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Visual Reimagining of Median Ecbatana for the Interpretation and Presentation of World Heritage: Herodotus, Assyrian Reliefs and Generative AI[1]

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Abstract

Hegmataneh was inscribed on the UNESCO World Heritage List in 2024. In its Statement of Outstanding Universal Value (OUV), UNESCO identifies Hegmataneh as the capital of the Median Empire and notes that it also served as a governmental centre during the Achaemenid, Parthian, Sasanian, and Islamic periods. Nevertheless, the image of this capital is based primarily on Herodotus's description of seven concentric walls with colourful crenellations. The World Heritage Convention requires States Parties to strengthen public understanding of and respect for heritage through educational and information programmes. ICOMOS charters concerning the interpretation and presentation of heritage sites, as well as virtual archaeology, likewise require visual reconstructions to be grounded in systematic analysis of evidence, to disclose their sources, and to maintain a clear distinction between authentic and reconstructed elements.This article converts Herodotus's account, together with Assyrian and Babylonian texts and three Assyrian reliefs, into input data for a generative artificial intelligence model, Midjourney. The process consisted of four stages: generating sets of base images; selecting a base image according to textual criteria; refining the output using generative editing tools; and evaluating the final image against nine clauses of Herodotus's historical account. A clause-by-clause assessment showed that the final image explicitly represents five of the nine clauses and partially corresponds to three others. In some intermediate outputs, the model relied on visual stereotypes rather than textual descriptions, such as a stepped structure resembling a ziggurat. Generative editing also introduced houses into the spaces between the concentric walls. These elements were identified as forms of AI bias and excluded from the final results. Such a photorealistic image may be interpreted by some viewers as historical evidence. Therefore, its public presentation is consistent with these principles only when labelled an "AI-based hypothetical reconstruction" and accompanied by a link to its textual source.

Keywords: Hegmataneh (Ecbatana), Outstanding Universal Value, Heritage interpretation and presentation, Herodotus, Generative AI, Archaeological illustration

1. Introduction

Hegmataneh has been inscribed on the UNESCO World Heritage List, and standards are therefore needed for conveying its Outstanding Universal Value (OUV) through public awareness and understanding. This requirement is written into the World Heritage Convention itself: States Parties are to strengthen their peoples' appreciation of and respect for the cultural and natural heritage "by all appropriate means, and in particular by educational and information programmers" (UNESCO, 1972: Art. 27). The launch of UNESCO's Dive into Heritage platform, and its explicit emphasis on interactive 3D digital experiences, shows that visual communication has moved in UNESCO policy from a supplementary activity to part of heritage management (UNESCO World Heritage Centre, 2023). Given these UNESCO statements, and the fact that much of Hegmataneh's public identity rests on Herodotus' account, this study seeks to meet part of this need by presenting that account transparently. The Statement of OUV presents Hegmataneh as one of the ancient cities of the Middle East, chosen as the capital of the Medes and an important seat of government in the Achaemenid, Parthian, Sasanian and Islamic periods

[1] The Persian version of this paper, under the following title, is also published in this issue of HSA:
بازآفرینی بصری هگمتانه مادی برای تفسیر و ارائه ارزش برجسته جهانی: روایت هرودوت، نقش‌برجسته‌های آشوری و هوش مصنوعی مولد

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(UNESCO World Heritage Committee, 2024). Yet our knowledge of Median occupation in Hamadan itself is slight (Stronach, 1986), and the architectural complex excavated on Tepe Hegmataneh is attributed mainly to the Parthian, Sasanian and Islamic periods. One of the components through which the site's universal value is presented, "capital of the Medes", is therefore known to the general public mainly through text. In its inscription decision, the World Heritage Committee also requested the State Party to develop research and conservation measures within a comprehensive programme for research, conservation and presentation of archaeological findings, and to extend documentation (UNESCO World Heritage Committee, 2024).

The reference documents of ICOMOS, the advisory body of the World Heritage Committee for cultural heritage, set out how such presentation should be done. The ICOMOS Charter for the Interpretation and Presentation of Cultural Heritage Sites requires visual reconstructions, whether by artists, architects or computer modelling, to be based on detailed and systematic analysis of environmental, archaeological, architectural and historical data; their information sources should be clearly documented, and alternative reconstructions based on the same evidence should, where possible, be provided for comparison (ICOMOS, 2008: Principle 2.4). The Seville Principles for virtual archaeology stress three points: it must always be possible to distinguish what is real and authentic from what is not (Principle 4); any visualisation of the past must be based on historical and archaeological research and documentation (Principle 5); and visualisations must be verifiable by other researchers (Principle 7) (ICOMOS, 2017). The London Charter likewise requires documentation of the interpretative decisions made in the process (Denard, 2009).

The true nature of Hegmataneh is one of the long-standing problems of Iranian archaeology. The ambiguity stems from an interpretive gap between two key sources: historical accounts such as that of Herodotus (I.98), which describes the Median capital with seven concentric walls, and the evidence of extensive excavations, which mainly reveal the remains of a regular urban grid and water systems attributed to the Parthian, Sasanian and Islamic periods. Despite repeated excavation, this mismatch between the historical description of the Median period and the later finds continues to fuel interpretive disagreement among archaeologists and has left a visual-interpretive gap in public understanding of the site's identity. This study reconstructs the historical account visually, that is, the Median city as described in the texts.

In digital archaeology, visualisation is recognised as an important cognitive and communicative tool that can turn the most abstract data into more tangible virtual models (Reilly, 1989: 576; Bornik & Neubauer, 2022: 19). Conventional illustration, however, depends on time, cost and specialist skill (Masson-MacLean et al., 2021: 599). Generative AI tools such as Midjourney produce an image in seconds without drawing skills (Magnani & Clindaniel, 2023; Cobb, 2023). In this study, several sets of images could be generated from each prompt within a short time and compared with Herodotus' text (Section 5.1). Selecting the data, writing the prompt and judging the outputs nevertheless still required specialist knowledge. For a city described only in text, this method allows the description to be turned into an image clause by clause and then checked against the same text.

Research questions: (1) How can Herodotus' account, as the textual basis of one component of Hegmataneh's OUV, be visualised with generative AI in accordance with ICOMOS principles for interpretation and presentation? (2) How faithful is the resulting image to the text, and which of its elements were added by the model?

2. The site and the location of Median Hegmataneh

The archaeological site of Hegmataneh lies on an oval ridge of grey schist bedrock within the urban fabric of Hamadan. The steep southern slope of the ridge and the integration of the site into modern neighbourhoods pose many challenges for excavation and visual interpretation (Dyson, 1957). The site was registered on the National Heritage List as No. 28 in 1931 and inscribed on the World Heritage List as No. 1716 at the 46th session of the World Heritage Committee (New Delhi, 2024). The inscribed property covers 27.8 ha and its buffer zone 334.2 ha (UNESCO World Heritage Centre, 2024). The other candidate for the Median citadel of Hegmataneh is Tepe Mosalla, a steep natural rock in the south-east of the city, on which stood the remains of a citadel apparently no older than the Parthian period (Brown, 1997). Mosalla lies outside the inscribed World Heritage property.

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The reconstruction of Median Hegmataneh rests on Herodotus' description of seven concentric walls with symbolic colours (white, black, purple, blue, orange, silver and gold), a symbol of the splendour of the Median capital. The initial design of the reconstruction draws on Assyrian reliefs, surviving Assyrian and Babylonian texts and, finally, Herodotus' account of the ancient city.

The identification of Ecbatana with Hamadan is certain on both historical and archaeological grounds (Brown, 1997). The absence of visible pre-Islamic remains in Hamadan led some nineteenth-century European travellers to propose other locations such as Susa, Kangavar and Takht-e Soleyman (ibid.); Rawlinson's proposal, in fact, concerned a second and older Ecbatana in Atropatene (Rawlinson, 1840). The main debate therefore concerns whether the Median citadel lay on Tepe Hegmataneh or on Tepe Mosalla in Hamadan. Tepe Hegmataneh, a ridge about 30 m high in the Sar-e Qaleh quarter, has been regarded as the site of the Median citadel and the Achaemenid royal buildings on the basis of chance finds and archaeological surveys (Brown, 1997), but extensive excavation on the mound has not produced clear evidence of Median occupation. In eleven seasons between 1983 and 1999, Sarraf exposed large, regular architecture (Sarraf, 2003); according to Boucharlat, the main architectural level was apparently built in the Parthian period, and thermoluminescence dates on bricks (1806±150, 1830±130 and 1700±160 years) are consistent with this date (Boucharlat, 2012). Azarnoush's soundings yielded no Iron Age evidence, although Sarraf had observed painted sherds, possibly of Iron Age III, in a limited area in the north of the site. On this evidence, Boucharlat suggests that Tepe Hegmataneh was a military settlement within or beside the city of Ecbatana itself, which existed somewhere before the Parthians, and regards it as probably a military plan of Mithradates I or his successors in the second half of the second century BC (ibid.). This reading agrees with Hozhabri's interpretation of the complex as a garrison town (Hozhabri, 2014). According to another report, no Median occupation layer had been identified on the mound up to the twenty-first season, and possibly Median material was reported only in the twenty-second season (Ahmadee, 2023). Hozhabri notes that the identification of Tepe Hegmataneh with ancient Ecbatana originally relied on the irregular, unscientific excavations of 1913, which provide no methodologically reliable results, and despite the Achaemenid column fragments he still considers the location of Median Hegmataneh uncertain (Hozhabri, 2014).

Tepe Mosalla is a steep natural rock about 80 m high in the south-east of the city, on whose summit the stone and brick remains of a quadrangular citadel with perimeter towers are visible. The first excavation there was carried out by Fossey in 1913, who in six weeks recovered a large quantity of glazed bricks and tiles and a fragment of a column base with arabesque decoration and an inscription (Brown, 1997; Chevalier, 1989). In the same year Fossey also excavated on the eastern slope of Tepe Hegmataneh (Brown, 1997); the "1913 excavations" therefore cover both mounds. Some, including Flandin, considered Mosalla the site of the Median citadel, although according to Brown the existing building is apparently no older than the Parthian period. Boucharlat describes Mosalla as most probably the best-protected area of Ecbatana in the Parthian period, perhaps even earlier, and probably the political centre of the city (Boucharlat, 2012).

The defensive use of the hill continued into later periods: Morier reported a strong fortress on Mosalla that Agha Mohammad Khan Qajar destroyed, leaving only one round tower, and Stronach documents continued citadel building on the hill from the Parthian period to the early Qajar period (Stronach, 2003: 243). In 1983 Yaghmaei also obtained evidence of Parthian architecture from soundings on Mosalla (Malekzadeh, 1995: 117).

Mollazadeh and Taheri Dehkordi (2011) and Mollazadeh (2024) have reviewed the arguments for and against placing the Median citadel on Tepe Mosalla. Among the supporters, Jackson, who visited Hamadan in 1903, considered Mosalla the ancient site of the citadel of Hegmataneh (Jackson, 1973: 177–179). Among the opponents, Mostafavi regards Mosalla as a natural hill bearing no building remains other than a Parthian rampart (Mostafavi, 1953: 66–68); Sarraf considered it an entirely natural hill with the remains of a Parthian fort on its upper part (Sarraf, 1989: 293); and Malekzadeh describes it as a natural rock with a "fort or temple" on its summit that has been destroyed in recent decades by modern construction (Malekzadeh, 1995: 98). For Mollazadeh, the height, extent and full command of Mosalla over the city make it the best candidate for the Median royal citadel; the natural character of the hill does not contradict a Median date, since known Median sites such as Nush-i Jan were also built on natural hills and rocks. Mollazadeh attributes the absence of a Median layer to repeated levelling and rebuilding in later

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periods (Mollazadeh, 2024). This study does not attempt to locate the Median citadel. What is shown is the city that Herodotus described, and the image is therefore evaluated against the text (Section 5.2).

3. Previous research

Debate over the location of the Median city and citadel of Hegmataneh began in the nineteenth century, and sites such as Susa, Kangavar and Takht-e Soleyman were proposed (Brown, 1997; Rawlinson, 1840). Successive excavations on Tepe Hegmataneh, notably Sarraf's eleven seasons (Sarraf, 2003) and later work, did not produce clear evidence of the Median period (Boucharlat, 2012). This absence of evidence prompted the proposal to locate the Median citadel on Tepe Mosalla (Mollazadeh & Taheri Dehkordi, 2011; Mollazadeh, 2024), while some researchers still consider the location of Median Hegmataneh unknown (Hozhabri, 2014). Iron Age evidence has so far come mainly from outside the mound, within the historic fabric of the city, including the Meydan-e Emam Khomeini site (Shabani et al., 2022), and no definite Median occupation layer had been reported on the mound at least up to the twenty-fifth season (Ahmadee, 2023; Mohammadifar, personal communication, July–August 2026).

Some studies have examined theoretically the visual language of archaeology and the power of representation in shaping public understanding of the past (Moser, 1992). A visual reconstruction of "the Median city as described in the texts", however, has not yet been undertaken. Computer visualisation was proposed as a cognitive tool in archaeology decades ago (Reilly, 1989), and generative AI has now made rapid visual reconstruction from textual data possible. In one of the first systematic applications of this technology to archaeological illustration, Magnani and Clindaniel (2023) recorded prompts in a structured way and evaluated the results (see also Cobb, 2023). In parallel, the ICOMOS charters have set the framework for presenting such reconstructions at heritage sites (ICOMOS, 2008; ICOMOS, 2017; Denard, 2009). This study lies at the intersection of these two fields. As far as the author's literature review shows, it is the first attempt to turn Herodotus' account of Median Hegmataneh into an image within the frameworks for interpreting and presenting World Heritage, and to assess how closely the output matches the text.

4. Methods and reference data

Three kinds of reference data were turned into model input: Assyrian and Babylonian texts, Herodotus' account (Section 4.1) and three Assyrian reliefs (Section 4.2). Image-making with Midjourney followed four steps: generating sets of base images, selecting a base image against the clauses of Herodotus' text, refining the output with generative editing, and assessing the final image against the nine clauses of the text (Section 5). The model, the prompt and the bias review are described in Section 4.3.

4.1. Assyrian and Babylonian texts and Herodotus' account

Assyrian texts often refer to a Median centre (a seat of government or a city) called the "royal city" (āl-šarrūti), probably the city later named Hegmataneh. These texts mention various campaigns against the Median capital and deportations (Luckenbill, 1926: 257; Ikeda, 1979: 87; Galil, 2007: 71–79). The earliest explicit mention of the name Hegmataneh (Ecbatana) occurs in Babylonian texts dating to about 550 BC, **in** connection with events such as the campaign of Nabonidus and the revolt of Cyrus (Cogan, 2008: 211). The ancient city of Hegmataneh, called Ecbatana in Greek sources, was built as a fortress on the slopes of Mount Alvand (Mollazadeh, 2024: 75–76). The Bisotun inscription, in its account of the killing of Fravartish, mentions the "fortress" of Hegmataneh (Mollazadeh, 2024: 75–76; Stronach, 2003: 242; Cogan, 2008: 211). In Ctesias' account, Hegmataneh was built by Queen Semiramis on a low, level plain (Jackson, 1973: 174; Sarraf, 1989: 291–292). The houses of ordinary people were built in a circle around the outer wall of the city (Rawlinson, 1840: 128).

According to Herodotus, Median Hegmataneh had seven nested walls whose heights decreased from the centre outwards because the city stood on a hill:

> So, he built the big and strong walls, one standing inside the next in circles, which are now called Ecbatana. This fortress is so designed that each circle of walls is higher than the next outer circle by no more than the height of its battlements; to which plan the site itself, on a hill in the plain, contributes somewhat, but chiefly it was accomplished by skill. There are

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> seven circles in all; within the innermost circle are the palace and the treasuries; and the longest wall is about the length of the wall that surrounds the city of Athens. The battlements of the first circle are white, of the second black, of the third circle purple, of the fourth blue, and of the fifth orange: thus the battlements of five circles are painted with colors; and the battlements of the last two circles are coated, the one with silver and the other with gold. Deioces built these walls for himself and around his own quarters, and he ordered the people to dwell outside the wall.
>
> (Herodotus, 1920: I.98.4–99.1; trans. Godley[1])

Herodotus' text was divided into nine physical components (Table 1). These components were used to define the prompt and, in the fourth step, to assess the final image (Section 5.2).

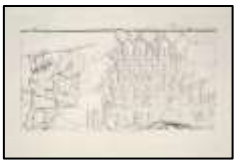
Table 1. Physical clauses of Herodotus' text (I.98) and their translation into prompt components.

No.	Text phrase (Godley translation)	Physical element	Corresponding prompt phrase
1	one standing inside the next in circles	Concentric circular walls	seven concentric fortification rings follow the oval contour of the hill, one standing inside the next
2	each circle … higher than the next outer circle by no more than the height of its battlements	Stepped rise of the rings toward the centre, by the height of the battlements	each inner ring is higher than the ring outside it by no more than the height of its battlements, so the rings rise in shallow, even steps toward the summit
3	the site itself, on a hill in the plain	A hill in the plain	built on an isolated elongated oval hill of grey schist bedrock rising about 30 meters above a broad plain
4	There are seven circles in all	Seven rings	seven concentric fortification rings
5	within the innermost circle are the palace and the treasuries	Palace and treasury in the innermost ring	inside the innermost ring, on the summit, a compact walled palace and treasury complex
6	the longest wall is about the length of the wall that surrounds the city of Athens	Scale: outermost wall equal in length to the wall of Athens	Not included in the prompt
7	battlements … white, … black, … purple, … blue, … orange	Coloured battlements of the first five rings	battlement colors from the outermost ring inward: white, black, purple, blue, orange; only the battlements are colored, the wall faces remain earth-toned
8	the last two circles are coated, the one with silver and the other with gold	Silver and gold battlements of the two inner rings	silver-plated, gold-plated (two inner rings, continuing the same colour sequence)
9	he ordered the people to dwell outside the wall	People dwelling outside the walls	no houses inside the rings; the common people's dwellings spread across the plain outside the outermost wall

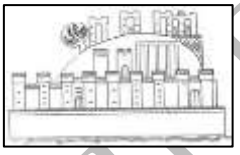
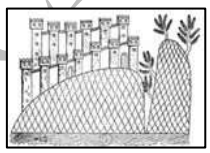
4.2. Assyrian reliefs

The three Assyrian reliefs presented in Table 2 formed the basis for extracting the physical features of Median towns in this study.

Table 2. Three Assyrian reliefs representing mountain towns of the Zagros and the main features of these towns.

Town represented / source relief	Period	Physical features visible in the image	Source of drawing	Image
1. An unnamed mountain town in the Zagros, during the campaign of Sargon II; relief from the palace of Sargon II at Dur-Sharrukin (Khorsabad), Room 2,	Sargon II (722–705 BC)	Wall with multiple superimposed rows of crenellated towers; defenders on the towers; attackers with spears and round shields on the left; rocky ground and bedrock	Botta & Flandin (1849–1850); see also Handcock (1912)	

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Town represented / source relief	Period	Physical features visible in the image	Source of drawing	Image
relief 22				
2. Kharkhar (in the Zagros, Median territory), after the reliefs of the palace of Sargon II at Khorsabad	Sargon II (late 8th century BC)	Town on an elevation/platform beside water (wavy lines at the bottom of the frame); lower wall line with regular crenellated towers and, behind it, towers at a higher level; gate with a semicircular opening; terrace strip at the foot of the building; a columned building and a tree inside the town	Халпахчьян (1970, Т. 1, сс. 292–294)	
3. Fort/tower in the land of Mannea (Lake Urmia region), after an Assyrian relief	Late 7th century BC	Fortifications on a mountain slope, with the cross-hatching that is the Assyrian convention for rock and mountainous terrain; wall line with crenellated towers; plant motifs/trees beside the site	Shukurov (2010)	

In extracting data from these three drawings, features visible in the image were separated from interpretive readings, and for each feature the relief in which it appears is stated:

1. Location on high ground (natural-defensive architecture): In reliefs 2 and 3 the town and its fortifications stand on high ground or a mountain slope, and in relief 1 rocky bedrock is drawn beneath the town; in none is the town shown on flat ground. This is consistent with the use of natural topography for security.

2. Vertical layering of ramparts: In relief 1 the wall is drawn as multiple superimposed rows of crenellated towers. In relief 2, behind the lower wall line, towers appear at a higher level, which may represent two levels of fortification or a citadel on high ground; relief 3 shows only a single wall line with regular towers. Multiple layering is therefore not a pattern shared by all three reliefs and appears clearly in only one. Its similarity to Herodotus' seven concentric walls can be raised only as a possibility; these three examples are not sufficient evidence that Herodotus' description was rooted in a real tradition, and a larger corpus of Assyrian reliefs would need to be examined.

3. Towers and defensive crenellations: In all three reliefs the rampart lines are topped with merlons, and square or rectangular towers stand on them at regular intervals. This element of organised military architecture served observation and defence.

4. Tall buildings at the centre/summit (citadel or central fort): In relief 1 some towers are drawn taller than others. If this difference in height is meaningful, it may indicate a spatial hierarchy and the separation of a governmental citadel from the body of the town; in relief 2 the upper-level towers may show such a distinction, but in relief 3 no such distinction is visible, and this reading is not certain.

5. Distinct gates and entrances: Relief 2 shows a gate with a semicircular opening in the lowest part of the wall. No gate can be recognised in the other two reliefs.

6. Relation to water sources: In relief 2, wavy lines at the bottom of the frame represent water (a river or channel). This is consistent with choosing a settlement site for access to water. In Urartu, the neighbouring mountain kingdom of the ninth to seventh centuries BC, water infrastructure also contributed to the survival and consolidation of the state (Sheikh Baikloo Islam, 2025).

7. Surrounding gardens and farmland: Relief 3 shows plant motifs (trees or shrubs) beside the site, and relief 2 a tree inside the wall. This may point to the link between the settlement and the surrounding fields and gardens, although the plant species cannot be determined from these drawings.

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8. Absence of an extensive unwalled "lower town": Unlike large Mesopotamian cities, which usually had an extensive open lower town, all three drawings show a compact, fully walled complex. This may be consistent with the fragmented political structure of the Median tribes before unification. These reliefs were also made as propaganda for the attackers, and the absence of a lower town in the image does not mean that no such town existed under Median rule.

Summary: The three drawings are consistent with a pattern of small, strongly fortified "fort-towns" on high ground. Elements seen in all three are a location on high or rocky ground, walls with regular crenellated towers, and a compact walled complex; multiple layering of ramparts is clear in only one and appears possibly in another. In this study these features were used only as prompt input data.

4.3. Model selection, prompt and bias review

Midjourney version 6.0 was used to generate the images. The model was chosen for its precision in rendering architectural detail and material texture (mud brick, stone and metal). The mechanism of text-to-image models is described by Magnani and Clindaniel (2023).

Each prompt was divided into structured components, and the prompts whose text was recorded are given in the Appendix[2]. The main prompt of this study was as follows:

> A hyper-realistic cinematic aerial reconstruction of an Aerial oblique reconstruction of Median Ecbatana (Hegmataneh) as described by Herodotus, Histories 1.98, built on an isolated elongated oval hill of grey schist bedrock rising about 30 meters above a broad plain, with the Alvand mountain range in the background. Seven concentric fortification rings follow the oval contour of the hill, one standing inside the next. Each inner ring is higher than the ring outside it by no more than the height of its battlements, so the rings rise in shallow, even steps toward the summit. Thick mud-brick curtain walls on rough stone footings, topped with continuous crenellations, with square towers at regular intervals, in the manner of Assyrian reliefs of Zagros fortresses. Battlement colors from the outermost ring inward: white, black, purple, blue, orange, silver-plated, gold-plated; only the battlements are colored, the wall faces remain earth-toned. Inside the innermost ring, on the summit, a compact walled palace and treasury complex. No houses inside the rings; the common people's dwellings spread across the plain outside the outermost wall, with fields and orchards beyond. Clear late-afternoon light, wide view showing the whole hill. --ar 2:1 --v 6.0 --style raw --chaos 15 --no ziggurat, stepped pyramid, amphitheater, arena, radial walls, domes, minarets, Greek columns, Roman architecture, text, lettering, signature, watermark

Technical parameters: aspect ratio 2:1, version 6.0, quality 2, style raw, chaos 15. The output files of the base sets measure 1536 × 768 pixels, and the final image (Figure 5) 1774 × 887 pixels.

Generative models may add incorrect or stereotyped elements to an image, such as inappropriate clothing or incongruous architectural forms (Magnani & Clindaniel, 2023). All outputs were therefore reviewed in the second and third steps against Herodotus' text and the features extracted from the reliefs.

5. Results: step-by-step reimagining

5.1. Steps one and two: generating and selecting the base image

Before generating images with Midjourney, other image generators such as GPT and DALL-E were also tested, and Midjourney was chosen for its ability to produce images with architectural detail.
Some generated images were discarded from the outset because of AI biases in image-making. Bias here means that the model built the image from its own knowledge of ancient cities rather than following the text. Some images were turned into 3D models to generate ideas and to reconstruct the main images visually, and another group was used to evaluate different AI tools for image generation.
In the first step, sets of base images were generated with the structured prompt of Section 4.3. Midjourney produces a set of four images for each command, and because decoding is stochastic, each run of the same prompt yields a different set. Four sets of four (16 images) from this stage are shown in Figure 1.

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Figure 1. Four sets of base images generated with Midjourney version 6.0 (each row is one set of four). The selected base image is the first image from the left in the top row (Source: author).

To complete the visualisation, one of the main components was 3D modelling of the landscape and position of the ancient mound (Figure 2). Given the accumulation of deposits over the centuries, the mound of Hegmataneh was probably lower in the Median period than it is today.



Figure 2. Landscape and present position of the ancient mound (Source: author).

In the second step, the outputs of each set were compared with the clauses of Table 1. Clause 1 (concentric circular walls) is respected in most images, but clause 2 (rings rising toward the centre) is not respected in all: in row 2, the first image from the left, the rings descend toward the centre and resemble an amphitheatre; in row 1, the second image, radial walls divide the outer ring into sectors. In row 4, the second image, a stepped quadrangular building resembling a Mesopotamian ziggurat replaces the ring city. Clauses 7 and 8 (battlement colours) appear in none of the 16 images.

The selected base image (row 1, first image from the left; Figure 3) shows the rings of the wall on high ground, rising toward a fort-like complex at the centre. It was chosen because realism, consistency with the geography and landscape, and fidelity to Herodotus' text and the Assyrian reliefs are the main principles of image representation in this study.



Figure 3. Selected base image: Midjourney version 6.0 output without generative editing (1536 × 768 pixels). The colour sequence of the battlements is not applied; the text in the lower-right corner is a spurious signature generated by the model (Source: author).

5.2. Steps three and four: refining the output and the final image

In the third step, the Generative Fill feature of Adobe Photoshop 2025 (Firefly) was used to edit the outputs; it allows part of an image to be erased and refilled (inpainting) and the frame to be extended (outpainting). Three kinds of edit were needed for this image: replacing the ground texture and adding details not included in the main prompt; adding farmland outside the walls with the prompt "agricultural fields outside the city walls"; and colouring the battlements according to Herodotus. All three changes were applied, and the result is shown in Figure 4.



Figure 4. Output of generative editing (Adobe Firefly, Generative Fill): battlement colours and farmland were added, but buildings resembling ordinary houses appeared in the spaces between the rings; this output was discarded (Source: author).

The changes made in Adobe Firefly came with visual bias: the added architectural elements evoke the houses of ordinary people, which contradicts clause 9 of Herodotus' text (people living outside the walls). The revised prompt was therefore given to Midjourney again and a new image was generated (Figure 5).

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The final image (Figure 5) shows the concentric rings of the wall stepping up from the foot of the hill to the central citadel. Continuous battlements and spaced towers appear on the rings, with mountains in the background. The battlements of the rings, from the outside inwards, are white, black, purple, blue, orange, silver and gold.



Figure 5. Visual reimagining of Median Hegmataneh based on Herodotus' account; final image generated in Midjourney with the revised prompt (1774 × 887 pixels). AI-based hypothetical reconstruction (Source: author).

In the fourth step, to assess fidelity, the final image was compared with the nine clauses of Table 1 (Table 3). One question in reviewing the image was what buildings or architectural elements lay between the seven rings. None of the sources answers this directly, but Herodotus' text rules out some possibilities. According to him, the palace and treasury were in the innermost ring. Deioces built the walls around his own residence and ordered the people to live outside the wall. Before the walls were built, the Medes had also built him great houses and assigned him guards chosen from all the Medes (Herodotus, 1920: I.98–99). Ordinary people living between the rings is therefore inconsistent with the text.

The Assyrian reliefs give no clear answer either. Relief 1 (Table 2) shows superimposed rows of crenellated towers, with defenders falling from them. At the foot of the building is an arched structure, and at the lower left two separate towers. The Assyrian artist drew the town in elevation. These rows can be read as successive walls on a slope or as a convention for showing depth; in either case, what lay behind each wall is hidden. In the three reliefs of Table 2 only one interior structure appears: the columned building inside the wall in the drawing of Kharkhar (relief 2).

The geometry Herodotus describes gives another clue. Each ring is higher than the outer one only by the height of its battlements. These walls therefore bear little resemblance to independent fortifications and seem rather to have been terrace retaining walls. In that case, the spaces between them would be terrace strips whose width depends on the slope of the hill.

It should also be considered that the seven rings may have had a symbolic meaning rather than being the plan of a real citadel. Rawlinson related the seven battlement colours to the seven planets. James and van der Sluijs (2008) have shown that his reconstruction of the colours of the Borsippa ziggurat rested largely on conjecture. According to them, Herodotus' colour sequence is partly confirmed by evidence from Khorsabad and Ur.

Taking this evidence together, this study proposes that the whole seven-ring complex belonged to the royal establishment. The spaces between the rings were probably assigned to guards, officials and storerooms. This proposal is a hypothesis, and there is no direct evidence for it.

Table 3. Fidelity of the final image (Figure 5) to the clauses of Herodotus' text.

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No.	Physical element (Table 1)	In final image	Notes
1	Concentric circular walls	Visible	Concentric rings from the foot of the hill to the central citadel
2	Stepped rise of the rings toward the centre	Partial	The rings rise toward the central complex, but the height difference between rings exceeds the height of one battlement
3	A hill in the plain	Visible	Prominent elevation with the plain and mountains in the background
4	Seven rings	Visible	Seven rings with seven battlement colours can be counted
5	Palace and treasury in the innermost ring	Partial	A central fort-like complex is present, but palace and treasury cannot be distinguished
6	Scale equal to the wall of Athens	Not assessable	The image has no external scale reference; this clause cannot inherently be shown in a single image
7	Coloured battlements of the first five rings	Visible	White, black, purple, blue and orange, from the outer ring inwards
8	Silver and gold battlements of the two inner rings	Partial	The gold battlements are clear; the silver ones appear light grey and are hard to distinguish from the white of the outer ring
9	People dwelling outside the walls	Visible	Settlement fabric and fields outside the walls; no houses between the rings

5.3. Supplementary test: reimagining on Tepe Mosalla

Another hypothesis examined in this study is the location of Median Hegmataneh on Tepe Mosalla (Section 2). Old photographs and maps (Figure 6) suggest that Tepe Mosalla in Hamadan is one of the places that seem plausible for Hegmataneh, because it matches the textual description of a prominent hill in a plain. On this basis, a reconstructed image on Tepe Mosalla was also generated (Figure 7). This test shows only the visual possibility of the hypothesis and, as stated in Section 2, is not a judgement on the location of the Median citadel.



(a)



(b)

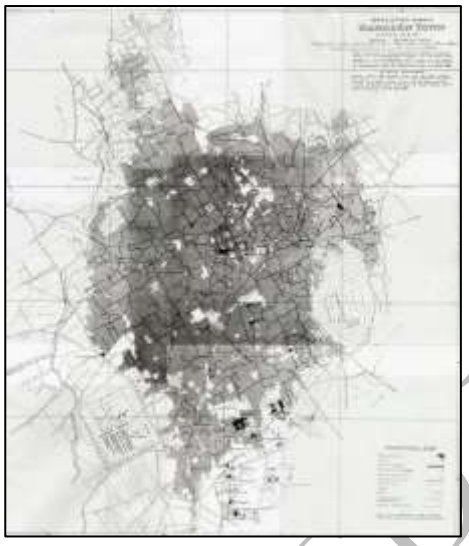
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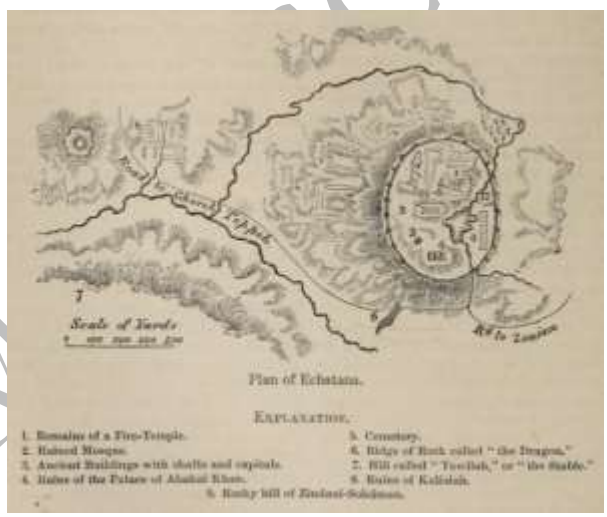
(c)



(d)



(e)



(f)

Figure 6. Tepe Mosalla in Hamadan in old photographs and maps: (a) view of the hill from the residential fabric; (b–d) aerial photographs of Hamadan; (e) old map of Hamadan; (f) "Plan of Ecbatana". Blue lines added by the author mark the extent of Tepe Mosalla (Source: Documentation Centre and National Library of the Western Region; "Akkaskhaneh Hamedan" page).

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Figure 7. Visual reimagining of Median Hegmataneh based on Herodotus' account on Tepe Mosalla; AI-based hypothetical reconstruction (Source: author).

6. Discussion

6.1. Meeting the requirements for interpreting and presenting World Heritage

Table 4 sets the requirements of the UNESCO and ICOMOS documents alongside this study's responses and the relevant sections. Of the nine requirements listed, seven are addressed in this study, but two, "alternative reconstructions" and "public release of the data", have not yet been met.

Table 4. Requirements of UNESCO and ICOMOS documents for the interpretation and presentation of heritage, and this study's response to each.

Document and clause	Requirement	Response of this study	Section
World Heritage Convention (UNESCO, 1972), Art. 27	Strengthening public understanding of and respect for heritage through educational and information programmes	A publicly accessible image of the "capital of the Medes" component of the OUV, with its boundary from the material evidence	5.2; 6.3
Decision 46 COM 8B.17 (2024), recommendation b	Comprehensive programme for research, conservation and presentation of archaeological findings	Documented visual presentation of the textual component of the site's value; the excavation findings are examined in a separate study by the author	5
Decision 46 COM 8B.17 (2024), recommendation d	Extending documentation	Recording of the main prompt, parameters and output sets	4.3; 5.1; Appendix
ICOMOS Interpretation Charter (ICOMOS, 2008), Principle 2.4	Reliance on systematic data analysis; documentation of sources	Division of Herodotus' text into nine clauses (Table 1); source recorded for each relief feature (Table 2)	4.1; 4.2
Ibid.	Alternative reconstructions for comparison	Not met: Ctesias' account has not been visualised	6.4
Seville Principles	Distinguishing what is real	Label "AI-based hypothetical	6.3

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Document and clause	Requirement	Response of this study	Section
(ICOMOS, 2017), Principle 4	and authentic from what is not	reconstruction" for any public presentation	
Seville Principles, Principle 5	Reliance on historical and archaeological research and documentation	Assyrian and Babylonian texts, Herodotus' text and three Assyrian reliefs as input data	4
Seville Principles, Principle 7	Verifiability by other researchers	Clause-by-clause assessment (Table 3); public release of the data not yet done	5.2; Data availability statement
London Charter (Denard, 2009)	Documentation of interpretative decisions (paradata)	Structured recording of the main prompt and parameters	4.3; Appendix

The first is discussed in Section 6.4 and the second in the data availability statement.

6.2. Fidelity to the text and the replacement of text by stereotype

This reconstruction cannot be evaluated against field data, because if the account is correct, its physical remains have not been identified at the present site or, under the Mosalla hypothesis, lay elsewhere (Section 2). This study therefore assessed the image's fidelity to Herodotus' text and to the features extracted from the reliefs, not its agreement with excavation evidence. The result is given clause by clause in Table 3: of the nine clauses of Herodotus' text, five (concentric walls, hill in the plain, the number of seven rings, the colours of the battlements of the first five rings, dwelling outside the walls) are clearly visible in the image; three (rings rising by the height of the battlements, palace and treasury, silver and gold battlements) match only partially; and the scale clause cannot be assessed in a single image.

In Figure 1, two outputs contain elements not mentioned in Herodotus' text: a stepped structure resembling a ziggurat (row 4) and amphitheatre-like rings descending inwards (row 2). In both cases the model produced a different form in place of clause 2 of the text (the rings rising toward the centre), and neither was chosen as the main image. In the third step, generative editing also added houses resembling those of ordinary people to the spaces between the rings (Figure 4). How common this kind of substitution is in Midjourney outputs for Iranian sites could be assessed by generating more samples from a single prompt.

6.3. The risk of documentary reading

Photorealistic AI-generated images may be taken by some viewers as historical documents rather than reconstructions. This applies particularly to Median Hegmataneh, because no element of the image has been confirmed on site. Any public release of these images should therefore carry the label "AI-based hypothetical reconstruction" and a reference to Herodotus' text, in line with Principle 4 of the Seville Principles (ICOMOS, 2017) and the documentation principle of the London Charter (Denard, 2009). Magnani and Clindaniel (2023) could not obtain a usable base image in a photorealistic style with DALL·E 2 and chose a "digital art" style; the realistic style used in this study increases the need for this label. In the context of Southwest Asia, "transparency in documentation" is also among the principles proposed for the ethical justification of reconstruction (Alimirzaei, 2025).

6.4. Limitations

The limitations of this study bear on its findings. The final image depends on the author's choices in writing the prompt and selecting the base image; Tables 1 and 3 make these choices reviewable but do not eliminate them. The assessment in Table 3 was carried out by the author alone, and a second independent assessment could strengthen its validity. The final image (Figure 5) was not obtained by directly editing the base image (Figure 3) but generated with a revised prompt; the differences between the two images are therefore the result of running the model again. The features of the Median town were extracted from three reliefs, and multiple layering of ramparts is clear in only one of them (Section 4.2); a larger sample of Assyrian reliefs could strengthen or refute this feature. Ctesias' account, which places the city on a level plain (Section 4.1), was not visualised, although the ICOMOS Charter recommends alternative reconstructions for comparison (ICOMOS, 2008: Principle 2.4). Image decoding in these models is stochastic (Magnani & Clindaniel, 2023), and the chaos parameter was set to 15; the differences between

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the sets in Figure 1 illustrate this variability. Running the same prompt again therefore does not yield the same image, and reproducibility in this study means the availability of the prompts and outputs in a data repository. The text of some prompts, including the revised prompt for the final image, was not recorded (Appendix), which further limits reproducibility.

7. Conclusion

The Statement of OUV presents Hegmataneh as the chosen capital of the Medes, but for the general public this component is known mainly through text. Herodotus attributes the building of Hegmataneh to Deioces, the first Median king, and reports its seven coloured walls. His account offers a vivid cultural and narrative image of the city, and much of Hegmataneh's public identity rests on it, but physical evidence for it is still lacking. In response to Article 27 of the World Heritage Convention and ICOMOS principles for interpretation and presentation, this study visualised the account, together with Assyrian and Babylonian texts and three Assyrian reliefs, using generative AI, and assessed the resulting image clause by clause against the text. The assessment showed that the final image reproduces the overall structure of the account, namely stepped concentric walls on high ground with coloured battlements; the symbolic colouring of the battlements, the most distinctive element of the account, appeared in the image only after the prompt was revised, and the scale of the walls cannot be shown in a single image.

In the 16 base images, the concentric rings of the wall appeared in most outputs, but the battlement colours were applied in none, and in two outputs the model produced forms that are not in Herodotus' text. Clause-by-clause comparison of outputs with the text was needed to identify and exclude these cases. As UNESCO noted when introducing the Dive into Heritage platform, interactive digital experiences can enrich public understanding of World Heritage properties (UNESCO World Heritage Centre, 2023).

Acknowledgements

The author is grateful to Dr Yaghoub Mohammadifar and Dr Kazem Mollazadeh for valuable scientific advice during the writing of this article.

Ethical statements

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Authors' contributions: The article has a single author; conceptualization, methodology, generation and assessment of the images, and writing and revision of the text were carried out by the author.

Competing interests: The author declares no competing interests.

Data availability: All generated image sets (Figure 1), intermediate and final outputs (Figures 3–5), the recorded prompts with their technical parameters (Appendix), and Tables 1 and 3 are available from the corresponding author and will be deposited in a public data repository after acceptance.

Use of artificial intelligence: AI tools were used in preparing this article as follows, in accordance with the regulations on the permitted use of AI in research:

1. Generating and editing the reimagined images (clause 5-5): the generative AI tools Midjourney (version 6.0) and Adobe Firefly (Generative Fill) were used to generate and edit the images of Median Hegmataneh based on Herodotus' account (Figures 1–5 and 7). These images serve an auxiliary, visual purpose, and the scientific accuracy of their content was reviewed and confirmed by the author.

2. Refining and optimising prompts (clause 5-2): the language models ChatGPT (OpenAI) and Claude (Anthropic) were used to suggest and improve the wording of the prompts for the above image generators.

3. Editing and translating the text (clause 5-1): in accordance with the authorisation issued by the Ministry of Science, Research and Technology on the use of AI for language editing and translation of scientific

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texts, the same two tools (Claude and ChatGPT) were used for language editing and translation of the article.

Full details of how these tools were used are given in Sections 4 and 5. All interpretive decisions, the selection of reference data, the assessment and validation of the outputs, and the final drafting of the article were the author's responsibility, and AI is not credited as an author or scientific contributor in any part of the work.

Endnote

[1] **Appendix: Prompt texts**

Appendix 1. Prompt for the base images, Midjourney version 6.0 (Figures 1 and 3)

A hyper-realistic cinematic aerial reconstruction of an Aerial oblique reconstruction of Median Ecbatana (Hegmataneh) as described by Herodotus, Histories 1.98, built on an isolated elongated oval hill of grey schist bedrock rising about 30 meters above a broad plain, with the Alvand mountain range in the background. Seven concentric fortification rings follow the oval contour of the hill, one standing inside the next. Each inner ring is higher than the ring outside it by no more than the height of its battlements, so the rings rise in shallow, even steps toward the summit. Thick mud-brick curtain walls on rough stone footings, topped with continuous crenellations, with square towers at regular intervals, in the manner of Assyrian reliefs of Zagros fortresses. Battlement colors from the outermost ring inward: white, black, purple, blue, orange, silver-plated, gold-plated; only the battlements are colored, the wall faces remain earth-toned. Inside the innermost ring, on the summit, a compact walled palace and treasury complex. No houses inside the rings; the common people's dwellings spread across the plain outside the outermost wall, with fields and orchards beyond. Clear late-afternoon light, wide view showing the whole hill. --ar 2:1 --v 6.0 --style raw --chaos 15 --no ziggurat, stepped pyramid, amphitheater, arena, radial walls, domes, minarets, Greek columns, Roman architecture, text, lettering, signature, watermark

Parameters: aspect ratio 2:1, version 6.0, quality 2, style raw, chaos 15

[2] **Appendix 2. Generative editing prompts in Adobe Photoshop 2025 (Firefly, Generative Fill) (Figure 4)**

Adding farmland outside the walls: agricultural fields outside the city walls

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