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ВПЛИВ ЕТАНОЛУ НА БІОПРОДУКТИВНІСТЬ, ФОТОСИНТЕЗ ТА ДИХАННЯ МІКРОВОДОРОСТІ *CHLAMYDOMONAS REINHARDTII*

Деякі органічні сполуки здатні значно стимулювати ріст одноклітинної зеленої водорості *Chlamydomonas reinhardtii*. Серед них найбільш активними стимуляторами росту є ацетат і одноатомний спирт метанол. Метою даної роботи було вивчення впливу на продуктивність *C. reinhardtii* іншого спирту – етанолу, який при внутрішньоклітинному окисненні трансформується у ацетат. Отримані результати показали, що етанол стимулює дихання, пригнічує фотосинтез і зупиняє ріст культури. Зроблений висновок, що причиною гальмування росту *C. reinhardtii* було зниження рН середовища культивування внаслідок окиснення етанолу до оцтової кислоти.

Ключові слова : *Chlamydomonas reinhardtii*, фотосинтез, дихання, етанол, міксотрофія.

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ВЛИЯНИЕ ЭТАНОЛА НА БИОПРОДУКТИВНОСТЬ, ФОТОСИНТЕЗ И ДЫХАНИЕ МИКРОВОДОРΟΣЛИ *CHLAMYDOMONAS REINHARDTII*

Некоторые органические соединения способны значительно стимулировать рост одноклеточной зеленой водоросли *Chlamydomonas reinhardtii*. Среди них наиболее активными стимуляторами роста являются ацетат и одноатомный спирт метанол. Целью данной работы было изучение влияния на продуктивность *C. reinhardtii* другого спирта – этанола, окисляющегося внутри клеток в ацетат. Результаты показали, что этанол стимулирует дыхание, подавляет фотосинтез и останавливает рост культуры. Сделан вывод, что причиной торможения роста *C. reinhardtii* было снижение рН среды культивирования в результате окисления этанола до уксусной кислоты.

Ключевые слова : *Chlamydomonas reinhardtii*, фотосинтез, дыхание, этанол, миксотрофия.

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THE INFLUENCE OF LOW MOLECULAR WEIGHT ORGANIC COMPOUNDS ON ANTIOXIDANT DEFENSE SYSTEM OF THE GASTRIC MUCOSA UNDER ETHANOL-INDUCED GASTRIC LESIONS IN RATS

It was investigated the preventive effect of low molecular weight organic compound (LMOC) on erosive and ulcerative lesions in the gastric mucosa of rats caused by ethanol. It was found that prophylactic injection of this substance at a dose of 1 mg/kg effectively protects the stomach from ethanol injuries. LMOC effectively restored the pro-/ antioxidant equilibrium by reducing the intensity of lipid peroxidation in the gastric mucosa of rats after ethanol injection and increase of superoxide dismutase, catalase activity and activity of glutathione system.

Keywords: ethanol-induced injuries, lipid peroxidation, low molecular weight organic compound.

Introduction. Gastric ulcer is a common disease affecting many people worldwide [1]. The peptic ulcer, characterized by mucosal damage, is predominantly caused by *Helicobacter pylori*, antiplatelet agents such as acetylsalicylic acid [2], nonsteroidal anti-inflammatory drugs (NSAIDs) such as oral bisphosphonates, potassium chloride, immunosuppressive medications [3], serotonin reuptake inhibitors [4], alcohol consumption, and cigarette smoking [5]. The ulcer disease may lead to upper gastrointestinal haemorrhage and perforation [6], which have high morbidity and mortality rates [7]. Thus, the search of the new nontoxic medications is very important today. So the aim of the work was to investigate the preventive effect of low molecular weight organic compound (LMOC) on erosive and ulcerative lesions in the gastric mucosa under ethanol-induced gastric lesions in rats.

Methods. The animals used in the study were bred and kept on a standard diet in terms of accredited vivarium of Educational and Scientific Center "Institute of Biology" Taras Shevchenko National University of Kyiv in accordance with the "standard rules on arrangement, furnishing and maintenance of experimental biological clinics (vivarium)".

The study was carried out on 30 white laboratory Wistar rats. The research was conducted in accordance with the Law of Ukraine dated 21.02.2006 № 3447-IV "On protection of animals from abuse" and the ethical standards and rules of working with laboratory animals (Guide for the Care and Use of Laboratory Animals, National Academy Press, Washington DC, 1996) [8]. All animals selected for the experiment were subjected to veterinary examination,

were acclimated for five days, and then randomly divided into groups, numbered and marked appropriately.

For examine of the preventive action of LMOC (sodium 2-(2-hydroxyphenoxy) acetyl)-L-proline) rats were divided into 3 groups of 10 animals each: 1st group was intact rats, 2nd and 3rd – rats, which had ethanol-induced ulcer at the level of the gastric mucosa (GM). Rats of 2nd group were injected with normal saline at a volume of 2 ml/kg 30 minutes before ulcerogenic factor action, they were the control for the 3rd group. Rats of the 3rd group were treated with LMOC which was injected at the dose of 1 mg/kg (2 ml/kg of saline solution) 30 minutes before ethanol action (compound was synthesized at Lomonosov Moscow State University).

Erosive and ulcerative lesions of GM of rats in the 2nd and 3rd groups were caused by intra gastric ethanol infusion. After 1 hour from ethanol exposure the rats were sacrificed. To assess the state of GM of rats after ulcerogenic factor action stomach was removed, cut along the lesser curvature, turned mucous out and thoroughly washed with saline. The area and number of ulcers was measured using experimental gastroscopy.

In the homogenate of GM of rats the content of lipid peroxidation (LP) products (the concentration of hydrogen peroxide, diene conjugates, thiobarbituric acid (TBA)- active products and Schiff's bases) was measured by standard biochemical methods [9-12]. Antioxidant protection of the GM under condition of ethanol administration was assessed by the superoxide dismutase, catalase and glutathione system activity [13-15]. To study the influence of LMOC on glutathione system we examined the content of reduced (GSH) and oxidized glutathione (GSSG), glu-

tathione peroxidase (GP), glutathione reductase (GR) and glutathione transferase (GT) activity [14, 16-19]. All obtained data were subjected to statistical analysis using software package "Statistics, 8.0". Shapiro-Wilks criterion was used for the analysis of data distribution type. As the data were normally distributed, we used Levan criterion for evaluation the equality of variance and Student's t-test for independent samples. We calculated mean values (M) and standard error of mean (m). Significant difference was considered at $p \leq 0,05$ [20].

Results. After an hour from ethanol exposure in the group of rats which were injected with water simultaneously with ethanol ulcerative lesions of gastric mucosa were reported in 100% of animals. The number of ulcers per one stomach was 13.1 ± 1.8 , and the total area of the ulcerative lesions was equal to $256.1 \pm 68.0 \text{ mm}^2$. Prophylactic administration of LMOC had no effect on the number of ulcerative lesions in animals. However, the average size of lesions was $83 \pm 18.61 \text{ mm}^2$, so it was established the significant reduction in lesion area by 67.6 % ($p < 0.05$) compared to the control group (Fig.1).

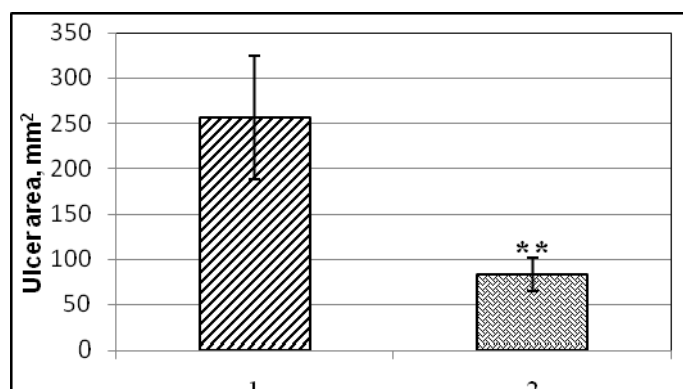


Figure 1. The ulcer area in the gastric mucosa of rats caused by the introduction of ethanol under treatment with low molecular weight organic compound (10 rats in each group, M±m):

1 – saline + ethanol;
2 – low molecular weight organic compound + ethanol

After the ethanol introduction it was established a significant increase of the intensity of LP in the GM of rats. The content of diene conjugates, TBA-active products and Schiff's bases was increased by 5.2 times, 2.3 times and 4.93 times accordingly compared with intact control (Table 1). This indicates the active accumulation of reactive oxygen

species (ROS) after administration of ethanol. Indeed, hydrogen peroxide content in GM was exaggerated by 4.87 times. As a result of intensification of LP in the GM of rats superoxide dismutase and catalase activity was raised by 4.28 times ($p < 0.001$) and 2.33 times ($p < 0.01$) accordingly compared with intact controls (Table 2).

Table 1. Lipid peroxidation in the gastric mucosa of rats with erosive and ulcerate lesions caused by ethanol and prophylactic injection of low molecular weight organic compound (M+m)

	Intact control	Saline group	Low molecular weight organic compound group
H ₂ O ₂ , μmol × mg of protein ⁻¹	2.1±0.2	10.23±0.92***	10.51±0.94***
Diene conjugates, nmol × mg of protein ⁻¹	71.3±6.4	371.3±35.3***	239.6±21.9***/##
TBA-active products, nmol × mg of protein ⁻¹	44.2±4.4	101.7±9.94***	63.6±5.95*/#
Shiff's bases, c.u. × mg of protein ⁻¹	1.2±0.1	5.91±0.58***	4.02±0.35*/#

*, *** – $p < 0.05$, $p < 0.001$ compared with intact control, #, ## – $p < 0.05$, $p < 0.01$ compared with saline group

LMOC decreased the content of diene conjugates by 1.55 times ($p < 0.01$), TBA-active products – by 1.6 times ($p < 0.05$), Schiff's bases – by 1.47 times ($p < 0.05$) in the GM of rats compared with the control group. The superoxide dismutase activity was increased by 1.65 times ($p < 0.01$) under influence of LMOC compared with intact animals. However, comparing the group of rats injected with saline and LMOC, it should be noted that LMOC diminished the enzyme activity compared with control group. Given the lower superoxide dismutase and higher catalase activity in rats treated with LMOC, the concentration of hydrogen peroxide in both groups was similar, suggesting acceleration of ROS scavenging by LMOC.

Examining of glutathione system activity it was established that GSH significantly decreased by 29 % ($p < 0.05$) in the GM of the group of animals exposed to ethanol compared with intact control (Table 3). In contrast, oxidized

glutathione content increased, indicating the use of its reduced form for the scavenging of ROS. This effect may be due to both increased use of glutathione by GP and its use for inactivation of ROS. Indeed, in our study found that the GP activity exceeded by 38 % ($p < 0.05$) values of intact animals. One of the likely causes of a GSH decrease may also be a reduction in the GR activity, which restores GSSG to GSH, by 27 % ($p < 0.05$) compared with intact rats. This enzyme uses NADPH as a reducing equivalent, and NADPH content is significantly reduced under conditions of ethanol-induced oxidative stress [21]. As a result of ethanol effect the GR activity decreased by 54 % ($p < 0.001$) versus intact control. After the introduction of ethanol the GT activity was reduced by 43 % ($p < 0.05$). This effect may be explained by depletion of glutathione system under the accumulation of excessive amounts of ROS.

Table 2. The antioxidant enzymes activity in the gastric mucosa of rats with erosive and ulcerative lesions caused by ethanol and prophylactic injection of low molecular weight organic compound ($M \pm m$)

	Intact control	Saline group	Low molecular weight organic compound group
Superoxide dismutase activity, c.u. $\times \text{min}^{-1} \times \text{mg of protein}^{-1}$	0.16 $\pm$ 0.01	0.686 $\pm$ 0.050***	0.264 $\pm$ 0.024*/###
Catalase activity, nmol $\times \text{min}^{-1} \times \text{mg of protein}^{-1}$	314.7 $\pm$ 29.8	733.4 $\pm$ 63.8**	1110.4 $\pm$ 109.7***/##

, * – $p < 0.01, p < 0.001$ compared with intact control, ##, ### – $p < 0.01, p < 0.001$ compared with saline group

Under conditions of LMOC treatment GSH content decreased by 52 % ($p < 0.01$) compared to the intact control, and by 46.2 % ($p < 0.05$) compared to the saline group. The content of the oxidized form of glutathione under conditions of prophylactic administration of LMOC was higher by 35 % ($p < 0.05$) versus the intact rats, but decreased by 26.5% ($p < 0.05$) compared with the control. Given increased activity of GT by 16 % ($p < 0.05$) compared to the control in rats treated with LMOC, this sug-

gested a more intensive use of glutathione in the inactivation ROS under LMOC treatment. This finding was confirmed by a decrease in the content of LP products under conditions of administration of the investigated compound. The GR activity was reduced by 54.3% ($p < 0.001$) versus the intact rats, and was less by 37.3% ($p < 0.05$) compared with the saline group. The high content of oxidized glutathione form gave the evidence of glutathione catabolism decrease under the treatment with LMOC.

Table 3. Glutathione content and enzymes activity of glutathione antioxidant defense system in the gastric mucosa of rats under condition of erosive and ulcerative lesions caused by ethanol and prophylactic injection of low molecular weight organic compound ($M \pm m$)

	Intact control	Saline group	Low molecular weight organic compound group
Reduced glutathione, nmol of GSH $\times \text{mg of protein}^{-1}$	33.26 $\pm$ 0.82	23.31 $\pm$ 0.12*	15.94 $\pm$ 1.04**/#
Oxidized glutathione, nmol of GSSG $\times \text{mg of protein}^{-1}$	39.49 $\pm$ 1.71	72.44 $\pm$ 0.79**	53.36 $\pm$ 2.83*/#
Glutathione transferase activity, nmol of conjugate glutathione with 1-chloro-2,4-dinitrobenzene $\times \text{min}^{-1} \times \text{mg of protein}^{-1}$	135.88 $\pm$ 13.06	78.29 $\pm$ 7.26**	90.93 $\pm$ 8.78*/#
Glutathione reductase activity, nmol NADPH $\times \text{min}^{-1} \times \text{mg of protein}^{-1}$	1156.7 $\pm$ 49.3	844.05 $\pm$ 16.1*	528.7 $\pm$ 48.5***/#
Glutathione peroxidase activity, nmol of GSH $\times \text{min}^{-1} \times \text{mg of protein}^{-1}$	0.78 $\pm$ 0.05	1.08 $\pm$ 0.06*	0.8 $\pm$ 0.03#

The GP activity did not differ from the intact control and significantly decreased by 26% ($p < 0.05$) compared with the control group. These data indicate a resumption of the normal GP activity under conditions of ethanol administration and prophylactic administration of LMOC.

Thus, the results of the study showed that the LMOC reduces the intensity of LP in the GM of rats after administration of ethanol and possesses the antioxidant effect by increasing superoxide dismutase, catalase and glutathione system activity.

Conclusions: 1. LMOC significantly reduces the intensity of LP in GM of rats under conditions of ethanol-induced injury. 2. LMOC increased the superoxide dismutase, catalase activity and activity of glutathione system.

References

1. Antiulcer activity of Trigonella foenum-graecum leaves in cold restraint stress-induced ulcer model / S. Anand [et al.] // *Mol Clin Pharmacol.* – 2012. – Vol. 13, № 1. – P. 90-99.
2. Gastrointestinal toxicity of low-dose acetylsalicylic acid: a comparison with non-steroidal anti-inflammatory drugs / N. D. Yeomans [et al.] // *Curr Med Res Opin.* – 2009. – Vol. 25, № 11. – P. 2785-2793.
3. Yuan Y Peptic ulcer disease today / Y. Yuan, I. T. Padol, R. H. Hunt // *Nat Clin Pract Gastroenterol Hepatol.* – 2006. – Vol. 3, № 2. – P. 80-89.
4. Use of selective serotonin reuptake inhibitors and upper gastrointestinal disease / T. Itatsu [et al.] // *Intern Med.* – 2011. – Vol. 50, № 7. – P. 713-717.
5. Risk factors for peptic ulcer bleeding / T. Soberg [et al.] // *Tidsskr Nor-Laegeforen.* – 2010. – Vol. 130, № 11. – P. 1135-1139.
6. Acute upper GI bleeding: did anything change? Time trend analysis of incidence and outcome of acute upper GI bleeding between 1993/1994 and 2000 / M. E. van Leerdam [et al.] // *Am J Gastroenterol.* – 2003. – Vol. 98, № 7. – P. 1494-1499.
7. Systematic review of the epidemiology of complicated peptic ulcer disease: incidence, recurrence, risk factors and mortality / J. Y. Lau [et al.] // *Digestion.* – 2011. – Vol. 84, № 2. – P. 102-113.
8. Guide for the Care and Use of Laboratory Animals. – Washington DC: National Academy Press, 1996.

9. Nourooz-Zadeh J. Measurement of plasma hydroperoxide concentrations by the ferrous oxidation-xylenol orange assay in conjunction with triphenylphosphine / J. Nourooz-Zadeh, J. Tajaddini-Sarmadi, S. P. Wolff // *Anal Biochem.* – 1994. – Vol. 220, № 2. – P. 403-409.

10. Гаврилов В. Б. Измерение диеновых конъюгатов в плазме крови по УФ-поглощению гептановых и изопропанольных экстрактов / В. Б. Гаврилов, А. Р. Гаврилова, Н. Ф. Хмара // *Лабораторное дело.* – 1988. – № 2. – С. 60-63.

11. Колесова О. Е. Перекисное окисление липидов и методы определения продуктов липопероксидации в биологических средах / О. Е. Колесова, А. А. Маркин, Т. Н. Федорова // *Лабораторное дело.* – 1984. – № 9. – С. 540-546.

12. Jiang Z. Y. Hydrogen peroxide production during experimental protein glycation / Z. Y. Jiang, A. C. Woollard, S. P. Wolff // *FEBS Lett.* – 1990. – Vol. 268, № 1. – P. 69-71.

13. Корольюк М. А. Метод определения активности каталазы / М. А. Корольюк, Л. И. Иванова, И. Г. Майорова // *Лабораторное дело.* – 1988. – № 1. – С. 16-18.

14. Орехович В. Н. Современные методы в биохимии / В. Н. Орехович. – М.: Медицина, 1977. – С. 66-68.

15. Чевари С. Роль супероксиддисмутазы в окислительных процессах клетки и метод определения ее в биологических материалах / С. Чевари, И. Чаба, Й. Секей // *Лабораторное дело.* – 1985. – № 11. – С. 678-681.

16. Habig W. H. Glutathione S-transferases. The first enzymatic step in mercapturic acid formation / W. H. Habig, M. J. Pabst, W. B. Jakoby // *J Biol Chem.* – 1974. – Vol. 249, № 22. – P. 7130-7139.

17. Mokrasch L. C. Glutathione content of cultured cells and rodent brain regions: a specific fluorometric assay / L. C. Mokrasch, E. J. Teschke // *Anal Biochem.* – 1984. – Vol. 140, № 2. – P. 506-509.

18. Власова С. Н. Активность глутатионзависимых ферментов эритроцитов при хронических заболеваниях печени у детей / С. Н. Власова, Е. И. Шабунина, И. А. Персегина // *Лабораторное дело.* – 1990. – № 8. – С. 19-22.

19. Hissin P. J. A fluorometric method for determination of oxidized and reduced glutathione in tissues / P. J. Hissin, R. Hilf // *Anal Biochem.* – 1976. – Vol. 74, № 1. – P. 214-226.

20. Гланц С. Медико-биологическая статистика / С. Гланц. – М.: Практика. – 1998. – 459 с.

21. Minicis De S. Oxidative stress in alcoholic liver disease: role of NADPH oxidase complex / De S. Minicis, D. A. Brenner // *J Gastroenterol-Hepatol.* – 2008. – Vol. 23 Suppl 1 – P. S98-103.

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ВПЛИВ НИЗЬКОМОЛЕКУЛЯРНОЇ ОРГАНІЧНОЇ СПОЛУКИ НА СИСТЕМУ АНТИОКСИДАНТНОГО ЗАХИСТУ СЛИЗОВОЇ ОБОЛОНКИ ШЛУНКА В УМОВАХ ЕТАНОЛ-ІНДУКОВАНОГО УРАЖЕННЯ ШЛУНКА У ЩУРІВ

Було досліджено профілактичний ефект низькомолекулярної органічної сполуки на ерозивно-виразкові ураження в слизовій оболонці шлунка щурів, викликані етанолом. Встановлено, що профілактичні ін'єкції цієї речовини в дозі 1 мг/кг ефективно захищали шлункові дуражень, викликані етанолом. Сполука ефективно відновила про-/антиоксидантну рівновагу шляхом зменшення інтенсивності перекисного окислення ліпідів у слизовій оболонці шлунка щурів після введення етанолу та підвищення супероксиддисмутазної, каталазної активності та активності глутатіонової системи.

Ключові слова: етанол-індуковані ураження, перекисне окислення ліпідів, низькомолекулярна органічна сполука.

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ВЛИЯНИЕ НИЗКОМОЛЕКУЛЯРНОГО ОРГАНИЧЕСКОГО СОЕДИНЕНИЯ НА СИСТЕМУ АНТИОКСИДАНТНОЙ ЗАЩИТЫ СЛИЗИСТОЙ ОБОЛОЧКИ ЖЕЛУДКА В УСЛОВИЯХ ЭТАНОЛ-ИНДУЦИРОВАННЫХ ПОРАЖЕНИЙ ЖЕЛУДКА У КРЫС

Было исследовано профилактический эффект низькомолекулярного органического соединения на эрозивно-язвенные поражения в слизистой оболочке желудка крыс, вызванные этанолом. Установлено, что профилактические инъекции этого вещества в дозе 1 мг/кг эффективно защищали желудок от поражений, вызванных этанолом. Соединение эффективно восстановило про-/антиоксидантное равновесие путем уменьшения интенсивности перекисного окисления липидов в слизистой оболочке желудка крыс после введения этанола и повышение супероксиддисмутазной, каталазной активности и активности глутатионовой системы.

Ключевые слова: этанол-индуцированные поражения, перекисное окисление липидов, низькомолекулярное органическое соединение.

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VERTEBRATES FROM THE METHOLITHIC SITE LASPI VII (CRIMEA, UKRAINE)

The article deals with the results of studying the remains of vertebrates from the Mesolithic site Laspi. It is established that a relatively small taxonomic diversity is inherent to this locality; it is mainly represented by four basic species: Great Bustard, Wels catfish (recently became extinct in the Crimea), Zander and the European hare, and four other species that have seemingly been hunted occasionally, as their bones are present, but few: Grey Partridge, Spotted Crane, European hamster and European hedgehog. In those days the basis of the local people's ration was bustard, and the successful hunting for this bird was probably the reason for the Mesolithic people to stop on this territory. Analysis of species diversity suggests that the animals were hunted in the winter. It is established that the rivers of the region, destroyed by an earthquake in 1790, were deep enough for catfish to live there.

Key words: mesolit, Crimea, vertebrates.

Introduction: In the territory of Ukraine, as well as in many other regions of the Palearctic, formation of the modern climatic zones with species richness close to the modern one began during the Mesolithic. Research into the history and trends of wildlife is extremely important for understanding the anthropogenic transformation of ecosystems. It is not possible without studying fossils. The historical aspect of description of the animal world is a basis for understanding the real ties that bind the living world into a single functioning system [10]. Information about findings of the fossil vertebrates, with their careful studying and interpretation, is rather important.

Taxonomic richness of the Crimean peninsula is much higher than that of the neighboring areas due to the great diversity of terrain and climate. The main game animals in the mountainous part of the peninsula were wild boar (25% of bones from archaeological sites belonging to this species), roe deer (20%), red deer (14%), and also rabbit (10%). Saiga and carnivorous mammals were hunted much less frequently (5% and 10%, respectively). Bones of marine mammals (seals and dolphins) were found in some Crimean localities, which are remote from the sea (Zamil-Koba and Fatma-Koba) [2].

At the end of the Mesolithic basis of the population on the Southern coast of the Crimea were Tauri tribes associated with the Kizil-Koba culture [7]. Locations of most Mesolithic sites in the Crimea and in the rest of Ukraine were determined by their proximity to water and suitability for hunting, fishing and gathering [3].

Location. Laspi VII site was discovered in 1973, and excavated in 1974-76 under the guidance of Dmitri Telegin (60 m² were dug out). The site is located in a rock canopy, with several large stones in front of it serving as a wind barrier [Бупов]. Radiocarbon dating indicates the age of 5670-7135 BC [Телерін]. The sea level was lower then and the site was further from the sea by 0.5-1.5 m [2].

Skeletal remains in Laspi VII are located in five layers that were signified by the letters of the Cyrillic alphabet during the field work: А (top layer), Б, В, Г and Д (bottom layer). Here we use the Latin alphabet, the letters of which correspond to Cyrillic. Top layer – А ("А" in Cyrillic) beneath layers: В ("В"), С ("С"), Д ("Д"), Е ("Е"). Thin layers of clay, ash and the shellfish remains are deposited between bonyferous horizons. The type of sedimentation indicates that they are naturally transferred from the higher area (eastern part of the cliff).

Laspi VII is repeatedly mentioned in the papers (mainly by archaeologists). In addition to information about the instruments, we know about the discovery of a large number of mollusk shells (*Helix*, *Dreissena*) [2]. Most of the tools are different flint cores. But there are also bone harpoons (except for Laspi in the Crimea they were found only at Murzak-Koba and Kara-Koba). Spindly darts present at the Laspi site are also known from Shang-Koba and Fatma-Koba) [7]. Birds from this site are described by Tsvelykh and Taykova [8]. In our work we used other, previously non-published, material from the Laspi VII. Tsvelykh & Taykova did not mention all the birds in their paper, because those bones