



Arhaeoastromical Research of Chashkovsky Ridge

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Abstract

This paper is devoted to research on arheoastronomicheskim Chashkovskom ridge spur Ilmeny Southern Urals, in conjunction with mountain Golukha and lake Large Elancik. This entity is the central research hole on the top of the mountain and view it from a review of the horizon. Hull has a natural origin, but artificially increased by ancient people for not yet clear goals for us. To check the version of astronomical taken a photocall at the equinoxes and solstices. Pre- map were conducted prospective observation direction of sunrise and sunset on the dates indicated year. Especially interesting was the eastern direction, which indicated two small slides and a long peninsula lake Big Elancik. Checking directions on mountain confirmed the sunrise at the equinox of the base nearest hills to the east, and from the long peninsula on the lake - the sun set in the west. No less interesting was the direction of the sunrise at the winter solstice of two hollow hills on the south- east. It is safe to conclude that on the mountain Golukha in several millennia conducted astronomical observations are likely to calendaring. Assumptions are confirmed chance finds of fragments of ceramics and stone tools on the mountain and on the lake.

Keywords: ritual complex, calendar, equinox and solstice

Introduction

Arhaeoastromical research Chashkovsky Range and, specifically, the Mountains Golukha with a hole in the horizontal plate on top, have its own background. The fact is that this kind of natural object in the form of a mountain with a hole at the top and was seen by the author in Kazakhstan in August 1983, during participation in the expedition of the Chelyabinsk state University under the direction of the Tatyana Malyutina near the village Kinetkel in Zerendinsky area of Kokchetav region (53° N; 69° EAST). There, at the foot of the mountain, on the steep Bank of the River Chaglinka, was excavated coach bronze age Chaglinka II.

The author, together with Nina Voronina, then a third year student at the history Department, wandering around the area from the East from the digs of the Parking lot, we came to the summit with a rocky access and a hole in a horizontal plate. Hole seemed mysterious, the size of a man's head, and evoked a different sort of idea about the possibility of its use for ritual purposes ancient people. Next grew lonely pine tree, which would bind any ribbon or to make something unusual like that. At that time there were Soviet times, and we were all atheists, therefore such archaic desire seemed weird. The mountain is view along the line of the horizon, therefore, are having second thoughts about the astronomical observations in the calendar purposes.

Two years later, in 1985, during a tourist trip for the South Urals and directly Chashkovsky Ridge, the author was awarded a similar peak with the rocky access and a hole in a horizontal plate on the Mountain Golukha (Fig. 1).

Uniformity of natural objects suggested that the coincidence is not accidental. Even if it is a purely natural objects, and, most likely, partly processed, they could be used by ancient people to calendar observations over the horizon. Therefore Chashkovsky Ridge need to look for traces of ancient people and possibly their settlements.

On July 10, 2007 began the planned outputs Chashkovsky Ridge to detect traces of ancient people and their possible astronomical observations. Staff of the expeditions in different time was different, but in all cases prosecuted the same research goals - arhaeoastronomical. The first idea of research on Chashkovsky Ridge supported to Andrey Matsyna is the candidate of philosophic Sciences, lecturer of the chair of Humanitarian studies in the Chelyabinsk Institute of Aviation. Help to us and the former teacher of tourism Danil Mukhametov, which in 1985 for the first time led the author to the top of the Mountain Golukha, and also, students of Aviation Institute, our children and friends. Find fascinating archaeoastronomical study, however, largely dependent on the weather, so it dragged on for several years [1,2].

Object of Study

Mountain Golukha (54.51°N 60.10° EAST) is situated in the South-Western part of the array Chashkovsky Mountains, in Miass district of the Chelyabinsk region. Mountain Golukha is the most visited by tourists from all the picturesque hills in the given array because of its free availability (at a distance of 1 km from the highway of the Miass-Kundravy), open review of the horizon (in good weather seen the main sights of Southern Urals Mountains Taganai, Itsil, the Alexander Sopka, Iremel, the Ilmen Mountains), and also, because of the peculiar hole in the flat plate on top, where everyone tries to get his head. Climbers organize competitions and trainings on steep slopes Mountain Golukha.

The object of our archaeoastronomical research is the hole at the top of this mountain and viewable from him overview of the horizon. Port may be of natural origin, because stove under it have the usual type of weathering, of which there are many in the surrounding rocks. But a closer look reveals that the shape of the holes has angular rim, which could hardly have natural origin, most likely, they were treated to increase the hole, with the aim of room out there or the observers heads, as we assume, or for the post, as suggested by other historians, perhaps in the role of the torch, which is visible far around, maybe with some other objectives, probably, ritual, and possibly astronomical (post with astronomical wheel (?)) (Fig. 1, 2).



Figure 1. The hole is at the top of the Mountain Golukha. Visible sharp, artificially processed the edge of the hole. Photo: O. Polyakova.



Figure 2. The top is view of the hole in the horizontal plate on top of the Mountain Golukha. Photo: O. Polyakova.

To check the astronomical versions were made photo session in the days of equinoxes and solstices. But first, on the map were carried out prospective direction of observation of sunrises and turns of the Sun in this cardinal point of the year.

Development of methods

1. Marking of alleged astronomical directions on the map.

Preliminary work connected with the application of the alleged astronomical directions on the map. There are a lot of interesting directions for the next slides and far heights, as well as from the Eastern side on a Long Peninsula (as we call him) of Lake Big Elanchik. As to the East direction came across other interesting slides, it was decided first of all to study the Eastern direction of the Mountain Golukha (Fig. 3).

2. The corrected points of sunrise and turns of the Sun above the horizon in particular areas.

For a faithful beginning it is necessary to verify the situation of the real points of sunrise in the study area, as hilly horizon line above astronomical, so in astronomical calculations and prospective directions we have to make adjustments.

The point of the rising of the Sun in spring and autumn equinox match, visible in the East and at all times occur in the same place in particular areas. When calculating the points of sunrise on classic formulas for astronomical horizon [3] azimuth is equal to 88.9° , but when viewed from the Mountains Golukha, sunrise comes from the Foundation of the Mountain Ravnodenstvennaya slides (as we called it) with the azimuth of the 90° time of astronomical events at 7 hours 08 minutes (Fig. 4, 5). In the figure 4 shows that the base of the hills as if with a groove - perhaps it was made by ancient people to provide the sunrise at the equinox exactly from the base of the hill.

In the study of Mountain Ravnodenstvennaya slides it turned out that the rock in the place where the Sun comes at the equinox when viewed from the Mountains Golukha, as if lopped to a height of 2 meters, and on the spot «cut», close to it, vertically increased pine tree in the centre of the image (Fig. 6).

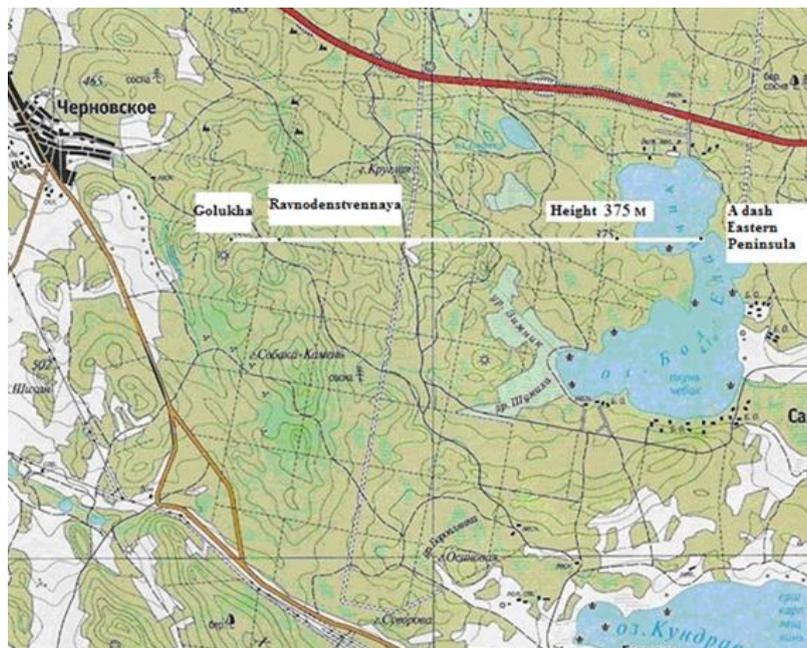


Figure 3. Map Chashkovsky Ridge with a focus on the East of the Mountain Golukha.

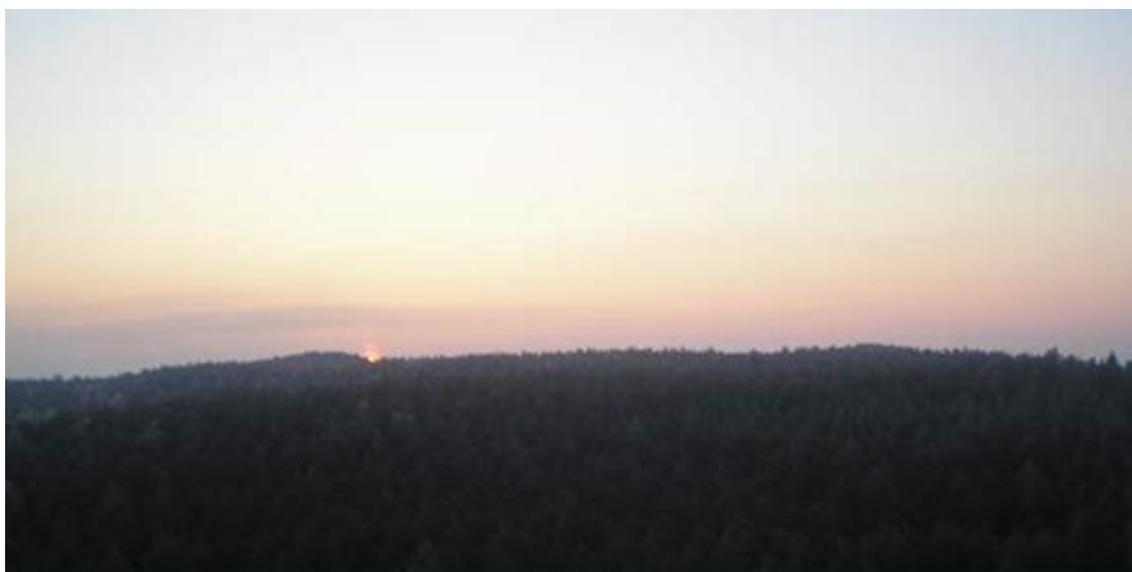


Figure 4. March 21, 2010, 7 hours 08 minutes. Sunrise is at the East exactly (90° azimuth). Photo: O. Polyakova.

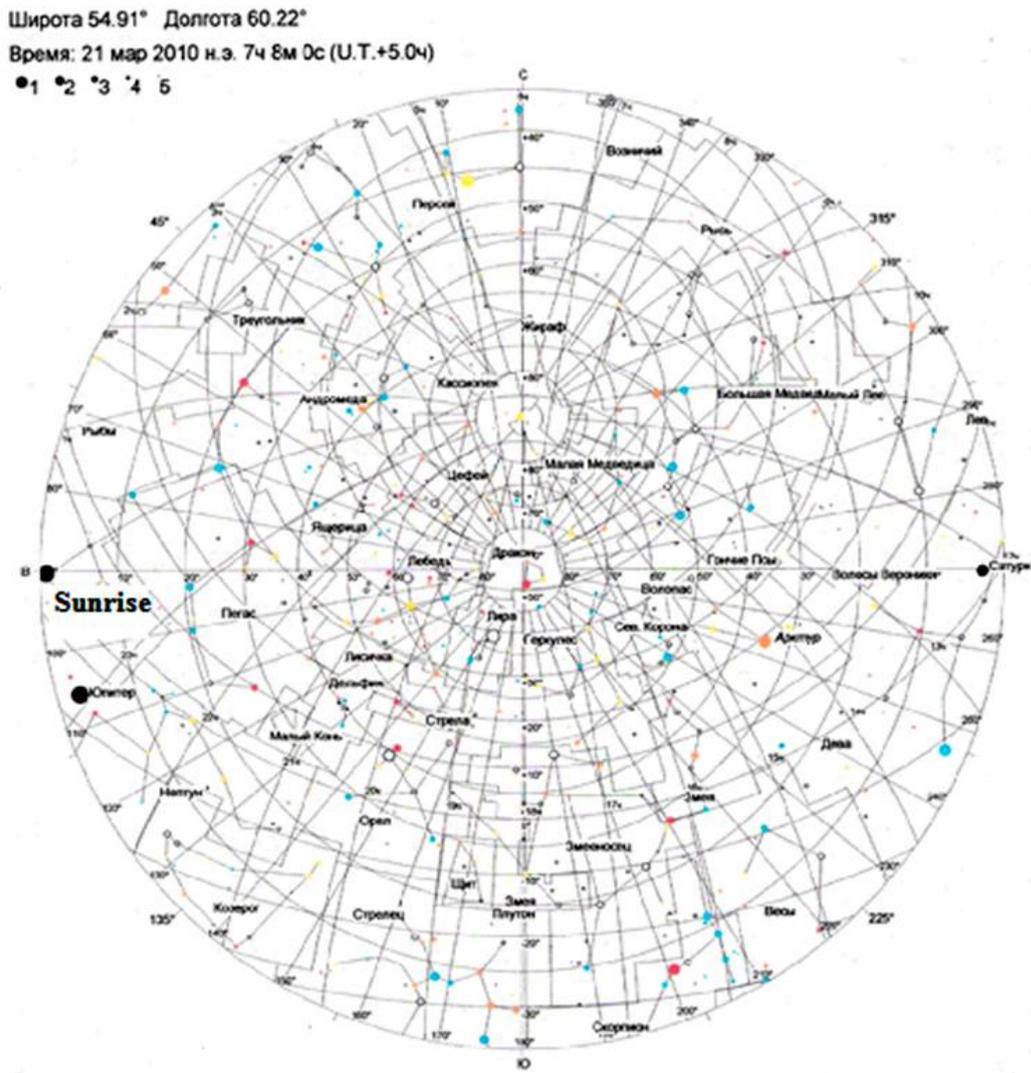


Figure 5. The astronomical map of the sky shows sunrise at the equinox on Mount Golukha [4].



Figure 6. View from the South on Mountain Ravnodenstvennaya hill, at the foot of which the Sun appears at the equinox when viewed from the top of the Mountain Golukha. Photo: O. Polyakova.

It is interesting to note that the direction of the East of the Mountains Golukha coincided with one top, Height of 375 m, closer to the Western shore of Lake Big Elanchik and further with the Long Eastern Peninsula of the same lake. A preliminary examination of a Long Peninsula has shown that Mountain Golukha there is not visible, but we rise the tip with a Height of 375 m can be seen (Fig. 7, 8).

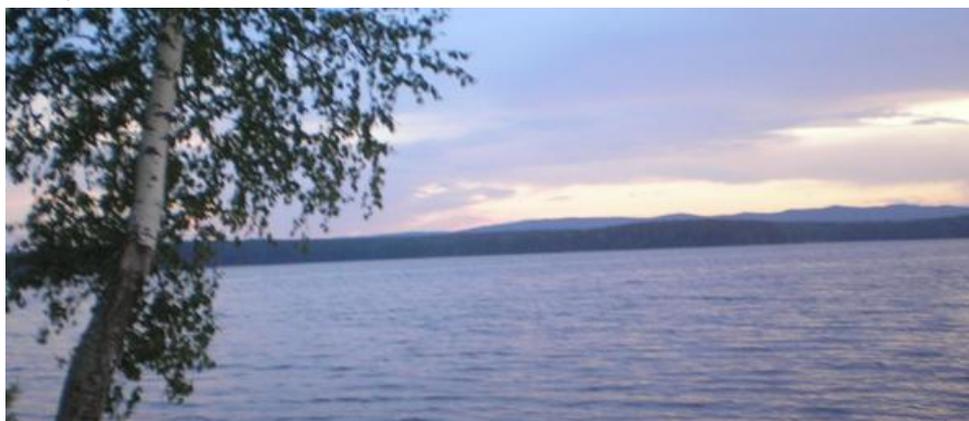


Figure 7. View from the Eastern shores of Lake Big Elanchik on small round top in the foreground, Height of 375 m, and next to her on Chashkovsky Mountains. Photo: O. Polyakova.



Figure 8. Observation with a dash of Eastern Peninsula of the Lake Big Elanchik: touch the Sun skyline before Mountain Ravnodenstvennaya slide in the autumn equinox in 19 hours, 37 minutes and 21 September 2012. Photo: A. Belyakov.

In result of studies of the Eastern directions from the Mountains Golukha, we can assume that ancient astronomers, watching calendar, lived on the Eastern shore of Lake Big Elanchik and every day could see the Sun when you step approaching equinox point. If the Sun at the equinox was cherished point in the West and in the morning, at dawn it will rise from the base Mountain Ravnodenstvennaya slides exactly in the East, with supervision from the Mountain Golukha. That is, after the event was to lead the people to the mountain, and make their festive rites.

In arhaeoastronomical studies we helped device ASHT, with the help of which has been calculated in the Eastern direction of the vernal equinox, and then the other side of the world (Fig. 9).

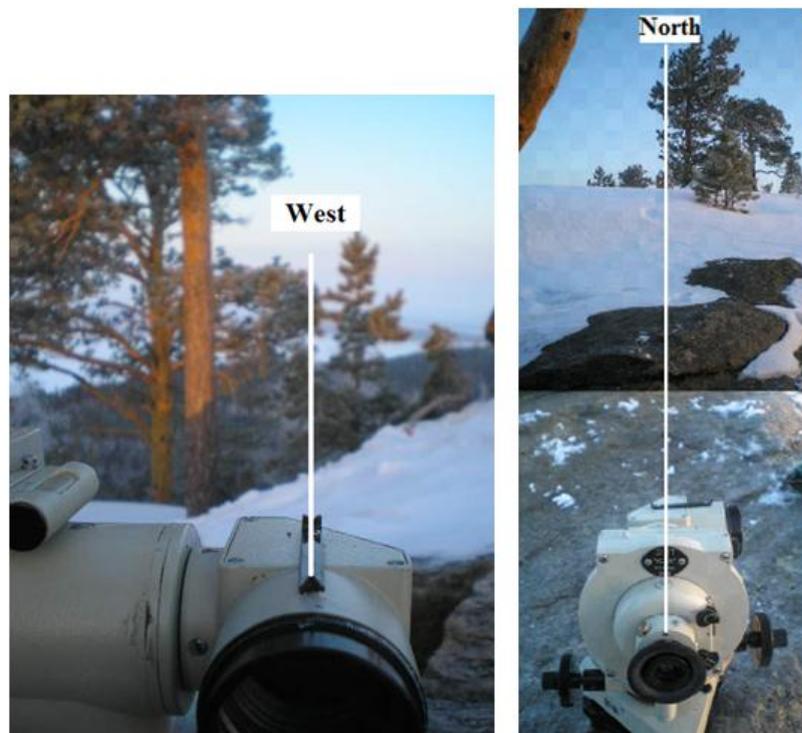


Figure 9. Direction of gaze to West and North, certain risk astronomical instrument ASHT, a pre-configured to the East. Photo: O. Polyakova.

To confirm our assumptions archaeologists, in particular, this Sergey Botalov, doctor of historical Sciences, Director of the South-Ural branch of the Ural Academy of Sciences, was asked to give evidence visiting these places by ancient people. At first we could not imagine what to look for. Looking for ancient drawings on the rocks, but did not find any. The first discovery discovered by accident on the path, which usually made the ascent to the Mountain Golukha. Dmitry Berdnikov, cadet aviation Institute, not once been in archaeological expeditions, with a practiced eye, allocated from the various items on the trail shard of pottery. After that we began to find fragments of ceramics and also on the trail, and on the top of the mountain. Moreover, it was discovered that after each spring floods and rain, not only ceramics appears on the path, but stone arrowheads and copies. We found pattern: at the bottom of the trail were black pottery shards with talc - clear they are the most ancient, because the water washes longer. In the middle part of the trail is ceramics orange with talc, sometimes combined - outside orange, inside black, often with a picture of «herringbone». Ceramics with talcum powder is found only in the Urals and archaeologists refer to it or to Cherkaskulskaya culture (middle of the 2nd Millennium BC), presumably, Ugric, they, along with bronze cannons were used stone arrows and scrapers [5], or to Gorokhovskaya culture (mid-1st Millennium BC) attributable to the ancient Magyars, mixed populations Ugric peoples with ancient Iranians [6].



Figure 10. Stone composition «Horse's head» and finds under it. Photo: O. Polyakova.

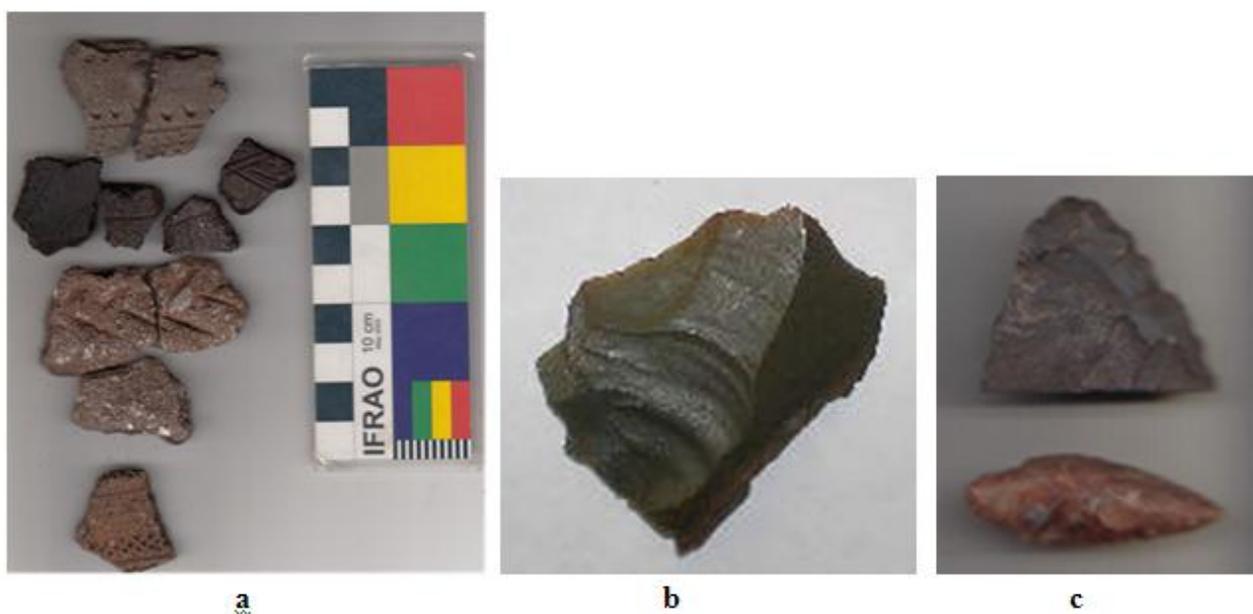


Figure 11. Other findings: **a** - the fragments of the ceramics found at different altitudes paths during the ascent to the top of the mountain Golukha (findings O. Polyakova and Maksim

Polyakov); **b** - scraper with Western shore of Lake Big Elanchik (finding O. Polyakova); **c** - finds on the path rise to the top of the Mountain Golukha: fragment of stone spearhead (finding O. Polyakova) and quartz arrowhead (finding Aleksandr Ostrovsky).

Closer to the top, mainly under «Horse's head» (Fig. 10), is ceramics without talc with fine carved ornament, by assumption, this Sergey Botalov attributable to Kushnarenkovskaya culture (mid-1st Millennium ad) [7]. He told us that he Kushnarenkovo culture of the early middle ages refers to the ancient over Magyars (Hungarians), who later went to Europe, and what historians looking for ancestral home. On the flat top of all were the above described types of ceramics (Fig. 11).

The most interesting finds on the top include ceramics, like metallurgical, discovered in the mid peak above «Horse's head» (Fig. 12) and teeth horses found by the author in the Little Grotto the Northern tip top. The Little Grotto found A. Matsyna, together with a fragment of pottery at the entrance (Fig. 13). Other bones near the teeth were not. There is an assumption that it is the «teeth horses» were a kind of ritual character, in particular relating to the observation of celestial Pole and worships him as a God. Interestingly, in this case, pay attention to the description of the concept of a stake in the dictionary of Russian words V.I. Dal: «number, «Kol» - the groom horse Fang, lower tooth between the incisors... «Kol» - funny, North star... «Kol» - «Kolanets», ... splinter, chipped a piece» [8].

The location of the findings, see the diagram at the end of the article (Fig. 14).



Figure 12. Presumably, the findings of the metallurgical activity:

a - pieces of baked clay, presumably, metallurgical pottery found at the site in the middle of the mountain near the composition «Head's horse»; **b** - presumably, metallurgical semi-products, and on the southern tip top; Photo and finds: O. Polyakova.



Figure 13. Findings from Grotto in the Northern part of the vertex: **a** - the Corolla of the vessel, presumably Kushnarenkovskaya culture (in S. Botalov) – finding A. Matsina; **b** - Teeth horses (the lower incisors) - finding O. Polyakova. (Photo: A. Matsyna).

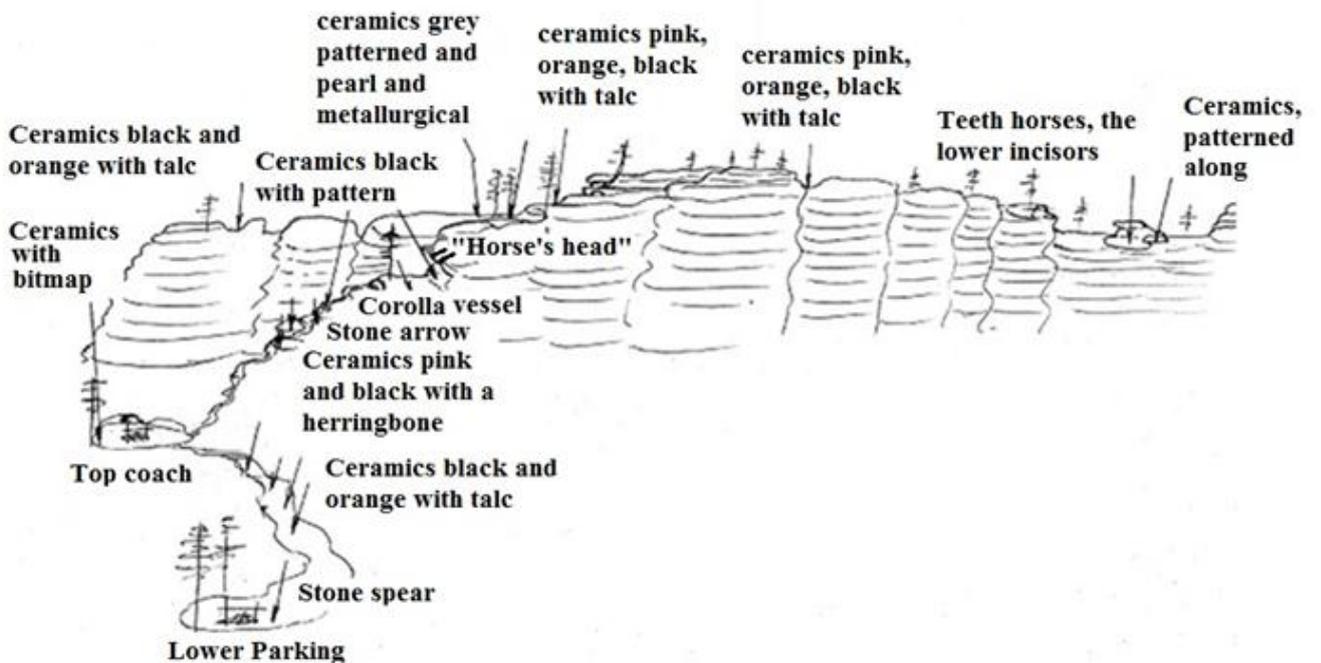


Figure 14. The diagram showing location of findings are on the Mountain Golukha.

Photo of the night sky, taken from the holes at the top (Fig. 15) gives us an idea of what the stars could observe ancient people on top of the mountain.



Figure 15. The starry sky observed from the hole on Mountain Golukha. Photo: O. Polyakova

Quite by accident it turned out, that the crown of pine in the centre of the image as would have pictured the circular line of the Precession of the Celestial Pole, along which you can see the North star:

- 1) the modern North star alpha Ursa Minor in the right upper part of the crown;
- 2) the North star III thousand BC alfa Draco at the bottom right of the crown;
- 3) the North star VIII Millennium BC tau Hercules in the lower Central part of the crown;
- 4) the North star XII BC alfa Lira (VEGA) in the bottom left part of the crown;
- 5) the North star XIV BC beta Cygnus in the upper left part of the crown.

In the same way the ancient people could see the same North star, but with a shift along the lines of Precession (here is the crown of pine) - at the place of modern North star is a Celestial Pole and in him were the North star, which corresponded to the observed period. It is possible that in the hole on top of the ancient astronomers installed a post with the wheel, across the sectors of which (the distance between the spokes) you can distribute the sky on uniform sectors. Center of the wheel, most likely, were sent to the Pole of the Ecliptic (next to the «head» of the constellation of the Draco), since in ancient times, all the calculations were held in Ecliptic coordinate system (Fig. 16).

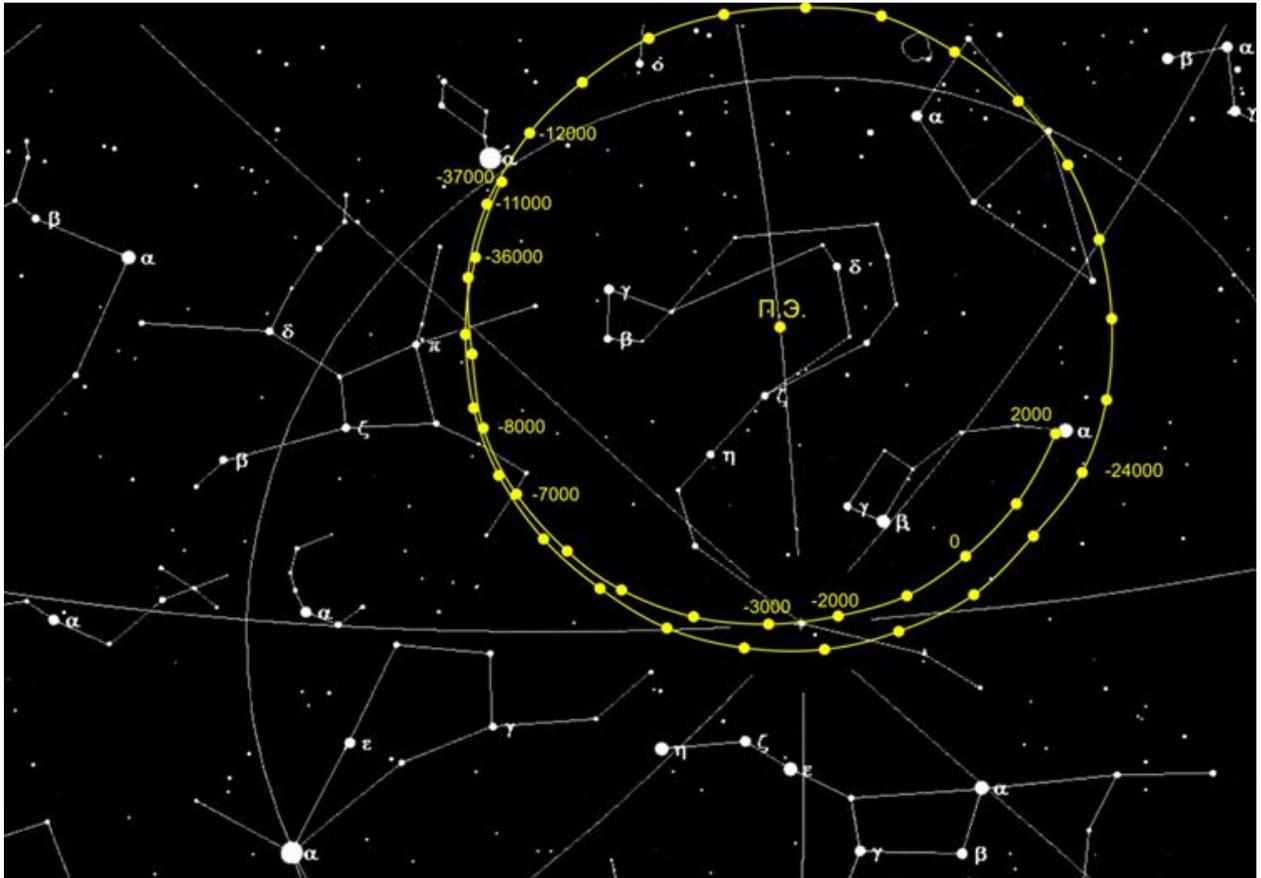


Figure 16. The movement of the Celestial Pole along the circular line of the Precession around the Pole of the Ecliptic (“Π.Ε.”) center in Ecliptic coordinate system. Figure: O. Polyakova and N. Boyko.

Calculations

Research sunrises and turns of the Sun in the solstice forced to consider change the angle of the Ecliptic to the Equator, and in view of these changes fix the difference between modern and ancient sunrises (traces) of the luminaries. This method of accounting only «ecliptic shift» allows arhaeoastronomical research in particular areas with hilly horizon.

The formula to calculate the azimuth of the rising of the sun:

$$\text{By } \cos A = \frac{\sin \Delta - \sin \varphi \times \sin h}{\cos \varphi \times \cos h},$$

where Delta - declination of the rising stars, the solstice is equal to the angle of the Ecliptic to the Earth's Equator. In our time it is;

f is the latitude of the area. In our case, on the Mountain Golukha, it equals;

h - the height of the lights above the horizon at sunrise, you can take h = 0.

But you also need to consider amendments:

1) the refraction - it is necessary to take 0.65°, because the optical distortion of the atmosphere raises shone before it come up actually;

2) the radius of the luminaries should take 0.25° as the formula azimuth sunrise lights calculated at the centre of the disc, and we mainly sunrise fix the upper edge of the disk;

3) on the curvature of the surface of the Earth - it is necessary to take amendment 0.0045° per kilometer;

4) on the parallax of the moon - we must add 0.95° , because the closer to the Ground lights down below the horizon, as the formula is calculated for the center of the Earth [3].

The angle of the Ecliptic to the Equator of the Earth in our time is 23.44° . But this corner over time gradually changing for about 0.13° degrees for 1000 years due to swing the equator of the Earth relative to the Ecliptic within 26.5° - 21.5° - 26.5° for approximately 80 thousand years [9] or, according to other sources, 47 seconds in a hundred years, i.e. 0.13° [10]. That is approximately 5 degrees for 40 thousand years in one direction and 5 degrees in the same time in the opposite direction. In our time, the angle decreases, but to 5000 years ago it was about 24° .

The calculation for the Mountain Golukha:

Sunrise 21 June 2010, where $f = 54.91^\circ$ North latitude;

$$\cos A = \sin 23.44 / \cos 54.91^\circ = 0.39779/0.57486 = 0.69041; A = 46.34^\circ$$

$$\text{Real azimuth } Ar = A - 0.6^\circ - 0.25^\circ - 0.0045^\circ \times 60 = 45.22^\circ,$$

where 0.6° - amendment on the refraction phenomenon visible lifting the lights above the horizon when it is still below the horizon;

0.25° - amendment to the radius of the light, since the moment of sunrise we look at the top edge of the disk lights, and the formula to calculate the azimuth is given on the centre of the disc lights;

$0.0045^\circ \times 60$ - amendment on the curvature of the surface of the Earth, multiplied by 60 km to the line of the far Eastern horizon.

Consider the sunrises in ancient times, with step 2500 years back centuries.

Sunrise at the summer solstice - 500 BC:

$$\delta = 23.765^\circ$$

$$\cos A = \sin 23.765^\circ / \cos 54.91^\circ = 0.40299/0.57486 = 0.70102; A = 45.49^\circ$$

$$\text{Real azimuth } Ar = A - 0.6^\circ - 0.25^\circ - 0.0045^\circ \times 60 = 44.37^\circ;$$

Sunrise at the summer solstice - 3000 BC:

$$\delta = 24.09^\circ$$

$$\cos A = \sin 24.09^\circ / \cos 54.91^\circ = 0.40817/0.57486 = 0.710035; A = 44.76^\circ$$

$$\text{Real azimuth } Ar = A - 0.6^\circ - 0.25^\circ - 0.0045^\circ \times 60 = 43.64^\circ;$$

Sunrise at the summer solstice - 5500 BC:

$$\delta = 24.415^\circ$$

$$\cos A = \sin 24.415^\circ / \cos 54.9^\circ = 0.41334/0.57486 = 0.71903; A = 44.03^\circ$$

$$\text{Real azimuth } Ar = A - 0.6^\circ - 0.25^\circ - 0.0045^\circ \times 60 = 42.91^\circ.$$

Thus, for every 2500 years on the horizon at sunrise on the day of the solstice was shifting about 0.73° .

The modern photos of sunrises and turns of the Sun in the summer and winter solstice, we make adjustments to the obtained in the calculations of the difference of time to the depth of centuries, given the scale of the image on the photo using maps of the area (Fig. 17 - 20).

On analyzing the obtained results can be seen that most exact position of sunrises and turns of the Sun happened in hollows between the mountains (saddles) and comes at a time of about 500 BC the Given such a Dating the most accurate astronomical observations, we can assume that the ritual complex in terms of astronomical and calendar of observations was mastered by ancient people in the middle of I Millennium BC, that most likely is related to Gorokhovskaya archeological culture, but it is undeniable astronomical observations equinoxes and in earlier times.

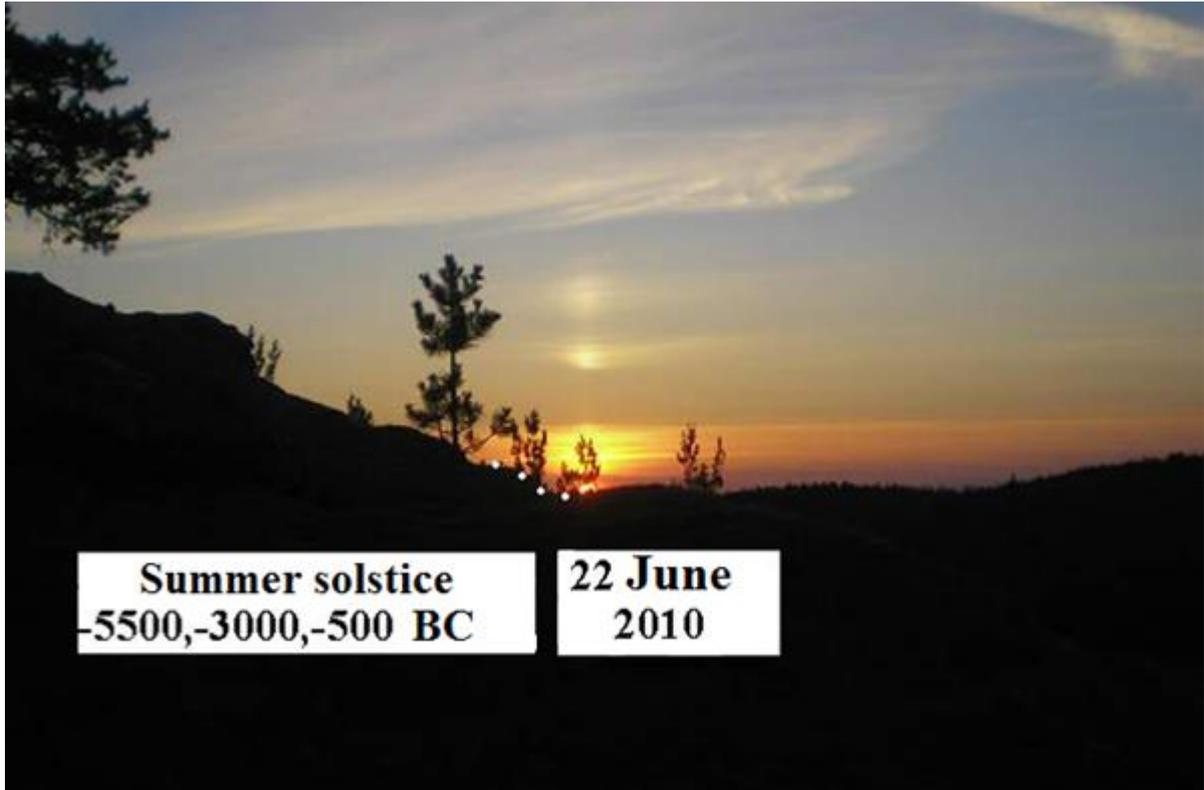


Figure 17. Approximate ancient point of sunrise in the days of the summer solstice on the Mountain Golukha observed from the hole. Photo and photo collage: O. Polyakova.

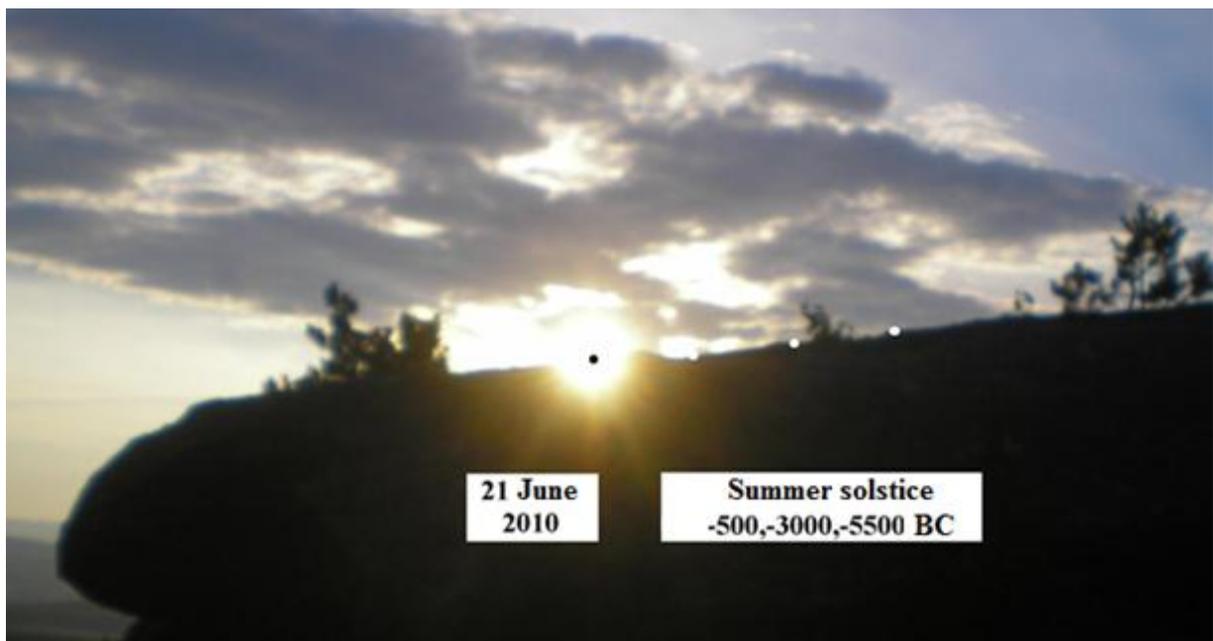


Figure 18. Approximate ancient point of sunset in the days of the summer solstice, the observed from the hole on the top of Mountain Golukha. Photo and photo collage: O. Polyakova.



Figure 19. Approximate ancient point of sunset in the summer solstice, the observed from Cape near the Long East Peninsula of the Lake Big Elanchik. Photo and photo collage: O. Polyakova.

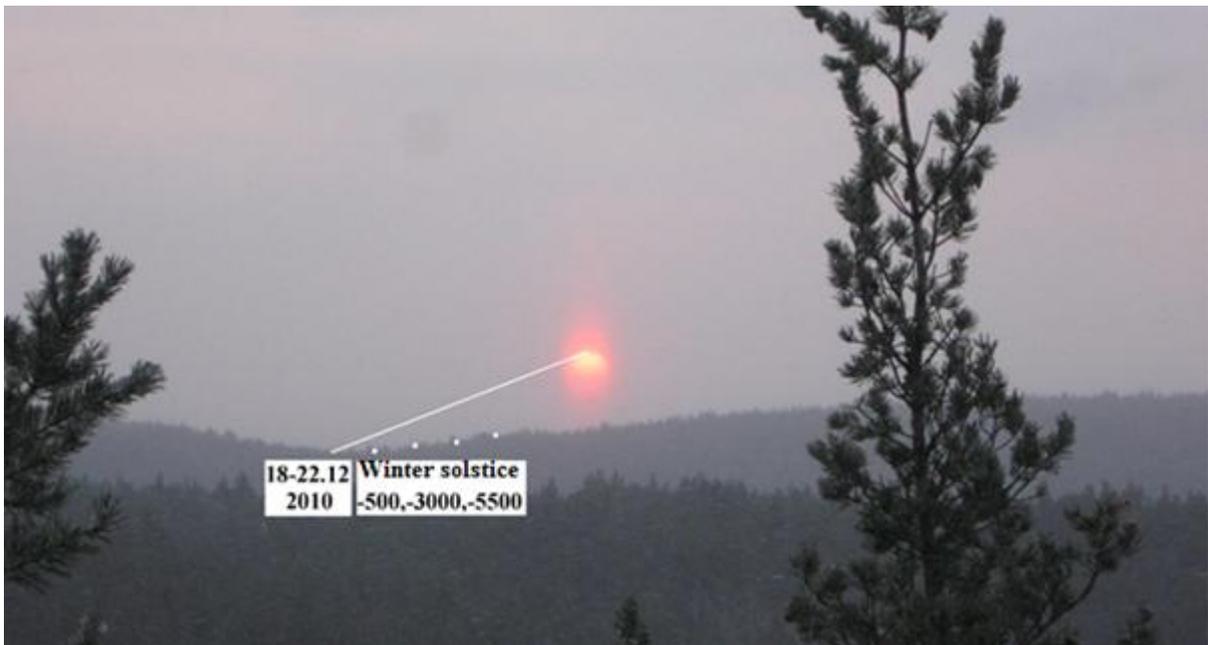


Figure 20. Approximate ancient point of sunrise increments 2500 years, observed from the hole on top of the Mountain Golukha the winter solstice. Photo: Olesya Chernova. Photo collage: O. Polyakova.

Conclusions

The most valuable results of the research were:

1. We have noted fixing sunrises and turns of the Sun in hollows (saddles) between the mountains on the horizon in the days of equinoxes and solstices. Apparently, it is a hollow

mountains were mostly when calendar observations over the horizon from the Mountain Golukha. Probably, it is a generic ancient principle of observations over the horizon, because the Egyptians have similar character - the character «horizon» shows the Sun in a hollow between the

mountains:  [11].

2. We applied the method of calculation of the points of sunrise and sunset for a given area with undulating line of the horizon. The necessity of this method arose due to the fact that normally used for arhaeoastronomical calculation formula methodology T.M. Potemkina and V.A. Yurevich yield results only for smooth astronomical horizon that can be seen in the bare steppe, but is not visible for the mountains in a hilly area. The proposed method consists in the fact that on astronomical calculations determined only difference between modern and ancient sunrise, given the change in tilt angle of the Ecliptic to the Equator. And only this difference is taken into account when arhaeoastronomical studies of particular areas with hilly horizon. A comparative analysis of modern and ancient sunrises and turns of the Sun most precise provisions of the Sun in the hollows of the mountains belong to the middle of I Millennium BC.

3. Findings on Mountain Golukha ceramics and stone tools of different times and peoples allows to judge about the importance of the investigated ritual complex, presumably, as the use of astronomical directions for calendaring.

Stone inventory suggests that the Mountain Golukha used since the Neolithic age, as a ritual complex, due to the open top, which can be fully observing the starry sky and the horizon, in contrast to the lake, where one can see only half of the sky and the horizon.

Traces of metallurgical activity suggest that the mountain was used in bronze centuries as the metallurgical complex due to open space at the top of the mountain where winds are stronger and can arrange for extra traction due to the drop heights that has been widely used for other mountain areas, in particular, the Urals [12].

Gratitude

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