

ORIGINAL ARTICLE

Comparative analysis between Inkilltambo in Cusco, Peru, and the Longmen Caves in Henan, China

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Abstract

Rock-cut architecture constitutes key cultural infrastructure in many ancient societies, shaping ritual, spatial, and symbolic practices through direct engagement with the geological substrate. This study addresses the relationship between rock-cut architecture and sacred landscapes through a comparative analysis of Inkilltambo in Cusco, Peru, and the Longmen Caves in Henan, China, with the aim of identifying construction, spatial, and functional principles that reflect adaptation to lithology, the organization of ritual spaces, and the relationship to the surrounding topography. This research employed a qualitative approach, utilizing manual planimetric surveying and systematic photographic recording at Inkilltambo, complemented by published information on the Longmen Caves, and operationalized analytical dimensions such as lithology (rock), ritual space, topography, landscape, water channels, public space, spatiality, and functionality. The results reveal similarities in the use of rock as support and boundary; spatial hierarchy; control of ritual routes; and the connection between symbolic and practical functions, as well as divergences in scale, the openness of public spaces, and the relationship to the external landscape. The findings highlight that these patterns reflect adaptive cultural strategies in diverse rock-cut contexts and confirm the relevance of manual documentation methodologies for transregional comparative analyses, offering criteria for interpreting the spatiality, functionality, and symbolism of rock-cut architecture at different latitudes.

Keywords: Rock-cut architecture; Sacred landscape; Ritual spaces; Topography analysis; Comparative study

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1. Introduction

Rock art architecture represents one of the most complex and significant manifestations of the dialogue between humans and their territory, as it not only responds to utilitarian criteria of habitability or defense but also articulates ritual, symbolic, and landscape dimensions that express particular worldviews in different geographical and cultural

contexts. Within this framework, the comparative study of the archaeological site of Inkilltambo in Cusco, Peru, and the Longmen Caves in Henan, China, allows for a critical approach to understanding how two architectural traditions distant in space and time resort to the use of rock as a material support and topography as both a constraint and a design opportunity, generating sacred landscapes of high cultural value whose understanding demands rigorous architectural analysis supported by planimetric surveys and visual field records.

The archaeological site of Inkilltambo is a compact Inca ceremonial-agricultural complex developed primarily during the Late Horizon (15th–16th centuries) and functioned as a local node within the greater ritual-agricultural landscape of Cusco, integrating terraces, carved rock outcrops, water channels, and small ritual enclosures (Cultura Cusco, 2017; National Institute of Culture-Cusco, 2007). Archaeological evidence, including surface finds such as Killke and Inka ceramic assemblages, carved niches, and retaining masonry, indicates sustained occupation and multifunctional use that combined irrigation, production, and ceremonial practice (Callapiña Huamán & Oroz Marquéz, 2014). For the purposes of comparative analysis, this study describes Inkilltambo using the same units of information applied to Longmen—namely: (i) geological substrate and fracture pattern; (ii) construction technique (additive masonry vs. rock modification); (iii) ritual-architectural inventory (e.g., niches, platforms, altars); (iv) topographic metrics (e.g., slope, relative height, visibility); and (v) hydraulic features (e.g., channel length, gradient, connectivity)—which enables a symmetric, unit-by-unit comparison between the Late Horizon Inca site and the historical phases of Longmen documented in the literature (Harvard University, 2017; Wu, 2012).

Inkilltambo is configured as an Inca center of an agricultural and ritual nature linked to the hydraulic system of the Cusco valley, which utilizes rock outcrops shaped with niches, terraces, and canals that articulate ceremonial spaces, reinforcing the sacredness of the natural environment and enabling the integration of productive and cultural practices. Numerous studies suggest that this site constitutes an extension of the logic of the sanctuaries linked to the ceque system, which symbolically organized the Cusco territory in relation to the huacas and water flows (Bauer, 1998; Dean, 2010), indicating that rock architecture was not an isolated phenomenon but part of a complex ideological framework.

Meanwhile, the Longmen Caves represent one of the most important Buddhist complexes in China, carved into limestone cliffs along the Yi River and developed mainly between the 5th and 10th centuries under the Wei

(386–534) and Tang (618–907) dynasties. This complex articulates more than 2,000 grottoes with thousands of statues and reliefs, transforming the rock into a liturgical and narrative support, where the excavated space becomes a container of sacredness and political legitimacy linked to imperial patronage (Li & Zhang, 2017; Luo, 2021; Wu, 2012). The monumentality of the Longmen Caves lies in the combination of natural landscape and human work, reflecting a constant dialogue between topography and devotion.

The central research problem is reframed from a mere lack of bilateral architectural comparisons to a theoretical inquiry into how human communities transform natural rock into a mediating architectural language that negotiates culture and territory. Building on classic comparative anthropology (such as Frazer [1915]’s *The Golden Bough*) and recent landscape studies (Flores, 2020; Guo, 2019), the study examines how the material properties of rock and the cultural regimes that ascribe meaning to them co-produce sacred landscapes, and to what extent divergent social institutions (e.g., Inca ritual-agricultural collectives vs. imperial Buddhist patronage) shape analogous architectural responses to lithology and topography. This reframing positions the case-pair (Inkilltambo Late Horizon; Longmen historical phases of Wei-Tang dynasties) as an opportunity to interrogate universal and variable mechanisms of nature-culture mediation, rather than to catalogue formal similarities alone.

Previous studies on rock architecture in the Peruvian context have highlighted the importance of hydraulic integration in Inca sanctuaries, where water functions as the organizing principle of the constructed space. For example, Protzen (1993) has demonstrated how the Incas developed architecture that responded to the geology of the environment and transformed rock into a support for ritual and productive functions. Likewise, Gutiérrez (2016) & Zegarra (2021) have demonstrated the articulation between agricultural terraces and lithic outcrops in Inkilltambo, emphasizing the inseparable relationship between landscape and worship.

Inkilltambo should be understood as a node within the system of *huacas* and *ceques* of Cusco that connected the sacred spaces and ritual routes of the *Tawantinsuyu*. Archaeological field investigations report evidence of Killke- (900–1200) and Inka-period (1438–1533) ceramics, as well as carved niches, sculpted staircases, and retaining walls that visually organize the territory. These findings allow us to infer its function as a space of ritual and administrative convergence linked to Sacsayhuamán and other high-altitude sanctuaries, which is corroborated in the Master Plan of the Sacsayhuamán Archaeological

Park. This plan includes inventories, maps, and records of the Inka Cárcel sector that document the construction phases and spatial pattern of the site (National Institute of Culture-Cusco, 2007).

In the Chinese context, research on the Longmen Caves has been prolific in highlighting the iconographic and religious dimensions of the caves; however, several studies have focused on stylistic and chronological aspects, leaving the architectural reading of the grottoes as spaces configured in close relation to the cliff's topography largely unexplored. Li & Zhang (2017) highlighted that the design of the caves responds both to geological constraints and to ritual programs that define spatial hierarchies and devotional sequences, which facilitates approaching this complex from architectural categories comparable to those used in the Andes.

A similar finding in the studies of both Inkilltambo and the Longmen Caves is the recognition of the rock as an element that generates meaning. In the Andean case, the rock is interpreted as a *huaca* and is sacralized due to its association with water and ancestors, whereas in the Longmen Caves, the rock supports the Buddhist image and becomes a sacred substance through sculptural inscription. Nonetheless, in both cases, the material condition of the rock and the topography shape the architectural morphology. This convergence highlights the need for a comparative analysis that transcends regional frameworks and situates rock-cut architecture within a transcultural perspective (Bauer, 1998; Wu, 2012).

In the theoretical framework, the analysis is now enriched by incorporating a broader anthropological perspective that emphasizes the dialectic between nature and culture, drawing on Frazer (1915)'s *The Golden Bough* as a foundational text for understanding how human communities worldwide sacralize natural elements through ritual and myth. This perspective helps to view rock not merely as a material substrate but as an actor in the sacred landscape, whose features—such as fractures, forms, and orientation—are perceived as imbued with agency and meaning. Recent religious anthropology and landscape studies have extended Frazer's comparative method to include ecological cosmologies and sacred geographies, as seen in Giulio Magli's work on the astronomical content of the sacred landscape of Cusco (Magli, 2004) and in recent studies of vernacular rock-cut sites that address how human ritual behavior responds to geological and hydrological constraints.

Furthermore, this expanded perspective enables the introduction of a new analytical dimension: The scopic or visual regime of sacred nature, which considers how visibility, seclusion, exposure, and the experience of

nature inform the sacred value of places. In each culture (Andean and Chinese), this regime takes different forms. At Inkilltambo, terraces, water reflection, and panoramic views promote a sacred relationship that is visible in the landscape; at Longmen, internal cliff-caves, iconography, and regulated access create sacred spaces that are partially hidden and mediated. This allows for a better comparative symmetry and inclusion of units such as visibility of natural features, ritual exposure to natural light, and the role of water and stone morphology in shaping human perception of sacredness (Tilley, 2004).

Figure 1 shows the immediate physical environment of both archaeological complexes. In the case of Inkilltambo, the integration of the site with the Andean relief is observed through terraces and rock outcrops, whereas in Longmen, the limestone cliffs carved along the Yi River are prominent. It visually introduces the landscape and scale differences that underpin the comparative analysis.

The state of the art on topography and ritual placement has been developed in Andean studies that highlight the Inca architecture's ability to appropriate the natural forms of the terrain. Similarly, previous studies on the Longmen Caves have demonstrated that the selection of the cliff was not accidental but responded to criteria of visibility and monumentality associated with the legitimacy of imperial power, which shows that in both cases, the placement constitutes a design act charged with symbolism (Monteith, 2017).

In contrast, the vernacular of the Longmen Caves refers to a tradition of intensive subtractive carving in limestone that favors deep chambers, interior sequences, and finished surfaces for sculptures—a feature that crystallizes a professionalized and hierarchical technique with strong institutional sponsorship. Thus, the local vernacular manner incorporates specialized workshops, standardized formal patterns, and a monumental scale that transforms the monolith into a narrative and liturgical support rather than an agricultural one, so that technique and social organization are reflected in an architectural language of interiority and monumentality.

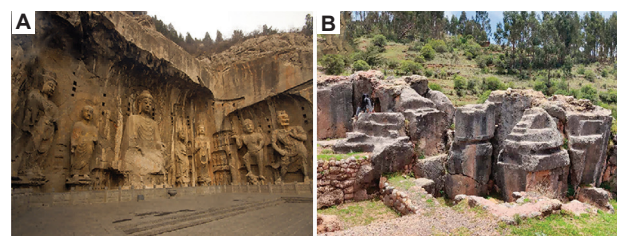


Figure 1. General views of ritual spaces of the (A) Longmen Caves and (B) Inkilltambo
Source: Photos by the author (2025).

Table 1. Overview of scholarly studies on the role of rock, topography, and rituality in rock-cut architecture and sacred landscapes in Peru and China

Analytical dimension	Sources	Synthesis of main contributions	Comparative application: Inkilltambo-Longmen
Rock, lithology, and fracturing	Castro (2019); Chen <i>et al.</i> (2021); Hu (2019); Rodríguez & Flores (2019)	These studies describe the rock as both structural and symbolic material. Rodríguez & Flores (2019) examine the integration of natural rock outcrops in Inca architecture, while Chen <i>et al.</i> (2021) and Hu (2019) explore the limestone of Longmen and its carving technologies. Castro (2019) highlights the sacred role of the rock surface as an active medium	Explains how lithological properties determine the scale, form, and depth of carved versus additive architectural spaces in both cultural contexts
Topography, setting, and sacred landscape	Díaz (2016); Morales (2017); Sun (2018); Torres (2018); Zhao (2019); Zhao & Chen (2020)	All studies emphasize topography as a determinant of sacredness. Andean studies link elevation and visual control, whereas Chinese studies discuss symbolic alignments along fluvial cliffs	Provides the spatial and symbolic framework to interpret landscape hierarchy and site selection criteria in both regions
Ritual spaces and ceremonial hierarchy	Herrera & Ramos (2018); Morales (2017); Torres (2018); Vargas (2021)	These works analyze altars, niches, and processional layouts as hierarchical ceremonial systems that structure ritual movement and spatial sequence	Supports the comparative reading of ascending ritual routes in Inkilltambo versus descending devotional itineraries in Longmen
Hydraulic systems and water symbolism	Díaz (2016); Gutiérrez (2020); Zhao & Chen (2020)	These studies address the relationship between water, fertility, and ritual. In Inkilltambo, water integrates agricultural terraces and sacred functions, whereas in Longmen, the Yi River defines the axial orientation and purifying character of the complex	Reinforces the interpretation of water as both a technical and metaphysical agent linking production and spirituality
Construction techniques and materiality	Chen <i>et al.</i> (2021); Herrera & Ramos (2018); Hu (2019); Rodríguez & Flores (2019)	These studies discuss strategies of quarrying, carving, and assembly. Andean contexts employ combined masonry and rock-carving methods, whereas Chinese contexts privilege subtractive carving directly into the cliff	Clarifies the technological contrast between additive Inca architecture and subtractive Chinese rock-cut architecture
Architectural documentation and survey methods	Pacheco & Torres (2019); Vargas (2021)	These studies examine the use of planimetric documentation, manual survey, and photogrammetry applied to rock-cut sites	Justifies the methodological consistency of this study, which combines visual documentation and morphometric analysis
Iconography, symbolism, and visual interpretation	Bauer (1998); Castro (2019); Li & Wang (2020); Liu (2018)	These studies explore the role of imagery and sacred symbolism. Li & Wang (2020) and Liu (2018) analyze Buddhist iconographic hierarchies, whereas Castro (2019) & Bauer (1998) study the sanctification of rock surfaces within the Inca ritual landscape	Enables the correlation between iconographic expression (Longmen) and the symbolic sacrality of natural rock (Inkilltambo)
Typology and architectural morphology	Chen <i>et al.</i> (2021); Protzen (1993); Vargas (2021); Wang (2020);	These studies establish morphological classifications of caves, chambers, and terraces, highlighting spatial hierarchy and proportional systems	Provides equivalent formal categories (niche-chamber-platform) for cross-cultural architectural comparison
Public space, circulation, and connectivity	Gutiérrez (2020); Pacheco & Torres (2019); Torres (2018);	These studies examine movement patterns, processional routes, and spatial thresholds as integral components of ceremonial practice	Offers analytical criteria to assess accessibility, spatial hierarchy, and processional sequencing within both complexes
Chronology, phasing, and historical processes	Hu (2019); Zhao (2019); Zhao & Chen (2020)	These studies document successive excavation phases, functional transformations, and religious reinterpretations over time	Supports diachronic analysis and identification of constructive stages in both archaeological settings

Note: This table compiles the sources, objectives of the studies, methodologies, and relevant contributions to the analysis of rock art and ritual landscape. It serves as the conceptual basis of the comparative theoretical framework.

In terms of architectural morphology, studies on Inkilltambo emphasize the duality between excavated and added spaces, where rock-carved niches coexist with dressed stone structures, creating a hybrid architecture that adapts to the relief and generates ceremonial pathways articulated with hydraulic channels (Protzen, 1993). The

study also highlights the transition between small initial grottoes and large halls excavated in later stages, showing a process of progressive monumentalization conditioned by the cliff's topography and the growing importance of imperial patronage. In both contexts, the architecture responds to the rock but with different formal solutions.

Regarding rituality, studies in the Andean context highlight that Inkilltambo was part of the *ceque* system and was associated with water and ancestor worship practices, as evidenced by the presence of channels that carry water to the ceremonial enclosures and the arrangement of niches that would have served to deposit offerings (Dean, 2010; Flores, 2020). In Longmen, rituality is manifested in the Buddhist iconography carved on the walls of the caves, where the arrangement of the images responds to doctrinal hierarchies and a devotional program that organized the pilgrim's route (Li & Zhang, 2017; Wu, 2012). Both cases show how architecture not only creates a physical space but also structures symbolic practices and collective experiences of sacredness.

The knowledge gap lies in the lack of a comparative framework that allows for analyzing these architectures from a common architectural perspective. Most existing studies have favored archaeological, historical, or iconographic interpretation, which has limited the understanding of the architectural design itself. This study aims to overcome such fragmentation and establish a methodology that integrates planimetric analysis, topographical relationships, and symbolic reading of space, to generate a comparative dialogue between the Andes and China, thereby contributing to architectural theory on rock-cut architecture and sacred landscape (Flores, 2020; Guo, 2019).

Accordingly, the research objective has been reformulated: This study aims to develop and apply a theory-informed comparative framework that investigates how rock-cut architecture operates as a cultural language mediating natural features and social meaning across two distinct sociohistorical contexts. The study operationalizes this objective through equivalent units of analysis: Geological substrate and fracture regime; constructive technique (additive vs. subtractive); ritual-architectural inventory (e.g., niches, platforms, altars); scopic regime (e.g., visibility, seclusion, exposure); and hydraulic relations, and uses symmetric metrics to compare the Late Horizon Inca node of Inkilltambo and the Wei-Tang dynasties at Longmen, thereby enabling interpretation of both shared strategies and culturally specific inscriptions on the landscape (Bauer, 1998; Flores, 2020; Frazer, 1915; Guo, 2019; Wu, 2012).

The expansion of the archaeological framework of Inkilltambo should be based on institutional and academic sources that document its ritual and territorial context. Among these, the restoration reports from the Decentralized Directorate of Culture Cusco, the *Master Plan of the Saqsaywaman Archaeological Park* by the National Institute of Culture-Cusco (2007), and the study

conducted by Callapiña Huamán & Oroz Marquéz (2014) on Killke ceramics in the Urubamba area serve as key references. It is also relevant to include reference works on architecture and Inca *ceque* systems, such as those by Bauer (1998) & Protzen (1993), which contribute to a spatial and symbolic understanding of the Andean sacred landscape and strengthen the comparative interpretation with the eastern model.

Table 2 provides the main Andean concepts used throughout the study, offering their translation and disciplinary contextualization within the fields of Inca architecture and archaeology. This table enables international readers to accurately grasp the symbolic, ritual, and spatial significance of terms such as *huaca*, *ceque* system, and *ushnu*, which embody the relationship between landscape, spirituality, and architectural organization in Inca culture, thereby ensuring terminological clarity and intercultural coherence in the comparative analysis.

Inkilltambo is a small Inca architectural node located northeast of the city of Cusco, at approximately 3,550 masl, embedded within a system of terraces, water channels, and carved-rock ritual features that articulate the upper Tambomachay valley. Access to the site follows a progressive ascent from the urban periphery toward the highland plateaus, passing through sections of the Qhapaq Ñan and crossing areas of significant ecological transition. Recent route descriptions highlight that the approach to Inkilltambo combines natural scenery, hydraulic structures, and carved-stone ritual stations that frame the visitor's movement through the landscape (Auriperu, 2023; Cusco Journeys, 2023; Lifexpeditions, 2023; Tierras Vivas, 2023; TreXperience, 2025; Machu Picchu, 2025).

The conservation history of Inkilltambo reflects sustained institutional efforts to stabilize its carved-stone architecture, terraces, and hydraulic channels. Restoration programs undertaken by the Ministry of Culture of Peru have included structural consolidation, clearing of watercourses, and detailed documentation of retaining walls and carved features, allowing a clearer understanding of the site's spatial configuration. Media reports have also documented the progressive rehabilitation of the complex and its reintegration into heritage visitation circuits, underscoring the importance of state-led conservation actions (El Comercio, 2017). These interventions are consistent with earlier official inventories and architectural surveys compiled in the *Inventario de Sitios Arqueológicos del Cusco* (Dirección Desconcentrada de Cultura de Cusco, 2007), which remain foundational for understanding the site's condition and historical development.

Scholarly interpretations of Inkilltambo consistently emphasize its role within the ritual and territorial

Table 2. Glossary of Quechua terms and their technical meanings in English

Quechua term	Technical meaning in English	Disciplinary context/notes
<i>Huaca</i> (<i>Waka</i>)	A sacred place, object, or natural feature imbued with spiritual energy, often linked to ancestral worship and ritual offerings	Central concept in Andean cosmology; refers to loci of divine power expressed in mountains, stones, or springs
<i>Ceque</i> system (<i>Siq'i</i>)	A ritual and spatial network of sacred lines radiating from the Qorikancha Temple in Cusco, organizing shrines (<i>huacas</i>) across the landscape	A ceremonial cartography integrating astronomy, topography, and social hierarchy in Inca planning
<i>Apu</i>	A tutelary mountain deity considered a living protector of a community or territory	Personification of the Andean sacred landscape; often associated with the orientation of architectural sites
<i>Pukara</i>	A fortified hilltop structure or ceremonial enclosure used for defense and ritual activities during pre-Inca and Inca times	Combines military, ritual, and symbolic functions; reflects hierarchical territorial control
<i>Qocha</i>	Artificial or natural water reservoir used for ritual purification, irrigation, or as a symbolic element of fertility	Key element in the hydraulic and ritual architecture of the Andes
<i>Kancha</i>	Enclosed courtyard or group of rectangular structures organized around a central open space	Basic unit of Inca urban and domestic architecture; reflects modular spatial organization
<i>Ushnu</i>	A stepped ceremonial platform used for rituals, offerings, and astronomical observations in Inca centers	Architectural structure linking political authority with sacred ritual practice
<i>Suyu</i>	One of the four territorial divisions of the Inca Empire (Tawantinsuyu); also denotes regional or spatial organization	Geopolitical and cosmological framework of Inca spatial perception
<i>Tambo</i>	Roadside installation serving administrative, storage, or lodging purposes along Inca roads	Component of the <i>Qhapaq Ñan</i> network; demonstrates the infrastructural logic of the Inca state
<i>Qhapaq Ñan</i>	The extensive Inca road system connecting major administrative and ritual centers across the Andes	UNESCO World Heritage route; example of large-scale infrastructural integration
<i>Kallanka</i>	Large rectangular hall with gabled roofs used for gatherings, rituals, or military functions	Public architectural typology found in the main Inca settlements
<i>Inti</i>	The sun deity in Inca religion, central to state rituals and calendrical observations	Governs spatial orientation and the solar alignment of sacred architecture
<i>Sacsayhuaman</i> (<i>Saqsaywaman</i>)	Major ceremonial complex and fortress overlooking Cusco, characterized by cyclopean masonry and monumental terraces	Represents the apogee of Inca stonework and landscape integration
<i>Pachamama</i>	The Earth Mother deity symbolizing fertility, nourishment, and reciprocity between humans and nature	Foundational concept for understanding Andean cosmology and ritual ecology
<i>Inkilltambo</i>	Compound Quechua term meaning “resting or cultivated place,” referring to a small-scale Inca site integrated with terraces, water channels, and shrines	Archaeological site analyzed in the paper; illustrates ritual-agricultural architecture

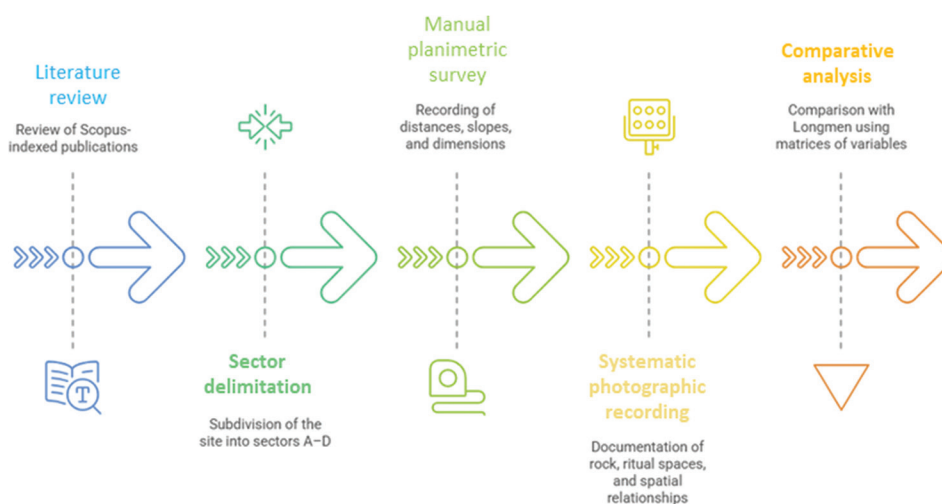


Figure 2. Operational flow of the methodology

Source: Diagram by the author using AutoCAD 2024 (Autodesk, United States).

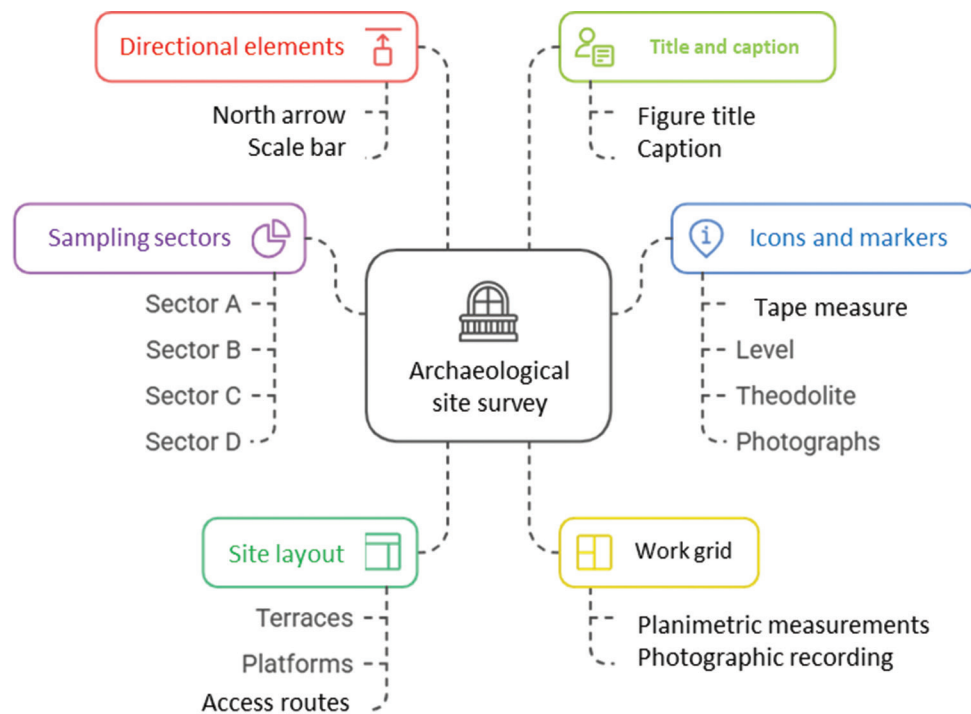


Figure 3. Inkilltambo base map with site layout, directional elements, icons, and markers, as well as areas of architectural recording, rock fractures, terraces, platforms, channels, and niches. The map delineates analysis zones for planimetric and photographic survey, and indicates where comparative measurement parameters were applied.

Source: Diagram by the author using AutoCAD 2024 (Autodesk, United States).

organization of the Cusco region, where carved-stone features, water channels, and elevated platforms formed nodes of ceremonial activity embedded within a broader sacred landscape. Studies of Andean sacred geography support the interpretation of such sites as ritual interfaces between topography, water, and ancestral veneration, where the materiality of the rock itself acquires symbolic agency. This perspective aligns with regional analyses that treat carved-rock sanctuaries as part of complex ceremonial circuits tied to political and cosmological order (Reinhard, 2002).

The Longmen Grottoes in Luoyang constitute one of the most significant Buddhist sculptural ensembles in East Asia, comprising thousands of niches and reliefs carved into the limestone cliffs along both banks of the Yi River. Their historical and artistic relevance has been formally recognized through their inscription on the UNESCO World Heritage List, which highlights their outstanding universal value in terms of religious iconography and artistic evolution (UNESCO, 2000). Complementary architectural and visual studies emphasize the complexity of the cliffside arrangement, the typological diversity of the caves, and the ritual staging embedded in their spatial organization (Oriental Architecture, 2025; Victoria and Albert Museum, 2025).

The iconographic program of the Longmen Grottoes reveals a sophisticated sculptural grammar that evolved through successive dynastic phases, particularly from the Northern Wei to the Tang dynasty. Colossal Buddhas, high-relief guardians, and finely carved niches articulate ritual pathways along the cliff, guiding devotional circulation through changing spatial hierarchies. Contemporary descriptions underline the monumental scale of the carvings, the technical precision of the reliefs, and the immersive sensory experience generated by the cliffside configuration—features that reinforce the grottoes' unique combination of landscape, devotion, and artistic mastery (BBC Travel, 2025; BJReview, 2025; MindTrip, 2025; WildGreatWall, 2025; Windhorse Tour, 2025).

The architectural analysis relied on classical documentation procedures for rock-cut heritage, including manual planimetric surveying, direct measurement, and systematic photographic recording. These procedures align with established standards for the documentation of rock-cut and heritage sites, which emphasize precision, replicability, and the integration of morphological and spatial data (Architectural Survey Techniques, 2021). By combining field-based measurement with graphic reconstruction, the study ensured methodological consistency for transregional comparison.

The comparative framework employed in the study was based on methodological principles designed to evaluate spatial configuration, carving strategies, ritual functionality, and landscape integration across distinct cultural contexts. Such approaches are grounded in established protocols for transregional comparison of rock-cut temples, which advocate for the identification of homologous variables and analytical symmetry between case studies (Comparative Analyses of Rock-Cut Temples, 2022). Likewise, recent methodological discussions in the comparative study of ritual architecture highlight the importance of integrating landscape, symbolism, and spatial hierarchies to capture the full cultural dimension of carved environments (Sacred Space and Landscape Analysis, 2021).

2. Data and methods

This study employed a qualitative comparative approach applied to the architectural documentation of the Inkilltambo site and compared it with published information about the Longmen Caves. The approach prioritized non-invasive techniques through manual planimetric surveying and systematic photographic recording to capture the rock layout, the organization of ritual spaces, and the topographic relationship with the surrounding landscape. The preparation included a thorough review of literature indexed in Scopus that addresses methodologies for architectural documentation and planimetric surveying in rock sites. This review allowed for the definition of operational variables and observation criteria to guide field surveying and facilitate transregional comparison. Among the references consulted, studies on spatial analysis of rock-cut sites and manual architectural recording procedures are particularly noteworthy (Carbonell Pastor, 2020; Marín-Buzón *et al.*, 2021; Zich, 2021).

Figure 2 represents the general research process, from bibliographic compilation and field recording to morphological analysis and comparative synthesis. It summarizes the procedures of direct observation, planimetric surveying, iconographic analysis, and correlation of variables used in the study.

Fieldwork at Inkilltambo was organized in phases that allowed for the systematization of observation and information recording. The first phase involved a general survey and delimitation of sectors according to topography, rock arrangement, and ritual routes. The second phase consisted of manual planimetric surveying using measuring tapes, a bubble level, and a basic theodolite, recording distances, slopes, and relative heights, as well as the dimensions of platforms, walls, and niches. Scaled plans were created to document architectural



Figure 4. General view of Inkilltambo
Source: Photos by the author (2025).



Figure 5. Layout of Longmen Caves
Source: Photos by the author (2025).

elements integrated into the natural landscape. The third phase included systematic photographic recording, with frontal, oblique, and diagonal angles to capture spatial relationships and rock details (Figure 3). Each photograph was cataloged with metadata on location and sector. These methodological strategies are supported by architectural documentation standards applied to rock heritage (Carbonell Pastor, 2020; Zich, 2021).

The planimetric survey allowed for the documentation of rock morphology and spatial organization. The plans were initially drawn on graph paper and later digitized for vector tracing in computer-aided design software (software name, version, developer, country). Measurements included distances between platforms, dimensions of niches, and relative heights of walls and terraces, as well as slopes and level changes relevant to understanding the relationship between architecture and topography. Attention was given to how the rock influenced the construction and arrangement of ritual spaces. This manual approach is considered sufficient for comparison with the Longmen Caves, given that existing studies include traditional plans and sections, and it supports the validity of classical surveys for the architectural interpretation of rock-cut sites (Carbonell Pastor, 2020; Marín-Buzón *et al.*, 2021).

The photographic record was structured as a tool for analysis and description, documenting niches, altars, platforms, stairs, water channels, and ritual paths. Images were taken following the criteria of overlap and detail capture to enable typological comparison with the Longmen Caves. The photographs were also used for the analysis of spatiality, hierarchies, and access sequences. These

strategies are based on methodologies for architectural documentation of rock environments and cultural heritage sites (Letellier, 2007; Marín-Buzón *et al.*, 2021).

The planimetric analysis was organized into three levels of reading: (i) the morphological description of the rock and the associated architectural elements; (ii) the reading of ritual spatiality, taking into account access axes, platforms, niches, and alignments with symbolic elements; and (iii) the functional evaluation of the spaces through dimensions, routes, and connectivity between areas. For each level, observable and measurable criteria were defined and coded into working matrices, facilitating the systematization of observations and the transregional comparison with the Longmen Caves. The methodological segmentation and variable coding are well-established practices in architectural studies of rock art and classical planimetric surveying (Carbonell Pastor, 2020; Zich, 2021).

The comparison with the Longmen Caves was based on typological and functional analysis of variables documented in the literature. The inclusion criteria included studies presenting plans, sections, and analyses of cavities, reliefs, and platforms. The comparison was performed through

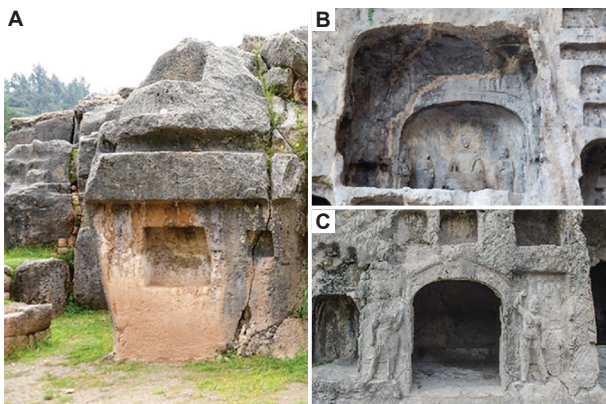


Figure 6. Niche from (A) Inkilltambo and (B and C) the Longmen Caves
Source: Photos by the author (2025).



Figure 7. Ritual spaces of Inkilltambo. This analytical diagram synthesizes the spatial organization of ceremonial chambers, illustrating the orientation of platforms, altars, and niches. It highlights how ritual hierarchy is expressed through differing alignments and access sequences in the Andean context.
Source: Photos by the author (2025).

Table 3. Principal architectural characteristics of Inkilltambo and the Longmen Caves as documented in the literature

Variable	Operational definition	Measurable indicator	Unit of measurement	Comparison threshold
Rock	Lithology, fracturing, texture	Rock type, fracture planes	Category/grade	Comparison of lithological characteristics
Ritual space	Presence of niches, altars, and platforms	Number and arrangement of ritual elements	Quantity/location	Typology and spatial distribution
Topography	Slopes and terrace layout	Inclination angles, levels	Degrees/meters	Relationship with ritual pathway
Landscape	Panoramic visibility and horizon lines	Observation points and orientation	Degrees/meters	Correspondence with landscape alignments
Water channels	Traces and sections of channels	Length, slope, and connectivity	Meters/gradient	Comparison of hydraulic functionality
Public space	Open areas for circulation and gathering	Dimensions and capacity	sqm	Comparison of scale and function
Spatiality	Connectivity between spaces and hierarchy	Number of pathways and accesses	Quantity	Similarity in spatial sequence
Functionality	Ritual or practical use of spaces	Typology of use, circulation flow	Category	Comparison of declared functions

Note: This table details the types of rock and fracture patterns observed in the different sectors of Inkilltambo, linking them to specific construction solutions such as walls, staircases, or niches.

matrices cross-referencing variables such as rock, ritual space, topography, landscape, water channels, public space, spatiality, and functionality, allowing for the identification of technical similarities, such as rock transformation, and differences in the production of interior and exterior spaces. This comparison methodology follows transregional analysis protocols to ensure homogeneity and reduce interpretative biases.

The operationalization of the variables is presented in Table 1, where the variables, indicators, and units of measurement used for the comparative analysis between Inkilltambo and the Longmen Caves are defined. This approach allowed for the systematization of data and ensured consistency in the comparison between the two sites (Carbonell Pastor, 2020; Marín-Buzón *et al.*, 2021).

The comparison between Inkilltambo and the Longmen Caves also necessitates the acknowledgment of the nature of the available archaeological data. In the Peruvian case, most findings derive from surface surveys, conservation work, and planimetric surveys carried out by local technical teams. Such interventions prioritized non-invasive observation and graphic documentation, a methodological approach consistent with the preservation of a site that remains in contemporary ritual use, and compatible with the approach adopted in this study, which utilizes plans, photogrammetry, and comparative morphological analysis as correlation tools (Cultura Cusco, 2017; National Institute of Culture-Cusco, 2007).

3. Results

3.1. The spatial and topographic articulation of Inkilltambo and Longmen

The Inkilltambo site is located on an andesite rock outcrop with slopes varying between 15° and 30°. This topography determines the arrangement of terraces, staircases, and retaining walls. The manual planimetric survey enabled the delimitation of sectors A, B, C, and D, accurately documenting platforms, ritual spaces, and circulation areas. Field photographs depict natural rock fracturing, rough texture, and stratification, which affect the construction and durability of walls. The carved staircases connect levels and facilitate hierarchical ceremonial routes (Figure 4).

Water channels run parallel to the terraces, ensuring irrigation and maintaining a visual connection with elevated platforms. The comparison with the Longmen Caves, based on published literature, shows that the caves were excavated in limestone cliffs with steep slopes and hierarchical pathways leading to ceremonial and funerary spaces. In Inkilltambo, vertical and horizontal routes allow for visual control of the landscape, while in Longmen, the sequencing of interior caves is emphasized. Figure 4 shows the general view of Inkilltambo with delimited sectors, whereas Figure 5 displays the arrangement of the Longmen Caves according to published surveys. Table 1 summarizes the spatial and functional characteristics of both sites, indicating similarities in the integration of rock and topography and differences in scale, number of spaces, and internal arrangement.

Figure 4 illustrates the articulation of the terrace complex with the relief at Inkilltambo, whereas Figure 5 depicts the systematic arrangement of caves carved into the eastern cliff of the Yi River. These figures highlight the contrast between architecture integrated into an agricultural landscape and architecture excavated in rock for devotional purposes.

Figure 5 presents an interpretative map based on official studies and previous cartographies, indicating the hierarchy and sequence of the main cavities (e.g., *Fengxian*, *Binyang*, *Guyang*). It facilitates understanding of the axial structure of the complex and its relationship with the riverbed.

3.2. Rock as architectural support and boundary

The rock at Inkilltambo is predominantly andesite, with subhorizontal fracturing that facilitates the construction of walls and platforms. In sectors C and D, the irregular

fracturing influences the height of walls and the placement of niches. The carving patterns indicate an architectural canon that defines ceremonial routes and ritual spaces (Figure 6). At the Longmen Caves, limestone was utilized to excavate internal cavities, creating niches and worship spaces. The carved surfaces exhibit smooth finishes suitable for sculptures and reliefs. Figure 6 shows the niches from Inkilltambo and the Longmen Caves. Table 2 classifies sectors according to rock fracturing and architectural adaptations, highlighting similarities in the use of natural cavities and differences in scale and type of carving. Sectors with greater fracturing at Inkilltambo contain smaller platforms, whereas the caves at Longmen allow accommodate large and complex interior spaces.

Figure 6 illustrates a visual comparison of niches carved in andesitic rock at Inkilltambo and limestone at the Longmen



Figure 8. Terrace system of Inkilltambo
Source: Photos by the author (2025).



Figure 9. Landscape dominance in Inkilltambo
Source: Photos by the author (2025).

Table 4. Spatial and functional characteristics of Inkilltambo and the Longmen Caves

Site	Total area (sqm)	No. of platforms/ caves	No. of niches	Relative height (m)	Average slope (°)	Main observations
Inkilltambo	4,100	23 platforms	14	12	18–28	Terraces and stairways, water channels, panoramic views
Longmen Caves	3,800	30 caves	>200	10–25	20–35	Rock-cut ritual cavities, interior sequences, niches for statues

Note: This table presents a quantitative comparison between both sites in terms of area, number of platforms or caves, relative height, and average slope. It allows establishing equivalent parameters of scale and proportion.

Table 5. Classification of sectors according to rock type and architectural adaptations

Site	Sector/cave	Rock type	Fracturing	Architectural adaptations	Observations
Inkilltambo	A	Andesite	Sub-horizontal	Walls, stairways	Stable main platform, integrated water flow
Inkilltambo	C	Andesite	Irregular	Short stairs, niches	Fractured rock limits wall height
Longmen Caves	Cave no. 1–10	Limestone	Continuous	Niches, chambers, reliefs	Interior cavities, integrated sculptures and reliefs
Longmen Caves	Cave no. 11–30	Limestone	Continuous	Niches, multiple chambers	Complex interior sequences

Note: This table expands the information in Table 2 by incorporating construction variables (e.g., wall heights, channel lengths, structural stability) that explain the relationship between lithology and technique.

Caves. The figure highlights differences in scale, finish, and function: At Inkilltambo, the niches are integrated into the local water-related liturgy, whereas at the Longmen Caves, they serve a sculptural and narrative role.

The vernacular character of the architecture at Inkilltambo is primarily expressed in the modular

adaptation of the landscape through terraces, retaining walls, and small enclosures integrated into a fractured rock base (Table 3 and Figure 7). This constructive logic corresponds to a technical economy based on the combination of precise carving on outcrops and the addition of masonry that corrects irregularities in the

terrain and enables simultaneous productive-ritual uses. Therefore, the Andean vernacular form is defined by the intimate relationship between agriculture, water, and ceremonial space, where the human and community scales influence the morphology of platforms and staircases.

3.3. Ritual spaces: Hierarchies and ceremonial sequences

In both Inkilltambo and the Longmen Caves, the sacred cannot be understood solely through the architectural typology of spaces but rather through what can be called their “scopic regime,” that is, the culturally determined way in which the sacred is made visible or remains hidden. Drawing from anthropological perspectives (Belting, 2011; Eliade, 1959; Frazer, 1915), sacredness manifests differently in each civilization: In Andean cosmology, the sacred is integrated into the visible landscape—where mountains, stones, and watercourses act as active deities—while in the Buddhist tradition of Longmen, sacredness becomes interiorized and represented through iconographic imagery and the controlled illumination within the rock-cut chambers.

The Andean regime of visibility corresponds to an open and participatory sacredness, expressed through collective rituals and spatial openness that allow worshippers to face the landscape as a living entity (e.g., Pachamama and Apus). Here, the sacred is demonstrative and experiential—it must be seen and shared through ritual offerings and interactions with the natural environment (Bauer, 1998; Dean, 2010). Conversely, the Chinese regime of sacred

concealment is introspective and mediated through carved representations, where divinity becomes visible only through the sculpted image, and access to sacred space requires a gradual transition from light to darkness, reinforcing introspection and transcendence (Guo, 2019; Li, 2020).

This contrast reveals how different civilizations develop architectural frameworks of sacred perception that negotiate the boundary between visibility and mystery. In Inkilltambo, light, topography, and water reflections form the collective experience of the sacred, whereas in Longmen, depth, iconographic density, and shadow guide an individual contemplative encounter. Understanding these distinct scopic regimes allows the comparative analysis to transcend formal parallels and address how architecture mediates the ontological relationship between humans, divinity, and the natural world across cultural traditions.

Regarding vernacular symbolic and material expression, the Andean landscape transforms rock into *huaca* through adaptations on the outcrop (e.g., rough niches, benches, and visible channels) that allow offering and ritual repetition without the need for an elaborate iconographic program. In contrast, the vernacular of the Longmen Caves articulates the rock with a dense sculptural arrangement, where the figurative images organize the space and regulate the devotional route. Therefore, the Andean vernacular reading is more plural, relational, and functionally hybrid, whereas the Longmen vernacular emphasizes narrative, iconography, and hierarchical organization.

Table 6. Ritual elements by sector or cave

Site	Sector/cave	Niches	Altars	Ritual platforms	Main orientation	Observations
Inkilltambo	A	5	3	2	NE	Main platform for ceremonial access
Inkilltambo	B	4	2	1	E	Connects productive areas with ceremonial spaces
Longmen Caves	Cave no. 1–10	>50	>10	0	Variable	Interior cavities with sculptures and reliefs
Longmen Caves	Cave no. 11–30	>150	>20	0	Variable	Complex interior sequences

Notes: This table reports the number of altars, niches, and platforms at each site, including their main orientation and relationship to access routes. It supports the evaluation of ritual density and the symbolic hierarchy of each sector. “E” indicates east-facing orientation, whereas “NE” indicates northeast-facing orientation.

Table 7. Comparative measurements of topography and structure

Site	Sector/cave	Average slope (°)	Wall/ceiling height (m)	No. of terraces/chambers	Observations
Inkilltambo	A	18	3.5	3	Main platform and water channels
Inkilltambo	D	28	2	2	Upper sectors, panoramic views
Longmen Caves	Cave 1–10	20–35	4–8	5–10	Stepped interior cavities
Longmen Caves	Cave 11–30	20–35	3–10	10–15	Complex interior sequences

Note: This table includes morphometric data such as slopes, chamber heights, and elevation differences, in order to correlate topographic and architectural variables.



Figure 10. Layout of Inca channels
Source: Photos by the author (2025).

3.4. Topography conditioning architecture

The terraces and stairways of Inkilltambo adapt to slopes between 15° and 30°, quantifying relative height and relationship with water channels. Figure 8 shows the adaptation of terraces, whereas Table 4 compares slopes, wall heights, and the arrangement of terraces or caves. The upper sectors of Inkilltambo present a higher concentration of ritual elements and panoramic views toward agricultural and urban areas. In Longmen, the topography conditions stepped accesses and interior sequences of caves. In both contexts, the topography functions as a structuring element of spatial and functional organization, demonstrating similar architectural principles of adaptation to the natural relief.

The photographic and graphic records of Inkilltambo (Figure 8) illustrate how retaining walls and terraces are adapted to the mountainous relief. These adaptations

demonstrate the integration of agricultural function, water management, and territorial symbolism, reflecting key aspects of Inca vernacular architectural practice.

3.5. Landscape and panoramic visibility

The landscape analysis revealed that there is visibility from the terraces of Inkilltambo toward agricultural and ceremonial sectors, as well as visual control of pathways and platforms. Figure 9 shows a perspective of Inkilltambo, whereas Table 5 summarizes sectors with panoramic visibility and spatial relationships. In both contexts, the orientation of ritual spaces toward strategic views was observed. In Longmen, the orientation prioritizes visual alignment with neighboring cliffs and the interior sequence of caves, whereas in Inkilltambo, the emphasis is on panoramic views and the relationship with the agricultural



Figure 11. Public spaces and movement flows of Inkilltambo
Source: Photos by the author (2025).



Figure 12. Inca spatial connectivity
Source: Photos by the author (2025).

Table 8. Sectors with panoramic visibility and ritual orientation

Site	Sector/cave	Panoramic visibility	Ritual orientation	Observations
Inkilltambo	A	High	NE	Main platform with visual control
Inkilltambo	D	Medium	NW	Upper sectors with partial views
Longmen Caves	Cave no. 1–10	Limited (interior)	Variable	Interior sequences, visibility toward the cliff
Longmen Caves	Cave no. 11–30	Limited (interior)	Variable	Deep cavities with controlled access

Note: This table summarizes the points with visual dominance over the valley and their predominant orientations (east, northeast, south). It is used to analyze the relationship between observation and rituality.

Table 9. Characteristics of water channels and their relation to ritual spaces

Site	Channel	Length (m)	Gradient (%)	Connected sectors	Main function	Observations
Inkilltambo	C1	75	2.5	A, B	Irrigation and ritual	Continuous flow, visual integration
Inkilltambo	C2	60	3	B, C	Irrigation	Secondary channel, connection with niches
Longmen Caves	D1	20	5	Cave no. 1–5	Drainage	Protection of sculptures and reliefs
Longmen Caves	D2	15	4	Cave no. 11–15	Drainage	Prevents moisture accumulation

Note: This table lists the length, slope, and position of the main channels, highlighting their functional and symbolic roles within the Inkilltambo construction system.

environment. The design principles revealed similarities in visual control and ritual hierarchy, although they differ in scale and in the type of surrounding landscape.

The panoramic views from elevated points at Inkilltambo (Figure 9) illustrate the visual articulation between ritual platforms, channels, and the surrounding

Table 10. Dimensions and connectivity of public spaces and routes

Site	Sector/cave	Area (sqm)	Pathway width (m)	Connectivity	Observations
Inkilltambo	A	400	3–4	High	Open plaza connecting ritual platforms
Inkilltambo	C	250	2.5–3	Medium	Irregular terrain with short stairways
Longmen Caves	Cave no. 1–10	300	1.5–2	Medium	Interior cave sequence, narrow corridors
Longmen Caves	Cave no. 11–30	450	1.5–2.5	Low	Hierarchized circulation, internal visual control

Note: This table presents the relationship between spatial dimensions, pathway width, and connectivity levels in both complexes, highlighting how these parameters reflect space hierarchy and ritual circulation patterns.

Table 11. Connectivity, hierarchy, and flows in Inkilltambo and the Longmen caves

Site	Sector/cave	Connectivity	Hierarchy	Main flow	Relationship with landscape	Observations
Inkilltambo	A–D	High	Vertical	Main route through terraces	Panoramic, visual control	Ceremonial and productive integration
Longmen Caves	Cave no. 1–30	Medium	Depth	Interior cave sequence	Limited to the cliffside	Ceremonial and sculptural narrative

Table 12. Summary of comparison between Inkilltambo and the Longmen Caves

Variable	Inkilltambo	Longmen caves	Convergence/complement/divergence
Rock	Andesite, fracturing conditions niches and platforms	Limestone, enables deep cavities and niches	Coincidence in adaptation to lithology
Ritual space	Niches, altars, and platforms organized hierarchically	Niches and sculptures arranged in an interior sequence	Coincidence in hierarchy and ritual function
Topography	Terraces and stairways integrated into the relief	Access to caves hierarchized by depth	Coincidence in adaptation to relief, divergence in the type of spatial setting
Landscape	Panoramic orientation and visual alignments	Interior-controlled experience, minimal panoramic relationship	Divergence in relation to landscape, coincidence in visual control
Water channels	Functional and symbolic, regulating irrigation and ritual pathways	Drainage systems and cisterns for sculpture protection	Divergence in function, coincidence in hydraulic integration
Public space	Open plazas, social and ceremonial interaction	Restricted interior circulation	Divergence in scale and openness, coincidence in ritual flow control
Spatiality	Connectivity between terraces and platforms, vertical flow	Sequence of caves, access control	Coincidence in hierarchy and control of pathways
Functionality	Simultaneous ritual and productive use	Ceremonial use and protection of reliefs	Divergence in specific function, coincidence in symbolic role

agricultural valley. The perspectives highlight how the site's architecture engages with the landscape, reinforcing its role in observation, spatial control, and ritual oversight.

3.6. Water channels and functional articulation

At Inkilltambo, water channels are distributed parallel to the terraces and connect ceremonial platforms with productive areas. The constant flow regulates irrigation and provides ritual symbolism linked to the control of water resources. Figure 10 shows the layout of the main and secondary channels, whereas Table 6 summarizes the length, slope, connection with ritual sectors, and function. According to the literature on Longmen, water management is more symbolic and limited to the drainage of caves and

small cisterns for sculpture preservation. In both contexts, water resources influence routes and ceremonial spaces. In contrast, at Inkilltambo, water acts as both a functional and symbolic element, mainly for the protection and maintenance of the caves. This comparison highlights how adaptation to water reflects different cultural strategies but converges in integrating water resources into architecture and ritual circulation.

The hydraulic network of Inkilltambo shows formal and symbolic affinities with other complexes in the Cusco area, such as Tipón and Tambomachay, where the management of water carries ritual connotations linked to fertility and the political order of the Andean landscape. In these places, hydraulic engineering combines technical efficiency with

aesthetic and religious intentionality, transforming the flow of water into a ceremonial element. Consequently, the comparative analysis with the Longmen Caves is strengthened if it is emphasized that, both in the Chinese and Inca sanctuaries, water acts as a mediator between the natural and spiritual order (Callapiña Huamán & Oroz Marquéz, 2014; National Institute of Culture-Cusco, 2007).

The thematic plan (Figure 10) illustrates the layout of the main hydraulic conduits and how they connect terraces, staircases, and ceremonial enclosures. It illustrates the integration of hydraulic infrastructure with ritual functions, characteristic of Andean vernacular engineering.

The vernacular difference in maintenance and management practices reveals distinct social models: Inkilltambo demonstrates solutions involving periodic community maintenance of canals, stairways, and terraces (reflecting vernacular conservation practices integrated into the local economy), while Longmen exhibits construction devices aimed at heritage preservation and mitigation strategies (e.g., drainage, cisterns, coatings) that respond to a centralized institution of care and restoration. Therefore, these vernacular regimes of use and care influence both the durability of structures and formal design decisions.

3.7. Public space and circulation

The open areas of Inkilltambo allow for the circulation of visitors and inhabitants in hierarchized spaces, connecting ritual platforms and productive terraces. Figure 11 illustrates areas of public interaction and movement flows in Inkilltambo compared to Longmen, where circulation is defined by sequences of caves and narrow corridors. Table 7 summarizes the dimensions, connectivity, orientation, and capacity of each sector. In Inkilltambo, the combination of terraces, stairways, and open plazas generates spatial diversity and visual control. In Longmen, the hierarchized interior routes influence ceremonial perception and the narrative sequence of sculptures. The analysis provides insights into how public spatiality organizes the ritual and functional experience of both contexts, showing convergences in the principle of visual control and divergences in the form and scale of spaces.

Figure 11 presents a descriptive scheme of internal circulation at Inkilltambo, illustrating processional routes, access axes, and spatial hierarchies as observed in the field photographs. The diagram highlights the organization of movement within the Andean site, emphasizing its open and communal character, as well as the integration between carved features, terraces, and hydraulic elements.

The vernacular difference in the management of public space and circulation is central: Inkilltambo creates open

plazas, panoramic platforms, and routes that integrate the community into productive and ceremonial processes. Consequently, the vernacular elements favor wide access points, territorial visibility, and the social multifunctionality of the platforms. In contrast, at Longmen, the vernacular of the devotional itinerary prioritizes narrow corridors, thresholds, and interior compartmentalization that organize the experience for individuals or small groups, revealing different vernacular modalities of spatial sociability.

3.8. Spatiality and integral functionality

Integrating the analyzed architectural and spatial variables, Inkilltambo presents a vertical hierarchy, clear pathways between terraces, integrated water channels, and ritual platforms. Figure 12 illustrates spatial connectivity. In Longmen, hierarchy is expressed through cave depth, access sequences, and the placement of niches and statues. Table 8 summarizes connectivity, hierarchy, flows, and their relationship with the landscape, while Table 9 provides additional quantitative data supporting the comparison of spatial patterns between the two sites.

The comparative analysis of circulation patterns and spatial hierarchies reveals significant contrasts between the Andean open-air ceremonial layouts and the enclosed ritual architectures of East Asia; as shown in Table 10, the dimensional configuration and pathway widths in Inkilltambo (3–4 m in Sector A and 2.5–3 m in Sector C) support high and medium connectivity across open plazas and stepped platforms, enabling fluid movement and continuous visual integration with the surrounding landscape. In contrast, the Longmen Cave system exhibits narrower passageways (1.5–2.5 m) and reduced connectivity, reflecting an internalized spatial logic characterized by sequential chambers, controlled circulation, and narrative visual framing within the rock-cut environment, this pattern is further reinforced by the hierarchical and functional distinctions summarized in Table 11, where Inkilltambo demonstrates a high-connectivity, vertically articulated flow aligned with panoramic landscape relationships, whereas the Longmen caves follow a medium-connectivity, depth-oriented circulation embedded within the cliffside. Together, these spatial indicators highlight how both complexes (despite their differing environmental contexts) construct ritual movement and symbolic hierarchy through distinct architectural grammars.

Table 12 further details functional interactions and usage hierarchies at Inkilltambo. At Inkilltambo, spatiality allows for simultaneous visual interaction and agricultural-ritual functionality. In Longmen, the experience is dominated by controlled interior spaces and a ceremonial narrative of sculptures and reliefs. The comparison shows

convergence in adaptation to rock and topography, ritual space hierarchy, and control of pathways, with divergences in space type, scale, and orientation. The comprehensive analysis allows the establishment of architectural patterns applicable to comparative studies of rock sites and ritual caves, providing insights into constructive and symbolic strategies in different cultural contexts.

Figure 12 depicts a synthetic diagram of nodes, paths, and platforms, illustrating levels of functional connectivity and usage hierarchy. It provides a basis for quantitative analysis of connectivity and enables comparison with the internal circuits of Longmen.

4. Discussion

The architectural analysis of Inkilltambo reveals a close relationship between the site's andesitic lithology, the arrangement of terraces and platforms, and the organization of ritual spaces. It was observed that rock fracturing directly influences the location of niches and altars. This relationship has been noted in previous studies on Andean rock architecture, which highlight adaptation to the relief and the use of the rock as both a functional and symbolic support (Carbonell Pastor, 2020; Marín-Buzón *et al.*, 2021). The comparison with the Longmen Caves reveals a convergence in the exploitation of rock as a means of ritual expression. At Longmen, the limestone's properties allow for the creation of deep cavities and hierarchized access sequences. The plans and sections reported in the literature show that depth and interior visual control serve functions equivalent to those of the terraces and staircases of Inkilltambo. In both cases, the rock acts as a physical boundary and a support for ceremonial elements, confirming existing evidence on the influence of lithology in the construction of ritual spaces (Letellier, 2007; Zich, 2021). The novelty of the present study lies in the integration of manual planimetric analysis with systematic photographic recording to document spatial interactions and ceremonial flows, thereby complementing the data previously reported for Longmen.

The spatial organization of Inkilltambo, characterized by the vertical hierarchy of platforms and stairways connecting ritual sectors with productive areas, allows for visual control and the definition of ceremonial routes. This evidence aligns with previous studies highlighting the relationship between topographic arrangement, platforms, and ritual experiences at Andean sites (Marín-Buzón *et al.*, 2021). In contrast, at Longmen, the hierarchical routes through caves and narrow corridors influence interior perception and the sequence of access to niches and sculptures. This finding indicates that although the spatial mechanisms differ in scale and orientation, the functional and symbolic objectives remain equivalent. Previous studies

on Longmen indicate that the depth of caves and alignment of niches correspond to the vertical articulation observed at Inkilltambo. In both contexts, spatiality was organized to guide the visitor's ritual experience, confirming the convergence of results regarding spatial hierarchy and the control of ritual routes (Rajendran, 2022).

The water channels of Inkilltambo, arranged parallel to terraces and connecting ceremonial platforms with productive areas, represent a functional and symbolic strategy that regulates irrigation and emphasizes the relationship between water resources and rituality. These findings support and align with previous research on ritual hydraulics at Andean sites, where water acts as a mediator between the productive and the ceremonial spheres (Carbonell Pastor, 2020; Marín-Buzón *et al.*, 2021). In Longmen, the drains and cisterns documented in the literature serve as sculpture protection and humidity control, demonstrating a divergence in functional purpose but convergence in the integration of water resources into the built environment. The comparison reveals that adaptation to water reflects different cultural strategies but converges on the importance of the resource for spatial and ritual organization. These results expand the understanding of how water can structure pathways and ceremonial areas in rock art contexts at different latitudes.

Regarding spatiality and integral functionality, the connectivity between platforms, terraces, and niches in Inkilltambo allows for visual interaction and fluid circulation between ritual and productive spaces. The vertical hierarchy and integration with the topography reinforce the perception of visual control over the landscape. These findings partially align with studies on spatial planning in Andean rock architecture, which highlight the articulation between relief, functionality, and rituality (Carbonell Pastor, 2020; Marín-Buzón *et al.*, 2021). The comparison with Longmen shows that hierarchy is expressed through depth, access sequence, and orientation of cavities. Existing studies have reported that the interior sequence generates a controlled ceremonial experience, demonstrating the relationship between architectural form and ritual function, although there is divergence in scale and type of space. These findings support the validity of conducting comparative analyses based on functional and spatial variables, with access flows, connectivity, and the relationship with the rock being key indicators for interpreting architectural and ritual strategies.

The analysis of public space in Inkilltambo reveals that open plazas and pathways between platforms allow for social and ceremonial interaction. The sizes, dimensions, and capacity of open areas align with literature on Andean sites, where planimetric architecture organizes both visitor

flow and ritual experience (Marín-Buzón *et al.*, 2021). In Longmen, the interior circulation, hierarchized by caves, restricts social interaction but generates narrative control over sculptures and reliefs, indicating divergence in the scale and openness of spaces. The comparison reveals that the intention of control and order of ritual flow converges in both contexts, although the spatial strategy differs. These findings align with those of previous studies and allow for the establishment of ritual design principles in rock architecture that transcend the Andean region, providing criteria for the functional interpretation of interior and exterior spaces.

The landscape and panoramic visibility analysis at Inkilltambo reveals alignments between horizon lines and observation points, suggesting a deliberate design that organizes both visual perception and ritual activities. These findings align with research on landscape alignment and platform orientation in Andean archaeological centers (Carbonell Pastor, 2020). At Longmen, landscape perception is limited to the interior of caves and narrow corridors. Literature indicates that the orientation of niches and sculptures follows an internal ceremonial axis rather than a panoramic one. The comparison indicates a divergence in the relationship with the external landscape but a convergence in the use of orientation to guide the ritual experience. The results confirm that the integration of landscape and visual control is a recurring principle in rock-cut architectures, adapted to local topographic and lithological conditions.

Regarding the morphological reading of the rock, at Inkilltambo, the findings reveal that the texture, fracturing, and lithology of andesite influence the location of niches, platforms, and staircases. This evidence correlates with literature highlighting the influence of rock on the organization of ritual and productive spaces in Andean contexts (Marín-Buzón *et al.*, 2021; Zich, 2021). The comparison with Longmen confirms that the caves' limestone enables deep interior sequences and carved niches that fulfill equivalent ritual functions. The analysis in Longmen indicates controlled fracturing and adaptation to the lithology, evidencing a convergence of results regarding the role of rock as an architectural constraint. The present study aligns with existing evidence by integrating planimetric and systematic photographic analysis, allowing documentation of spatial interactions and ritual routes that had not been detailed in previous studies.

The operationalization of variables such as spatiality, functionality, and connectivity allowed for the establishment of comparative analyses between Inkilltambo and Longmen. The results confirm a

convergence in patterns of spatial hierarchy, control of routes, and integration of ritual elements into the lithology. Divergences are present in scale, openness of public spaces, and the relationship with the panoramic landscape. These contrasts reflect cultural and functional adaptation to different geographical and lithological contexts. The findings expand the understanding of principles of rock-cut architectural design and validate the methodological approach based on manual planimetric surveying and systematic photographic recording, demonstrating that these methods are sufficient for transregional analysis and functional comparison. The results also corroborate and complement information previously reported in specialized literature, confirming the validity of combining direct documentation with bibliographic review for comparative studies of rock-cut architecture.

The joint analysis of all variables shows that Inkilltambo and Longmen share common principles of rock adaptation, spatial hierarchy, functional and symbolic integration, and control of ceremonial flows. Previous studies have reported these elements in a fragmented manner, whereas the present study provides a comprehensive view by systematizing variables through analysis matrices and correlating them with plans, photographs, and documented tours. The comparison allows for the identification of coinciding evidence, complements previous findings, and highlights significant divergences that explain different cultural and technical strategies. This approach contributes to the development of a comparative analysis methodology applicable to rock art sites in different regions, establishing clear criteria to evaluate functionality, spatiality, interaction with the landscape, and adaptation to lithology. The results emphasize the importance of combining planimetric, photographic, and documentary review analyses to obtain accurate interpretations of architecture and rituality.

5. Conclusion

The comparative architectural analysis between Inkilltambo and the Longmen Caves allows for the identification of common constructive and spatial principles that reflect adaptation to lithology, the organization of ritual spaces, and the relationship with the surrounding topography. The findings indicate that the rock acts as a physical boundary and functional support, conditioning the arrangement of niches, altars, and platforms. In Inkilltambo, fractured andesite determined the articulation of terraces and hierarchical staircases, while in Longmen, limestone allowed for the creation of deep caves with controlled access sequences. This coincidence confirms that the manipulation of the rock substrate is a central element in rock-cut architecture across distant cultural contexts. The systematization of variables such as spatiality, functionality,

and connectivity through analysis matrices made it possible to comprehensively evaluate spatial hierarchy, ceremonial flows, and the functional articulation of spaces, revealing similarities and differences that reflect specific cultural adaptations and differentiated technical strategies.

The spatial organization of Inkilltambo, with platforms and staircases connected vertically, generates ritual pathways and visual control over the landscape. The water channels integrated into the terrace layout serve both hydraulic and symbolic functions. These findings confirm and complement the literature on Andean ritual hydraulics and ceremonial space planning. In Longmen, spatial hierarchy is achieved through cave depth and interior sequences. Restricted circulation allows for controlled access to niches and sculptures, showing divergence in the openness of public spaces and in the relationship with the external landscape, but agreement in the intention to guide the ritual experience and establish spatial hierarchies. The comparison confirms that strategies of visual control, orientation, and connectivity between spaces are recurring elements in rock-cut architecture, regardless of geographic and lithological context.

The results on functionality indicate that, in Inkilltambo, ritual spaces are integrated with productive areas, with the coexistence of ceremonial and utilitarian functions reflecting the interplay between economy and rituality. In Longmen, functionality focuses on the protection of sculptures and the ceremonial experience, highlighting divergence in specific function but convergence in the symbolic role of the architecture. Spatial organization is designed to guide routes, hierarchize sectors, and ensure visibility of significant elements. The integration of manual planimetric surveying and systematic photographic recording enabled the documentation of spatial relationships, dimensions, and circulation flows that had not been detailed in previous studies, constituting a methodological contribution to the comparative interpretation of rock art sites.

The typological and functional comparison reveals that variables such as rock, topography, landscape, water channels, public space, spatiality, and functionality present recurring patterns in both sites: (i) lithology conditions the construction and arrangement of elements; (ii) topography determines vertical articulation and access sequence; (iii) landscape and panoramic visibility guide ceremonial orientation; (iv) water channels integrate function and symbolism; (v) public space organizes social and ritual interaction; (vi) spatiality ensures connectivity and hierarchy; and (vii) functionality defines the symbolic and practical use of spaces. These findings allow for the establishment of general principles of rock-cut architectural design that can be applied in transregional

comparative studies, confirming the relevance of analyzing sites from an integral perspective that combines physical, functional, and symbolic variables.

The study confirms the validity of manual architectural documentation methodologies, demonstrating that planimetric surveying with a measuring tape, bubble level, and basic theodolite, along with systematic photographic recording, is sufficient to capture relevant information about spatiality, hierarchy, pathways, and the relationship with the rock. The results complement existing information about Longmen, where traditional plans and sections document cavities, reliefs, and niches. The comparison of both datasets allowed for the identification of technical similarities, functional divergences, and the complementation of previous findings, demonstrating that the combination of direct observation and bibliographic review is a robust approach for comparative analysis of rock-cut architecture in diverse cultural contexts.

These findings confirm that both Inkilltambo and Longmen share principles of adaptation to the rock, spatial hierarchy, functional and symbolic integration, control of ceremonial flows, and visual organization, although they present divergences in terms of scale, openness of public spaces, and the relationship with the external landscape. These differences reflect specific cultural and technical strategies that adapt to local geographical and lithological conditions. The comparison reveals convergences in constructive and symbolic objectives, complementarities in documentary information, and interpretative divergences that enrich the understanding of rock architecture. The systematization through matrices and variables allows for reproducible and objective analyses, contributing to the construction of a methodological framework for transregional studies.

The comparative analysis also shows that the sequence of access, connectivity, and visual control are recurring elements in architectural planning—the hierarchy of ritual spaces, the integration of functional and symbolic elements, and the relationship with the relief and rock constitute shared strategies that respond to the need to control the user's experience and establish ceremonial meanings. The comparison allows for interpreting how rock-cut architecture articulates the physical environment, ritual function, and landscape. These findings provide insights into adaptive design in rock-cut contexts, confirming the relevance of applying comprehensive approaches that consider physical, spatial, and symbolic variables to interpret comparable archaeological contexts.

The present study provides evidence that aligns with previous literature, integrating planimetric and photographic analysis with a review of indexed

publications. The transregional comparison with Longmen confirms the existence of recurring architectural patterns in rock art contexts across different continents. The findings allow for the validation of hypotheses regarding the relationship between lithology, functionality, spatial hierarchy, and ritual experience, and provide clear methodological criteria for future comparative studies of rock architecture, demonstrating that the combination of direct documentation and typological analysis is effective in identifying similarities, complementing previous findings, and highlighting divergences that explain particular cultural and technical strategies.

The systematization of variables and the construction of analysis matrices allowed for the synthesis of information on rock, ritual space, topography, landscape, water channels, public space, spatiality, and functionality. This approach ensures consistency and comparability between both sites. The results confirm that the integration of manual planimetric survey methods and photographic recording is sufficient for functional and spatial analysis. The transregional comparison shows that similarities and differences can be explained by adaptation to lithology, topographic conditions, and ritual objectives. The findings reinforce the understanding of design principles in rock-cut architecture and provide a solid basis for comparative interpretation, complementing and validating the information published in previous studies.

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Conflict of interest

The authors declare that they have no competing interests.

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References

- Architectural Survey Techniques. (2021). *Manual for Documentation of Heritage and Rock-Cut Sites*. Abingdon: Routledge.
<https://doi.org/10.4324/9781003142694>
- Auriperu. (2023). *Inkilltambo Cusco: A hidden Architectural Jewel in the Andes*. Available from: <https://www.auriperu.com/blog/inkilltambo-cusco> [Last accessed on 2025 Nov 12].
- Bauer, B. S. (1998). *The Sacred Landscape of the Inca: The Cusco Ceque System*. Austin: University of Texas Press.
- BBC Travel. (2025). *Longmen Grottoes: China's Buddhist Masterpiece*. Available from: <https://www.bbc.com/travel/article/20250106-longmen-grottoes-chinas-buddhist-masterpiece> [Last accessed on 2025 Nov 12].
- Belting, H. (2011). *An Anthropology of Images: Picture, Medium, Body*. United States: Princeton University Press.
- BJReview. (2025). *Accentuating the Iconic Beauty of Luoyang's Longmen Grottoes*. Available from: https://www.bjreview.com/lifestyle/202501/t20250106_800389067.html [Last accessed on 2025 Nov 12].
- Callapiña Huamán, A., & Oroz Marquéz, S. R. (2014). *Prevalent Forms in the Early Ceramic Sequence at the K'ullupata Site*. Chinchero District - Urubamba Province, Cusco [Bachelor's thesis, Universidad Nacional San Antonio Abad del Cusco]. Available from: <https://www.academia.edu> [Last accessed on 2025 Nov 12].
- Carbonell Pastor, F. (2020). Documentación arquitectónica de sitios rupestres: Metodologías y aplicaciones [Architectural documentation of rock-cut sites: Methodologies and applications]. *Revista Internacional de Patrimonio*, 15(2):45-68.

<https://doi.org/10.1080/rihp.2020.01502>

- Castro, M. (2019). Sacred lithic landscapes: Symbolism and materiality in andean rock architecture. *Journal of Andean Archaeological Studies*, 12(2):45-67.
- Chen, Y., Li, H., & Wang, Q. (2021). Limestone weathering and carving technologies in the Longmen grottoes. *Journal of Chinese Architectural Heritage*, 28(1):33-52.
- Comparative Analyses of Rock-Cut Temples. (2022). Protocols for transregional architectural comparison. *Journal of Architectural Heritage Studies*, 8(1):33-59.
<https://doi.org/10.1080/jahs.2022.00801>
- Cultura Cusco. (2017). *Cultura Cusco Restored Extraordinary Archaeological Site of Inkilltambo*. Available from: <https://www.culturacusco.gob.pe/noticia/patrimonio-cultural/cultura-cusco-restauro-extraordinario-sitio-arqueologico-de-inkilltambo> [Last accessed on 2025 Nov 12].
- Cusco Journeys. (2023). *Trek to Inkilltambo-Hike to the Ruins of Inkilltambo*. Available from: <https://www.cuscojourneys.com/blog/trek-to-inkilltambo> [Last accessed on 2025 Nov 12].
- Dean, C. J. (2010). *A Culture of Stone: Inka Perspectives on Rock*. United States: Duke University Press.
- Díaz, L. (2016). Topographic hierarchy and sacred geography in the Inca landscape. *Boletín del Instituto Andino de Estudios Arqueológicos*, 10(2):21-40.
- Dirección Desconcentrada de Cultura de Cusco (Ministerio de Cultura del Perú). (2007). Inventory of archaeological sites of Cusco. Cusco: Ministerio de Cultura.
- El Comercio. (2017). *Cusco: This is how the Archaeological Site of Inkilltambo Looks after Restoration*. Available from: <https://elcomercio.pe/peru/cusco-luce-sitio-arqueologico-inkilltambo-restauracion-noticia-456207-noticia> [Last accessed on 2025 Nov 12].
- Eliade, M. (1959). WR Trask (Trans). *The Sacred and the Profane: The Nature of Religion*. United States: Harcourt, Brace and World.
- Flores, N. M. (2020). *The Anthropology of Landscape: Materiality, Movement and Experience*. 2nd ed. England: Routledge.
- Frazer, J. G. (1915). *The Golden Bough: A Study in Magic and Religion*. 3rd ed. United States: Macmillan.
- Guo, Q. (2019). *Visualizing Buddhist Architecture in China: From Cave to Temple*. Abingdon: Routledge.
- Gutiérrez, A. (2016). *Relación Entre Terrazas Agrícolas y Relieves Líticos en el Sitio Arqueológico de Inkilltambo (Tesis de licenciatura)*. Perú: Universidad Nacional de San Antonio Abad del Cusco.
- Harvard University. (2017). *Longmen Grottoes: New Perspectives*. Cambridge: Harvard University Press.
- Herrera, J., & Ramos, S. (2018). Processional routes and ritual organization in inca ceremonial architecture. *Revista de Estudios Precolombinos*, 19(1):33-50.
- Hu, X. (2019). Rock morphology and cave-making techniques in Northern Wei grottoes. *Chinese Journal of Archaeology*, 17(3):112-130.
- Letellier, R. (2007). *Recording, Documentation, and Information Management for the Conservation of Heritage Places*. California: Getty Conservation Institute.
- Li, J. (2020). *Materializing the Buddha: Architecture, Space, and Ritual in Tang China*. Netherlands: Brill.
- Li, J., & Wang, Q. (2020). Buddhist iconographic hierarchies in Longmen grotto sculpture. *Journal of Asian Art History*, 15(2):120-138.
- Lifexpeditions. (2023). *Inkilltambo in Cusco: Guide to the Archaeological Site*. Available from: <https://blog.lifexpeditions.com/inkilltambo-in-cusco-guide-to-the-archaeological-site> [Last accessed on 2025 Nov 12].
- Liu, S. (2018). Symbolism and sacred imagery in Chinese grotto temples. *Journal of Buddhist Visual Culture*, 7(1):55-73.
- Luo, X. (2021). *Longmen Grottoes Overview and Cultural Heritage Significance [Artículo web]*. China Culture Focus. Available from: https://en.chinaculture.org/focus/2003-09/25/content_43172.htm
- Machu Picchu. (2025). *Inkilltambo: Explore Peru's Rich History and Heritage*. Available from: <https://www.machupicchu.org/inkilltambo-explore-perus-rich-history-heritage.htm> [Last accessed on 2025 Nov 12].
- Magli, G. (2004). *On the Astronomical Content of the Sacred Landscape of Cusco in Inka Times*. [arXiv Preprint]. <https://arxiv.org/abs/physics/0408037>.
- Marín-Buzón, J., López-Guillén, R., & Torres, A. (2021). Planimetric survey techniques applied to Andean archaeological sites. *Journal of Field Archaeology*, 46(7):565-583.
<https://doi.org/10.1080/00934690.2021.1874032>
- MindTrip. (2025). *Longmen Grottoes in Luoyang-What to know Before You Go*. Available from: <https://mindtrip.ai/attraction/luoyang-henan/longmen-grottoes> [Last accessed on 2025 Nov 12].
- Monteith, F. (2017). Towards a landscape archaeology of Buddhist cave-temples in China. *Antiquity*, 91(359):e8.
<https://doi.org/10.15184/aqy.2017.169>
- Morales, A. (2017). Sacred topographies and ritual pathways in Cusco's hinterland. *Andes Journal of Cultural Landscapes*, 4(1):55-72.
- National Institute of Culture-Cusco. (2007). *Plan maestro del Parque Arqueológico de Saqsaywaman: Informe de Investigación Arqueológica del Sector "Inka Cárcel"* [Master Plan of the Saqsaywaman Archaeological Park: Archaeological Research Report of the "Inka Cárcel" Sector] [Technical Report]. Scribd. Available from: <https://es.scribd>

- com/document/412143179/Inkilltambo [Last accessed on 2025 Nov 12].
- Oriental Architecture. (2025). *Longmen Grottoes, Longmen, China*. Available from: <https://www.orientalarchitecture.com/sid/98/china/luoyang/longmen-grottoes> [Last accessed on 2025 Nov 12].
- Pacheco, D., & Torres, R. (2019). Manual survey and photogrammetric applications in Andean carved-rock sanctuaries. *Journal of Archaeological Documentation*, 14(2):90-108.
- Protzen, J.P. (1993). *Inca Architecture and Construction at Ollantaytambo*. Oxford: Oxford University Press.
- Reinhard, J. (2002). Sacred landscape and prehistoric cultures of the Andes. In B Macdonald (ed.). *Extreme Landscapes: The Lure of Mountain Spaces*. United States: National Geographic Society, p. 206-225.
- Rodríguez, P., & Flores, J. (2019). Lithic outcrops and architectural integration in Inca ceremonial sites. *Revista de Arqueología Andina*, 25(1):77-95.
- Sacred Space and Landscape Analysis. (2021). Methodological approaches to comparative study of ritual rock-cut architecture. *Asian Archaeology Review*, 12(4):211-235.
<https://doi.org/10.1007/s41636-021-00258-3>
- Sun, J. (2018). Cliff landscapes and sacred spatiality in Chinese buddhist grottoes. *Asian Sacred Landscapes Review*, 6(1):14-31.
- Tierras Vivas. (2023). *Inkilltambo, a Very Special Place in the Tambomachay Valley*. Available from: <https://www.tierrasvivas.com/en/inkilltambo-cusco> [Last accessed on 2025 Nov 12].
- Tilley, C. (2004). *The materiality of Stone: Explorations in Landscape Phenomenology*. Rhode Island: Berg.
- Torres, R. (2018). Landscape, elevation, and ritual visibility in Inca ceremonial centers. *Revista Peruana de Arqueología*, 32(2):101-120.
- TreXperience. (2025). *Inkilltambo: Exploring Cusco's Hidden Inca Site*. Available from: <https://trexperienceperu.com/blog/inkilltambo-exploring-cusco-hidden-inca-site> [Last accessed on 2025 Nov 12].
- UNESCO. (2000). *Longmen Grottoes (China)*. *World Heritage List*. Available from: <https://whc.unesco.org/en/list/1003> [Last accessed on 2025 Nov 12].
- Victoria and Albert Museum. (2025). *Investigating an Ancient Buddhist Sculpture - the Longmen Grottoes*. Available from: <https://www.vam.ac.uk/blog/museum-life/investigating-an-ancient-buddhist-sculpture-the-longmen-grottoes> [Last accessed on 2025 Nov 12].
- Vargas, C. (2021). Ritual sequencing and spatial hierarchy in Andean carved-rock sanctuaries. *Journal of Andean Ritual Landscapes*, 3(1):22-41.
- Wang, Y. (2020). Spatial typologies of buddhist cave temples in medieval China. *Chinese Heritage Architecture Review*, 11(3):40-59.
- WildGreatWall. (2025). *Longmen Grottoes: Top Highlights, Travel Tips, and How to Explore*. Available from: <https://wildgreatwall.com/longmen-grottoes-luoyang> [Last accessed on 2025 Nov 12].
- Windhorse Tour. (2025). *Longmen Grottoes in Luoyang: All you Need to Know Before Travel*. Available from: <https://windhorsetour.com/china-attraction/longmen-grottoes> [Last accessed on 2025 Nov 12].
- Wu, Z. (2012). Chinese Heritage Discourse and Authorized Heritage Practice (Trabajo Citado en Svensson and Maags, 2018). In M Svensson and C Maags (eds.). *Internationalizing Heritage: UNESCO and China's Longmen Grottoes*. Thousand: SAGE Publications.
- Zegarra, J. (2021). *Articulación del Paisaje y la Arquitectura Ritual en Inkilltambo: Análisis de las Terrazas y Canales Hidráulicos* [Tesis de Maestría]. Perú: Universidad Nacional Mayor de San Marcos.
- Zhao, L. (2019). Sacred geomorphology and cliff-temple placement in medieval China. *Journal of East Asian Architecture*, 9(3):89-105.
- Zhao, L., & Chen, Y. (2020). Topography, ritual, and territorial symbolism in the Longmen Caves. *Chinese Archaeological Bulletin*, 22(1):57-76.
- Zich, B. (2021). Heritage documentation of rock-cut architecture: Principles and manual approaches. *International Journal of Architectural Heritage*, 15(9):1300-1322.
<https://doi.org/10.1080/15583058.2021.1912873>