

## INTERACTION OF THE NATURE AND ANCIENT PERSONS ON THE COAST OF THE WHITE SEA

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**Abstract:** The area of research – coast of the White Sea. The opportunity and effectiveness of materials application of remote sensing of Earth depends on the detail of the image. For the development of astroarcheological aspects of heritage it is necessary not only to describe objects, but also to establish space connection (precisely to measure an azimuth and distance between them). The islands of the archipelago are arranged according to astronomical azimuths of the main astronomical culminations by geological processes. "The geodetic network" created by nature gives the chance to use archipelago islands as a horizontal astronomical observatory. For example, the island Setna is well visible from the high stone throne established at the top of Chernetsky island. In days of a winter solstice from a throne it is possible to observe how the Sun rises from of the island Setna. The shadow of a throne falls on stone steps, forming a classical sundial. The Solovetsky islands of the White Sea are known thanks to the biggest congestion of stone labyrinths in Northern Europe. Our researches showed that the movement of a shadow of a gnomon deciphers a labyrinth drawing as a solar calendar: radiuses of arches of labyrinths correspond to the length of a midday shadow of a gnomon in days of solstices (extreme) and equinoxes (the second arch from the center). The record of a trajectory of movement of a shadow in a year in a form represents Labrys – a bilateral two-horned axe – attribute of the Supreme gods: founders of the world, masters of light and darkness. The most ancient labyrinths occupy the top terraces of the Bolshoy Zayatsky Island and date back to 5-7 thousand years old. The majority of labyrinths are on the coast that allows to receive very precise azimuths of the astronomical objects crossing the line of the water surface. In a complex of Belomorsky petroglyphs (will render 6000 years) archeologists found the most ancient rock drawing of the ankh known in Ancient Egypt as "a key of the house of the Sun and a kingdom dead". Studying of drawing of a two-spiral labyrinth shows that the ankh well reflects structure of its central part. Dating of petroglyphs will be coordinated as with paleogeographical reconstruction: 7000 years ago – during an era of a climatic optimum of the Holocene, where it was warmer, the efficiency of a landscape was higher than the modern. People of those times had good skills of sea navigation, built large boats with a capacity of up to 20 people, hunting big whales. Planet places which give the chance to receive precise information on a space-time order have always had vital value. Therefore, due to the extreme antiquity of the islands of the White Sea and the objects located there, it received the status of the especially esteemed sacral islands. Today they attract an increasing flow of tourists, need a research and protection as monuments of natural and cultural heritage.

**Keywords:** astronomical tools of the Stone Age, informational models, orientation in space-time, semiotics of geographical space.

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## Introduction:

Reconstruction of paleo-climate show that in the period of a climatic optimum of the Holocene the territory of the subarctic region and the Arctic had warmer climate and high efficiency of a landscape. Plots of rock drawings and a variety of ancient megalithic objects of Northern Europe will be coordinated with these data.

Northern labyrinths can be found in Karelia, Arkhangelsk region, Kolskiy peninsula, Estonia, Finland, Sweden, Norway, Denmark, Iceland and England. They are located on isles, peninsulas, near harbors and in river mouths. Their picture is complicated but organized. In terms of structure, there are unispiral, bispiral, concentric and radial types. In terms of outer shape: circles, ovals, rarely squares.

On the territories of Sweden, Norway and Finland labyrinths have been explored by D. Kraft, G. Kern, G. Olsen (Kern 2000). In Russia the first researches were made in the 19th century (Yelisseyev 1883). In the 1920s labyrinths were minutely described by N.N. Vinogradov, prisoner of the Solovetskiy concentration camp (Vinogradov 1927). He came to a conclusion that labyrinths were not burial places but sanctuaries, enormous altars, left by some ancient people. The proximity of labyrinths to the sea forced an archeologist N.N. Gurina to make an assumption that stone labyrinths are models of the ancient fishing traps (Gurina 1948). When such labyrinths were found deep in Kolskiy peninsula, this assumption was dismissed. A.A. Kuratov proved that some stone piles near labyrinths are remainders of ancient burials, connected with a "culture of the Arctic late Stone age" proper to the V and I centuries BC (Kuratov 2008). Assumptions about calendar designation link the picture of the labyrinth with schemes of orbits of the Sun, the Moon, planets and stars. Herman Wirth assumed that day and year tracks of the Sun are reflected in the picture (Kern 2000). However he did not manage to explain how the Sun track is noted in the picture.

Scientific descriptions have been made, the picture algorithms based on the cross have been proposed, a methodological classification has been developed – however the main question has not been answered yet – what are these labyrinths for and what does the sign symbolize? In order to answer this question we used the gnomon – a simple tool of the opposite alignment of the Sun's position (Paranin and Paranina 2009; Paranina 2010, 2011, 2012, 2013).

## Materials and methods:

The objects located on the coast of the White Sea were investigated from 2009 to 2013: in the archipelago of Kuzova, Solovki archipelago, in the gulf Kandalaksha, in the mouth of the river Vyg and near the river Umba entrance (Fig. 1, Annexes).

The objects of study were the monuments of ancient material culture of European Russia (siedis, menhirs, stone labyrinths) (Figs. 2, 3, 4, 5, 6 and 7, Annexes). The applied field research methods (survey, description, observation, work with maps) and Earth remote sensing, as well as methods of mathematical, conceptual modeling and mapping. The theoretical analysis is based on the theory of reflection and systemic and chorological approach, methodological statements of historical geography by Paranin (Paranin 1990, 1998).

## Results and discussion:

For the interpretation of a northern labyrinth the gnomon - the elementary astronomical tool - was used. The shadow of a gnomon codes a trajectory of the movement of the Sun on a firmament. In 2009 the authors proved that the drawing of a labyrinth fixes astronomically significant points (Fig. 8, Annexes):

- the provision of a midday shadow in days of winter and summer solstice

corresponds to extreme arches of spirals;

- the ends of spirals correspond to azimuths of risings/calling;
- the entrance to a labyrinth notes the beginning of an annual cycle (in an equinox or a solstice).

The sketch of a shadow of a gnomon in days gives the schedule similar to a pitchfork, horns, wings, a fish tail. The shadow schedule in a year fills the space whose shape form represents labris - a bilateral two-horned axe of god of light.

The basic units of the information model of the world (IMW) reveal different aspects and levels of the modeling of space-time: the first basic level - the navigation one- creates a spatial and conceptual framework of IMW; the second modeling level reflects semiotic, linguistic, cartographic, toponymic, mythological units that encode, duplicate and replicate vital navigational information; and the pinnacle of the model - a tradition that serves as the selection and storage of proven information to maintain the continuity of Life, including the Renaissance. The basic processes and phenomena form the reference benchmarks of fundamental concepts, the meaning of which it is priceless, and therefore sacred, and their shape is less exposed to other transformation. The structure flow, which has maintained the sustainability of this model throughout the history of our civilization, has been a continuous practical use of sunlight to ensure the order (Paranina 2010, 2011, 2012, 2013).

Northern labyrinths as navigation network elements (by results of our new researches):

- Stone labyrinths are located, as a rule, on a plot of sea coast estuaries (at the source of fresh water) – it is convenient for rest and orientation, waiting for the desired date of the astronomical calendar in which marks of important phenological events of the area (cycles of fishing animals, climate and hydrological mode, lighting) can be rendered.

- Key elements of the picture calendar are diameters of arcs and azimuths of entrance and end spirals – these reflect the effect of two factors: the latitude and discrepancies between the physical horizon (surface relief) and the astronomical horizon.
- Polar regions differ from moderate latitudes in terms of azimuths of sunrise/sunset in the solstice that vary considerably in adjacent parallel (Tab. 1, Annexes). If latitudes 40-50° rise at the summer solstice and shift by only 6.92°, and at latitudes of 50-60° only twice - at 13.42°, then advancing further at only 5° (60-65°) to the north - the rise shifts at 17.37°, and the latitudinal range of 1° 33' (65° - 66° 33', for instance B. Zayatsky Island to the Arctic Circle ) - to 20.03°. It is obvious that planetary space conditions of astronomical observations in the polar latitudes have become the main reason for the specific features of the drawings.
- The distorting influence of the physical horizon line on measurement of astronomical azimuths can be levelled by locating the instrument on the beach, whose calm and flat surface coincides with the astronomical horizon; therefore, this explains the location of the labyrinth near water. This fact partly explains the abundance of labyrinths in a small area of the Big Zayatsky Island (more than 30 items on 1.25 km<sup>2</sup>): firstly, the labyrinths are set in parts of the shore, open to different sectors of the horizon, which provides accurate measurements for different astronomical dates and various astronomical objects (objects in the light of the moon cast a shadow as well); secondly, the construction of new labyrinths is associated with the retreat of the shoreline; thirdly, arranged

compactly enough, they form a local network.

- An equally important reason for the construction of new labyrinths is the variability of subpolar latitudes of astronomical targets not only in space but also in time - here the change in the slope of the Earth's axis is most visible; being observed according to the displacement of the position of the Arctic Circle at other latitudes, these changes are not so dramatic (Tab. 1, Annexes). The table shows that 5,000 years ago, the azimuth of the summer solstice (SS) was significantly less than modern, therefore, the line of the Arctic Circle was located closer.
- Most labyrinths are located in the most dynamic area approximately from latitude  $57^{\circ}$  to  $66^{\circ} 33'$ , which primarily determines the differences in their pattern.
- At the latitude of the Arctic Circle, the azimuths of solstices coincide with the meridian, and the boundaries of the astronomical seasons are in the shape of a cross. In some cases the center corresponding to the polar day, is marked by a closed circle or spiral, as in a labyrinth in Iceland.
- To the North of the Arctic Circle, only equinoxes can be reliably determined by azimuth of sunrise/sunset. To divide the year into periods between the polar night and polar day, you can use the azimuths of sunrise/sunset, which, depending on latitude, more or less rapidly move in the range of  $0^{\circ} \pm 180^{\circ}$ . When the sun does not set over the horizon, the length of the midday shade - diameters of arches - becomes the only way to divide time into days.

## Conclusions:

Various objects of Stone Age like petroglyphs, seids, menhirs, labyrinths and other still remain on the shores of the White Sea. Traditional methods of archaeological research only consider the age and religious purpose of these objects. The methods of astroarcheology are aimed at identifying opportunities for the use of megaliths for astronomical observations.

Using a gnomon, northern labyrinths were transcribed by the authors as solar calendars. A variety of labyrinth patterns reflect the geographical position, the deviation of the physical surface of the earth (relief) of the celestial horizon, the time of creation and the calendar tradition (the beginning of the year).

Direct sight of sunrise/sunset and other astronomical targets provide the location of objects on the same line. Natural objects, fixing astronomically significant azimuths, even in ancient times got revered status (holy, sacred). To preserve and improve the calendar azimuths, ancient people used different methods for marking in the landscape - petroglyphs, megaliths.

For the research of astronomical and geodetic networks of local and regional scale in the White Sea, the authors used satellite imagery featured by Google. To proceed with the research, materials of remote sensing of the Earth with higher resolution are required.

## Rezumat:

### INTERACȚIUNEA DINTRE OAMENII PREISTORICI ȘI NATURĂ PE COASTA MĂRII ALBE

Aria de cercetare este reprezentată de coasta Mării Albe. Oportunitatea și eficiența aplicării materialelor de teledetecție a Pământului depind de detaliile imaginilor. Pentru dezvoltarea aspectelor astroarheologice ale patrimoniului nu este necesară doar descrierea obiectelor, ci și stabilirea conexiunilor spațiale (pentru măsurarea unui azimut și a distanțelor dintre

ele). Insulele din arhipelag sunt dispuse în concordanță cu azimutul astronomic al principalelor vârfuri astronomice ca urmare a proceselor geologice. "Rețeaua geodezică" apărută în mod natural oferă șansa folosirii insulelor din arhipelag ca un observator astronomic pe orizontală. De exemplu, insula Setna este vizibilă de pe tronul cel mare de piatră aflat în cel mai înalt punct din insula Chemetsky. În zilele solstițiului de iarnă, din punctul tronului este posibil să se observe cum soarele răsare din insula Setna. Umbra provenită de la tron cade pe treptele de piatră, formând un cadran solar clasic. Insulele Solovetsky din Marea Albă sunt cunoscute datorită celor mai mari aglomerări de labirinturi de piatră din Nordul Europei. Cercetările noastre indică faptul că deplasarea umbrei gnomului se prezintă ca un labirint desenat asemenea unui calendar solar: razele arcurilor labirinturilor corespund cu lungimea umbrei gnomului la amiază în zilele solstițiilor (extremă) și echinoclii (al doilea arc din centru). Forma înregistrată a traiectoriei unei umbre în mișcare pe parcursul unui an reprezintă Labrys – un topor cu două capete – atribut al zeilor supremi: fondatori ai lumii, maeștri ai luminii și întinericului. Cele mai numeroase labirinte vechi ocupă partea superioară a terasei din insula Bolshoy Zayatsky și având o vechime de 5-7 mii de ani. Majoritatea labirintelor sunt poziționate pe țărm, ceea ce permite recepționarea cu precizie a azimutului obiectelor astronomice care traversează linia de la suprafața apei. În complexul pietroglic Belomorsky (6000 de ani) arheologii au găsit cea mai veche hieroglifă (ankh) desenată pe o stâncă, cunoscută în Egiptul Antic ca și "cheia casei soarelui și a tărâmului morții". Studiind desenul unui labirint cu două spirale se evidențiază că hieroglifa reflectă foarte bine structura din partea sa centrală. Datarea pietroglicelor va fi corelată și cu reconstrucția paleogeografică – aproximativ acum 7000 de ani – în timpul unei ere de optim climatic din Holocen, cu temperaturi mai ridicate, în care peisajul arăta mult diferit față de prezent. Oamenii din acele

timpuri aveau abilități bune de navigație pe mare, construind bărci mari cu o capacitate de 20 de persoane și vânând balene de dimensiuni mari. Locuri de pe Pământ care să ofere posibilitatea recepționării unor informații de ordin spațiu-timp au avut întotdeauna o valoare deosebită. Prin urmare, insulele din Marea Albă, datorită antichităților și a obiectelor localizate acolo, au primit statut de insule sacre. Astăzi ele atrag un număr crescut de turiști, necesitând o cercetare și protecție ca monumente naturale și patrimoniu cultural.

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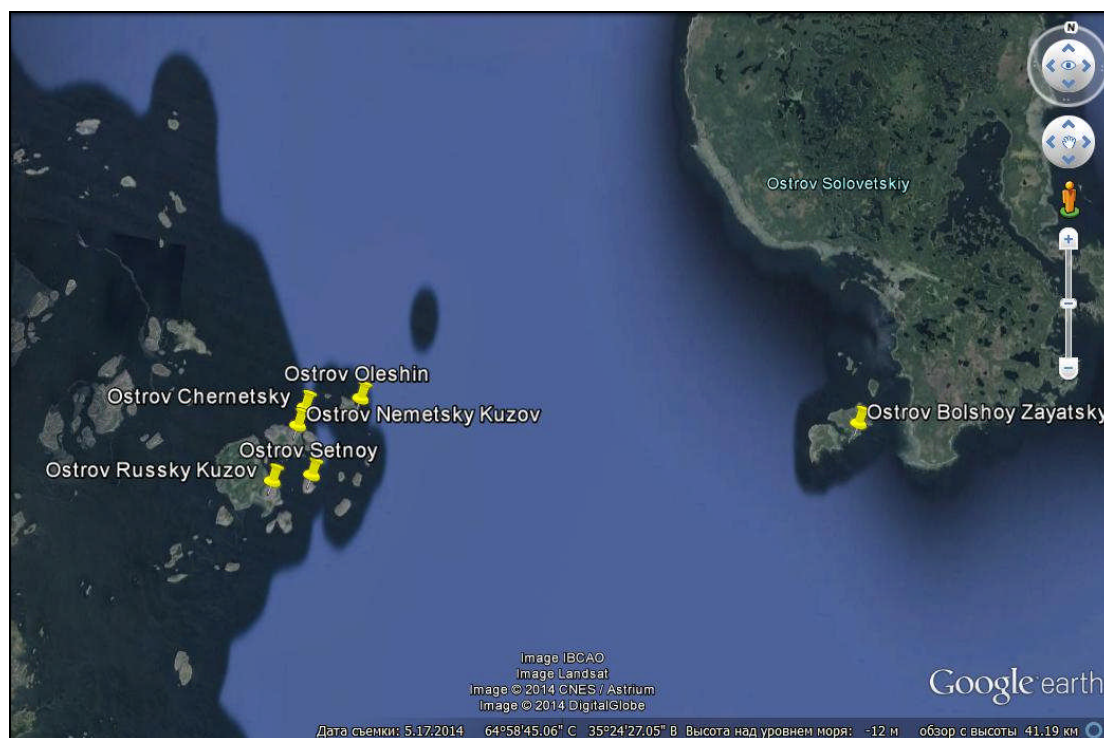
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## Annexes:

**Figure no. 1** Area and objects of research - coast of the White Sea.



**Figure no. 2** Archipelago of Kuzova. Plateau of siedis on island Nemetsky Kuzov: view of the island Chernetsky.



**Figure no. 3** Menhir-Throne and steps on the island Chernetsky. The shadow of the Throne falls at a step (last with the West-East direction), forming classical solar clocks-calendars.



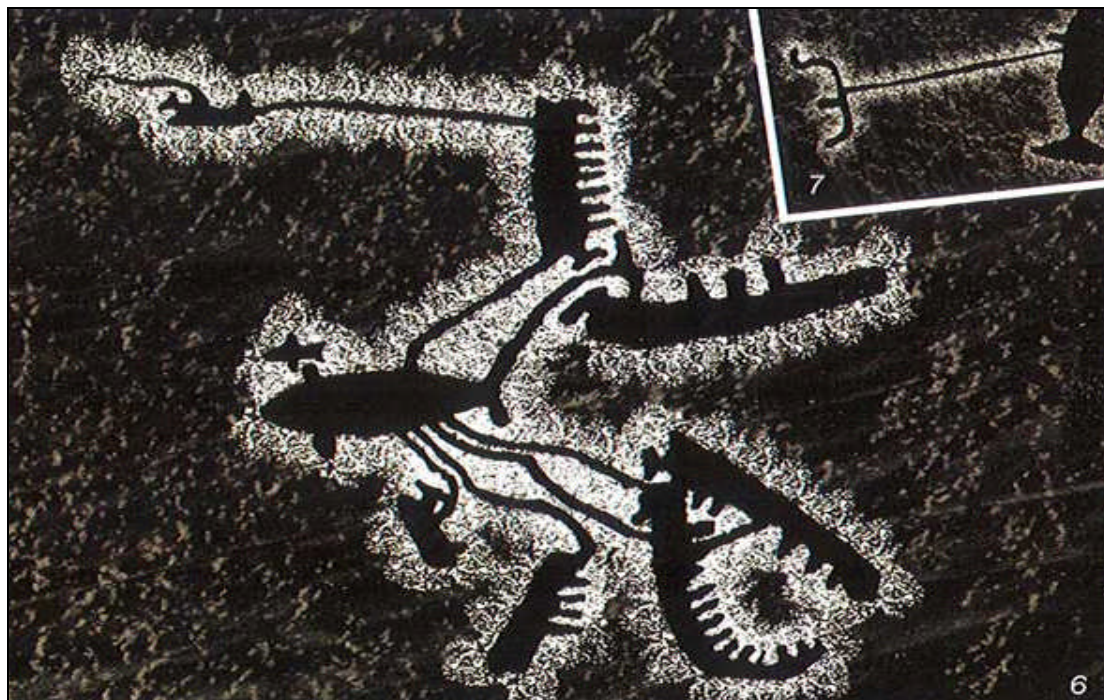
**Figure no. 4** Labyrinth on the island Oleshin: in the center there is a menhir-gnomon.



**Figure no. 5** Island Bolshoy Zayatsky: Labyrinth no. 1.



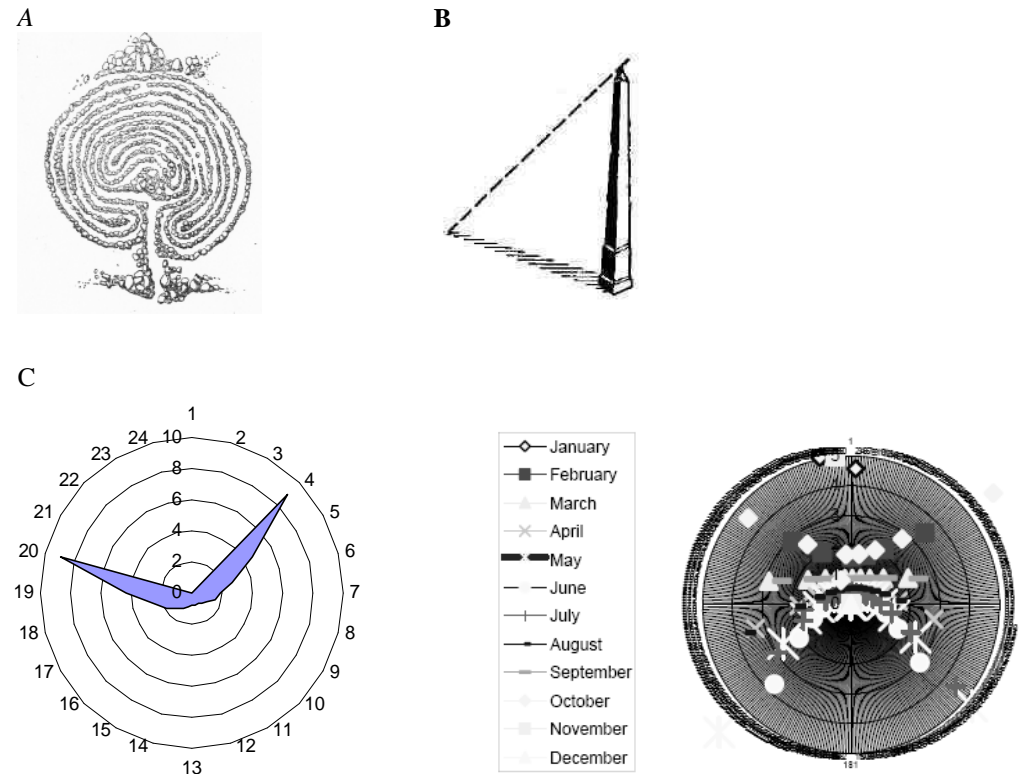
**Figure no. 6** Petroglyphs on the river bank Vyg (near the city of Belomorsk). Age - more than 6,000 years old (Lobanova 2005).



**Figure no. 7** Staraya Zalavruga: people, boats, deer (Lobanova 2010). The person with the ankh (in our interpretation: the priest with a calendar).



**Figure no. 8** Labyrinth No. 1, the topographical plan (A); gnomon (B) and geometry of its shadows (C): per day and per year (Paranina 2010).



**Table no. 1** Dynamics of astronomically significant directions in space and time.

No. (o)	2010		3000 BC	
	WS / 22 December	SS / 22 June	WS / 07 January	SS / 02 August
65	160	20.03	165.31	15.46
60	142.86	37.40	144.82	35.48
50	128.41	51.82	129.55	50.71
40	121.29	58.74	122.25	57.81
30	117.39	62.74	118.20	61.97
20	115.05	64.97	115.83	64.29
10	113.85	66.19	114.50	65.56
0	113.44	66.56	114.09	65.91

Note: WS-winter solstice; SS-summer solstice.