On the Astronomical Significance of Stone Number 137 of Zorats Qarer Megalithic Monument

H.A. Malkhasyan *

NAS RA V. Ambartsumian Byurakan Astrophysical Observatory (BAO), Armenia

Abstract

The work is dedicated to discovering a new type of "observational device" in the Zorats Qarer megalithic monument and uncovering a new layer of the continuous function of the monument using the "new device." The possible use of the "new device" significantly differs from the observation platforms and angular stones in the same monument. Stone No. 137 in question was previously considered a "periscope" based on some assumptions. By examining the astronomical and structural application of the mentioned stone in more detail and without preconceived assumptions (or with much simpler, obvious suppositions), new functions of its application are revealed. One relates to the observations of circumpolar stars in the direction of the stone hole. The other relies on the puddle and the special structure of the stone. The latter makes it possible to determine the days of the equinoxes and the summer solstice due to the Sun's positions. By combining these two functions, the probable date of the use of the stone is determined: 15500 BC, when it was possible to observe the appearance of the star γ *Cygni* (Sadr, Swan constellation) after sunset on the summer solstice in the direction of the hole.

Thus, a new layer of the "calendar observations" (15500 BC) is added to the already identified layers (9000, 5800, and 2341 BC), which is in harmony with the logic regarding this and other similar monuments (for example, Göbekli Tepe) and essentially complements the evolutionary chain of ancient cultural concepts with its content and time.

Keywords: Keywords: *Zorats Qarer, Stone No. 137, Megalithic Observatories, Swan Constellation, Ancient Gnomons, Observational Instruments, Archaeoastronomy, Ancient Calendar.*

1. Introduction

The recent studies of the Zorats Qarer megalithic monument have revealed many observational devices: platforms, angular stones, and mixed-type "observational instruments" (Broutian & Malkhasyan, 2021, Malkhasyan, 2021b, 2022a,b, 2023a, 2024b). However, the first attention-grabbing feature of the monument was the presence of the stones with holes. Those holes allowed the first researchers to comment on the astronomical significance of the monument (Herouni, 1998a,b, 2006, Khnkikian, 1984, Parsamian, 1985). Later, the hypotheses regarding the observational significance of the holes in the stones received various sharp criticisms (Piliposyan, 2016a,b, Piliposyan *et al.*, 2019). Notably, the large size of the holes was cited as a counterargument. Indeed, the stone holes average from 4 to 5 cm in diameter at their narrowest point, while their two-sided openings are conical and wide, up to 8 to 12 cm in diameter. Therefore, the observation field of the hole includes such a wide angular range that it becomes impossible to single out a specific direction and solve astronomical problems. Therefore, it is necessary to have additional means of guidance to use the holes as an "observational device." The "guiding stones," adapted to the observation platforms, serve that purpose (Malkhasyan, 2022a). Paris Herouni also discussed the difficulty concerning the hole sizes, offering the following:

A. The observer should be positioned 1 m from the hole. The angular error of the direction would then be reduced to 172 arcmin (Herouni (2006) pp. 25-26). To unequivocally claim that the observers were positioned at this distance, an objective argument has yet to be found, especially if we consider

*hayk.malkhasyan84@gmail.com

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it was practically impossible for some stones, such as stone No. 137. Moreover, the monument studies have already shown that the observations were made at various distances from the stones, up to 40 m and more (Broutian & Malkhasyan, 2021, Malkhasyan, 2021b, 2022a,b, 2023a, 2024b), while standing, sitting, or kneeling (Malkhasyan, 2022a). Thus, no data regarding the fixed distance of the observation position is currently available.

B. The tension axis direction of the hole should be considered the observation direction (Herouni (2006) pp. 26-28). There is also uncertainty about the latter because most holes are like tubes with different angular refractions.

The issue gets completely different when it comes to the guiding stones, and P. Herouni also studied this issue in the context of the complex description of the holed stones No. 60, 62, and 63. Here, stone No. 63 is described as a guide for the holes in stones No. 60 and 62 (Herouni (2006) pp. 64-67), so the directions determined for these holes are utterly acceptable from an astronomical point of view. However, the same stone complex still requires an additional, more detailed examination to increase the accuracy of the direction determination. For now, it is impossible because the results of laser precision measurement are still being refined.

In Herouni's works, the observation hole description of stone No. 137 is also worthy of attention; the author called it a "periscope." As the author notes (Herouni (2006) pp. 57-59), the hole axis breaks its course upwards (Figures 3b and 4). Therefore, if a polished obsidian piece was placed in the fractured part of the hole, it could serve as a "periscope" to observe the bright stars transitions through the zenith point by refracting the light vertically coming from bright stars to the horizontal direction (Herouni (2006) pp. 57-59). It should be noted that at the zenith point, it would make sense to observe only the appearance of any star immediately after sunset or its disappearance immediately before sunrise in the calendar context (Malkhasyan, 2022b). During such observations, the sky is sufficiently illuminated by the light of the Sun not yet risen or just set, so the reflective properties of an obsidian mirror will not be sufficient, to put it mildly, under such lighting conditions.

The bowl-shaped pit (puddle) on the northern slope of the stone (Figure 1b) is an additional justification in favor of the "periscope." It is assumed that by pouring water into that pit, it was possible to adjust the vertical axis of the hole by moving the stone (Herouni (2006) pp. 57-59). First, it should be noted that changing the water level in the puddle makes it possible to adjust any direction, and it does not necessarily have to be the vertical direction. Moreover, to regulate the position of the stone at the water level, a horizontal mark would be needed on the inner walls of the pit so that the dislocation of the stone could be noticed immediately[1]. A detailed observation did not find such marks. In addition, the stone itself has a broad base, and the probability of its displacement is minimal. Of course, the function of the obsidian mirror and the puddle used to adjust the stone position are hypotheses included to offer such a solution. **The thesis of using stone No. 137 as a "periscope" will not be applicable without these assumptions**.

The present work aims to provide a more detailed analysis of the unique structure of stone No. 137 being researched and the functional significance of the hole in it by including the minimum possible and more obvious assumptions necessary for solving the problem.

2. The Description of Stone Number 137

Stone No. 137 is located on the northern wing of the monument, about 40 m north of the central cromlech. It is part of the main stone row (Figure 1a). Its shape resembles an irregularly cut four-sided pyramid: the upper, relatively flat surface is inclined to the northeast. Descending at a 75° slope, the northern "slope" of the stone forms a bowl-shaped (or triangular) pit at the bottom (Figure 1b). The western wall of the pit continues to the top of the stone, forming about 90-100° angle with the northern "slope." The top of the stone is about 1.2 m above the ground. The hole "entrance" opening which has a diameter of about 10 cm is on the south side. It deepens in a conical horizontal direction to the north by about 10 cm, reducing in its diameter to 5.5 cm, then bends upward at an angle of about 110-120° and begins to widen in diameter, reaching 11 cm in the "exit" opening (Figures 3b and 4). The distance between the "entrance" and "exit" of the hole is about 20 cm.

[1]Astronomer Karen Tokhatyan expressed a similar opinion during a private discussion (Dilijan, 10 July, 2023).

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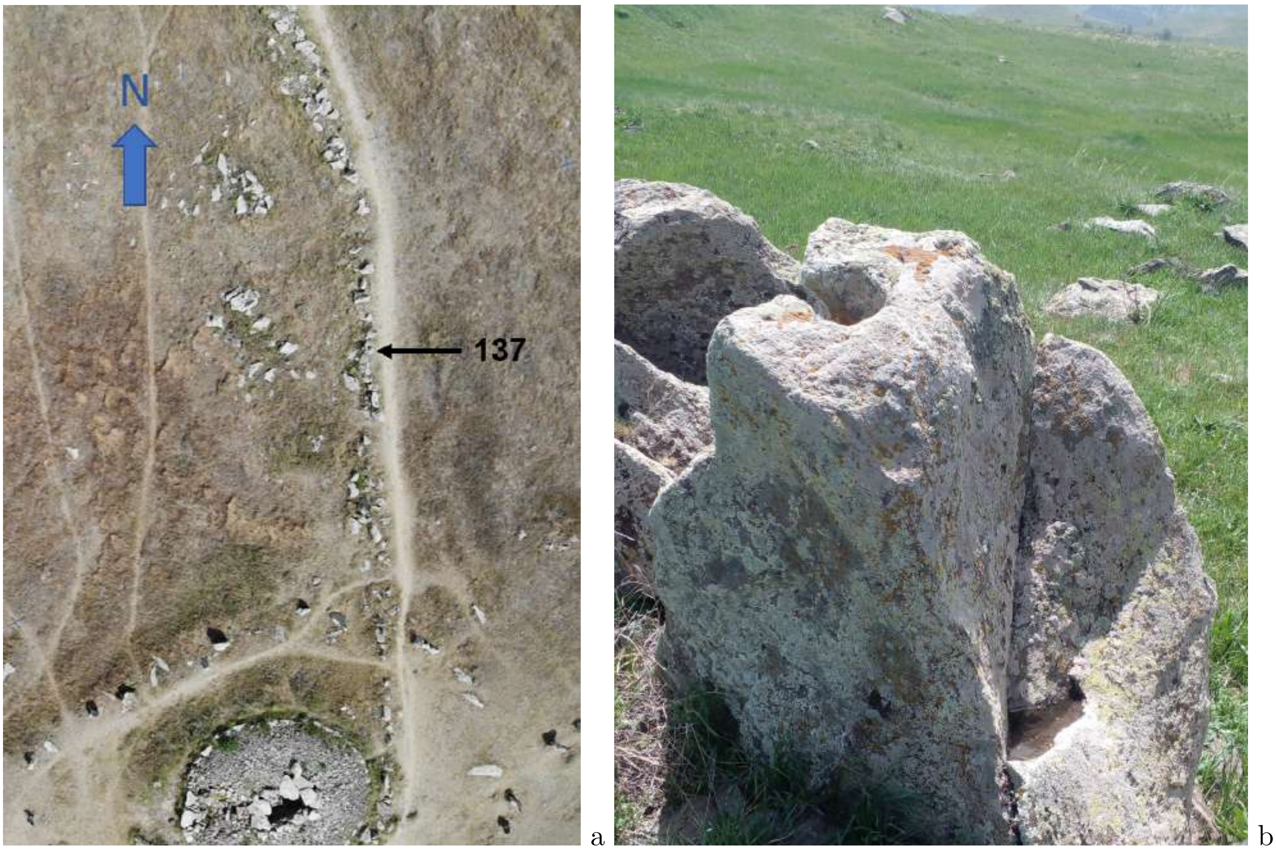

Figure 1. Stone No. 137 of the Zorats Qarer monument: (a) location in the stone row; (b) photo of the same stone from the northeast. Our expedition team took all the photos in the article in 2020.

Figure 2. Hole of stone No. 137. The arrows indicate the groove in the exit part of the hole: (a) photo from above; (b) photo from the south.

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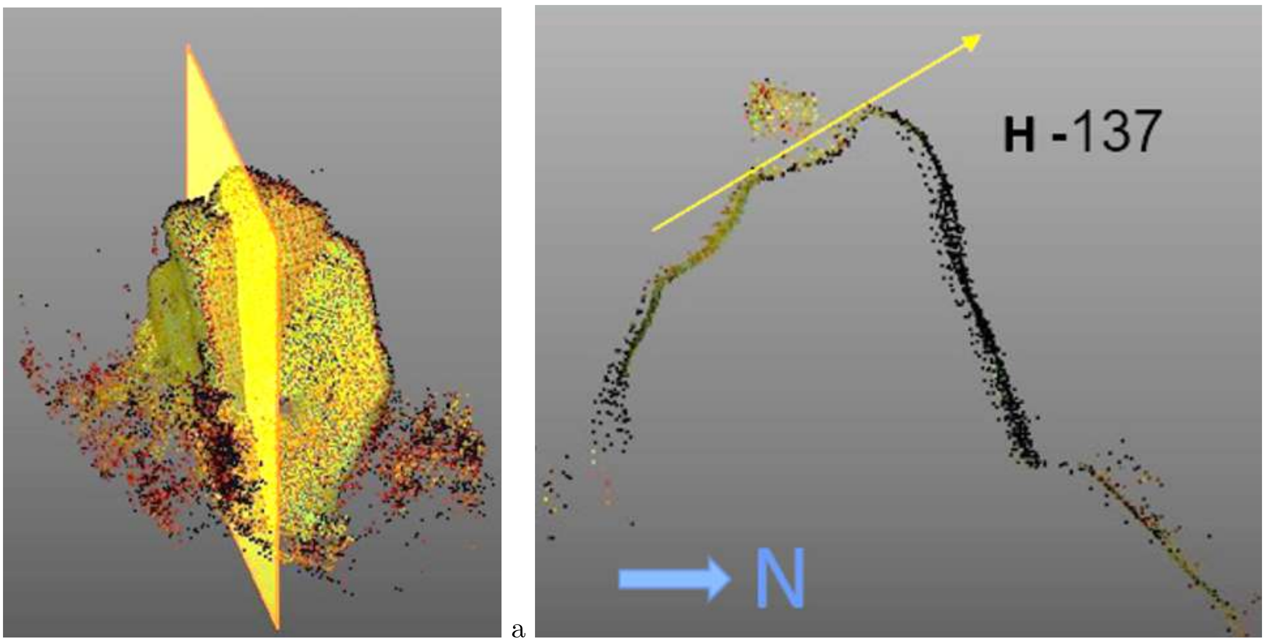
The hole “entrance” is about 1m above the ground, which is a regularity in making observations in a kneeling position in the case of this monument (Malkhasyan, 2022a,b, 2023a). A small part of the upper arch of the hole (3-4 cm long) is broken (Figure 2a, b). The fracture surface and the entire processed surface of the hole are covered with a dense lichen layer, which is macroscopically characteristic of the lichen layer on the outer surface of the stone. There is a straight groove on the upper flat surface of the stone on the north side of the “exit” opening, the axis of which roughly coincides with the hole axis (directed approximately to the north). The groove is located on the northern side of the “exit” opening of the stone and has a radial arrangement to the circle of the opening (Figure 2a, b).

As we can see, stone No. 137 is very different from the other stones of the monument due to its structure. Let us take a detailed look at the features mentioned above separately to clarify the purpose of the structure.

2.1. Structure and Direction of the Hole of Stone Number 137

For simplicity, let us consider the hole structure on the section along the meridian plane (Figures 3a, b, and 4) and consider that the hole was complete during the use of the stone. If we connect the lower point of the “entrance” opening to the northern point of the “exit” opening, this line will touch (or be very close to) the upper point of the section with the smallest diameter of the hole (Figures 3b, and 4). Thus, the observer’s field of view will be drastically limited when the eye position moves vertically. This structure allows us to specify the vertical component of the observation direction (H-137)[2] (the elevation angle from the mathematical horizon). However, such limitation of the observation field remains quite broad in the horizontal direction. The observation field gets horizontally almond-shaped (Figure 4). The accuracy problem of the horizontal component (azimuth) of the H-137 direction is solved by the above-mentioned approximately 1 cm deep groove on the northern curve of the “exit” opening (Figures 2a, b, and 4).



a b

Figure 3. Digital point cloud of stone No.137; (a) position relative to the meridian plane; (b) hole configuration projected on the meridian plane: the yellow arrow shows the H-137 direction of the hole.

[2] Such designation of direction is not an end in itself. In the previous works, the letter P (platform) is used to designate the directions from the observation platforms to the guiding stones, and the letter A (angle) is used to designate the directions of the angular stone corners (Malkhasyan, 2022a). From now on, the letter H (hole) will denote the directions of the stone holes to avoid confusion.

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Figure 4. Schematic reconstruction of the integrity of the hole and the orientation of H-137 direction on the longitudinal section of the hole structure.

Star (m)	Right ascension	Azimuth	Disapp.	App.	Date (BC)
α Ursae Minoris ($1^m.95$)	23^h41^m	173°52′	AE + 38	VE + 28	808 (AD)
β Ursae Minoris ($2^m.05$)	16^h29^m	173°51′	SS + 44	WS + 31	375
	19^h29^m	173°53′	AE - 11	VE - 23	1725
α Lyrae ($0^m.00$)	10^h28^m	173°50′	VE + 48	AE + 30	11070
	1^h39^m	173°52′	WS - 32	SS - 38	13140
γ Cygni ($2^m.20$)	7^h04^m	173°53′	VE - 36	SS + 32	14935
	4^h56^m	173°54′	WS + 15	SS - 2	15500
α Cygni ($1^m.25$)	9^h54^m	173°49′	VE + 37	AE + 17	15075
	2^h06^m	173°53′	WS - 25	SS - 36	16990
α Cephei ($2^m.45$)	14^h52^m	173°53′	SS + 26	WS + 12	17845
	21^h04^m	173°52′	AE + 6	VE - 6	20235
α Ursae Minoris ($1^m.95$)	10^h45^m	173°53′	SS - 39	AE + 35	23085

Table 1. Stars of apparent magnitude up to $2^m.50$ and their data that have been observable in the H-137 direction during the last 26000 years; (A=173°58′; h=34°09′); m - apparent magnitude, VE – vernal equinox, SS – summer solstice, AE - autumn equinox, WS - winter solstice, Disapp. – day of disappearance, App. – day of appearance.

Hence, the significant refraction of the axis of the stone hole and the groove on the "exit" opening together specify the vertical and horizontal components of the direction under examination (elevation and azimuth). Our expedition team measured the data related to this direction (H-137) in 2020; the data are in Table 1. The same table also shows the stars observable in the H-137 direction during the last 25776 years (one complete Earth's Precession) and their observation days and conditions. Notably, the obtained direction is very close to the North Pole direction (the angular elevation of the North Pole at the geographic latitude of the monument is 39°33′, and the azimuth is 180° from the South point). Thus, **one can observe only stars but not other celestial bodies in the given direction**.

2.2. Possible Function of the Puddle on Stone Number 137

The puddle has a triangular structure with two walls continuing upwards but accessible on the third, northern side (Figures 1b, 5). The continuing western and southern walls form an approximately 90-100° angle with each other. The southern wall is inclined to the south, forming an angle of 15°06′ to the vertical axis of the latitudinal plane (Figure 3b) and about 30° to the horizontal axis (Figure 5). The western wall is inclined to the west, forming an approximately 40° angle with the vertical axis

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of the meridian (Figure 5). Starting from the top of the southern wall corner, the intersection line of the western and southern walls forms a clear direction upwards with the following components: 39°34′ height from the mathematical horizon and 49°17′ azimuth from the south point (Figures 1b, 5). Let us find out what kind of practical significance this structure could have.

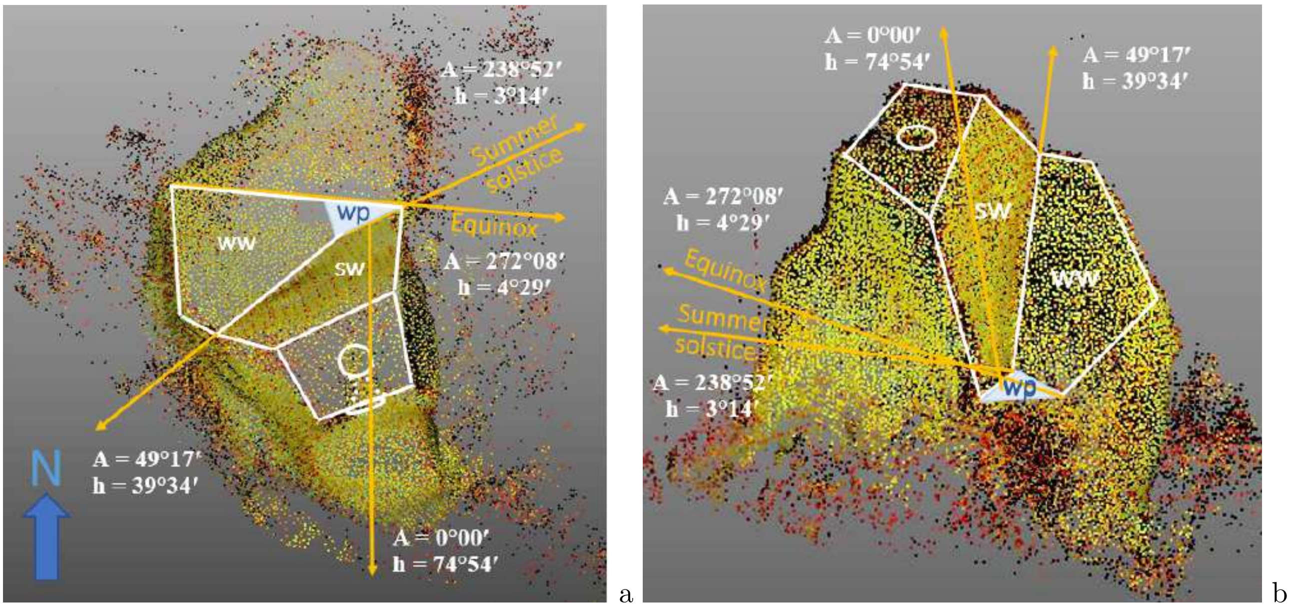

Figure 5. Digital point cloud of stone No. 137: (a) some directions are indicated from above; (b) from the northeast, the southern (northern "slope") and western walls are highlighted, which form the two sides of the triangular puddle.

In the simplest case, the puddle can relate to the Sun's light reflection, which has been noticed before (Herouni, 2006)[3]. First, no matter how reflective the water surface is, it is hard to imagine that it can reflect the light from bright stars or visible planets. On the other hand, we already know other ways of observing stars in the monument (for example, the angular stones) (Malkhasyan, 2022a), which are easier to use and do not require any "mirror" observations. As for the Moon's disk, its constantly changing shape and large orbital obliquity (5.14°) are questionable regarding regular observations. Additionally, it is unsuitable for calendar purposes since the Moon can appear in the same position more than once during its yearly cycles, at different phases, on different days and hours. At the same time, there is no strict need for any instrument to observe the Moon's phases and periods. Therefore, the connection between the puddle function and the Sun's light reflection is more than logical. Now, let us see how the Sun's visible movement in the sky can be expressed in the puddle under discussion.

First, let us consider the most obvious direction, formed by the intersection of the western and southern walls and resembles the angular stone structure (Malkhasyan, 2021b). In this direction ($A = 49°17'$, $h = 39°34'$) (Figure 5), the Sun makes a brief transition about 3.5 hours before sunset, two days after the vernal equinox, and three days before the autumn equinox (Figure 6), under the conditions of today's Ecliptic obliquity ($\varepsilon = 23°26'18.9''$)[4]. If we consider the upper point coordinates of the Sun's disk rather than its center point coordinates, we will be one day closer to the equinoxes. **Notably, the elevation of this direction is equal to the geographical latitude of the monument location (39°33′ N latitude), that is, the elevation of the North Pole**. At the same time, the first sunbeams (A=272°08′, h=4°29′) will illuminate the northern edge of the western wall at sunrise on the same days. The western wall cannot be illuminated during the winter period between these two days (vernal and autumn equinoxes). The point is that the slope of the southern wall of the stone

[3]In Figure 27 of the book, the sunlight is reflected in the puddle of stone No. 137. The photo is dated 23 June 1996 (one day after the summer solstice). However, he does not address this issue in his works and attributes a stone-position regulating function to the puddle.

[4]All the data in the article were taken and calculated with the help of the *Stellarium v.0.20.4* computer package. (https://stellarium.org)

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shadows the puddle and part of the western wall throughout the year, from sunrise to noon. The puddle can be illuminated throughout the day at the Sun's northernmost positions (at its maximum declination) only on days close to the summer solstice (Figures 5 and 6. At the summer solstice, at the Sun's culmination, the zenith distance of the upper point of the disk[5] is $15°51'$ under the circumstances of today's ecliptic obliquity ($\varepsilon = 23°26'18.9''$). However, if we consider the puddle size, which is about 10 cm[6] in the north-south direction, the Sun's disk will be fully reflected in the puddle because the zenith distance of the southern wall slope is $15°06'$ (Figure 6). After noon, when the sunlight begins to change its direction from north to northeast, the Sun can be reflected in the puddle during the summer period from the vernal to autumn equinoxes. Thus, we have the following picture. Sunlight illuminates the puddle for about 180 days from the vernal to autumn equinoxes, only during the afternoon. Moreover, from sunrise to noon, a part of the western wall is always in shadow, except for the days close to the summer solstice, when there is no shadow on the western or southern walls. The puddle and the western wall are not illuminated from the autumn to vernal equinoxes (Figure 7). **This device can help accurately determine the equinox and summer solstice days**. In addition, considering the shadow position of the western wall at sunrise can also provide guidance. For example, if we divide the western wall into three longitudinal parts (even with markings), the shadow will coincide with them for 30 days with great accuracy. This way, using the movement of the Sun's shadow, one can determine the limits of six months, each consisting of 30 days. Since the conditions of today's ecliptic obliquity are discussed, the stone can perform the same function even today, and today, **the obtained results can be verified through experimental observations.**

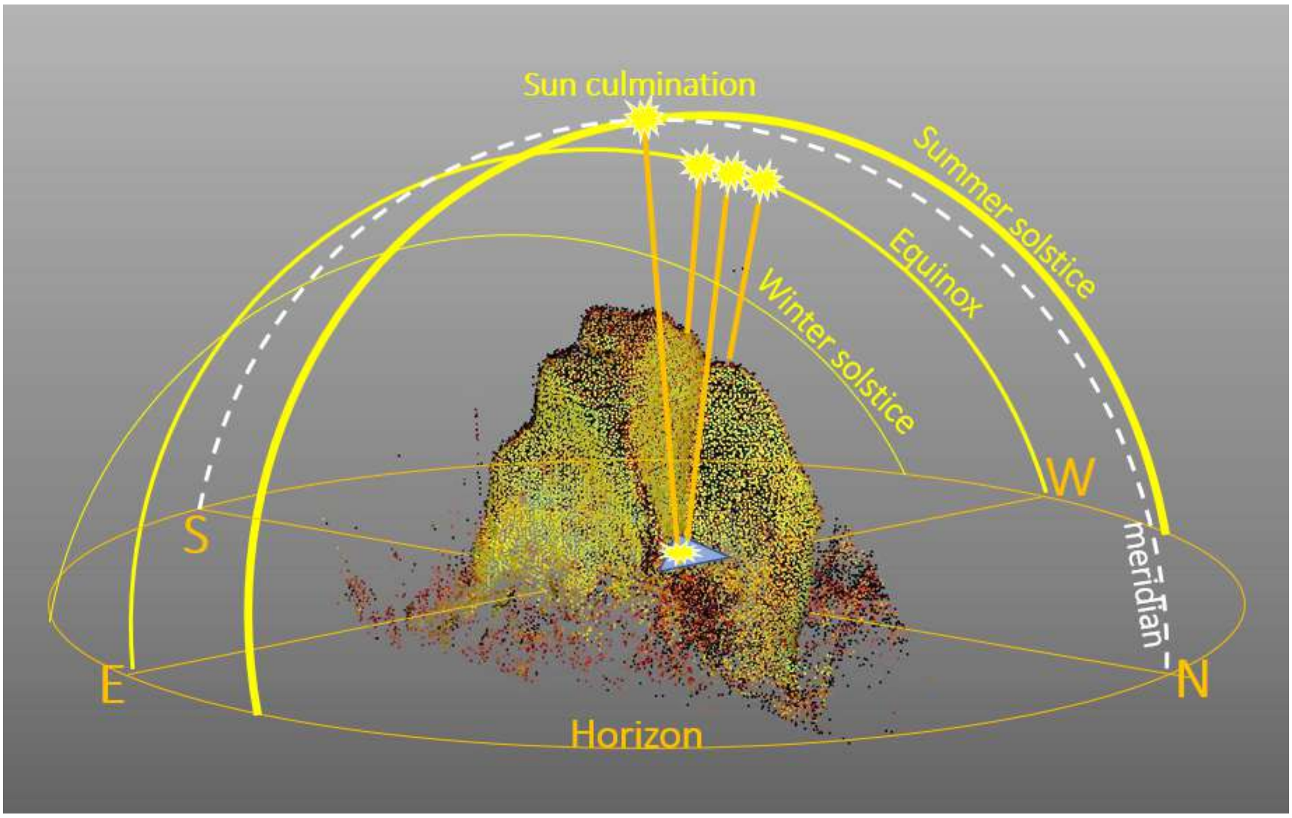

Figure 6. The visible movement of the Sun towards the geographical directions on the days of the equinox and solstices is described. The diagram shows the Sun's reflection in the puddle at the summer solstice, at the Sun's culmination, and when the Sun is reflected in the puddle approximately 3 hours 30 minutes before sunset at the equinoxes. It is taken into account in terms of today's angle formed by the Ecliptic and Equatorial planes ($\varepsilon = 23°26'18.9''$).

[5]The visible angular diameter of the Sun's disk is about $32'$.

[6]It depends on the water level.

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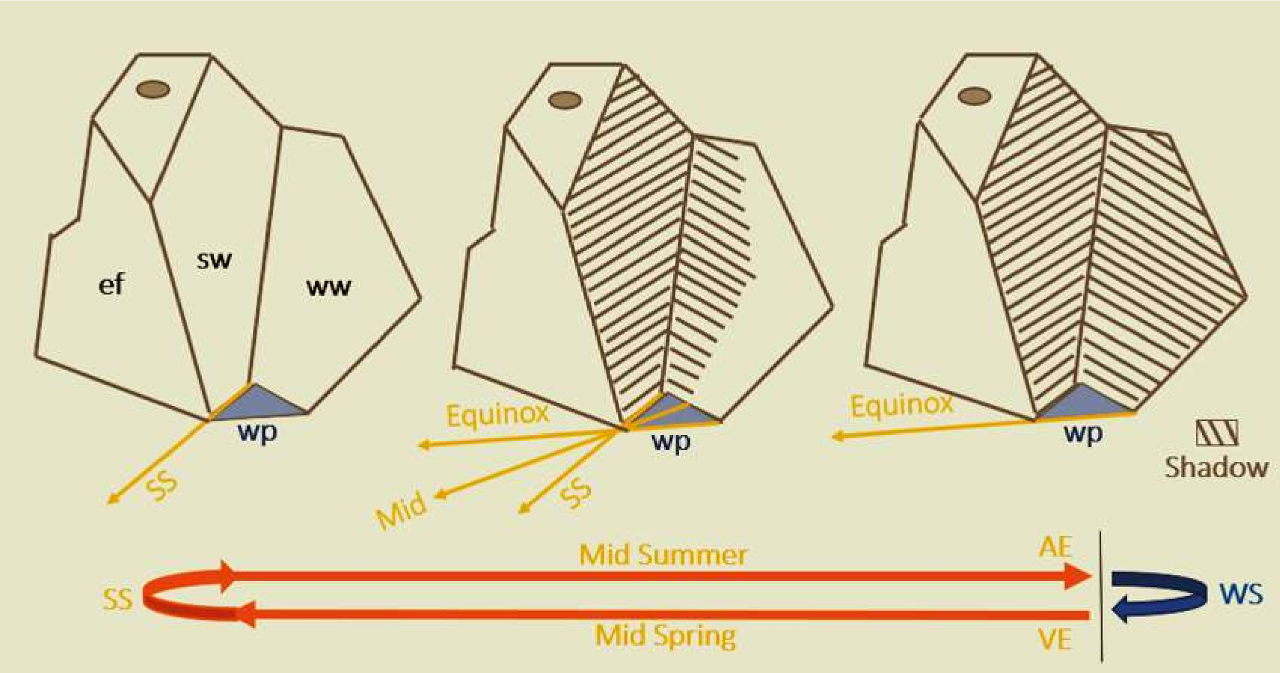

Figure 7. Position of the shadow on the western and southern walls of stone No. 137 on the days of equinoxes and summer solstice. Schematic simplified diagram: ef – eastern face, sw- southern wall, ww – western wall, SS – summer solstice, VE – vernal equinox, AE – autumn equinox, wp – puddle (triangular water pit).

Thus, the puddle function and the unique structure of the northern part of stone No. 137 are fully explained, which is related to determining the days of the equinoxes and the summer solstice[7]. However, it is noteworthy that when the Sun rises and goes up, the puddle is illuminated only on the days close to the summer solstice (± 15 days, depending on the ecliptic obliquity and the water level in the puddle). On other days, the descending Sun's light can only illuminate the puddle in the afternoon. Moreover, the eastern face of the stone almost coincides with the meridian plane, so immediately after the Sun's culmination, its luminous surface will be shadowed immediately, thus serving as an indicator for determining the midday. This is important to the extent that **the ancient world gave immense importance to the worship of the rising and culminating Sun, which is strongly expressed in the stone function described here and is associated with the summer solstice.**

3. Results and Discussion

As we have seen, stone No. 137 has several functions. On the one hand, its hole was most likely intended to observe the circumpolar stars and, on the other hand, to determine the equinoxes, especially the summer solstice, with the help of the puddle. **Hence, if the stone has two functions, it can be surely assumed that they must be somehow related. Particularly, circumpolar star observations in the direction of the hole can relate to the equinoxes and the summer solstice.** This point of view has a full right to exist because the results of the studied parts of the monument testify to the fact that if the same stone performs more than one function, they are necessarily connected to each other (Broutian & Malkhasyan, 2021, Malkhasyan, 2021b, 2022a,b, 2023a, 2024b). Now, let us consider the data in Table 1 in this context.

[7]The determination of equinoxes and solstices with the help of shadows is also known in many other monuments. Particularly, such a function is attributed to the Sev Sar's petroglyph (Armenia) (Frincu *et al.*, 2021).

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3.1. Probable Date of Full Application of Stone Number 137

First, as shown in Table 1, no bright star observation has been possible in the astronomical "layers" of the monument studies obtained so far (9000, 5800, and 2341 BC). At the same time, Stone No. 137 under discussion cannot be classified among observation platforms and their guiding stones or angular stones. Though the reciprocal arrangement of its southern and western walls resembles the angular stone structure, no observations are possible from this angle, and, as we have seen, its function is probably related to the sunlight reflection in the puddle. **These considerations allow us to attribute the observational use of stone No. 137, especially its hole, to another date.**

Next, in Table 1, it is noteworthy that in 20235 BC, star α *Cephei* was possibly observed six days before the vernal equinox and six days after the autumn equinox because the second function of the stone, as we have seen, is related to the equinoxes. Notably, these days differ by six to seven days from the days pointed by the "shadow meter" described above. Thus, the second function does not coincide with the days of the appearance or disappearance of α *Cephei* in the indicated direction because the sunlight does not illuminate the western wall and the puddle of the stone in any way. Therefore, this date can be considered less likely. **The days when the other stars are observable differ significantly from the equinoxes and the summer solstice days, except for 15500 BC, the appearance date of star γ *Cygni*, which almost exactly corresponds to summer solstice day** (Table 1). If we consider that the observation of this star was possible two days before the summer solstice immediately after the sunset, the following day's sunrise differs from the summer solstice by one day, which is directly related to the second function of the stone – the determination of the summer solstice. Now, let us look at this date in more detail.

3.2. Additional Reasoning Regarding the Date 15500 BC

Notably, the 15500 BC is consistent with the results we have obtained regarding the preliminary expansion date of the monument (29300 BC) (Malkhasyan, 2020). At the same time, stone No. 137 is not a part of the central cromlech; the latter's construction date we obtained refers to 9000 BC (Malkhasyan, 2022b, 2023a, 2024b). In addition, this is not related to the observation platforms studied; therefore, there is no contradiction with the previous results. It is more than possible that the stone could have been placed at an earlier date related to the operation of the monument and used in later times as well. The reason is that, as we have seen, its function of determining the Sun's positions still applies today. Moreover, in 15500 BC, the ecliptic obliquity ($\varepsilon = 23°32'04.5''$) does not significantly differ from today's value ($\varepsilon = 23°26'18.9''$). Therefore, there is no need to recalculate the results obtained for the mentioned date.

The fact that **the summer solstice is closely related to the beginning of the year in ancient Armenian calendars (Navasard Festival)** (Broutian, 1997, 2016, Malkhasyan, 2021a) makes the possibility of this observation more significant, especially when considering the following:

1) The examination of Platform 3 of Zorats Qarer monument has already revealed that the appearance of star γ *Cygni* was observable in the angle direction of stone No. 7 in 9000 BC, 27 days before the summer solstice, especially as the detailed examination of this star's calendar and ideological content unveils close connections with the summer solstice, the Navasard month, and the Holiday of Navasard (Malkhasyan, 2024b).

2) On the same occasion, this star is also associated with the "mythical bird's" crop, the content of which is explained by moving the highest Sun from the beak right into the crop (Malkhasyan, 2024b). We have the same thoughts concerning Stone No. 137. The sunlight reflection in the stone puddle on the summer solstice can definitely be explained in the same context if we consider the puddle as the "stone (bird's) crop" and its upper part as the beak.

3) Stone No. 137 is located between the center of the monument and its northern wing, which does not contradict these ideas either and is expressed, for example, in the bas-relief of the vulture on Portasar's (Göbekli Tepe) Pillar 43 and the bird decoration on the Early Bronze Age vessel from Keti (Armenia) (Malkhasyan, 2024b), which has a calendar content (Broutian, 2007).

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4) The plan structure of the monument is related to the Swan (Angegh-Vulture) constellation (Malkhasyan, 2020, Vahradyan & Vahradyan, 2010).

5) The astronomical calculation of the age of an episode of the "Sasnay Tsrer" epic resulted in a qualitatively similar date, and it is vitally important to note that this calculation is based on the time having the closest coordinates to the north pole of star α *Cygni* in the same constellation. Moreover, in 15500 BC, o_1 and o_2 *Cygni* stars (Vulture's Beak) were polar (Broutian, 2021, Malkhasyan, 2020).

6) The obtained date (15500 BC) entirely fits into a regularity previously obtained in a different way. The point is that the astronomical dating of the Fish-shaped Vishap (dragon) stones resulted in a regular period of the change of the calendar's main star (with a difference of 3250 $\pm$ 50 years) (Malkhasyan, 2023b). Since 18800 BC was revealed as the time of Dragon-fish's worship, one should assume another change occurred 3300 years after that, which refers to the date obtained for the use of Zorats Qarer's stone No. 137 (15500 BC).

The listed considerations allow us to discover the stars performing heliacal rising on the summer solstice in 15500 BC, that is, to discover the calendar's main star of that time. Our examination shows that the heliacal rising of only several stars was observable on the summer solstice at that time, depending on the angular elevation of the visible (real) horizon. These stars are ε *Pegasi,* β *Aquarii*, and β *Capricorni.* A separate detailed examination is necessary to determine which of the mentioned stars had the paramount significance, which is beyond the scope of the main problem of this article.

It is worth giving a solid explanation to one more question here. **What is the reason for such accuracy of the hole direction on stone No. 137 if most of the holed stones in the monument lack such features? The point is that high accuracy is needed to notice the daily coordinate changes of the stars near the North Pole.** This is the fundamental reason for providing exceptional accuracy to the hole direction, and this, in turn, additionally confirms that we are dealing with circumpolar star observations in this case.

As we can see, there are many arguments in favor of considering the γ *Cygni* star observations in 15500 BC realistic, which are expressed in the results of these calculations, previous research on the monument, astronomical examination of the Armenian folklore material, and the analysis of the iconography present in the archaeological monuments found elsewhere (particularly in Portasar(Göbekli Tepe) (Malkhasyan, 2024b)).

Summary

The detailed astronomical examination of stone No. 137 of the Zorats Qarer monument reveals several observational functions unrelated to being a "periscope," as previously assumed (Herouni (2006) pp. 57-59).

a) The unique structure of the stone hole and the additional groove were intended to improve the accuracy of observations of circumpolar stars.

b) The most likely observation refers to the appearance of star γ *Cygni* right after sunset in 15500 BC on the summer solstice.

c) The structural features of the stone and its water puddle, serving as a solar shadow meter, enable quite precise determination of the days of the equinoxes and summer solstice. The presence of a stone with this function in this monument can be considered a new reality.

d) The above-mentioned stone functions are directly related to each other and refer to the summer solstice. A similar principle of "observation devices" was also used for later calendar times (9000 BC) of the same monument (Malkhasyan, 2024b) and in the case of Portasar's (Göbekli Tepe) Pillar 27 ((Malkhasyan, 2024a).

e) The shape and structure of the stone fully correspond with their content to the summer solstice and its ancient pictorial and substantive perceptions. Moreover, if the observation of star γ *Cygni* in later periods relates to the morphological expressions of the mythical bird (in this case, the Vulture's crop) swallowing the Sun, we deal with its deeper perception here. Thus, the Sun's being on the bird's

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beak and in the crop simultaneously (Malkhasyan, 2024b) is expressed by the Sun's culmination on the summer solstice and its reflection in the puddle of stone No. 137.

Hence, a new temporal observational (calendar) "layer" dating to 15500 BC is revealed in the Zorats Qarer monument, outlined in the previous studies to some extent. The "observation device" described in this layer significantly differs from the observation platforms and angular stones. However, Portasar's Pillar 27 has a very similar use in principle, which is again a shadow meter and is covered with holes oriented towards same-day observations (Malkhasyan, 2024a). Here, it is also possible to identify the calendar's main star for the mentioned period. It is necessary to look for other similar stones in the Zorats Qarer monument, which will allow us to distinguish the given "layer" more clearly and make the changes made in later periods evident.

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