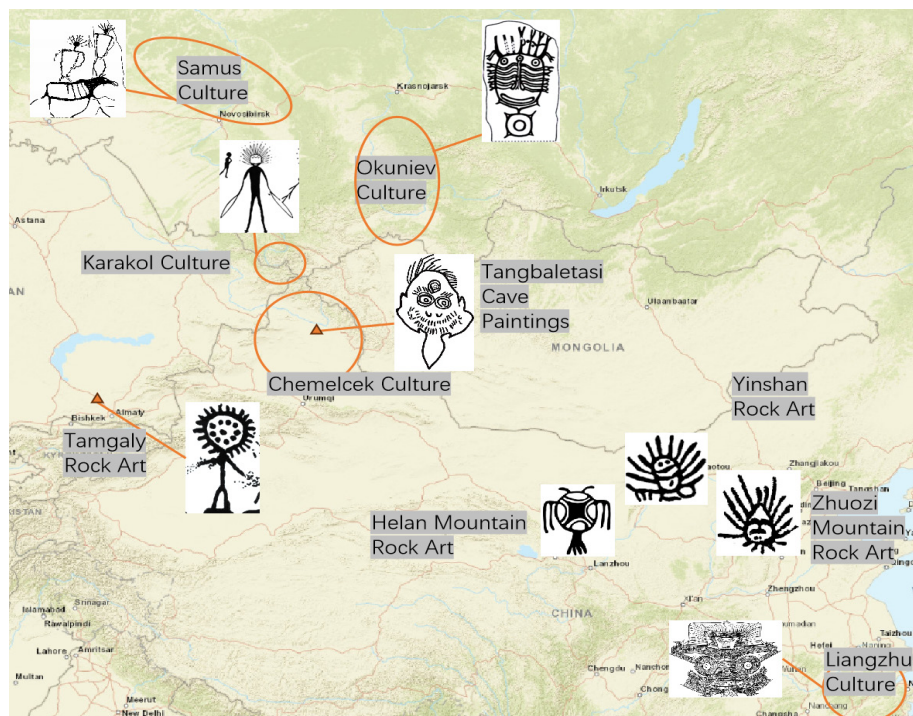


Figure 10 Distribution of “*Sun-headed Figure*” Images in the Altay Region and the Yellow River Basin

compared with the “Chemurchek” anthropomorphic figures, confirming their classification as “Chemurchek” anthropomorphic images. Meanwhile, the “Sun-headed Figure” images in the cave paintings were compared with similar images from the Okuniev Culture, suggesting that the Tangbaletasi Cave paintings were influenced by the Okuniev cultural tradition during their creation. Furthermore, correlation analyses between the “Sun-headed Figure” and “Horned Anthropomorphic Figure” images at the Tangbaletasi site and corresponding figures from multiple key rock art sites in the Altay region and the Yellow River Basin established the transitional position of Tangbaletasi within the stylistic evolution of Shamanic anthropomorphic images. From an iconographic perspective, a “realistic-simplified-abstract” evolutionary gradient sequence was constructed, highlighting the intermediate characteristics of Tangbaletasi as a bridge between the northwest and southeast rock art systems, thereby demonstrating its role as a transitional zone for cultural interactions between Shamanic communities of the Altay region and the Yellow River Basin. Moreover, from a macro-spatial perspective, buffer and terrain analyses further indicate the potential pivotal function of the southern Altai foothills in the dissemination of Shamanic culture.

However, this study has certain limitations. Due to the lack of precise absolute dating, the temporal characteristics of these cultural phenomena can only be inferred to a limited extent. Although spatial analysis reveals correlations between rock art sites and static environmental factors, other dynamic elements, such as human migration routes, have not been fully considered. Therefore, future research should aim to establish more precise chronological data for the rock art sites in order to accurately determine their positions within the temporal sequence of regional cultural imagery.

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