KEYWORDS: ***Canaima Complex – Rock art – Lithic tradition – Canaima National Park***

PREHISTORIC LANDSCAPES OF THE CANAIMA COMPLEX: NEW ROCK ART SITES AND LITHIC TOOLS IN SOUTHEASTERN VENEZUELA

José Miguel Pérez–Gómez and Roger Swidorowicz

Abstract. This study presents four newly identified rock art sites within Canaima National Park, southeastern Venezuela, expanding the understanding of pre-Historic cultural landscapes in the region. Located in diverse environments, including a boulder in a dense forest, a cliff overlooking a savanna, and rapids along the Caroní and Carrao Rivers, these sites significantly enhance the archaeological record of this part of South America. Stylistic analyses reveal connections with existing rock art in the Upuigma-Tepui at the Arauák River Valley, 160 km southeast of Canaima, as well as broader parallels with sites across the Guiana Shield, Orinoco Basin, southern Colombia and northern Brazil. Lithic tools were discovered at newly identified pictogram sites. These tools align with artefacts reported by José Maria Cruxent in the Canaima savanna in 1959. While establishing direct connections between the region's lithic traditions and rock art remains challenging due to the absence of precise dating. The lithic evidence suggests a cultural continuity spanning the transition from the Late Pleistocene to the Holocene. This article considers the new rock art within the region's broader archaeological context, emphasising the cultural complexity of the Canaima region as an important centre of pre-Historic interaction and cultural continuity.

Introduction

The study of rock art serves as an essential tool for uncovering the presence and cultural expressions of Amerindian groups in northern South America. As visual artefacts left by past societies, rock art provides unique insights into the beliefs, rituals and social practices of those who created them. The Orinoco River basin in central Venezuela is particularly significant, with hundreds of archaeological sites featuring pictograms and petroglyphs that illuminate the lifeways and cosmologies of its ancient inhabitants. This wealth of material has been extensively documented in prior studies (Cruxent 1950, 1955; Padilla 1956; Arroyo 1970; Dupouy 1971; González 1980; Scaramelli 1992; Gassón 2002; de Valencia and Sujo Volsky 1987; Greer 1995; Sujo Volsky 2007; Tarble and Scaramelli 2010; Riris and Oliver 2019). Recent research reveals that rock art in this region is more widespread than previously thought, reshaping timelines of pre-Historic activity while serving as symbolic markers for cosmogonic myths and playing a central role in Indigenous place-making along the rivers (Riris et al. 2024).

While databases and studies of rock art in the Guiana Shield (Guyana, Suriname and French Guiana) provide extensive documentation (Braunholtz 1955; Homet 1963; Dubelaar 1986; Mazière 1997; Gassie 2006), the upper Caroní River region in Venezuela has received comparatively little attention, with only a few references known (Schomburgk 1822; Im Thurn 1883; Koch-Grümberg 1979). This gap was partially addressed by the recent study of the Upuigma-Tepui rockshelter, which highlighted the pre-Historic and cultural significance of the Canaima region landscape (Pérez-Gómez and Swidorowicz 2023, 2025). However, much of the region's rock art remains undocumented. This research seeks to bridge this gap by analysing four newly discovered rock art sites in Canaima National Park. These sites, featuring pictograms and petroglyphs, will be contextualised within the broader rock art traditions of the Guiana Shield, Orinoco Basin and northern Amazonia. A systematic comparison of these traditions will enable an in-depth discussion of similarities and differences, providing insights into the distinct regional variations in rock art styles, motifs and functions. By integrating these new sites with established examples from the surrounding regions, this study will enhance the understanding of cultural continuities, interactions and local adaptations of rock art practices across a large geographic area.

Situated in Bolívar state, Canaima National Park is a region of extraordinary cultural and geological significance, characterised by its iconic tepuis, the an-

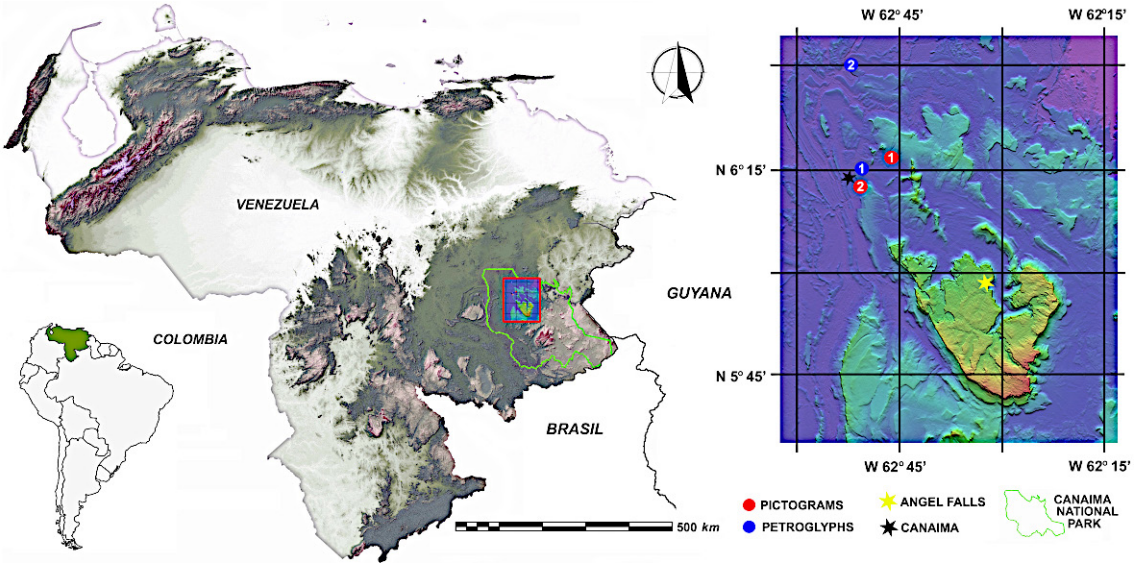

Figure 1. *Shaded relief digital map from NASA's Space Shuttle Radar Topography Mission (SRTM) showing the location of rock art sites within the Canaima National Park and close-up radar image illustrating the location of the rock art sites. Images from USGS (Garrity et al. 2004), TanDEM-X, DLR, with additions.*

cient table-top mountains. The geological uniqueness of this region, coupled with its rich cultural legacy, has attracted global scholarly attention (Briceño and Schubert 1992; Huber 1995; Huber et al. 2001). The Pemón people, long-time inhabitants of the Park, carry forward traditions that reflect a deep connection to their environment (Layrisse and Wilbert 1966; Thomas 1982; Barceló 1982; Gutiérrez 1978, 2002; Lokiñe et al. 2013). This study aims to explore how the newly identified rock art sites in Canaima align with the broader regional framework of pre-Historic rock art, revealing not only the cultural practices of past groups but also their interactions with neighbouring territories. Through this comparison, the study will contribute to broader discussions of cultural continuity and the evolution of rock art across time. While direct evidence linking these specific rock art sites to the Late Pleistocene-Holocene transition is not yet conclusive, the research will provide key insights into the long-term cultural practices of the region and offer a better understanding of the temporal context of these artworks.

Rock art locations

Canaima National Park, covering approximately

Figure 2. *An oblique aerial photograph depicting the Kusari boulder with a newly discovered set of pictograms (Pictogram Site 1). Photo by the authors.*

Figure 3. *Oblique aerial photograph showing the cliff where new pictograms were found at the Cerro Kuyarimpa (Pictogram Site 2, red arrow). The Kurún and the Kusari-Tepuis are in the background. Photo by the authors.*

Figure 4. *Oblique aerial photograph showing the Canaima lagoon and the waterfalls (from left, Hacha, Golondrina and Ucaima). Petroglyph Site 1 is in the centre of the island (red arrow). Photo by the authors.*

30,000 km², is the 6th largest national park in the world (Fig. 1). It is recognised for its unique geological features and its exceptional biodiversity, which contribute to its status as a UNESCO World Heritage Site. The Park is primarily drained by rivers within the Caroní River basin, with some influence from the upper part of the Cuyuní River basin in the northeast. Archaeological evidence indicates that Venezuela has been inhabited by Palaeoindian groups, with human presence dating from approximately 17,000 to 7000 years ago (Rouse and Cruxent 1963; Cruxent and Rouse 1982). However, recent studies propose a more nuanced chronology. The peopling of South America has been the subject of ongoing debate, with some researchers suggesting a rapid post-Last Glacial Maximum expansion of humans across the continent. Early settlers adapted to diverse ecological niches in the Amazon, the Andes and the Orinoco basin (Borrero 2016; Riris et al. 2018). Prates et al. (2020), for example, suggest a first arrival in South America between 15,100 and 16,600 cal BP, refining the timeline for the continent's early human settlement and providing new insights into the speed and patterns of migration. The settlement of the Canaima region in southeastern Venezuela and the broader Guiana region witnessed a succession of indigenous occupations, with the Pemón people being the most recent group to establish themselves in the area by the time Spanish colonisers arrived in the 17th century (Thomas 1982; Rivera-Lombardi 2009).

The identified archaeological sites are situated within the boundaries of Canaima National Park (Fig. 1). The first rock art site, which also includes lithic tools at the surface, is located on a massive boulder nestled in a densely forested region near the Kusari-Tepui, at the headwaters of the Moroco River, one of the tributaries of the Carrao River (Fig. 2). Another set of pictograms was discovered on a cliff wall at the Cerro Kuyarimpa (Fig. 3), near the village of Canaima, where also stone tools were found near the cliffs.

In addition to the pictograms, our research team also made significant findings of two sets of petroglyphs in the region. The first set is found on an island in the Carrao River, positioned between the Golondrina and Hacha Falls, directly opposite the Canaima lagoon (Fig. 4). The second set of petroglyphs was located at the Ariwe-merú rapids in the Caroní River, about 30 km north of Canaima village, carved into a small cliff next to the rapids (Fig. 5)

In addition, we encountered a solitary petroglyph (Petroglyph Site 2A) situated on an island facing the cliff. Preliminary observations indicate that these petroglyphs are at risk from erosion but may also experience occasional submersion during the rainy season.

The weather and climate of the region are strongly influenced by the annual movement of the intertropical convergence zone and trade winds (Galán 1992). This dynamic interplay results in an average annual precipitation of 3.169 m, characterised by a rainy season from May to November and a dry season from December to April (CVG-EDELCA 2003; Rivera-Lombardi 2009).

Figure 5. *Oblique aerial photograph showing the small cliff with the Ariwe-merú petroglyphs (Petroglyph Site 2; red arrow). Photo by the authors.*

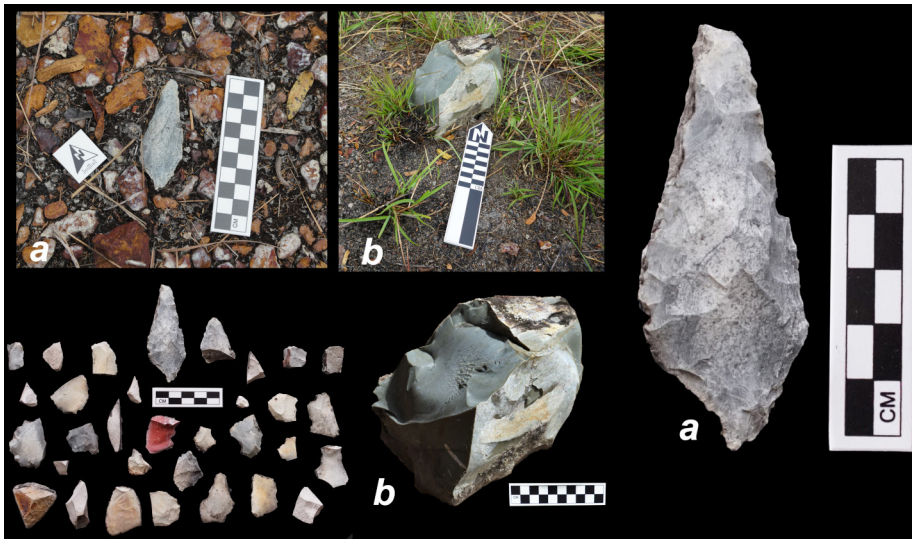

Figure 6. *Lithics from the Savanna area close to the Canaima village. The close association of the core with debitage flakes and arrow points suggests a workshop like that described by Cruxent in 1959. Photo by JMP-G.*

Regional archaeology

The Canaima region in southeastern Venezuela occupies a significant position in the pre-Historic archaeology of northern South America. Walther Dupouy (1956/1957, 1960) documented individual finds of plano-convex scrapers recovered from the Icabarú River and Urequén near the Kukenán River, alongside stemmed projectile points from the Paragua and Chiguao Rivers in the Canaima region. Similarly, stone tools first identified in Canaima by José María Cruxent in 1959 (Rouse and Cruxent 1963) provide critical insights into the ancient societies of the area. Primarily crafted from jasper, these artefacts closely resemble pre-Historic tools discovered throughout Venezuela, Colombia, the Guianas and Brazil (Evans and Meggers 1960; Cruxent 1970, 1971; Boomert 1980; Miller 1987; Williams 2003; Meggers and Miller 2003; Bueno 2010; Roosevelt 2013; Morcote-Ríos et al. 2020; Nami 2016; Iriarte et al. 2022).

Recent discoveries in the region, particularly those associated with rock art sites like the Upuigma-Tepui rockshelter (Pérez-Gómez and Swidorowicz 2023), highlight the significance of lithic evidence in reconstructing the pre-Historic landscapes of the Canaima Complex. Lithic tools recovered in proximity to rock art contexts, such as those in the Canaima savanna (Fig. 6) and the Kusari-Tepui rockshelter (Fig. 7a), exhibit technological and morphological characteristics that parallel assemblages previously documented at the Upuigma-Tepui rockshelter (Fig. 7b). To substantiate these observations, a comparative analysis was conducted on the lithic assemblages from these sites, including metric attributes and raw material characterisation. The stone tools, currently curated at the Universidad Simón Bolívar, were examined using macroscopic methods to assess technological traits. The preliminary results indicate that these artefacts belong to the broader Canaima Complex, aligning with documented lithic industries featuring plano-convex scrapers, bifacial knives and projectile points crafted from jasper, quartz and other fine-grained materials available in the region (Dupouy 1956/1957, 1960; Rouse and Cruxent 1963; Cruxent 1970, 1971).

These lithic tools found at the Upuigma and Kusari-Tepui rockshelters, as well as in the Canaima savanna, support the idea of cultural continuity from earlier traditions, such as the El Jobo industry (Rouse

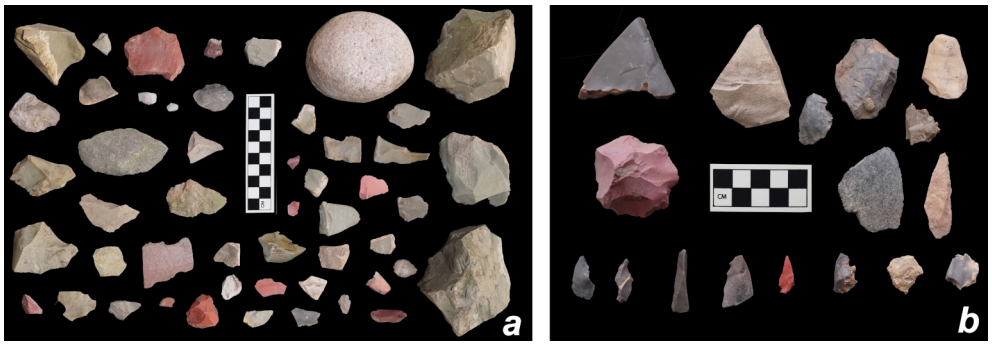

Figure 7. *Lithics from below rock art panels are similar to those from the Canaima savanna (Fig. 6). (a) Kusari site; (b) Upuigma-Tepui rockshelter. Photo by JMP-G.*

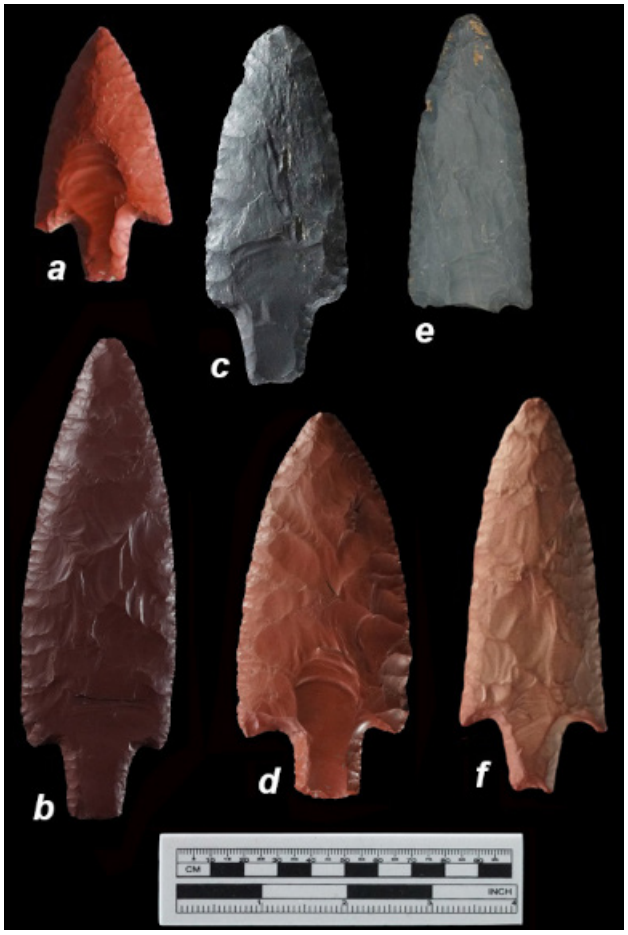

Figure 8. *Stemmed projectile points from the Canaima region similar in shape to Fell points. Points a, b, d, and e are from the Canaima savanna; c, Supamo River; f, Icabarú (note original flake scar resembling fluting). Photo by JMP-G.*

and Cruxent 1963; Cruxent and Rouse 1982). Known for its lanceolate projectile points and scrapers, the El Jobo industry is regarded as the foundation for subsequent technological and cultural developments, including the Las Casitas Complex and probably the Canaima and Sipaliwini Complexes. The persistence of these tool types, accompanied by stylistic adaptations, reflects both environmental responses and cultural innovations as large Pleistocene fauna became extinct (Rouse and Cruxent 1969; Cruxent and Rouse 1982). Furthermore, the association of these tools with the pictogram contexts in the savanna suggests that these landscapes functioned not only as centres of subsistence activity but also held significant symbolic and cultural value.

The Canaima Complex exhibits technological parallels with the Sipaliwini Complex in southern Suriname (Boomert and Kroonenberg 1977; Boomert 1980) and the Rupununi savanna preceramic lithic horizon (Evans and Meggers 1960), which are part of a larger lithic tradition spanning the Guiana Shield (Williams 2003). These traditions demonstrate a sophisticated understanding of material properties, with a preference for core-and-flake tools crafted from jasper and quartz, known for their conchoidal fracture qualities (Boomert 1980). Notably, projectile points similar to Fell points, distinguished by their large size and convex blades, have been found at Canaima (Fig. 8 and presumably dating 11,000–10,000 BP (Evans and Meggers 1960; Denis Stanford, pers. comm. 2010; Nami 2016). The form is considered to be associated with early hunter-gatherer groups across South America, and their presence underscores the region's connections to broader pre-Historic cultural traditions (Evans and Meggers 1960; Roosevelt et al. 1996; Dillehay 2000; Meggers and Miller 2003; Flegenheimer et al. 2013; Williams 2003; Nami 2016). The extensive distribution of Fell-type points and related lithic technologies highlights a network of cultural interaction that links the Canaima region to the Amazon Basin, the Guianas, the Andes and as far as Patagonia. These findings establish Canaima as a key hub for understanding the cultural dynamics of South America during the Pleistocene-Holocene transition.

Materials and methods

Our research began in 2018, building on previous findings in the Upuigma-Tepui rockshelter (Pérez-Gómez and Swidorowicz 2023). Initial efforts included conducting interviews with indigenous communities in the Gran Sabana area, specifically in Canaima, Kamarata and Campo Grande villages. Surprisingly, many residents were unaware of the existence of nearby rock art. However, interviews in Canaima directed us to pictograms near the Kusari-Tepui and petroglyphs in front of the Canaima lagoon. Additionally, the authors inferred the existence of pictograms on a cliff wall near Canaima village, visible from a savanna area where lithic artefacts were found. Another set of petroglyphs at the Ariwe-merú rapids was initially

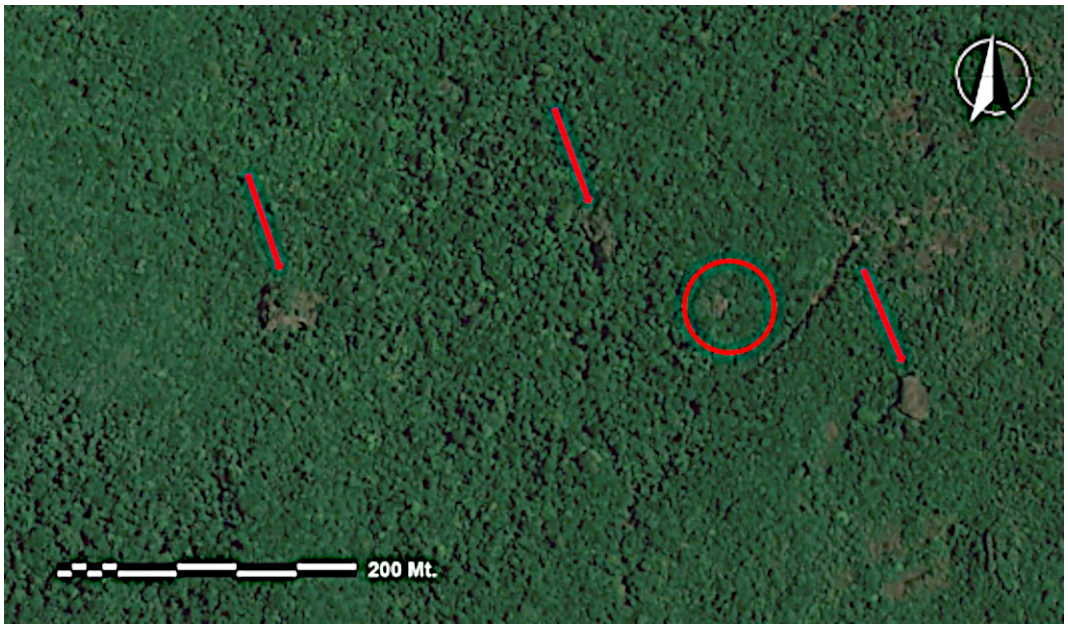

Figure 9. *Set of boulders found on the Landsat satellite image. The Kusari rockshelter is indicated by the red circle. Image from Landsat with additions.*

noted during a 2006 field survey.

Potential rock art sites in densely vegetated areas were identified through the analysis of satellite imagery obtained from Landsat and TanDEM-X sensors (Krieger et al. 2007; DLR-HR 2010). The radar data underwent orthorectification, mosaicking, and geocoding to the WGS84 coordinate system. Strip map data from the TanDEM-X sensor was processed using the 'Ortho Engine' tool in PCI Geomatics, resulting in a 3D elevation model with 12-m pixel resolution and 2-m horizontal accuracy. This analysis allowed us to view the landscape in 3D, helping to detect a cluster of boulders near the Kusari-Tepui, also evidenced in the satellite image (Fig. 9), prompting the development of a logistical plan for accessing these sites.

The fieldwork took place in February 2023. Transportation from Caracas to Canaima was facilitated by a Swearingen Merlin turboprop plane, while aerial surveys and site access were supported by a Bell 206 LongRanger helicopter. In some cases, temporary helipads were established to ensure safe landings near the target locations (Fig. 10). Upon arrival, machetes and GPS units were used to clear paths through a dense forest, prioritising boulders identified via satellite imagery due to their remote and challenging accessibility. High-resolution aerial photography was utilised to document details of sites and their geographical context, alongside photogrammetry to generate detailed 3D models from a series of overlapping 2D images, capturing both the precise geometry and texture of rock surfaces with accuracy (Remondino et al. 2014; Magnani et al. 2020). We performed a preliminary typological study on the lithic tools focusing on the form, style and function of the stone tools (Odell 2003; Andrefsky 2010; Whittaker 2009; Clarkson and O'Connor 2014). Our quantitative analysis included measurements of dimensions, weight and raw material, using an electronic scale and callipers to ensure accuracy.

The use of software such as Agisoft Metashape not only facilitated the creation of highly accurate 3D models but also ensured a comprehensive digital record for detailed analysis and interpretation, enabling precise and high-quality representations of the sites and the rock art surfaces in 3D models (Dell Unto 2014; Urcia et al. 2022). The photogrammetric process involved capturing images using a 35 mm full-frame Sony Alpha a99 DSLR camera with a Sony Vario-Tessar T FE 24-70mm lens, supplemented by a Sony FDR-AX700 Handycam and a Sony FDR-X3000 action camera for additional video documentation. Artificial lighting was provided by a Sony HVL-F43M flash and a Lume Panel Cube Bicolor Mini-LEDs to enhance visibility in low-light conditions. A DJI Avata drone with a 1/1.7-inch CMOS sensor alongside a 206 LongRanger helicopter was used for aerial photography, photogrammetry and survey, providing a broader perspective of site layout.

Scales, including the IFRAO Scale (Bednarik 1991), were used for colour calibration. Digital tracing and stylistic analysis of the rock art were conducted using Photoshop and DStretch tools to enhance faint pictograms that are invisible to the naked eye (Harman 2008, 2015; Palonka and Zynch 2022). These analyses facilitated the identification of key artistic elements and allowed for a preliminary classification of stylistic attributes. For the purpose of this study, 'style' is defined as a set of formal and technical characteristics that include motif morphology, line thickness, pigment saturation, composition and spatial arrangement (Conkey 1980; Whitley 2005). This definition considers both intra-site variability and regional comparisons, enabling a systematic evaluation of potential connections between the rock art of Canaima and other stylis-

Figure 10. *Section of the main panel at the Kusari pictograms (1 m scale). Original photo left; DStretch enhancement right. Image by JMP-G.*

Figure 11. *Detail of the main panel at the Kusari pictograms (10 cm scale) showing a vertical series of geometric figures similar to others in the region. Original photo left; DStretch enhancement right. Photo by JMP-G.*

tic traditions documented in northern South America.

To further refine these stylistic comparisons, we employed a formal analytical framework integrating motif typology, relative size distributions, superimposition patterns and spatial organisation. Comparative assessments were carried out against previously documented stylistic traditions, considering diagnostic elements such as geometric configurations, anthropomorphous and zoomorphic representations, and the use of specific compositional structures (Chippindale and Taçon 2004; Bednarik 2007). Additionally, a Sokkia SET530R3 Total Station and two Garmin Rino 750 GPS devices were used for precise spatial mapping of rock art panels, ensuring that stylistic patterns were examined within their broader topographical and environmental context. Communication between the helicopter and ground teams was maintained using a Vertex VXA-70 handheld radio, which allowed for real-time coordination during documentation efforts.

Results

Our land surveys identified four new rock art sites: two featuring pictograms and two with petroglyphs. The pictogram sites (1–2) are situated 12 km apart, one on a boulder wall surrounded by dense vegetation at the foothills of Kusari-Tepui and the other on a cliff face at Cerro Kuyarimpa, overlooking the Canaima savanna. The petroglyph sites (1–2) are located along the Caroní and Carrao Rivers, with the Carrao being a tributary of the Caroní. The furthest site, the Ariwe-merú petroglyphs, is approximately 30 km from Canaima village (see Fig. 1). Preliminary stylistic analyses suggest that these new rock art sites relate to each other and the Upuigma-Tepui rock art site, located roughly 160 km to the southwest. They also show notable similarities to rock art traditions along the Orinoco basin, southern Colombia, northern Brazil and the western regions of the Guianas, highlighting the potential cultural links across these regions.

Pictogram Site 1

The first group of pictograms (Fig. 10) was discovered on the wall of a sandstone boulder near the slopes of Kusari-Tepui (see Fig. 2). This area, part of the 'Middle Lands', lies between 500 and 1500 m a.s.l., encompassing the slopes of the tepuis (Huber 1995; Huber et al. 2001). The region is characterised by an ombrophilous forest associated with palm trees, covering approximately 50% of Canaima National Park. This premontane evergreen forest is the largest forested area within the park (Hernández 1994; Delgado et al. 2009). Vegetation here thrives on shallow, highly acidic, nutrient-poor soils. Still, it can also be found on hills and diabase mounds, where Pemón communities cultivate crops due to the comparatively nutrient-rich soils in these locations (Delgado et al. 2009). The boulder itself, located at an elevation of 487 m a.s.l., belongs to the Roraima Formation (Huber 1995; Briceño and Schubert 1992), covers an estimated area of 300 m^2 and rises approximately 25–30 m above ground level.

The boulder is surrounded by dense vegetation, some of which has taken root atop its surface. The main

panel, featuring the majority of the pictograms, measures approximately 15 m in length and 8 m in height (Figs. 10–11). This panel is naturally sheltered from rain and provides a spacious area for a group of 10–20 individuals. High-altitude and superimposed rock paintings are evident, alongside mineral accretions partially covering some of the pictograms (Bednarik 2002, 2007). The motifs on this panel bear stylistic similarities to those previously documented at the Upuigma-Tepui rockshelter (Pérez-Gómez and Swidorowicz 2023), the Orinoco basin, southern Colombia, Pedra Pintada and the Arara Vermelha Rockshelter in northern Brazil (Homet 1963; Koch-Grümberg 1979; de Valencia and Sujo Volsky 1987; Michab et al 1998; Greer 2001; Reis et al. 2008; Castaño-Uribe 2019; Morcote-Ríos et al. 2020; Muñoz 2020; Cavallini et al. 2022). A prominent fracture splits the boulder into two distinct sections. This significant crack serves as a nesting site for bats and conceals a completely dark interior space. Within this secluded area, a large pictogram, along with other motifs with a similar style to the main panel, was documented (Fig. 12). A photogrammetric 3D model of the panels was created (see model in Fundacion Manoa 2024a)

Pictogram Site 2

The second set of pictograms was discovered at the base of a cliff at 'Cerro Kuyarimpa,' near Canaima village (see Fig. 3). This site is located at an elevation of approximately 235 m a.s.l. and consists of sandstone from the Roraima Group. Situated 12 km southwest of the Kusari-Tepui rockshelter (Pictogram Site 1), the cliff faces southwest and stands 30–40 m tall. The primary panel is

Figure 12. *The largest image on the Kusari boulder (10 cm scale) is in a dark area inside a crack. The white line on the left from mineral accretions. Photo by JMP-G.*

Figure 13. *Main panel at the Cerro Kuyarimpa cliff pictograms. Photo by Jose Javier Llovera.*

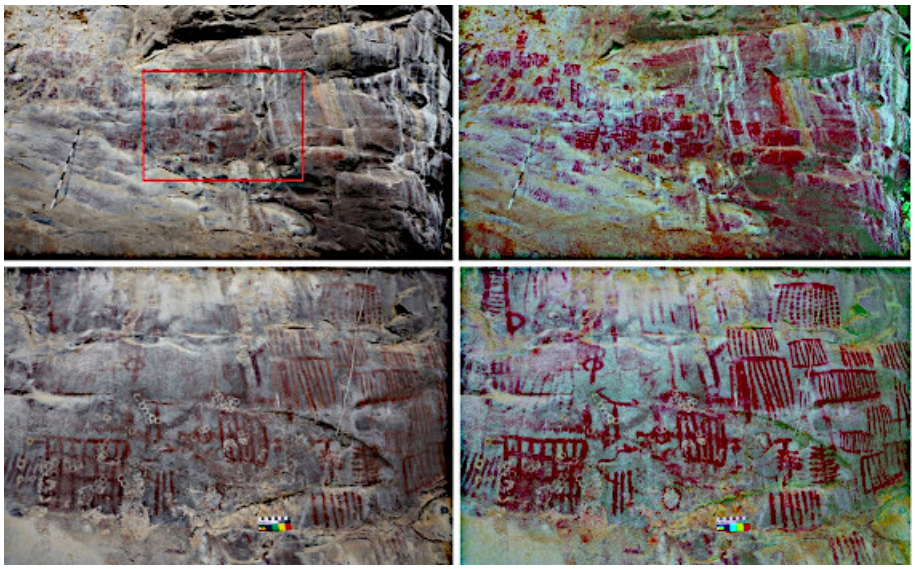

Figure 14. *Main panel at Cerro Kuyarimpa cliff with similarities to Upuigma and Kusari-Tepui imagery, indicating possible cultural connections. Upper photo: general view (1 m scale); lower photos: details (10 cm scale). Original images (left); DStretch enhancements (right). Photos by JMP-G.*

Figure 15. *Upper Carrao River and island with the first set of petroglyphs (red arrow) next to the rapids. Photo by the authors.*

Figure 16. *Exposed bedrock with petroglyphs (red arrow) at the Upper Carrao River Island. Photo by JMP-G.*

Figure 17. *Carrao River island petroglyphs on bedrock (10 cm scale). Photo by JMP-G.*

approximately 4 m above ground level (Fig. 13). The site lies in front of an open savanna area, about 6 km away from the Caroní River. The base of the cliff features a stepped formation characterised by loose rocks, small bushes and grasses. A recent fire cleared much of the vegetation from the savanna below, making access to the pictograms easier.

A significant portion of the pictograms are obscured by a large number of wasp nests, covering nearly half of the panel. Mineral accretions are also evident on the cliff wall, with some layers partially overlaying the pictograms. Preliminary stylistic analysis (Fig. 14) reveals notable similarities between these pictograms and those documented on the boulder at the slopes of Kusari-Tepui, and the Upuigma-Tepui rockshelters (Pérez-Gómez and Swidorowicz 2023). Superpositioning suggests a chronological depth for these motifs. Furthermore, the figures display stylistic elements, such as the scalariforms and 'chain' vertical patterns that align with rock art at archaeological sites as distant as the Tramen cliffs of western Guyana and Pedra Pintada in northern Brazil, indicating potential cultural connections across these regions (Braunholtz 1955; Homet 1958; Attenborough 1958; Dubelaar 1986; Reis et al. 2008).

Petroglyphs Site 1

The first set of petroglyphs is located on a small island in the Carrao River, approximately 1.7 km long and 150 m wide and considerably forested. The petroglyphs are at the western end of the island, near a small savanna and between the Golondrina and Hacha falls, opposite the Canaima lagoon (see Fig.4). They are accessed during the dry season by climbing the rapids from the Canaima lagoon or otherwise by boat through the upper part of the Carrao River (Fig. 15).

Petroglyphs are pounded into granitic bedrock (Huber 1995) by direct percussion (Fig. 16). Seasonal inundation has eroded the durable surface, significantly affecting the images and making some barely discernible. Despite a thorough walking survey, no additional rock art was found in the surrounding area. The production style and images are similar to ones on riverside bedrock at the Buena Vista rapids on the Casiquiare River off the upper Orinoco (de Valencia and Sujo Volsky 1987; Pérez-Gómez and Swidorowicz 2025).

Notable features include repeated triangular signs with a tail and a depiction of a fish with four fins (Fig. 17). To address the challenges posed by weathering, the DStretch tool was used to enhance the surface texture and colour variations, aiding in the detection of additional carvings and improving the visibility of existing figures (Fig. 18).

Petroglyphs Site 2

The second set of petroglyphs is located at the Ariwe-merú rapids along the Caroní River, approximately 30 km north of Canaima village (Fig. 5). These images are situated on a small cliff adjacent to the rapids (Fig. 19) and were first detected by the authors in 2006 during a survey of the river's right bank by boat. Navigation beyond this point is not possible due to a series of rapids. This segment spans over 19 km up to the confluence with the Paragua River at the southernmost extent of the Guri Dam reservoir. At least seven petroglyph sites have previously been reported in the vicinity of this confluence. During the construction of the Guri Dam in 1971, some petroglyphs were rescued, although others were left submerged and inaccessible (Arroyo 1970; Dupouy 1971; de Valencia and Sujo Volsky 1987; Sujo Volsky 2007).

Figure 18. *DStretch analysis of petroglyphs at the Carrao River showing faded motifs. Image by JMP-G.*

Figure 19. *Small cliff where the Ariwe-merú petroglyphs are located. Photo by José Llovera.*

Figure 20. *A 3D model provides clearer information about the location (Fundación Manoa 2024b), showing the arrangement of Ariwe-meruú petroglyph panels (10 cm scales) next to the rapids. From photo by JMP-G.*

Figure 21. *Ariwe-merú panel 1 detail, showing depths of grooves and eroded figure to the right. Photo by JMP-G.*

Figure 22. *Ariwe-merú panel 1, photogrammetry image (Fundacion Manoa 2024b) showing depths of the petroglyphs, the cupules in different parts of the panel, and the eroded figure on the left (1 m scale). From photo by JMP-G.*

The petroglyphs at this site are carefully pecked into the sandstone of the Roraima Formation. Two panels are identified as Panel 1 and Panel 2 (Fig. 20). Some figures are well-preserved and highly visible, while others are heavily weathered and difficult to discern. During the February 2023 field season, both panels were 130 cm above water level and were probably submerged during the rainy season.

Panel 1 contains two primary petroglyphs. The first is an anthropomorph featuring a 'crown', large ears, and what appears to be a nose ornament (Fig. 21). Measuring over 1 m in length and about 1.5 m tall, this motif exhibits lines of varying depth, with some reaching 1.5 cm, while others are more eroded. Cupules (Bednarik 1993, 2008), similar to the 'eyes' of the anthropomorph, are on other parts of the panel. Adjacent to the upper right of the 'human' is a more eroded rayed circle. At the base of the panel are small pounded lines initially interpreted as grinding grooves (Fig. 23). To document the Ariwe-merú petroglyphs, photogrammetric 3D models were created (Fig. 20–22) to preserve a digital record of their intricate details for further study and comparison (Fundación Manoa 2024b).

Notably, certain motifs, possibly abraded grooves, are deliberately organised into a scalariform arrangement, creating a distinctive scalariform pattern (Fig.

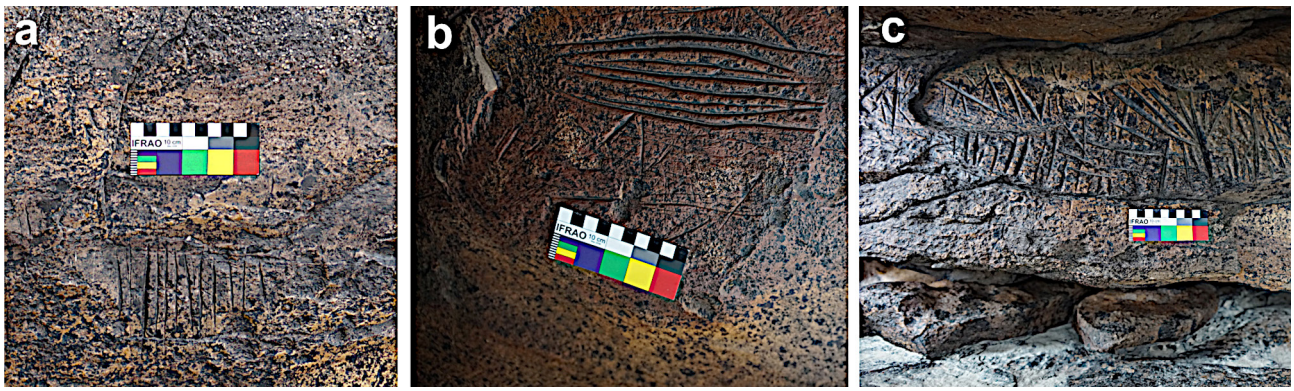

Figure 23. *Ariwe-merú, petroglyphs at the bottom of the panel, interpreted as abraded groves (10 cm scales). Photos by JMP-G.*

23a). This design closely parallels similar patterns identified at the Upuigma and Kusari rockshelters, as well as on the Cerro Kuyarimpa cliff. Such recurring elements point to a broader cultural continuity and suggest a symbolic linkage underlying the region's rock art.

Panel 2 consists of two pounded designs (Fig. 24). One looks like a volcano erupting with circular volutes. This figure is approximately 50 cm tall and 30 cm wide. Interestingly, it is similar to a petroglyph on the Chiguao River, approximately 30 km to the northwest (de Valencia and Sujo Volsky 1987). Next to this is another severely weathered, barely visible petroglyph. Beneath Panel 2 is a small overhang approximately 40 cm tall and 1 m long (see Fig. 20). The ceiling is near the water level. Pounded lines, perhaps also abraded grooves, are on the ceiling and the wall of this crevasse. It is necessary to view some figures lying on the ground (Fig. 23).

Figure 24. *Ariwe-merú, Panel 2 detail with an eroded figure barely visible on the right (10 cm scales). Photo by JMP-G.*

Petroglyph Site 2-A

A small rocky island lies directly in front of the Ariwe-merú petroglyphs. Given its proximity, we considered the possibility that it might also harbour additional petroglyphs. After completing the documentation of the Ariwe-merú site, we used a helicopter to cross the approximately 140 m of rapids separating Petroglyph Site 2 from the island. With no suitable landing spots, the helicopter hovered briefly, allowing us to jump out and unload our equipment. The island, composed entirely of rock geologically similar to the petroglyph site, measures approximately 50 m in length and 40 m in width and is sparsely vegetated. Preliminary observations suggest that the island may connect to the river's left bank during the dry season, though this requires confirmation.

During a challenging walking survey, hindered by the island's irregular rocky surface, we identified a petroglyph depicting what appears to be a large snake or fish (Figs 25–26). This isolated motif is located on an elongated boulder measuring

Figure 25. *The petroglyph near Site 2 on Ariwe-merú Island suggests a depiction of a gigantic snake or fish, as shown in the photograph (1 m scale). Photo by José Llovera.*

Figure 26. *Part of the petroglyph resembling a snake or a fish head, with carvings on it (10 cm scale). Photo by JMP-G.*

Figure 27. *3D reconstruction of the Ariwe-merú petroglyphs, created through photogrammetry by Fundación Manoa (2024c), provides a detailed representation of the island's rock formations and the petroglyph found, including the size and arrangement of it (1 m scale). After photo by JMP-G.*

approximately 300 cm in length and 50 cm in width. The markings are concentrated on opposing ends of the boulder, resembling the head of an animal. Algae and lichen cover portions of the rock, indicating that the figures are submerged during the rainy season. The sign representing the 'eye' of the 'animal' closely resembles motifs at the confluence of the Caroní and Paragua Rivers, about 19 km north (Arroyo 1970; de Valencia and Sujo Volsky 1998). The petroglyphs were photographed using high-resolution digital cameras (Fig. 27), enabling the creation of a detailed photogrammetric 3D model (Fundación Manoa 2024c).

Discussion

The Orinoco Basin in southern Venezuela is celebrated for its abundant rock art, including both pictograms and petroglyphs, which offer profound insights into the rituals and lifeways of its ancient creators. Yet, the Caroní River Basin, despite its proximity, has remained largely overlooked in archaeological research. The Canaima National Park, known globally for its iconic natural landmarks such as Angel Falls and its rich biodiversity, has only recently begun to reveal archaeological discoveries that emphasise its significance in the broader cultural landscape of South America (Dubelaar 1986; de Valencia and Sujo Volsky 1987; Pérez-Gómez and Swidorowicz 2023, 2025).

This study documents four newly discovered rock art sites in the Caroní River Basin, situating them within a regional framework of interconnected artistic traditions. Stylistic analyses of the new sites reveal strong similarities between the new pictograms and those previously documented at the Upuigma-Tepui rockshelter, separated by nearly 160 km (Pérez-Gómez and Swidorowicz 2023, 2025). Similarly, the petroglyphs at the Ariwe-merú rapids share motifs with those salvaged during the construction of the Guri Dam at the Caroní River and with sites in neighbouring regions, such as southern Colombia, northern Brazil and the Guianas (Schomburgk 1822; 1831; Im Thurn 1883; Homet 1963; Arroyo 1970; Dupouy 1971; Koch-Grümberg 1979; de Valencia and Sujo Volsky 1987; Michab et al 1998; Reis et al. 2008; Castaño-Uribe 2019; Morcote-Ríos et al. 2020; Muñoz 2020; Cavallini et al. 2022). These findings suggest the existence of shared artistic traditions and extensive cultural networks, likely spanning the Guiana Shield, the Orinoco and Amazon Basins, and northern South America. The physical placement of these sites within tepui and savanna landscapes further supports the notion of cultural adaptation to similar environmental conditions (Braunholtz 1955; Evans and Meggers 1960; Boomert 1980; Dubelaar 1986; Gassie 2006).

Although lithic debitage and tools found in the same rock art contexts highlight technological continuity, such as the El Jobo tradition into the Canaima Complex, there are currently no links between the sequence of the rock art and the tool traditions. Nonetheless, the lithic findings of the fishtails or Fell points (Evans and Meggers 1960; Cruxent 1970, 1971; Miller 1987; Meggers and Miller 2003; Williams 2003; Bueno 2010; Roosevelt 2013; Nami 2016) highlight the Canaima region's pre-Historic and cultural complexity and its role as a hub of interaction and innovation during the Late Pleistocene-Holocene transition. The absence of precise dating prevents a conclusive linkage of the lithic with the rock art traditions, though taphonomic observations suggest significant antiquity, with the rock art showing severe weathering. Comparisons with dated rock art in the Amazon and Guiana Shield suggest that these sites could belong to the Holocene period (Evans and Meggers 1960; Roosevelt et al. 1996; Reis et al. 2008; Iriarte et al. 2022). Further studies involving advanced dating techniques such as radiocarbon dating in oxalate microlayers, uranium-series (U-Th), optically stimulated luminescence (OSL) and microerosion dating are essential to clarify the chronological and cultural relationships between these elements.

The stylistic parallels between these rock art sites and others across northern South America point to a cohesive symbolic language that transcended individual communities, fostering cultural continuity across vast distances. Recurring motifs, such as the aligned dots, scalariforms and the 'net' or 'chain' patterns, indicate a shared symbolic framework, emphasising

the cultural connection and ritual significance of these sites. Advanced methodologies, including satellite imagery, photogrammetry and DStretch, have proven crucial in documenting these remote and weathered sites, ensuring their preservation and offering new insights into the symbolic and cultural dimensions of these pre-Historic societies and their landscapes. This study firmly establishes the Canaima region and its rock art tradition as a pivotal node within South America's cultural landscape, blending its natural and cultural heritage into a unified narrative of pre-Historic human activity and interaction.

Conclusion

The discovery of new rock art sites in the upper Caroní River Basin significantly enhances our understanding of the pre-Historic cultural landscape of Canaima National Park and the broader region. These findings emphasize the region's role as a centre of cultural interaction, continuity and innovation, perhaps during the Late Pleistocene-Holocene transition. Stylistic similarities with rock art from southern Colombia, the Guianas, northern Brazil and the Orinoco and Amazon Basins point to extensive cultural networks and shared artistic traditions, illustrating the complexity and adaptability of ancient Amerindian societies.

The presence of lithic tools in close proximity to rock art sites suggests that these locations may have served as multifunctional spaces, integrating subsistence activities with symbolic or ritualistic practices. However, the lack of chronological data limits our ability to establish a definitive temporal relationship between these elements. While the spatial association between lithic artefacts and rock art is compelling, additional evidence is required to determine whether they were produced contemporaneously or represent distinct occupational phases at these sites.

To address these critical gaps, future research should prioritise the application of advanced dating techniques and an expanded scope of field investigations. Methods such as radiocarbon dating of organic residues associated with artefacts or optically stimulated luminescence (OSL) dating of sediments could provide a more robust chronological framework. Additionally, systematic stylistic analyses of rock art, integrated with stratigraphic and contextual studies of the surrounding deposits, may yield deeper insights into the cultural and temporal dimensions of these sites. However, ultimately, only a 'direct dating' methodology can provide credible dating of rock art. A multidisciplinary approach will be essential for clarifying the complex interactions between human activities and artistic expressions in the Canaima region, as well as for situating them within broader cultural networks across northern South America.

Beyond their archaeological significance, these sites offer valuable opportunities for cultural tourism and heritage promotion. Their proximity to renowned landmarks like Angel Falls positions them as potential drivers of sustainable tourism initiatives that benefit local Pemón communities. These efforts can foster pride and ownership while showcasing Venezuela's rich archaeological heritage on a global stage. However, the deteriorating condition of many sites underscores the urgent need for preservation, advocacy and possible inclusion in the UNESCO World Heritage List to ensure long-term protection.

Collaboration among archaeologists, government agencies, local communities, and international organisations is essential to preserve and promote these cultural treasures. By raising public awareness and engaging stakeholders, the legacy of these rock art sites in the Canaima National Park can be secured to inspire and educate future generations. These efforts will not only protect their cultural value but also deepen our appreciation of South America's pre-Historic cultural landscape.

Acknowledgments

We are deeply grateful to the Cultural Department of Simón Bolívar University, and especially to Professor Jorge Stephany Ruiz, the university's rector, and the university's Directorate of Culture for their trust and support. Our sincere thanks also go to the Venezuelan Institute of Cultural Heritage (IPC). We wish to express our immense gratitude to the Pemón communities of Kamarakoto, Arekuna and Taurepán in the Gran Sabana region for their support. We are particularly thankful to the esteemed legitimate authorities of the Pemón people, with special recognition to main Chief Néstor Ramírez, as well as to the leaders and members of these communities. Their support and leadership have been pivotal in advancing our initial studies within Canaima National Park. We also extend our heartfelt thanks to Canaima Captain Domingo Castro, José García 'Muerte', and Lino Figueroa and Antonio Hitcher for their invaluable assistance and cultural insights. Additionally, we are deeply appreciative of the critical support provided by helicopter captains Freddy Irigoyen and Wilfren Cortez, and Luis Montes of INPARQUES in Canaima, who were instrumental during our fieldwork. Our thanks also go to Freddy Jiménez, Antonio Hitcher, Luisa Cabrera, Miguel Cabrera, Mrs Sagrario Pérez-Soto, Inés Virginia Jiménez, Gabriela Truffino, Mili Ochoa and Milenys Mieres for their kind support in the Canaima area. We offer special thanks to the Pemón communities of Canaima, Campo Grande, Kamarata and Yunek, with particular acknowledgment of Arturo Berti, Julio Moreno, Daniel Fernández and Manuel Fernández García for their cooperation. We also thank the six anonymous *RAR* peer reviewers for their rigorous reviews. Finally, we wish to thank Mr Alejandro Chumaceiro José Javier Llovera and Richard Carpio for their invaluable technical contributions.

Funding statement

This research was funded by Fundación Manoa, a non-profit organisation (*https://fundacionmanoa.org/*).

Data availability statement

Artefacts analysed in this research are curated by the Universidad Simón Bolívar in Caracas, with additional items held in private collections in Canaima. Data supporting the findings are available upon request to the corresponding

author, subject to review by relevant curators due to the cultural and archaeological sensitivity of the artefacts and data.

Competing interests statement

The authors declare no competing interests related to this research. All data collection, analysis and interpretations were conducted independently, without any influence from funding organisations or third parties. The authors have no financial, personal or professional affiliations that could be perceived as influencing the outcomes of this study.

José Miguel Pérez–Gómez[1,*] and Roger Swidorowicz[2]
[1]Direccion de Cultura, Universidad Simón Bolívar, Caracas, Venezuela
[2] Fundación Manoa, FL, U.S.A.
* *fundacionmanoa@gmail.com*

REFERENCES

Andrefsky, W. 2010. *Lithics: macroscopic approaches to analysis*. Cambridge University Press, Cambridge.

Arroyo, M. 1970. *Petroglifos del Guri*. Catálogo Nº 11, junio. Museo de Bellas Artes, Caracas, Cromotip.

Attenborough, D. 1958. *Zoo quest to Guiana*. The Reprint Society, London.

Barceló, S. 1982. *Pemonton Wanamari*. Monte Ávila Editores C.A., Caracas.

Bednarik, R. G. 1991. The IFRAO Standard Scale. *Rock Art Research* 8(1): 78–79.

Bednarik, R. G. 1993. About cupules. *Rock Art Research* 10(2): 138–139.

Bednarik, R. G. 2002. The dating of rock art: a critique. *Journal of Archaeological Science* 29(11): 1213–1233.

Bednarik, R. G. 2007. *Rock art science: the scientific study of palaeoart*. Aryan Books International, New Delhi.

Bednarik, R. G. 2008. Cupules. *Rock Art Research* 25(1): 61–100.

Boomert, A. 1980. The Sipaliwini archeological complex of Surinam: a summary. *New West Indian Guide /Nieuwe West-Indische Gids* 54(1): 94–107.

Boomert A. and S. Kroonenberg 1977. Manufacture and trade of stone artifacts in prehistoric Surinam. In B. L. van Beek, R. W. Brandt and W. Groenman (eds), *Ex Horreo, IPP 1951–1976*. van Waateringe Publisher, University of Amsterdam, Albert Egges van Giffen Instituut voor Prae- en Protohistorie.

Borrero, L. A. 2016. Ambiguity and debates on the early peopling of South America. *PaleoAmerica* 2: 11–21.

Braunholtz, H. J. 1955. *Rock paintings in British Guiana*. Separata Anais Do XXXI Internacional de Americanistas, Sao Paulo.

Briceño, H. and C. Schubert 1992. Geología. In O. Hubber (ed.), *Chimantá, escudo de Guayana, Venezuela: un ensayo ecológico tepuyano*, pp. 53–60. Oscar Todmann Editores C.A., Caracas.

Bueno, L. 2010. Beyond typology: looking for processes and diversity in the study of lithic technology in the Brazilian Amazon. *Journal of World Prehistory* 23(3): 121–143.

Castaño-Uribe, C. 2019. *Chiribiquete: la maloka cósmica de los hombres jaguar*. Artes Graficas Palermo, Bogotá.

Cavallini, M. S., B. M. Valle, F. Stampanoni, P. Moraes, M. Amara, C. Palheta, E. Brito de Castro, R. Andrade, M. da Silva Santos, J. Wai Wai, L. Mendoça and M. Villareal 2022. The Arara Vermelha Rock Shelter, Roraima, Brazil: perspectives concerning Amazonian sheltered petroglyphs. In M. Carrero-Pazos, R. Döhl, J. Van Rensburg, P. Medici and A. Vásquez-Martínez (eds), *Rock art research in the digital era: case studies from the 20th International Rock Art Congress IFRAO 2018, Valcamónica*, pp. 7–23. BAR Publishing, Oxford.

Chippindale, C. and P. Taçon (eds) 2004. *The archaeology of rock art*. Cambridge University Press, Cambridge.

Clarkson, C. and S. O'Connor 2014. *An introduction to stone artifact analysis*. In J. Balme and A. Patterson (eds.), *Archaeology in practice: a student guide to archaeological analyses*, pp. 151–206. Wiley Blackwell, Chichester.

Conkey, M. W. 1980. The identification of prehistoric hunter-gatherer aggregation sites: the case of Altamira. *Current Anthropology* 21(5): 609–630.

Cruxent, J. M. 1950. The archaeology of Cotúa Island, Amazonas Territory, Venezuela. *American Antiquity*16: 10–16.

Cruxent, J. M. 1955. *Petroglifos Venezolanos*. Revista 'A' Hombre y Expresión 2.

Cruxent, J. M. 1970. *Projectile points with Pleistocene mammals in Venezuela*. *Antiquity* 44: 223–225.

Cruxent, J. M. 1971. Apuntes sobre arqueología Venezolana. In M. Arroyo, J. M. Cruxent and S. Perez 1971. *Arte Prehispánico de Venezuela,* pp. 19–59. Fundación Eugenio Mendoza, Caracas.

Cruxent, J. M. and I. Rouse 1982. *Arqueología cronológica de Venezuela*, Vol. 1–2. Gráficas Armitano C.A, Caracas.

CVG-EDELCA 2003. *Gerencia de Gestión Ambiental, Unidad de Sistemas de Información Ambiental. Ciudad Guayana.*

Delgado, L., H. Castellanos and M. Rodríguez 2009. Vegetación del Parque Nacional Canaima. In J. C. Señaris, D. Lew and C. Lasso (eds). 2009. *Biodiversidad del Parque Nacional Canaima: bases técnicas para la conservación de la Guayana venezolana*. Fundación La Salle de Ciencias Naturales and The Nature Conservancy, Caracas.

Dell Unto, N. 2014. The use of 3D models for intra-site investigation in archaeology. In F. Remondino and E. Campana (eds), *3D recording and modelling in archaeology and cultural heritage: theory and best practices*, pp. 151–158. BAR International Series, Oxford.

de Valencia R. and J. Sujo Volsky 1987. *El diseño de los petroglifos Venezolanos*. Fundación Pampero, Caracas.

Dillehay, T. 2000. *The settlement of the Americas: a new prehistory*. Basic Books, New York.

DLR-HR 2010. *TanDEM-X Ground Segment. TD-PD-PL-0069 TanDEM-X Science Plan*. Microwaves and Radar Institute, Oberpfaffenhofen.

Dubelaar, C. 1986. *The petroglyphs in the Guianas and adjacent areas of Brazil and Venezuela; with a comprehensive bibliography of South American and Antillean petroglyphs*. The Institute of Archaeology, The University of California, Los Angeles.

Dupouy, W. 1956/1957. Dos piezas de tipo Paleolítico de la Gran Sabana, Venezuela. *Boletín del Museo de Ciencias Naturales* 2/3: 95–102.

Dupouy, W. 1960. *Tres puntas líticas de tipo Paleo-Indio de la Paragua*, Estado Bolívar, Venezuela. *Boletín del Museo de Ciencias Naturales* 5/6 : 7–14.

Dupouy, W. 1971. *Los petroglifos de Guri*. Revista El Farol, XXII, Caracas.

Evans, C. and Meggers, B. J. 1960. Archaeological investigations in British Guiana. *Smithsonian Institution, Bureau of American Ethnology Bulletin* 2: 77.

Flegenheimer, N., L. Miotti and N. Mazzia 2013. Rethinking early objects and landscape in the Southern Cone: fishtail point concentrations in the Pampas and northern Patagonia. In K. Graf, C. Ketron and M. Waters (eds), *Paleo-*

american Odyssey Conference companion book, pp. 359–376. Texas A. and M. University Press, College Station.

Fundaciòn Manoa 2024a. 3D model of the Kusari-Tepui rock-shelter site 1. *https://sketchfab.com/3d-models/kusari-tepui-site-1-perez-gomez-swidorowicz-27af466483954ee9934f4eb-32b45eec3*

Fundaciòn Manoa 2024b. 3D model of the Ariwe-meru Petroglyph site 2. *https://sketchfab.com/3d-models/ariwe-meru-site-2-perez-gomez-swidorowicz-8cc70dd0405040fbbb7e-94defdd8e57c*

Fundaciòn Manoa 2024c. 3D model of the Ariwe-meru Petroglyph site 2A. *https://sketchfab.com/3d-models/ariwe-meru-2a-perez-gomez-swidorowicz-4ba6206916ee4adc-9cf5d47aaf23dcad* (accessed 12/02/2024).

Galán, C. 1992. El Clima. In O. Hubber (ed.), *Chimantá, escudo de Guayana, Venezuela: un ensayo ecologico tepuyano*, pp. 37–52. Oscar Todmann Editores C.A, Caracas.

Garrity, C. P. Hackley and F. Urbani 2004. *Digital shaded-relief map of Venezuela. https://pubs.usgs.gov/of/2004/1322/* (accessed 2/12/2024).

Gassie, E. 2006. ICOMOS Caribbean rock art information request form submission for French Guyana. *In Rock art of Latin America and the Caribbean. ICOMOS World Heritage Convention,* pp. 70–74. https://openarchive.icomos.org/id/eprint/2652/1/Rock_Art_of_Latin_America_and_the_Caribbean.pdf (accessed 6/11/2025).

Gassòn, R. 2002. Orinoquia: the archaeology of the Orinoco Basin. *Journal of World Prehistory* 16(3): 237–311.

González, N. 1980. *Mitología Guarequena*. Monte Ávila Editores, Caracas.

Greer, J. 1995. Rock art chronology in the Orinoco Basin of southwestern Venezuela. Ph.D. thesis, University of Missouri – Columbia, UMI Dissertation Services, Ann Arbor, Michigan.

Greer, J. 2001. *Lowland South America*. In D. Whitley (ed.), *Handbook of rock art research*, pp. 665–706. Altamira Press, Walnut Creek.

Gutiérrez, F. M. 1978. *Los Pemón, su h**ábitat**, su cultura.* Centro de Lenguas Indígenas, Universidad Católica Andrés Bello. Editorial Arte, Caracas.

Gutiérrez, F. M. 2002. *Cultura Pemón: mitología Pemón bilingüe, guía mítica de la Gran Sabana.* Hermanos Menores Capuchinos. Universidad Católica Andrés Bello. Editorial Texto C.A, Caracas.

Harman, J. 2008. *Using decorrelation stretch to enhance rock art images*. DStretch. Available at: *www.dstretch.com/AlgorithmDescription.huml* (accessed 12 April 2009). Paper originally presented at American Rock Art Research Association Annual Meeting, 2005.

Harman, J. 2015. *Using DStretch for rock art recording*. *International Newsletter of Rock Art* 72: 24–30.

Hernández, L. 1994. *Bosques*. In N. Dezzeo (ed.), *Ecología de la altiplanicie de la Gran Sabana (Guayana Venezolana)*, pp. 80–94. Scientia Guainae.

Homet, M. 1963. *The sons of the Sun*. Neville Spearman, London.

Huber, O. 1995. Geographical and physical features. In J. Steyermark, P. Berry and B. Holst (eds). *Flora of the Venezuelan Guayana*, Vol. 1: Introduction, pp. 1–61. Missouri Botanical Garden, St Louis.

Huber, O., G. Febres and H. Arnal (eds) 2001. *Ecological guide to the Gran Sabana*. The Nature Conservancy, Caracas.

Im Thurn, E. 1883. *Among the Indians of Guiana: being sketches chiefly anthropologic from the interior of British Guiana*. Kegan Paul, Trench and Co, London.

Iriarte, J., M. Ziegler, A. Outram, M. Robinson, P. Roberts, Aceituno, F. Morcote-Ríos and T. Keesey 2022. *Ice Age megafauna rock art in the Colombian Amazon*. *Philosophical Transactions B* 377(1849). DOI: 10.1098/rstb.2020.0496.

Krieger, G., A. Moreira, H. Fiedler, I. Hajnsek, M. Werner, M. Younis and M. Zink 2007. TanDEM-X: a satellite formation for high-resolution SAR interferometry. *IEEE Transactions on Geoscience and Remote Sensing* 45(11): 3317–3341.

Koch-Grümberg T. 1979. *Del Roraima al Orinoco*. Ediciones del Banco Central de Venezuela, Caracas.

Layrisse, M. and J. Wilbert 1966. *Indian societies of Venezuela: their blood group types*. Instituto Caribe de Antropología y Sociología Fundación La Salle de Ciencias Naturales. Editorial Sucre, Caracas.

Lokiñe, R., A. Leal, R. Gassòn and B. Bilbao 2013. Ecología histórica de la Gran Sabana (Edo. Bolívar) entre los Siglos XVIII y XX. In S. Rostain (ed.), *Antes de Orellana: Actas 3r Encuentro de Arqueología Amazónica*, pp. 113–122. Instituto Francés de Estudios Andinos, Lima.

Magnani, M., M. Douglas, W. Schroder, J. Reeves and D. Braun 2020. *The digital revolution to come: photogrammetry in archaeological practice*. *American Antiquity* 85(4): 737–760.

Mazière, M. 1997. *L'art rupestre Amérindien de Guyane*. In *L'archéologie en Guyane*, pp. 99–130. Edition APPAAG, Association pour la Protection du Patrimoine Archéologique et Architectural de la Guyane.

Meggers, B. and E. Miller 2003. Hunter-gatherers in Amazonia during the Pleistocene Holocene transition. In J. Mercader (ed.), *Under the canopy: the archaeology of tropical rain forests*, pp. 291–316. Rutgers University Press, Princeton.

Michab, M., J. Feathers, L. Joron, N. Mercier, M. Selo and H. Valladas 1998. Luminescence dates for the Paleoindian site of Pedra Pintada, Brazil. *Quaternary Geochronology* 17: 1041–1046.

Miller, E. 1987. Pesquisas arqueológicas Paleoindigenas no Brasil occidental. In B. Meggers and L. Nunes (eds), *Investigaciones Paleoindias al sur de la línea ecuatorial*. Estudios Atacameños No. 8, Taraxacum, Washington D.C. https://pdfs.semanticscholar.org/4caa/4e53724bf7000e5addb35090b3b07ccd6257.pdf (accessed 11/6/2025).

Morcote-Ríos, G., F. J. Aceituno, J. Iriarte, M. Robinson and J. L. Chaparro-Cárdenas 2020. Colonisation and early peopling of the Colombian Amazon during the Late Pleistocene and the Early Holocene: New evidence from La Serranía La Lindosa'. *Quaternary International* 578: 5–19.

Muñoz, G. 2020. Estética Amazónica y discusiones contemporáneas: el arte rupestre de la Serranía de La Lindosa, Guaviare – Colombia. Grupo de investigación. In *Arqueología y arte rupestre*, pp. 18–39. GIPRI, Colombia.

Nami, H. 2016. Paleo American finds from Venezuela: evidence to discuss the spread of Fell points and the peopling of northern South America. *Cuadernos do Ceom Estudos Arqueológicos Regionais* 29(45): 212–219.

Odell, G. 2003. *Lithic analysis*. Springer, New York.

Padilla, S. 1956. *Pictografías indígenas de Venezuela*. Grabados Nacionales C.A., Caracas.

Palonka, R. and B. Zych 2022. Digital documentation of ancestral Pueblo and Ute rock art in the canyons of ancient National Monument, Colorado, USA. In M. Carrero-Pazos, R. Döhl, J. Van Rensburg, P. Medici and A. Vásquez-Martínez (eds), *Rock art research in the*

digital era: case studies from the 20th International Rock Art Congress IFRAO 2018, Valcamónica, pp. 63–79.. BAR Publishing, Oxford.

Pérez-Gómez, J. M. and R. Swidorowicz 2023. New rock art site in the Arauák River valley, southeastern Venezuela. *Rock Art Research* 40(2): 131–144.

Pérez-Gómez, J. M. and R. Swidorowicz 2025. *Between the rock and the sky: rock art of Canaima National Park, Venezuela.* Fundación Manoa (ed.), Vol. I, Bubok Publishing SL, Madrid.

Prates, L., G. Politis and I. Pérez 2020. Rapid radiation of humans in South America after the last glacial maximum: a radiocarbon based study. *PLoS ONE* 15(7): e0236023. *https://doi.org/10.1371/journal.pone.0236023*

Reis, N., C. Schobbenhaus and F. Costa 2008. Pedra Pintada, RR - Ícone do Lago Parime. In M. Winge, C. Schobbenhaus, C. Souza, A. Fernandes, M. Berbert-Born and E. Queiroz (eds), *Sítios Geológicos e Paleontológicos do* Brasil, *atualmente https://sigep.eco.br/sitio012/sitio012.pdf* (accessed 6-11-2024).

Remondino, F., S. Del Pizzo, T. Kersten and S. Troisi 2014. Low-cost and open-source solutions for automated image orientation: a critical overview. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* 41: 149–156.

Riris, P., J. Oliver and N. Mendieta 2018. Missing the point: re-evaluating the earliest lithic technology in the middle Orinoco. *Royal Society Open Science* 5: 180690. *http://dx.doi.org/10.1098/rsos.180690*.

Riris, P. and J. Oliver 2019. Patterns of style, diversity, and similarity in middle Orinoco rock art assemblages. *Arts assemblages*, Vol 8, pp. 48–66. Institute of Archaeology, University College London.

Riris, P., J. R. Oliver and N. Lozada 2024. Monumental snake engravings of the Orinoco River. *Antiquity* 98(399): 724–742.

Rivera-Lombardi, R. 2009. Aspectos geográficos y físicos del Parque Nacional Canaima. In J. C. Señaris, D. Lew and C. Lasso (eds), *Biodiversidad del Parque Nacional Canaima: bases técnicas para la conservación de la Guayana venezolana*. Fundación La Salle de Ciencias Naturales y The Nature Conservancy, Caracas.

Roosevelt, A. 2013. The Amazon and the Anthropocene: 13,000 years of human influence in a tropical rainforest. *Anthropocene* 4: 69–87.

Roosevelt, A., M. Lima Da Costa, C. Lopes-Machado, M. Michab, N. Mercier, H. Valladas, J. Feathers, W. Barbnett, M. Imazio Da Silveira, A. Henderson, G. Solva, B. Chernoff, D. Reese, J. Holman, N. Toth and K. Schick 1996. Paleoindian cave dwellers in the Amazon: the peopling of the Americas. *Science* 272(5260): 373–384.

Rouse, I. and J. M. Cruxent 1963. *Venezuelan archaeology*. Yale University Press, New Haven.

Scaramelli, F. 1992. Las pinturas rupestres en: el Parguaza: mito y representación. MA thesis, Universidad Central de Venezuela, Caracas.

Schomburgk, R. 1822. *Travels in British Guiana* 1840–1844 (Vols I–II). Transl. by W. E. Roth (ed.). Daily Chronicle Ltd, Georgetown. Original available 2024 at: *https://ufdc.ufl.edu/UF00080954/00001/images*; and *https://ufdc.ufl.edu/UF00080954/00001/thumbs*.

Schomburgk, R. 1831. *Travels in Guiana and on the Orinoco during the years 1835–1839*. According to his reports and communications to the Geographical Society of London. Transl. by W. E. Roth. (ed.). Argosy, Georgetown.

Sujo Volsky, J. 2007. *El estudio del arte rupestre en Venezuela*. Universidad Católica Andrés Bello. Editorial Texto, Caracas.

Tarble, K. and F. Scaramelli 2010. El arte rupestre y su contexto arqueológico en el Orinoco medio, Venezuela. In E. Pereira and V. Guapindaía (eds), *Arqueología Amazònica*, pp. 285–315. Museo Paraense Emilio Goeldi, Belém.

Thomas, D. 1982. *Order without government. The society of the Pemón Indians of Venezuela*. Illinois Studies in Anthropology 13, University of Illinois Press, Urbana.

Urcia, A., A, Bucato, C. Gatto and A. Curci 2022. The site of Nag el-Hamdulab in 360°: an alternative way to experience a story from the past. In Carrero et al (eds), *Rock art research in the digital era: case studies from the 20th International Rock Art Congress IFRAO 2018, Valcamónica*, pp. 135–148. BAR Publishing, Oxford.

Whitley, D. 2005. *Introduction to rock art research*. Left Coast Press, Walnut Creek, CA.

Whittaker, J. 2009. *Flintknapping: making and understanding stone tools*. University of Texas Press, Austin.

Williams, D. 2003. *Prehistoric Guiana*. Ian Randle Publishers, Kingston.

RAR 43-1483