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Landscape, Defense, and Symbolism: An Anthropological Interpretation of the Kolun Hillfort, Bosnia and Herzegovina

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Abstract

Elevated fortified settlements occupy some of the most prominent mountain landscapes of the western Balkans. Their locations were rarely accidental. Natural protection, broad visibility, access to building stone, and control of communication corridors repeatedly influenced where communities established permanent settlements. The Kolun Hillfort, near Mrežica in Bosnia and Herzegovina, occupies a limestone plateau reaching approximately 1190 m above sea level (with the surveyed enclosure ranging from 1158 - 1191 m a.s.l.), a prominent but not exceptional elevation among fortified summits of the region. Field observations combined with UAV photogrammetry, RTK-GNSS surveying, digital elevation modelling, GIS analysis, and LiDAR documentation were used to examine the relationship between the natural landscape and the organization of the settlement. Particular attention is given to the elongated north–south orientation of the summit plateau, the alignment of the principal dry-stone walls with the ridge, the use of natural limestone escarpments as part of the defensive system, and field-observed visibility over the surrounding mountain terrain. The cultural-historical attribution of Kolun to the Illyrian Iron Age, with probable later reuse, follows surface morphology and typological comparison with regional hillforts and is treated throughout this paper as provisional pending excavation and absolute dating; the label 'Illyrian' itself is used here as a conventional archaeological shorthand rather than as a claim about the ethnic self-identification of the site's builders. Rather than viewing Kolun solely as a defensive structure, this paper interprets it as the result of deliberate landscape selection. The combination of topography, geology, construction material, visibility, and spatial organization is interpreted as reflecting careful planning by a socially organized community—a hypothesis consistent with, but not yet confirmed by, excavated evidence. Comparison with other Illyrian hillforts (Daorson, Varvaria, Asseria, and Meteon), based on published literature and a defined set of comparison variables rather than new fieldwork, suggests that similar principles influenced the selection and development of fortified mountain settlements throughout the western Balkans. Building on these observations, the paper proposes a five-component conceptual framework—the Kolun Model of Illyrian Landscape Selection—linking landscape, topography, human decision-making, architectural response, and cultural landscape, and offers it as a testable hypothesis for comparative work at other Illyrian hillforts. The Kolun Hillfort provides a case study for discussing how environmental, strategic, and symbolic considerations may have shaped settlement location within the Illyrian cultural landscape and demonstrates the value of integrating modern geospatial documentation with anthropological interpretation.

Keywords

Kolun Hillfort, Illyrian, Landscape Archaeology, Anthropological Interpretation, Cultural Landscape, Defensive Architecture, Settlement Selection, Dry-Stone Construction, Symbolism, Bosnia and Herzegovina, GIS, LiDAR

1. Introduction

Elevated fortified settlements are among the most distinctive archaeological features of the western Balkans. Their distribution extends from the eastern Adriatic coast to the mountainous interior of Bosnia and Herzegovina, Montenegro, Albania, and adjacent regions. Although these settlements differ in size, chronology, and architectural complexity, many occupy remarkably similar topographic settings. Mountain ridges, isolated plateaus, and naturally protected summits were repeatedly selected for permanent occupation. Such regularity suggests that the relationship between human communities and the landscape followed recognizable patterns rather than isolated local decisions (Tilley, 1994; Bradley, 2000; Johnson, 2010).

Landscape has long been understood as more than a physical setting for human activity. It shapes movement, communication, territorial organization, and social identity while simultaneously being modified through human occupation and construction (Ingold, 1993; Ashmore, 2004; Ashmore & Knapp, 1999; Knapp & Ashmore, 1999). Elevated places offered practical advantages, including extensive visibility, natural protection, and access to construction material, but they could also acquire symbolic significance through their prominence within the surrounding environment. The repeated selection of similar locations throughout prehistory indicates that environmental, strategic, and cultural considerations often operated together rather than independently (Renfrew & Bahn, 2020; Trigger, 2006).

Within this broader landscape, fortified settlements conventionally attributed to Iron Age Illyrian communities represent one of the defining archaeological characteristics of the western Balkans. Monumental dry-stone walls preserved at Daorson, Varvaria, Asseria, Meteon, and numerous other sites demonstrate considerable technical knowledge, organized labour, and long-term planning (Wilkes, 1992; Stipčević, 1977; Čović, 1987; Benac, 1975, 1985). At the same time, 'Illyrian' is itself a label with a complex historiography: it derives largely from external, later Greek and Roman ethnography rather than from an attested Iron Age self-designation, and its retrospective application to specific material-culture groups has been increasingly questioned in recent scholarship (Dzino, 2014). Regional chronological syntheses further show that Bosnian hillfort communities were organized into multiple, only partly related archaeological groups (e.g., the Glasinac and Central Bosnian groups) whose settlement histories, internal chronologies, and degree of shared ethnic identity remain actively debated rather than settled (Gavranović & Sejfuli, 2018). This paper therefore uses "Illyrian" as a conventional archaeological label for a recognized regional Iron Age fortification tradition, not as an assertion about the ethnic identity of Kolun's builders. Such achievements point to socially organized communities capable of mobilizing resources for large-scale construction projects and adapting complex mountain environments to their needs. While chronology and regional development continue to be discussed, the engineering and spatial organization of these settlements leave little doubt that their builders possessed sophisticated knowledge of construction, landscape, and defensive planning. Comparable evidence for the deliberate selection of elevated, naturally defensible terrain has been documented at other eastern Adriatic hillforts, including Grad on the Pelješac peninsula and the wider Dalmatian gradina tradition (Forenbaher & Rajić Šikanjić, 2006; Marijanović, 2009; Chapman, Shiel, & Batović, 1996).

Previous investigations of Illyrian hillforts have focused primarily on architecture, excavation results, chronology, and material culture. Comparatively less attention has been given to why particular mountain summits were selected for settlement and how natural landforms influenced the organization of fortified landscapes. Modern geospatial technologies have significantly improved archaeological documentation during the past two decades, allowing researchers to examine settlement morphology, visibility, terrain, and spatial relationships with unprecedented precision (Doneus et al., 2008; Forte & Campana, 2016). These methods provide an opportunity to reconsider fortified settlements not simply as isolated defensive structures, but as carefully selected components of a broader cultural landscape.

The Kolun Hillfort, situated near the village of Mrežica in southeastern Bosnia and Herzegovina, occupies a limestone plateau reaching approximately 1190 m above sea level, with elevations across the fortified enclosure itself ranging from 1158 to 1191 m a.s.l. and the wider surveyed extent spanning 1082 - 1248 m a.s.l. (**Figure 1**; §3.1, **Table 1**). Despite its imposing position and well-preserved dry-stone fortifications, the site has remained virtually uninvestigated. Prior to the present research, no systematic archaeological documentation, geodetic survey, airborne LiDAR acquisition, UAV photogrammetry, or GIS analysis had been undertaken. The integrated documentation presented here, together with the companion geospatial-methods paper (Osmanagich, 2026a), establishes the first comprehensive spatial record of the site and creates a permanent reference framework for future archaeological, anthropological, architectural, and environmental investigations. As with any fortified site known only from surface observation, the Illyrian Iron Age attribution used throughout this paper is provisional: it follows typological comparison with regional hillforts rather than excavated stratigraphy or absolute dating, and probable later reuse (e.g., during the Middle Ages) cannot be excluded (see §2.7, Limitations).

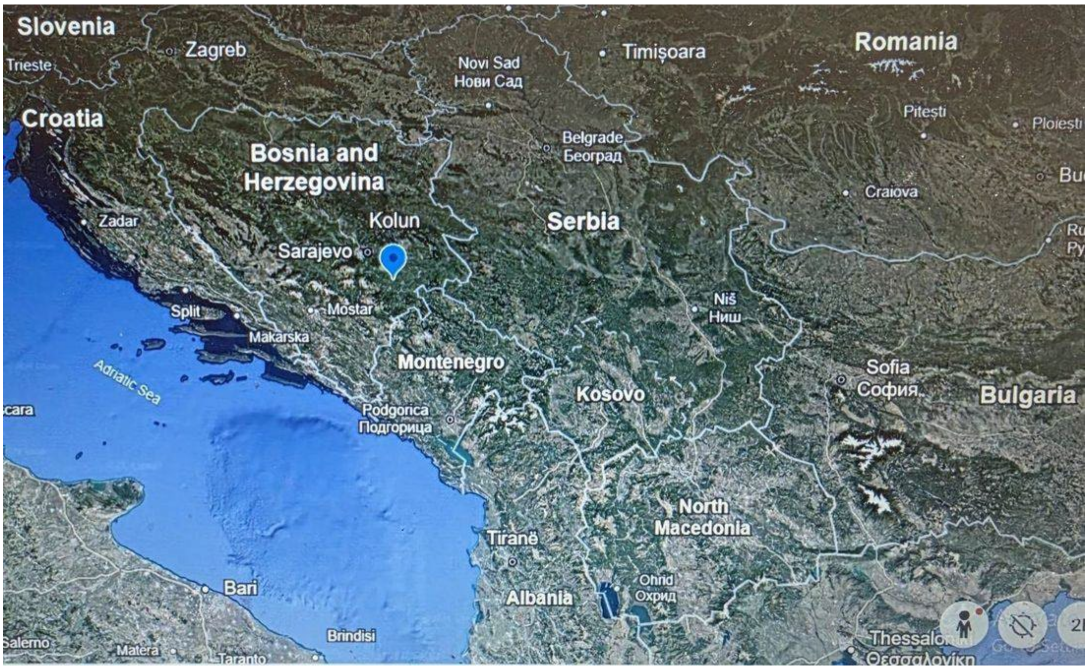

Figure 1. Location of the Kolun Hillfort within the southeastern Dinaric Alps of Bosnia and Herzegovina. Situated at an elevation of approximately 1190 m above sea level, the site occupies a naturally prominent mountain summit overlooking the surrounding landscape.

Several questions arise from the position and organization of the Kolun Hillfort. Why was this particular summit selected when numerous surrounding elevations were available? Which natural characteristics contributed to its defensive potential? To what extent did the builders adapt their enclosure to the morphology of the plateau? Does the pronounced north–south orientation of the summit influence the alignment of the defensive walls? Finally, how does Kolun compare with other Illyrian fortified settlements distributed across the western Balkans?

Particular attention is given to the relationship between natural landforms and human construction. The elongated north–south orientation of the summit plateau is reflected in the alignment of the principal defensive walls, suggesting that the builders deliberately adapted the settlement to the mountain's existing morphology rather than reshaping it extensively. This relationship between natural topography and architectural organization has received little attention in studies of Illyrian hillforts and forms one of the central themes of the present analysis. The regional distribution of Illyrian territories during the Late Iron Age (**Figure 2**) situates Kolun within this broader cultural landscape and its long-recognized network of highland communities occupying naturally defensible terrain.

Figure 2. Approximate distribution of Illyrian territories during the Late Iron Age, showing the location of the Kolun Hillfort within the mountainous cultural landscape of the western Balkans.

2. Materials and Methods

The investigation combines archaeological field observations with high-resolution geospatial documentation and comparative anthropological analysis. The objective was not to establish chronology through excavation or artifact analysis, but to examine how the physical characteristics of the landscape influenced the selection and organization of the settlement. The methodological framework therefore integrates direct observation of preserved architectural remains with quantitative spatial documentation and regional comparison.

2.1. Study Area

The Kolun Hillfort is located near the village of Mrežica in the Municipality of

Foča, Bosnia and Herzegovina, within the mountainous region of the southeastern Dinaric Alps. The fortified settlement occupies an elongated limestone plateau at an elevation of approximately 1190 m above sea level, with the fortified enclosure itself ranging from 1158 to 1191 m a.s.l. Steep natural slopes surround much of the summit, while access is limited to comparatively gentle approaches along the ridge. Extensive limestone outcrops dominate the local geology and supplied abundant material for dry-stone construction.

The summit exhibits a pronounced north–south orientation that strongly influences its overall morphology. Rather than modifying this natural configuration, the builders adapted the principal enclosure walls to the existing ridge, producing a fortified settlement that closely follows the geometry of the mountain itself. A general aerial view of the site (**Figure 3**) illustrates the elevated plateau surrounded by steep limestone slopes that defined the location's advantages for settlement, surveillance, and defense.

Figure 3. General aerial view of the Kolun Hillfort obtained through UAV photogrammetry, illustrating the elevated plateau surrounded by steep limestone slopes that provided an advantageous location for settlement, surveillance, and defense.

2.2. Geospatial Documentation

The site was documented using an integrated geospatial survey consisting of UAV photogrammetry, RTK-GNSS measurements, airborne LiDAR, digital elevation modeling, orthophotography, and Geographic Information Systems (GIS). These datasets provided high-resolution representations of terrain morphology, preserved architectural remains, vegetation cover, and surrounding topography (Osmanagich, 2026a).

The principal survey parameters, reported in full in the companion methods paper (Osmanagich, 2026a), were as follows. Field data were collected between 10 and 21 July 2026 by GeoGIS Studio d.o.o. (Sarajevo) over a surveyed extent of approximately 14.1 ha (elevation range 1082 - 1248 m a.s.l.). Aerial data were acquired with a DJI Matrice 350 RTK platform carrying a DJI Zenmuse L2 combined LiDAR/RGB sensor, flown at a constant 45 m above the terrain surface; 580 UAV photographs were captured on 10 July 2026 (12:59 - 13:30 local time) with 70% along-track and 40% cross-track overlap, and airborne LiDAR was acquired at a point density exceeding 150 points/m^2. Ground control used Leica GS14 and South G1+ GNSS receivers and FOIF RTS362 and Trimble S6 Total Stations, referenced to the MGI 1901/Balkans zone 6 coordinate system (EPSG:3908; Bessel 1841 ellipsoid, Gauss-Krüger projection, central meridian 18˚E). Real-time corrections were obtained via RTCM messages from the permanent reference stations of the Federal Geodetic Administration of Bosnia and Herzegovina, with ground-control-point residuals of approximately 2 cm. Comparison of the LiDAR-derived terrain model against five independent RTK-GNSS check points yielded a horizontal RMSE of 0.031 m and a vertical RMSE of 0.019 m; the resulting raster terrain products (hillshade, DEM, slope) were generated at 0.3 m × 0.3 m resolution. **Table 1** summarizes these parameters alongside other quantitative results.

Visibility statements in §3 and §4 ("extensive visibility," "commanding views," "visual dominance") reflect direct field observation and inspection of the UAV orthophotography and LiDAR-derived DEM rather than a computed GIS viewshed. A quantitative viewshed analysis on the 0.3 m LiDAR-derived DEM—observer height 1.7 m, radius set from the surrounding ridgeline, bare-earth and canopy-height variants, and corridor visibility scored against mapped valley routes—is planned as the next stage of this research and is outlined in §5.

The resulting digital products enabled detailed examination of settlement boundaries, wall alignments, natural defensive features, access routes, elevation differences, and relationships between built and natural elements. Rather than serving an end in themselves, these technologies provided objective spatial evidence supporting anthropological interpretation. The general application of GIS and remote sensing to archaeological problems follows established practice in landscape archaeology (Conolly & Lake, 2006; Wheatley & Gillings, 2002; Lock, 2003; Opitz & Herrmann, 2018), including approaches to visibility and topographic prominence that inform the treatment of viewshed and terrain data in this study (Llobera, 2001, 2003) and, more broadly, the use of spatial and predictive modelling in archaeological landscape research (Verhagen, 2007). This survey builds methodologically on the author's previous LiDAR- and GIS-based documentation of related sites in the Visoko region, including the subterranean Ravne tunnel system and the wider Bosnian Valley of the Pyramids (Osmanagich, 2026b, 2026c).

2.3. Anthropological Approach

The analysis was guided by concepts developed within landscape archaeology and anthropology, which regard settlements as expressions of interaction between human communities and their physical environment (Ingold, 1993; Tilley, 1994; Knapp & Ashmore, 1999). Particular attention was given to characteristics that repeatedly appear among elevated fortified settlements, including topographic prominence, visibility, natural protection, access to building material, spatial organization, and orientation.

Comparative observations were made with well-documented Illyrian fortified settlements throughout the western Balkans, including Daorson, Varvaria, Asseria, and Meteon. These comparisons applied a defined, consistent set of variables drawn directly from the Kolun Model (§3.6): i) elevation and relative topographic prominence, ii) extent of natural defensibility (proportion of the perimeter formed by cliffs/escarpments versus constructed wall), iii) dominant local construction material, iv) correspondence between wall alignment and underlying ridge or landform geometry, and v) approximate enclosed area, where reported in the published literature. Values for the comparison sites are drawn from existing secondary literature (Wilkes, 1992; Stipčević, 1977; Benac, 1975, 1985) rather than from new field measurement, and the comparison is accordingly qualitative rather than a like-for-like geospatial dataset; a directly comparable, field-measured application of these same variables at other sites is proposed in §5 as the logical next stage of this research. The purpose of these comparisons was not to establish direct cultural relationships, but to identify recurring principles of landscape selection and settlement organization that may reflect broader patterns of Illyrian occupation.

3. Results

3.1. Topographic Setting and Landscape Selection

The Kolun Hillfort occupies the summit of an elongated limestone plateau at an elevation of approximately 1,190 m above sea level, with the fortified enclosure ranging from 1158 - 1191 m a.s.l. across a surveyed extent of approximately 14.1 ha (1082 - 1248 m a.s.l.; **Table 1**). The position dominates the surrounding mountain landscape, providing wide fields of view, based on field observation and orthophoto/DEM inspection (see §2.2 on the scope and limits of the visibility evidence), across adjacent valleys, ridges, and natural communication corridors. The summit is naturally protected by steep escarpments along much of its perimeter, reducing the need for extensive artificial fortification.

The selection of this location is interpreted here as reflecting a combination of environmental and strategic factors rather than a single criterion. The plateau offers sufficient ground for permanent occupation while remaining difficult to approach from most directions. Access is concentrated along comparatively gentle ridges, where defensive control could plausibly have been maintained with relatively limited construction.

The local geology also appears to have contributed directly to settlement selection. Massive limestone outcrops provided abundant construction material immediately adjacent to the occupied area, eliminating the need to transport large quantities of stone over long distances. The same bedrock formations simultaneously created natural cliffs that became integral components of the defensive system.

Together, these characteristics illustrate a close relationship between the physical landscape and the placement of the settlement. Rather than representing an arbitrary mountain occupation, Kolun appears to have been established where topography, geology, visibility, and accessibility formed a naturally integrated defensive environment.

Table 1 summarizes the quantitative parameters established by the survey. Metric extraction of individual wall-segment lengths, compass orientations, and the accessible-versus-naturally-protected proportion of the perimeter from the vectorized wall dataset (feature classes BW/EN/PT/CL/TR/RK; Osmanagich, 2026a) is planned as a dedicated follow-up geospatial analysis (§5).

Table 1. Quantitative survey parameters for the Kolun Hillfort, drawn from the integrated geodetic, UAV, and LiDAR survey (Osmanagich, 2026a). Parameters not yet quantified (plateau area net of survey extent, maximum slope, principal wall azimuth, total preserved wall length) are the subject of the dedicated follow-up analysis noted in §5.

Parameter	Value
Surveyed extent	≈14.1 ha
Elevation range, fortified enclosure	1158 - 1191 m a.s.l.
Elevation range, surveyed extent	1082 - 1248 m a.s.l.
LiDAR point density	>150 points/m^2
DEM/hillshade/slope raster resolution	0.3 m × 0.3 m
Terrain-model accuracy vs. GNSS check points	Horizontal RMSE 0.031 m; vertical RMSE 0.019 m
Ground-control-point residuals	≈2 cm

3.2. Defensive Architecture and Adaptation to Natural Topography

The preserved fortifications consist primarily of substantial dry-stone walls constructed from locally available limestone blocks. Instead of enclosing the summit through a geometrically regular plan, the walls closely follow the natural margins of the plateau and incorporate existing rock formations into the defensive system, as shown in the aerial view of the central occupation area (Figure 4).

Several wall segments terminate directly against exposed limestone cliffs, where additional construction would have provided little defensive advantage. Elsewhere, the builders reinforced naturally accessible sections of the plateau while leaving steep escarpments largely unmodified (Figure 5). This selective distribution of construction effort is consistent with, though not yet quantitatively confirmed as, an efficient use of available labor and materials.

Figure 4. An aerial view of the central occupation area showing preserved dry-stone wall remains enclosing the summit plateau.

Figure 5. Principal limestone escarpment forming part of the natural defensive system of the Kolun Hillfort.

The resulting defensive system therefore combines natural and artificial barriers into a single architectural unit. Rather than replacing the existing terrain, construction supplemented those parts of the landscape where natural protection was weakest.

This close integration between geology and architecture is interpreted as suggesting that the builders regarded the mountain itself as an essential component of the fortification rather than merely the foundation upon which walls were erected.

3.3. Settlement Orientation and Spatial Organization

One of the most distinctive characteristics of the Kolun Hillfort is the close correspondence between the shape of the summit plateau and the organization of the occupied enclosure. The elongated ridge follows a pronounced north-south axis, and the principal defensive walls preserve this same general orientation throughout much of the fortification.

The builders did not impose an independent geometric layout upon the landscape. Instead, the enclosure adapts to the existing form of the mountain, preserving its natural geometry while defining the occupied area through strategically placed dry-stone walls. Minor deviations occur where local topography required adjustment, but the overall configuration consistently reflects the shape of the ridge.

This relationship is interpreted here as indicating that terrain morphology was not simply a constraint to be overcome but an organizing principle in settlement planning. By aligning construction with the natural orientation of the plateau, the builders appear to have minimized unnecessary earthworks, reduced construction effort, and maximized the defensive advantages already provided by the landscape.

The observed correspondence between ridge orientation and architectural layout represents an important characteristic of the Kolun Hillfort and provides a useful framework for comparison with other Illyrian fortified settlements throughout the western Balkans.

3.4. Geospatial Documentation Results

The integrated geospatial survey produced the first comprehensive spatial documentation of the Kolun Hillfort. UAV photogrammetry generated high-resolution orthophotographs and three-dimensional surface models, while RTK-GNSS measurements established accurate positional control for visible archaeological features. Airborne LiDAR complemented these datasets by recording terrain morphology beneath vegetation cover, allowing subtle archaeological and geomorphological features to be identified with greater confidence (**Figure 6**).

The combined datasets provided detailed digital elevation models, slope analyses, contour maps, and three-dimensional visualizations that permitted accurate measurement of wall alignments, plateau dimensions, elevation differences, and relationships between constructed and natural features (**Figure 7**). The full technical specification of these survey products (accuracy statistics, resolution, and processing workflow) is reported in the companion geospatial paper (Osmanagich, 2026a; summarized in §2.2 above).

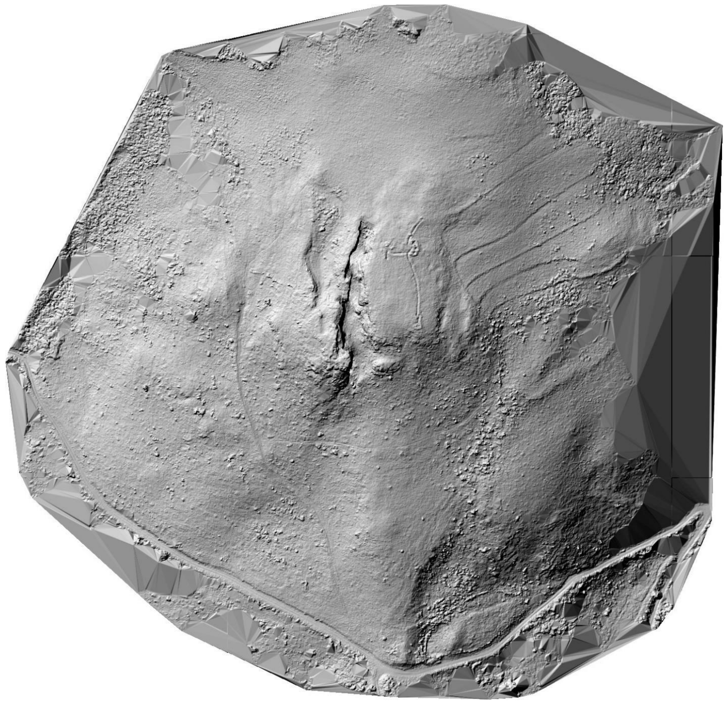

Figure 6. LiDAR-derived hillshade model of the Kolun Hillfort revealing the spatial organization of the fortified summit.

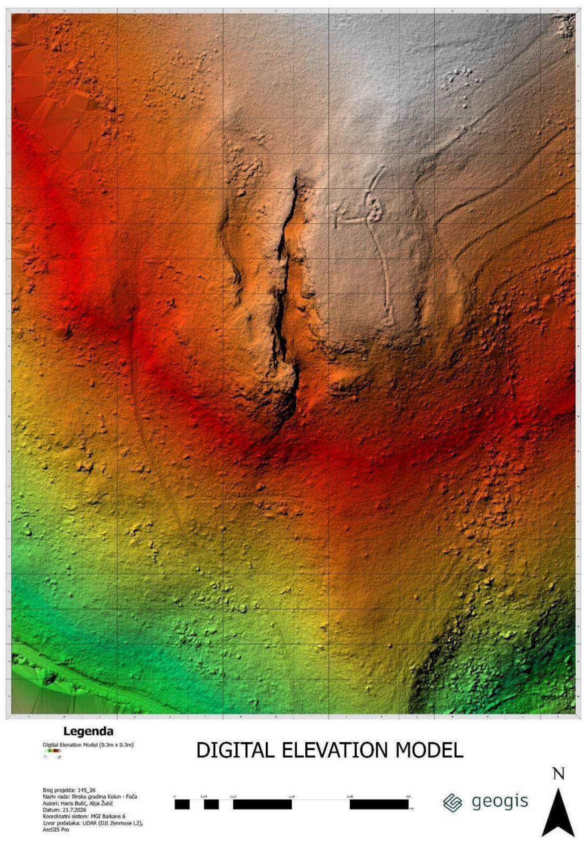

Figure 7. Digital Elevation Model (DEM) of the Kolun Hillfort and its surrounding terrain, emphasizing the settlement's commanding position above adjacent valleys.

3.5. Kolun within the Illyrian Cultural Landscape

Although each Illyrian hillfort reflects local environmental conditions, the principal characteristics observed at Kolun correspond to patterns documented at numerous fortified settlements across the western Balkans. Elevated positions, extensive visibility, exploitation of natural defensive features, and the use of locally available limestone for monumental dry-stone construction recur throughout the region.

Kolun contributes a particularly well-preserved example of how settlement planning could integrate natural landforms with human construction. Rather than relying solely on massive defensive walls, the builders appear to have incorporated the mountain's existing morphology into the settlement's overall organization. This approach may have reduced construction requirements while preserving a coherent defensive system that extended the surrounding landscape.

The combination of topographic adaptation, architectural planning, and comprehensive geospatial documentation suggests that Kolun represents considerably more than an isolated mountain fortification. It provides an important case study for examining how communities conventionally labeled 'Illyrian' (see §1 and §4.4 on the provisional and conventional nature of that label) selected, organized, and transformed elevated landscapes during the Iron Age. The principal factors identified through this analysis are summarized in **Table 2**, presented at the end of the Results section below.

3.6. Toward a Conceptual Model: The Kolun Model of Illyrian Landscape Selection

The recurring relationships identified in the preceding sections—between elevation, geology, ridge morphology, defensive architecture, and territorial visibility—can be organized into a single interpretive framework. Rather than treating landscape, topography, human decision-making, architectural response, and cultural landscape as independent observations, the Kolun evidence supports the proposal that these factors operate as sequential and interconnected stages in the selection and organization of a fortified settlement. This sequence is proposed here as the Kolun Model of Illyrian Landscape Selection (**Figure 8**)—a testable framework grounded in the Kolun evidence, to be confirmed or revised through comparative application at other sites rather than treated as a closed conclusion.

In this framework, landscape properties—elevation, geology, visibility, water, and access—define the range of topographic forms available to a community (ridges, cliffs, plateaus, slopes). These topographic forms in turn are hypothesized to shape human decisions about settlement location, defense, communication, and resource availability. Decisions are then expressed materially through an architectural response—wall alignment, adaptation to the ridge, use of local limestone, and enclosure design—which, over time, is hypothesized to produce a cultural landscape characterized by permanent occupation, territorial control, identity, and symbolic prominence.

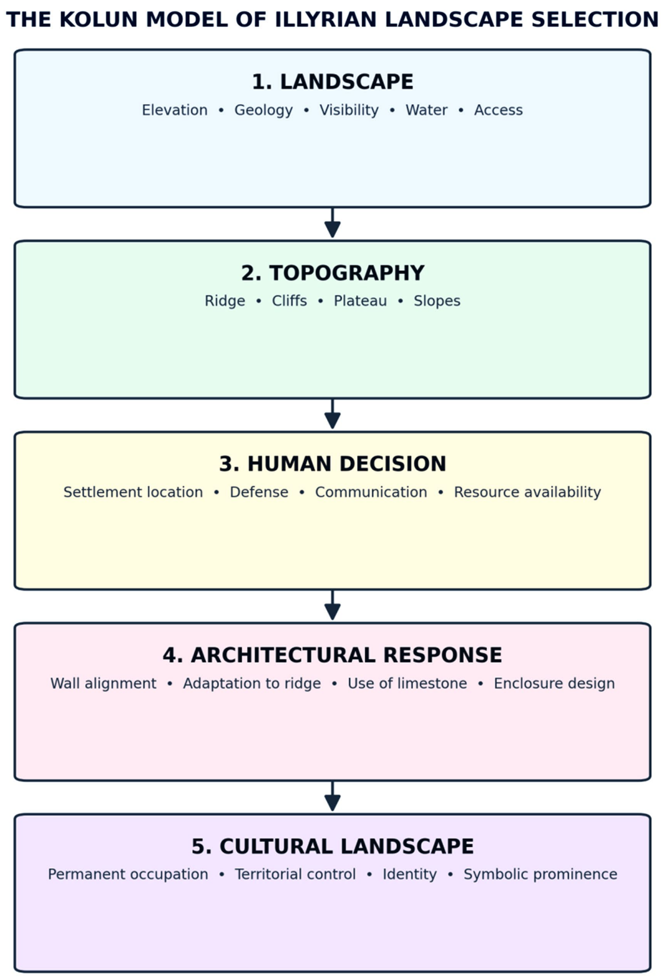

Figure 8. The Kolun Model of Illyrian Landscape Selection: a five-stage conceptual framework linking landscape properties, topography, human decision-making, architectural response, and the resulting cultural landscape.

Framed this way, Kolun is not simply an interesting individual hillfort but a case study through which the model itself can be tested. The same five stages are, in principle, observable at other Illyrian fortified settlements, including Daorson, Varvaria, Asseria, and Meteon, and the model is offered as a framework that future comparative and geospatial studies at these and other sites can apply and refine using the explicit comparison variables set out in §2.3, building on the same GIS- and LiDAR-based documentation methods applied here and in the author's related geospatial work in the Bosnian Valley of the Pyramids (Osmanagich, 2026c).

Unlike descriptive classifications of hillforts based primarily on chronology or architectural form, the Kolun Model emphasizes the sequence of decisions that may have transformed a natural landscape into a permanent cultural landscape. Because the model is process-oriented rather than site-specific, it is explicitly intended to be tested, modified, or rejected through comparative investigations at other Illyrian hillforts throughout the western Balkans.

Table 2. Principal environmental, architectural, and anthropological factors relevant to the Kolun Hillfort. Column 3 states hypotheses arising from field observation and geospatial documentation, not conclusions established by excavation.

Factor	Evidence at Kolun	Anthropological interpretation (hypothesis)
Elevation	≈1190 m plateau (1158 - 1191 m enclosure)	Long-distance visibility and territorial awareness (field-observed, not viewshed-modeled—see §2.2)
Limestone geology	Local bedrock	Immediate availability of construction material
Natural cliffs	Steep escarpments	Reduced need for artificial fortification
North-south ridge	Walls follow ridge	Adaptation of architecture to natural morphology
Limited access	Ridge approaches	Efficient control of movement (hypothesized)
Spatial dominance	Panoramic views (field-observed)	Strategic and potentially symbolic prominence (hypothesized)

4. Discussion

The Kolun Hillfort is interpreted here as demonstrating that the selection of elevated settlements during the Iron Age involved considerably more than the search for defensible terrain. The physical characteristics of the site reveal a close relationship between natural topography and human decision-making, indicating that environmental, strategic, economic, and symbolic considerations collectively influenced settlement planning. Rather than treating the mountain as an obstacle to be modified, the builders incorporated its existing morphology into the organization of the settlement, thereby maximizing the advantages already provided by the landscape.

One of the most significant observations concerns the relationship between the natural north-south orientation of the summit plateau and the alignment of the principal defensive walls. The enclosure closely follows the elongated ridge instead of imposing an independent geometric plan upon it. This adaptive approach plausibly reduced the need for extensive earthworks, minimized the volume of stone required for construction, and preserved the natural defensive strength of the mountain. The resulting settlement represents a balance between human engineering and environmental adaptation rather than complete transformation of the landscape.

This principle of architectural adaptation has broader anthropological implications. Throughout prehistory, communities repeatedly selected locations where natural landforms could be incorporated into settlement planning with relatively limited modification (Tilley, 1994; Bradley, 2000; Ingold, 1993; Ashmore & Knapp, 1999). Kolun provides a particularly clear example of this relationship because the ridge's morphology remains directly reflected in the preserved layout of the enclosure. The builders appear to have recognized that the mountain itself constituted an essential component of the defensive system, requiring reinforcement only where natural protection was comparatively weak.

The geological characteristics of the site also appear to have contributed to settlement organization. Extensive limestone outcrops supplied abundant building material immediately adjacent to the occupied area while simultaneously forming steep escarpments that functioned as natural barriers. This combination plausibly reduced construction effort and created a defensive system in which natural and built elements became structurally inseparable. Similar integration of bedrock and dry-stone architecture has been documented at several major Illyrian hillforts throughout the western Balkans, although the degree of preservation varies considerably from site to site (Wilkes, 1992; Stipčević, 1977; Benac, 1975, 1985). Comparable dry-stone construction techniques have also been documented in other archaeological contexts in Bosnia and Herzegovina, including the subterranean river-pebble dry-stone walls of the Ravne Tunnel Complex (Osmanagich, 2025). Comparable dry-stone traditions, analyzed with similar remote-sensing methods, have recently been documented on the Adriatic island of Cres and at the hillfort of Grad on the Pelješac peninsula, reinforcing the regional character of this construction technique (Doneus, Doneus, & Cowley, 2022; Forenbaher & Rajić Šikanjić, 2006).

Visibility represents another important component of landscape selection. From the summit, field observation and orthophoto/DEM inspection indicate extensive views extend across surrounding valleys, mountain passes, and neighboring ridges. Such visual dominance plausibly enhanced defensive awareness, but it may also have reinforced territorial identity and social presence within the broader cultural landscape. Elevated settlements frequently occupy positions that are not only strategically advantageous but also visually prominent, suggesting that practical and symbolic considerations often developed together rather than independently (Ashmore, 2004; Knapp & Ashmore, 1999; Ashmore & Knapp, 1999). Comparable relationships between visibility, territorial control, and symbolic prominence have been discussed for prehistoric hillfort landscapes of the eastern Adriatic more broadly, where elevated hillfort sites recur as markers of territory and communication across the Bronze and Iron Ages (Chapman, Shiel, & Batović, 1996; Harding, 1972).

The present investigation also demonstrates the value of integrating modern geospatial technologies with anthropological interpretation. UAV photogrammetry, RTK-GNSS surveying, airborne LiDAR, and GIS analysis provided the first comprehensive spatial documentation of the Kolun Hillfort, allowing subtle relationships between terrain morphology, architecture, and settlement organization to be examined quantitatively (Conolly & Lake, 2006; Wheatley & Gillings, 2002; Lock, 2003; Opitz & Herrmann, 2018). These technologies do not replace archaeological interpretation; rather, they provide objective spatial evidence that strengthens anthropological analysis and establishes a permanent reference framework for future investigations. The approach is consistent with, and extends, the author's earlier geospatial studies of the Ravne tunnel system and the wider Bosnian Valley of the Pyramids, which applied comparable LiDAR- and GIS-based methods to different classes of site (Osmanagich, 2026b, 2026c).

Because Kolun had not previously been subjected to systematic archaeological or geospatial documentation, the present study represents the first comprehensive scientific record of the site. The datasets generated during this investigation provide an essential baseline for future excavation, conservation, environmental monitoring, and comparative studies of Illyrian fortified settlements. Equally important, they demonstrate how non-invasive documentation can substantially expand archaeological knowledge even in the absence of large-scale excavation.

Although this investigation focuses on a single hillfort, its implications extend beyond Kolun itself. The recurring association between elevated topography, natural defensive features, local building materials, ridge morphology, and settlement organization suggests that similar principles may have influenced the selection of numerous hillforts across the western Balkans conventionally grouped under the 'Illyrian' label. The Kolun Model of Illyrian Landscape Selection, proposed in §3.6, offers one way of organizing these recurring associations into a testable framework; future comparative investigations employing standardized geospatial documentation and the explicit comparison variables of §2.3 may determine whether they constitute a broader regional pattern of settlement planning.

Rather than interpreting hillforts solely as military installations, the evidence from Kolun supports a more comprehensive anthropological perspective, consistent with broader conceptions of settlements as constructed and inhabited cultural landscapes (Ashmore & Knapp, 1999; Trigger, 2006). The settlement is interpreted as reflecting deliberate interaction between human communities and the mountain environment, in which defence, resource availability, landscape morphology, visibility, and social organization may have been integrated into a coherent system of occupation. Understanding these relationships contributes not only to the archaeology of communities conventionally described as Illyrian but also to broader discussions of how prehistoric societies selected, organized, and transformed prominent landscapes.

On the Provisional Nature of the "Illyrian" Attribution

The term "Illyrian" as applied to Iron Age hillforts of the western Balkans, including Kolun, is a historiographic and archaeological convention rather than a demonstrated ethnic self-designation. As Dzino (2014) has shown, the category derives largely from Greek and Roman external ethnography and was substantially reshaped by early modern and modern nation-building narratives, which limits its reliability as a marker of prehistoric group identity. Regional syntheses of the Bosnian Early Iron Age similarly caution against treating archaeological "cultures" or groups (e.g., Glasinac, Central Bosnian) as bounded, self-conscious ethnic units, given the patchy and geographically uneven excavation record on which such groupings are based (Gavranović & Sejfuli, 2018). Accordingly, this paper uses "Illyrian" only as a conventional label for a recognized regional fortification tradition and construction technique, consistent with prior usage in the cited literature (Wilkes, 1992; Stipčević, 1977), and all claims in this paper about the identity, social organization, or symbolic intentions of Kolun's builders should be read as archaeologically informed hypotheses rather than established facts.

The Kolun Hillfort illustrates a broader principle of prehistoric settlement planning: successful fortified communities did not simply build on mountains—they may have built with mountains. The morphology of the landscape is interpreted as having been incorporated into the settlement's architectural concept, creating a unified system in which natural and constructed features functioned together. This perspective encourages future investigations of Illyrian hillforts to examine landscape adaptation as a central component of settlement organization rather than as a secondary consequence of topography.

5. Limitations and Future Research

The present investigation is based primarily on non-invasive archaeological documentation and anthropological interpretation of the preserved landscape. Although the integrated use of UAV photogrammetry, RTK-GNSS surveying, airborne LiDAR, and GIS analysis provides an exceptionally detailed spatial record of the Kolun Hillfort, questions concerning chronology, construction phases, duration of occupation, cultural attribution, and internal settlement organization can only be resolved through systematic archaeological excavation and laboratory analyses.

Four points define the immediate research agenda arising from this study. First, the 'Illyrian' attribution (with probable later reuse) remains provisional pending excavated stratigraphy and absolute dating (§1, §4.4). Second, systematic quantitative extraction of wall lengths, orientations, plateau area, slope ranges, and the accessible-versus-naturally-protected perimeter from the existing vectorized survey dataset (§3.1, **Table 1**; Osmanagich, 2026a) is planned as a dedicated follow-up geospatial analysis. Third, a formal viewshed analysis on the existing 0.3 m LiDAR-derived DEM—with observer height, viewing radius, vegetation treatment, and corridor-identification criteria specified in advance—is planned to place the visibility observations in §3 and §4 on a quantitative footing (§2.2). Fourth, field-measured application of the §2.3 comparison variables at Daorson, Varvaria, Asseria, and Meteon would allow the Kolun Model to be tested quantitatively across sites rather than only illustratively.

Nevertheless, the absence of previous scientific investigations makes the present study an essential foundation for future research. The geospatial datasets generated during this project establish a permanent reference framework against which future archaeological discoveries can be accurately documented and interpreted.

Future investigations should combine excavation, geophysical prospection, archaeobotanical and zooarchaeological analyses, radiocarbon dating, micromorphology, and expanded landscape studies to reconstruct the settlement's occupational history more comprehensively. Comparative application of identical documentation methods at other Illyrian hillforts throughout Bosnia and Herzegovina and the western Balkans would also permit quantitative evaluation of whether the landscape-selection principles identified at Kolun—and formalized in the Kolun Model proposed in §3.6—represent a broader regional pattern.

6. Conclusions

The Kolun Hillfort is presented here as a candidate example of how communities conventionally labeled Illyrian may have selected and organized elevated sites within the mountainous terrain of the western Balkans, an attribution that remains provisional pending excavation (§1, §4.4, §5). Rather than relying solely on artificial fortifications, the builders appear to have incorporated the natural characteristics of the limestone plateau into the overall organization of the occupied enclosure, integrating topography, geology, visibility, and locally available construction materials into a coherent defensive and residential whole.

One of the principal findings of this investigation is the close correspondence between the morphology of the summit ridge and the alignment of the principal enclosure walls. The settlement follows the natural north–south orientation of the plateau (≈1190 m a.s.l.; §3.1) instead of imposing an independent architectural geometry upon the landscape. This relationship is interpreted as demonstrating that the builders adapted their construction to existing landforms, maximizing natural defensive advantages while minimizing unnecessary modification of the terrain. The observed integration of natural and built features represents one of the defining characteristics of the Kolun Hillfort and contributes to a broader understanding of prehistoric settlement planning.

The study also presents the first comprehensive scientific documentation of the Kolun Hillfort. Prior to this investigation, the site had not been systematically surveyed or analyzed using modern geospatial technologies. The integration of UAV photogrammetry, RTK-GNSS surveying, airborne LiDAR, digital elevation modelling, and GIS analysis has produced the first high-resolution spatial record of the settlement, establishing an important reference framework for future archaeological, anthropological, conservation, and environmental research.

Beyond documenting a previously uninvestigated archaeological site, the research proposes an anthropological model—the Kolun Model of Illyrian Landscape Selection—for understanding hillfort location and organization, offered explicitly as a testable hypothesis. The evidence indicates that landscape selection may have been influenced by the combined interaction of topographic prominence, natural protection, availability of building materials, accessibility, visibility, and adaptation to ridge morphology. These factors should not be viewed as isolated variables but as interconnected components of a hypothesized settlement strategy, summarized in **Table 2**.

Although based on a single case study, the findings have broader implications for the investigation of Illyrian fortified settlements throughout the western Balkans. Similar analyses conducted at other hillforts may determine whether adaptation to natural landscape morphology represents a recurring principle of settlement planning within this regional tradition. Such comparative research would contribute not only to regional archaeology but also to wider anthropological discussions concerning the relationships between human communities, architecture, and mountain landscapes.

The Kolun Hillfort is proposed as demonstrating that successful prehistoric settlements may have been shaped through collaboration between human ingenuity and the natural environment. Rather than transforming the mountain into an artificial fortress, its builders appear to have integrated architecture with the existing landscape, creating a settlement in which natural and constructed elements functioned as a unified system. This perspective expands our understanding of Illyrian hillforts beyond their defensive role and highlights the importance of landscape adaptation as a fundamental aspect of prehistoric community organization.

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Availability of Data and Materials

The geospatial datasets generated and analyzed during the present study, including UAV photogrammetry, RTK-GNSS measurements, digital elevation models, GIS datasets, and airborne LiDAR-derived products, are retained by the author. Selected data supporting the findings of this study are included within the article. Additional materials may be made available by the corresponding author upon reasonable request.

Declaration on the Use of Artificial Intelligence

The author used ChatGPT (OpenAI, GPT-5.5) during the preparation of the original manuscript, and solely as a language-editing and drafting assistant to improve the organization, clarity, and readability of the text and to assist in developing the manuscript structure. The AI tool was not used to generate original scientific data, perform analyses, interpret archaeological evidence, produce figures, or draw scientific conclusions. All archaeological observations, interpretations, references, figures, and final editorial decisions were independently verified by the author, who assumes full responsibility for the accuracy, originality, and integrity of the manuscript.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this paper.

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