



No 128 (128) (2023)

The scientific heritage
(Budapest, Hungary)

The journal is registered and published in Hungary.

The journal publishes scientific studies, reports and reports about achievements in different scientific fields.

Journal is published in English, Hungarian, Polish, Russian, Ukrainian, German and French.

Articles are accepted each month.

Frequency: 24 issues per year.

Format - A4

ISSN 9215 — 0365

All articles are reviewed

Free access to the electronic version of journal

Edition of journal does not carry responsibility for the materials published in a journal.

Sending the article to the editorial the author confirms it's uniqueness and takes full responsibility for possible consequences for breaking copyright laws

Chief editor: Biro Krisztian

Managing editor: Khavash Bernat

- Gridchina Olga - Ph.D., Head of the Department of Industrial Management and Logistics (Moscow, Russian Federation)
- Singula Aleksandra - Professor, Department of Organization and Management at the University of Zagreb (Zagreb, Croatia)
- Bogdanov Dmitrij - Ph.D., candidate of pedagogical sciences, managing the laboratory (Kiev, Ukraine)
- Chukurov Valeriy - Doctor of Biological Sciences, Head of the Department of Biochemistry of the Faculty of Physics, Mathematics and Natural Sciences (Minsk, Republic of Belarus)
- Torok Dezso - Doctor of Chemistry, professor, Head of the Department of Organic Chemistry (Budapest, Hungary)
- Filipiak Pawel - doctor of political sciences, pro-rector on a management by a property complex and to the public relations (Gdansk, Poland)
- Flater Karl - Doctor of legal sciences, managing the department of theory and history of the state and legal (Koln, Germany)
- Yakushev Vasilii - Candidate of engineering sciences, associate professor of department of higher mathematics (Moscow, Russian Federation)
- Bence Orban - Doctor of sociological sciences, professor of department of philosophy of religion and religious studies (Miskolc, Hungary)
- Feld Ella - Doctor of historical sciences, managing the department of historical informatics, scientific leader of Center of economic history historical faculty (Dresden, Germany)
- Owczarek Zbigniew - Doctor of philological sciences (Warsaw, Poland)
- Shashkov Oleg - Candidate of economic sciences, associate professor of department (St. Petersburg, Russian Federation)
- Gál Jenő - MD, assistant professor of history of medicine and the social sciences and humanities (Budapest, Hungary)
- Borbély Kinga - Ph.D, Professor, Department of Philosophy and History (Kosice, Slovakia)
- Eberhardt Mona - Doctor of Psychology, Professor, Chair of General Psychology and Pedagogy (Munich, Germany)
- Kramarchuk Vyacheslav - Doctor of Pharmacy, Department of Clinical Pharmacy and Clinical Pharmacology (Vinnytsia, Ukraine)

«The scientific heritage»

Editorial board address: Budapest, Kossuth Lajos utca 84,1204

E-mail: public@tsh-journal.com

Web: www.tsh-journal.com

CONTENT

AGRICULTURAL SCIENCES

**Aleksanyan V., Mirzoyan M.,
Galstyan S., Galstyan M.**

THE EFFECT OF THE USE OF ORGANIC-MINERAL
FERTILIZERS AND GROWTH STIMULANTS ON THE
GROWTH, DEVELOPMENT, PASSAGE OF
PHENOLOGICAL STAGES AND POTATO YIELD IN THE
CONDITIONS OF THE FOOTHILL ZONE 3

ART

Jafarova N.

UNESCO CREATIVE CITIES NETWORK AND
DEVELOPMENT PROSPECTS OF KNOWLEDGE SOCIETY
AND TOURISM IN AZERBAIJAN (IN THE CONTEXT OF
MUSEOLOGY) 9

ECONOMIC SCIENCES

Jolia G.

A PEACEFUL GLOBAL EMPIRE OF DIGITAL PLATFORMS
..... 13

MEDICAL SCIENCES

Koritarova V., Cherneva V.

ACUTE RESPIRATORY FAILURE DURING LABOUR IN A
PATIENT WITH CONGENITAL MITRAL VALVE
REGURGITATION 16

PHYSICS AND MATHEMATICS

Yurov V., Zhangozin K.

SURFACE LAYER THICKNESS, DEFECTS AND STRENGTH
OF GRAPHITE 20

TECHNICAL SCIENCES

**Mamonov K., Vyatkin R.,
Shterndok E., Shterndok A.**

METHODS OF MATHEMATICAL MODELING FOR
ASSESSMENT OF THE LEVEL OF LAND USE OF OBJECTS
OF THE NATURE AND PRESERVE FUND OF THE
REGIONS 28

VETERINARY SCIENCES

Băcescu B., Slătineanu C.

CLINICAL AND THERAPEUTIC OBSERVATIONS IN
PARASITIC DERMATITIS IN DOGS AND CATS 33

AGRICULTURAL SCIENCES

THE EFFECT OF THE USE OF ORGANIC-MINERAL FERTILIZERS AND GROWTH STIMULANTS ON THE GROWTH, DEVELOPMENT, PASSAGE OF PHENOLOGICAL STAGES AND POTATO YIELD IN THE CONDITIONS OF THE FOOTHILL ZONE

Aleksanyan V.,

Center for Ecologonoospheric Research at the National Academy of Sciences of the RA

ORCID iD: 0000-0001-8136-5236

Republic of Armenia

Mirzoyan M.,

Shushi University of Technology

ORCID iD: 0000-0003-1437-4807

Republic of Artsakh

Galstyan S.,

Shushi University of Technology

ORCID iD: 0000-0001-6728-7817

Republic of Artsakh

Galstyan M.

Agricultural Scientific Center of the Ministry of Economy of the RA

ORCID iD: 0000-0001-6703-5089

Republic of Armenia

DOI: [10.5281/zenodo.10467978](https://doi.org/10.5281/zenodo.10467978)

Abstract

The article presents the results of three-year studies on the growth, development, transition of phenological stages and changes in yield of cultivated potatoes under the conditions of the Askeran region of the Republic of Artsakh under the influence of separate and joint application of organo-mineral fertilizers and growth promoters. According to the research results, it was found that the fractional application of organomix and mineral fertilizers (in sowing and nutrition) and their joint equivalent doses in comparison to the one-time application (only in sowing), had a more positive effect on potato growth, development and transition of phenophases, contributing to high potato yields. Compared to the variant without fertilization, in the case of a one-time application of fertilizers, the yield increase was 146.8-150.3 c/ha or 101.3-104.1%, and their fractional equivalent doses were 158.1-167.8 c/ha or 109.1-115.8% increase in potato yield.

At the same time, the studies revealed that by changing the method of application of bioliquid as a growth stimulator, by soaking the seeds before planting, compared to foliar feeding, the increase in potato yield was 44.0 c/ha or 30.4%.

Keywords: organic-mineral fertilizers, growth stimulant, potato, phenological observations and biometric measurements, yield.

Modernity: In the life of plants and animals, in inanimate nature, there are many phenomena that are closely related to the successive changes of the seasons and are seasonal in nature. A special science, phenology, deals with the study of patterns of changes in such phenomena. The purpose of phenology is to highlight the development patterns of seasonal phenomena, as well as the changes occurring under the influence of this or that factor, to find the patterns caused by these changes and to make the phenomena caused by the given factor manageable with them [5,11]. One of the main goals of phenologists is also to help specialists in the field of agriculture and other fields to find the right solution to the issues raised. For example, during the period of spring work, farmers are primarily interested in the sowing dates of various crops, which can be determined with approximate accuracy with the help of phenoinicators obtained on the basis of observations made over many years. Thus, phenological observations have shown that the planting of potatoes coincides with the flowering of dandelions, and the best time for sowing corn coincides with cherry

blossom. Or, observations made on the ripening process of agricultural crops allow to determine the best dates for harvesting and to take measures to harvest the crop without loss. The peculiarity of the nature of mountainous regions is that the sequence of phenomena is observed according to vertical zonation. The analysis of the phenological data of many agricultural crops and wild plant species showed that for every 100m of elevation, plant development is delayed by an average of 3-5 days in spring, and in autumn it is relatively fast, only in the opposite direction, the periods are delayed from top to bottom [10]. It has also been found that the same plant grown at the same height above sea level, but in different regions, goes through one or another stage of its development at the same time. It is due to many reasons: the position of the slopes, soil moisture, the degree of nutrient availability, varietal characteristics, etc. It has been revealed that the same stage of plant growth and development is first observed on the southern Armenian slopes, which is mainly due to the radiation advantage of those slopes, as well as the

mechanical composition and moisture conditions of the soil [6,10,13].

Therefore, it is extremely important to study and find out with the use of organo-mineral fertilizers and growth promoter, what changes were made during the transition of potato growth, development and phenological stages and the effect caused by them on the yield of potato tubers and bushes.

Material and method: The purpose of the work is to study and find out for the first time the effect of the equivalent amounts and dates of application of organomix organic fertilizer, growth promoting bioliquid and organomineral fertilizers obtained by the Armenian-Norwegian joint enterprise (Orwako) from household and agricultural waste with the latest biotechnological methods, on the growth of potatoes cultivated in the arid conditions of the foothills of the Republic of Artsakh, on development, transition of phenological stages and yield and compare them with the results of the influence of the ratio of mineral fertilizers applied in the region.

The studies were carried out in 2021-2022 in the Ivanyan community of the Askeran district of the Republic of Artsakh. The field experiments were carried out in post-forest brown soils, which are characteristic for the region also in the sense that the predominant part of the potato fields (86.2%) is cultivated in this soil type.

The reaction of the soil environment of the testing ground: pH varies between 6.9-7.1, humus content is 3.3 - 3.4%, with easily hydrolyzable nitrogen (N) (3.4-3.6 mg) is weakly provided, with mobile phosphorus-medium (P_2O_5 is 5.1-5.3 mg), with exchangeable potassium is good (K_2O per 100 g of soil: 34.0-36 mg) [1,6,14,15].

The field experiments were set up with 3 repetitions, the size of each version in the repetition was 20m², according to the following variants:

1. Checker (without fertilization)
2. Organomix 8t/ha one time, in sowing
3. Organomix 10t/ha one-time, in sowing
4. Organomix 5t/ha (in sowing) + $N_{30}P_{40}K_{40}$ (in sowing) + N_{30} with nutrition
5. Organomix 5t/ha in sowing + organomix 3t/ha (with nutrition) + bio-liquid 14 l/ha (nutrition)
6. Bio-liquid 14 l/ha by wetting the planting material + organomix 5 t/ha (in sowing) + organomix 3 t/ha (nutrition)
7. $N_{80}P_{80}K_{80}$ (in sowing) + N_{40} (nutrition)

Studies were conducted on the Impala potato variety, the planting rate of which was 32.4 c/ha in 2021, 33.0 c/ha in 2022 and 32,8c/ha in 2023, further processing and harvesting were carried out in accordance with the agricultural rules adopted in the region.

The full norms of organomix in the 2nd and 3rd variants were applied in the spring once, in sowing, in

the 5th, 6th versions, fractionally, in sowing and with nutrition, at the same time, in those versions, the same rate of bio-liquid (14 l/ha), in one case, nutrition was given in a foliar method, in the other case, by soaking the potato planting material three days before planting. Equivalent doses of mineral fertilizers $N_{80}P_{80}K_{80}$ were given in sowing, and N_{40} - with nutrition (version 7). In version 4, as indicated in the scheme, $N_{30}P_{40}K_{40}$ in sowing and N_{30} with nutrition were added to the soil with organomix (5t/ha). The indicated amounts of organomix and NPK were given in order to provide the content of nutrients in them equal to the (applied) amount of full norms of organomix and mineral fertilizers.

Biometric measurements and observations on plant growth, development, and transition of phenological stages in the potato experimental field were performed according to A.I. Rudenko [12] and R. S. Mkrtchyan [5,10].

The yield of potato tubers and bushes was calculated using a widespread crop accounting method, and the yield data were mathematically analyzed using dispersion analysis method, determining experimental error ($S_x, \%$) and the most significant difference ($MSD 0.95 c$) [8].

Results and discussion. According to the average data of three years of repetitions of field experiments, organo-mineral fertilizers individually or together and growth-promoting bio-liquid had a certain effect on potato germination, growth and development, as well as the transition of phenological stages.

During the three years, potato seedlings germinated 25-27 days after planting in the version without fertilization, after 27-28 days in the version with a full combination of mineral fertilizers, and after 23-24 days in all versions that received organic mix. In the 6th version of the field experiments, where the potato planting material was soaked with bioliquid and planting work was performed after 3 days, in that variant the potato tubers germinated 5-7 days earlier and in all years the mass germination of the planting material took place after 19-20 days. It is noteworthy that in the version sown with bioliquid-treated planting material, the potato plants grew more lushly, and there were more stems and leaves. The effect of organomix was more evident during the transition of potato phenological stages. If this effect was not pronounced during the initial stages, it was evident in the last stages (flowering and ripening) and compared to the version of the full combination of mineral fertilizers, the length of plant vegetation was reduced by 5-7 days (table 1).

During the years of field experiments, fractional application of organic mix delayed the transition of the phenological stages of potato plants more than a single application.

Table 1
The effect of applying mineral and organic fertilizers and growth stimulants on the transition of potato phenophases

The effect of applying mineral and organic fertilizers and growth stimulants on the transition of potato phenophases														
N/N	Variants	In 2021				In 2022				In 2023				
		germination	from germination to			germination	from germination to			germination	from germination to			
			cocooning	blooming	ripening		Cocooning	blooming	ripening		cocooning	blooming	ripening	
1	Checker (without fertilization)	25/IV	25	34	64	18/IV	27	37	66	26/IV	26	36	67	
2	Organomix 8t/ha one-time, in sowing	23/IV	27	35	66	15/IV	29	39	70	22/IV	27	38	69	
3	Organomix 10t/ha one-time, in sowing	23/IV	27	36	67	14/IV	29	39	70	22/IV	28	38	69	
4	Organomix 5t (in sowing) N ₃₀ P ₄₀ K ₄₀ (in sowing)+ with N ₃₀ nutrition	24/IV	28	36	66	15/IV	28	40	69	21/IV	27	38	70	
5	Organomix 5t/ha in sowing + organomix 3t/ha (with nutrition) + bio-liquid 14l/ha (nutrition)	24/IV	29	37	68	15/IV	29	40	72	22/IV	29	40	71	
6	Bio-liquid 14 l/ha by wetting the planting material + organomix 5 t/ha (in sowing) + organomix 3 t/ha (nutrition)	20/IV	29	38	68	12/IV	30	40	71	19/IV	29	41	71	
7	N ₈₀ P ₈₀ K ₈₀ (in sowing)+ N ₄₀ (nutrition)	24/IV	27	37	71	15/IV	29	38	73	23/IV	29	29	74	

Thus, if the dosages of 8 and 10 t/ha of organomix were given one-time, in sowing, the vegetation duration of potato plants was 66-70 days, and when the same dosage was given, respectively, 5 and 3 t/ha in sowing and nutrition, the vegetation of the plants was prolonged by 2-3 days and became 69-72 days.

Biometric measurements showed that single and fractional application of organomix, as well as equivalent doses of organomix and mineral fertilizers, had a beneficial effect on the height of potato plants, the number of stems, and the weight of stems and leaves (table 2). The plants of the fields fertilized with organic mix were distinguished by dark green and lush bushes,

compared to the norm of a single application of organomix, the plant height on average was 6.0-6.1 cm higher. *Similar patterns of organomix and bioliquid effects were also observed in the results of other biometric measurements compared to the no-fertilization option and equivalent doses of mineral fertilizers.*

Effect of application of organomineral fertilizers and growth promoter on potato above-ground mass

N/N	Variants	2021				2022				2023				Average of three years			
		Plant height, cm	Number of stems, pc	Weight g/plant		Plant height, cm	Number of stems, pc	Weight g/plant		Plant height, cm	Number of stems, pc	Weight g/plant					
				stems	leaves			stems	leaves			stems	leaves	stems	leaves		
1	Checker (without fertilization)	48,0	4,2	320	120	52,5	4,4	330	130	50,0	4,4	345	130	50,2	4,3	331,7	126,7
2	Organomix 8t/ha (one-time, in sowing)	56,0	5,9	460	185	57,0	6,0	470	196	56,0	6,0	460	175	56,3	6,0	463,3	185,3
3	Organomix 10t/ha (one-time, in sowing)	56,5	6,0	470	190	58,0	6,3	484	198	56,8	6,0	468	190	57,1	6,1	474,0	192,7
4	Organomix 5t/ha (in sowing)+N ₃₀ P ₄₀ K ₆₀ (in sowing)+ N ₃₀ with nutrition	58,0	6,4	480	192	60,0	6,4	490	200	59,0	6,5	478	195	59,0	6,4	483,3	195,7
5	Organomix 5t/ha in sowing+organomix 3t/ha (with nutrition)+bio-liquid 14l/ha (nutrition)	60,0	6,8	482	195	61,5	6,5	496	204	60,0	7,0	484	200	60,5	6,8	487,3	199,7
6	Bioliquid 14l/ha soaking the planting material +organomix 5t/ha (in sowing)+organomix 3t/ha (nutrition)	62,0	7,2	510	225	63,0	7,4	520	216	63,0	7,2	500	218	62,7	7,3	510,0	219,7
7	N ₈₀ P ₈₀ K ₈₀ (in sowing)+ N ₄₀ (nutrition)	60,0	6,3	485	194	59,0	6,4	496	200	59,0	6,5	489	196	59,3	6,4	490,0	196,7

Both one-time and fractional application of organic mix and bio-liquids had a more positive effect on potato tuber germination, plant phenophase transition and above-ground mass (size and weight) of potato plants everywhere in all years than the full combinations of mineral fertilizers applied in the zone ($N_{80}P_{80}K_{80}$ in sowing + N_{40} nutrition). The similar effect of organomix and bio-liquid is due to the fact that due to intensive fermentation, biologically active substances accumulate in the soil, which contribute to the growth and development of tubers (germination of planting material) and plants, which mineral fertilizers do not have [2,3,4,7,9]. : The mentioned circumstance was expressed in the yield indicators of potato tubers (table 3). As can be seen from the data in the table, despite the three years of the studies, the effect patterns

of the tested fertilizers and growth promoters were everywhere preserved, but the level of potato yield in 2022 was higher than in 2021 and 2023. Thus, if in 2022 the potato yield in the version without fertilization was 150.0 c/ha, then in 2021 and 2023 it was 142.4 and 143.2 c/ha, respectively, or about 8 and 7 centners less. This circumstance is explained by the fact that in 2022, both the amount of atmospheric precipitation (562 mm) and the number of sunny days during tuber accumulation (38) were more favorable for the growth and development of potatoes than 2021 and 2023 which had relatively little precipitation (476 mm; 498 mm) and sunny days (with only 25 and 23 solar days during the vegetation period, especially during the tuber accumulation period [16].

Table 3

Effect of organomineral fertilizers and growth promoter on potato yield (average data of 2021-2023 repetitions)

N/N	Variants	The average yield of repetitions, by years, c/ha			The average harvest of three years, c/ha		Additional yield, c/ha
		In 2021	In 2022	In 2023		c /ha	
1	Checker (without fertilization)	142,4±2	150,0±3	143,2±2	144,9	-	-
2	Organomix 8t/ha (one-time, in sowing)	290,0±6	301,0±4	296,0±3	295,7	150,8	104,1
3	Organomix 10t/ha (one-time, in sowing)	296,0±7	315,±5	303,0±4	304,7	159,8	110,3
4	Organomix 5t/ha (in sowing) $N_{30}P_{40} K_{40}$ (in sowing)+) N_{30} with nutrition	300,0±4	307,0±5	302,0±3	303,0	158,1	109,1
5	Organomix 5t/ha in sowing+organomix 3t/ha (with nutrition)+bio-liquid 14l/ha (nutrition)	307,0±5	322,0±6	309,0±5	312,7	167,8	115,8
6	Bioliqid 14l/ha soaking the planting material +organomix 5t/ha (in sowing)+organomix 3t/ha (nutrition)	342,0±7	372,0±6,2	356,0±5	356,7	211,8	146,2
7	$N_{80}P_{80}K_{80}$ (in sowing)+ N_{40} (nutrition)	285,0±6	300,0±5,4	290,0±6	291,7	146,8	101,3

Sx,% 1,5 1,3 1,6

MSD 0,95 g 5,4 4,8 6,0

This fact was confirmed at the level of the Republic of Artsakh: as a result of relatively unfavorable climatic conditions in 2021 and 2023, potato yields significantly decreased compared to 2022, and this decrease amounted to 13.7 and 11.3 c/ha, respectively. Climatic conditions also had some impact on the efficiency of applied fertilizers and growth promoter: in the favorable year 2022, the efficiency of organic mix, mineral fertilizers and growth promoter was higher than in relatively unfavorable 2021 and 2023. From the data in Table 3, it is clearly seen that the yield of the tested variants in 2022 is higher by 3.8-8.8% and 1.9-4.3%, respectively, compared to similar variants in 2021 and 2023.

At the same time, it can be seen from the results of the research that the equivalent doses of organo-mineral fertilizers, compared to the version without fertilization, on an average of three years, almost

equally affected the increase in potato yield, but when in the version of fractional application of organic mix, the potato planting material was soaked with a bioliqid solution before sowing, in that version the yield increase compared to the control was the highest and was 211.8 c/ha or 146.2% even compared to the version where the bioliqid was given as foliar nutrition at the stage of potato cocooning, where the yield increase was 167.8 c/ha (115, 8%). By changing the method of bioliqid application, by soaking the seed material before planting, compared to using it in a foliar way, the difference in yield was 44.0 c/ha or 30.4% on average over three years.

This circumstance confirms that the bioliqid promoted the germination of dormant buds in the base of the potato plant material, due to which more above-ground (stems, leaves) and underground (stolons) organs appeared, resulting in increased potato yield.

According to the results of field experiments, it was proved that the fractional application of organomix and mineral fertilizers and their combined equivalent doses, compared to single application, had a more beneficial effect on potato growth, development, transition of phenological stages and increase in the amount of harvest, and as a result, if the single application of organo-mineral fertilizers provided 146, 8-150.3 c/ha crop increase (101.3-104.1%), then their fractional and combined doses - 158.1-167.8 c/ha or 109.1-115.8%.

Conclusions

Summing up the results of the field experimental work carried out during 2021-2023, we came to the following main conclusions:

1. The effect of organomix was more noticeable during the transition of potatoes to phenological stages: at the initial stages (germination, cocooning), this effect was not significant, while at later stages (flowering, ripening) it was more prominent and reduced the duration of vegetation by 5-7 days compared to the option of a full combination of mineral fertilizers.

2. Fractional application of organomix had a more favorable effect on the germination of potato tubers, the transition of phenologic stages of plants, as well as on the quantity and weight of the aboveground mass of plants (stems, leaves) than with a single application of the same norm and the introduction of complete combinations of mineral fertilizers applied in the zone ($N_{80}P_{80}K_{80}$ from sowing+ N_{40} with nutrition).

3. By changing the method of application of bioliquid as a growth stimulator, by soaking the seed material before planting, in comparison with the use of foliar method (with nutrition), the increase in potato yield was 44.0 c/ha or 30.4% on average over three years.

4. Fractional application of organic and mineral fertilizers and their combined equivalent doses compared to one-time application, more positively influencing potato growth, development, phenophase transition, contributed to ensuring a high yield of potatoes. Compared to the variant without fertilizing, on an average of 3 years, in the case of one-time application of organo-mineral fertilizers, 146.8-150.3 c/ha tuber crop addition or 101.3-104.1%, and their fractional and equivalent doses - 158.1-167.8 c/ha or 109.1-115.8% crop addition.

References

1. Aleksanyan V. A. "Ways of improving the agro-production properties of agricultural lands of Nagorno Karabakh", Stepanakert, 2016, 224 pages

2. Avagyan V. A. "Agroecology" - Yerevan, 2004, 100 pages

3. Galstyan M. H. The effect of mineral fertilizers with reduced amounts on the background of organic fertilizers on the quantity and quality of the potato crop in the conditions of the Sevan Basin of RA // *Agrosience*, 2007 N5-6, p. 250-254

4. Haykazyan V. Ts. Philosophy of new agriculture - Coursebook, 422 pages, 2019

5. Mkrtchyan R. S., Hayrapetyan F. P. Nature calendar of Armenia (second revised edition). Yerevan, YSU publishing house, 2008, 300 pages

6. Aleksanyan V. A. Attempts to increase the productivity of arable land. Soil science and agrochemistry, Almaty N3, 2013, p.63-67

7. Galstyan M.A. Efficiency of using different doses and methods of vermicompost on potato productivity // *mat. XV int. Symposium of Non-traditional plant growing, ecology, ecology and health, III Congress of Breeders*, Simferopol, 2006, p. 516-517. Dosepohov B.A., Methodology of field experience, M Kolos 1973, p.336

8. Mineev V.G. Agrochemistry, M., Kolos., 2004 p. 719

9. Mkrtchyan R. S. Features of the phenological seasons of the year in the Armenian SSR and their agricultural significance. V.K.N. Eql. And medico-eql. Problems of environmental management in Transcaucasia

10. Shultz G. E. General phenology, L. 1981 287 pages

11. Rudenko A.I. Determination of the development phases of agricultural plants. M.Mosk. total Nature. Test 1950, 150 pages

12. Adamyan M. S., D. Klem Jr Handbook of the Birds of Armenia. American Univ. of Armenia, an officiale of the Univ. of California, 1999, 19p.

13. Aleksanyan V.A., Mirzoyan M. Sh., Galstyan S. B., Galstyan M. H. (2023) Determination of the economic-ecological effectiveness of using organic mineral fertilizers and growth promoters in potato crops cultivated in the foothills of the republic of Artsak, Bulletin of High Technology N1(25) 2023.-pp. 48-58. <https://doi.org/10.56243/18294898-2023.1-48>

14. Mirzoyan M.Sh. The influence of introducing organic nutrients and growth stimulant into the soil in different periods on the growth, development and formation of potato tubers in arid conditions of the foothill zone Bulletin of High Technology N4(23) 2022.-pp. 40-49. <https://doi.org/10.56243/18294898-2022.4-40>

15. <http://www.stat-nkr.am/hy/2010-11-24-11-18-12/2021-/1344--2021>

UNESCO CREATIVE CITIES NETWORK AND DEVELOPMENT PROSPECTS OF KNOWLEDGE SOCIETY AND TOURISM IN AZERBAIJAN (IN THE CONTEXT OF MUSEOLOGY)

Jafarova N.

Azerbaijan National Academy of Sciences,

PhD on Art Study

ORCID: 0000-0003-2854-7780

DOI: [10.5281/zenodo.10467986](https://doi.org/10.5281/zenodo.10467986)

Abstract

The United Nations Educational, Scientific and Cultural Organization (UNESCO) are taking initiatives in various fields. One of these initiatives is the creation of the UNESCO Creative Cities Network. Three cities of Azerbaijan have been included in the UNESCO Creative Cities Network. In 2017, Sheki was included in the list of creative cities (the theme “Crafts and Folk Art”), in 2019 – Baku (the theme “Design”), and in 2021 – Lankaran (the theme “Gastronomy”). The inclusion in the future of our other cities in similar lists in the relevant industries will contribute to the comprehensive recognition of the republic on an international scale, and the establishment of broad ties in relevant areas, and the development in the country of various types of tourism, the creative economy and the knowledge society as a whole.

Keywords: Azerbaijan, knowledge society, creative economy, tourism, culture, art, museums.

Introduction. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has taken various initiatives in the relevant fields. One of them is the creation of the UNESCO Creative Cities Network (UCCN), in which the cities included in the network should share their experience and develop partnership relations with the participation of public and private sectors, as well as civil society. The network was founded in 2004 to collaborate with cities that identify creativity as a strategic factor for sustainable development. Currently, the cities included in the network are working to make creative and cultural industries the main focus of their development plans at the local level and to actively cooperate at the international level.

World Cities Day is celebrated on October 31 every year since 2014. This holiday was established by the decision of the UN General Assembly held in December 2013 in order to focus the attention of the international community on the problems of urbanization and solving the relevant issues to ensure the sustainable development of cities around the world.

It is no secret that the socio-economic development of every city depends on a number of factors. The safety and comfort of the city population, the environmental situation, the creation of the necessary infrastructure, the quality of the provided services, etc. – all these factors are characterize cities. According to the UN, more than half of the world's population currently lives in cities. In 2050, this number will increase to 68%. For comparison, let's say that at the beginning of the 19th century, only 2% of the population lived in cities, and in 1950, 30% [8]. The increase in the number of urban population creates a number of problems in the field of security and sustainable development.

In 2015, the member countries of the UN adopted 17 goals leading to sustainable development within the framework of the “The Global Goals and the 2030 Agenda for Sustainable Development”. These goals are 1) no poverty and 2) zero hunger, 3) good health and well-being, 4) quality education, 5) gender equality, 6)

clean water and sanitation, 7) affordable and clean energy, 8) decent work and economic growth, 9) industry, innovation and infrastructure, 10) reducing inequalities, 11) sustainable cities and communities, 12) responsible consumption and production, 13) climate action, 14) life below water, 15) life on land, 16) peace, justice and strong institutions and 17) partnerships [18].

If we look at the set goals, it is clear that the points listed above are reflected in all areas, including the development of cities. Therefore, the UNESCO Creative Cities Network initiative is particularly relevant for our time. It is no coincidence that the new cities included in the network are announced every two years on the eve of World Cities Day.

The place of UCCN in the development of tourism and creative economy. As noted by economists, “countries in the global world attach special importance to the development of exports in order to maintain their economic well-being and achieve sustainable economic growth... specializing in exports of limited products harms the country's economy with fluctuations in the world market. Therefore, there is a need for countries to expand their basket of export products” [5, p. 28].

Taking into account modern realities, tourism products must be included in this basket. Currently, tourism occupies an important place in inter-country relations. The reason for this is the expansion of mutual relations in economy, scientific-cultural integration, scientific-technical progress and other directions. According to scientists, tourism, especially cultural tourism, expands economic, social, cultural, scientific-technical relations between different countries, and also plays an important role in maintaining mutual trust, peace, and strengthening mutual friendly relations [6, p. 3].

The activity of UCCN is the expansion of cultural initiatives, the creation, production and distribution of cultural products and services, the development of creativity and innovation centers, the creation of opportunities for people working in the field of culture, the accessibility of cultural life, the participation of everyone

in these initiatives, including marginalized and disabled citizens. Activity, in short, is aimed at the integration of culture and creativity into sustainable development plans.

Created in 2004 and covering up to 350 cities of the world, UNESCO's Creative Cities Network promotes international cooperation among the world's cities. The cities included in the network are innovative and strategically important, they come up with large-scale initiatives that have a positive economic, social, cultural and environmental impact, thereby supporting the aforementioned "The 2030 Agenda for Sustainable Development" [13].

The network covers a range of creative fields: crafts and folk art, media art, cinema, design, gastronomy, literature and music. These listed are areas aimed at the development of various types of tourism and creative economy, along with a number of directions. Thus, through various projects, intercity cooperation in relevant areas is established, knowledge and experience are exchanged. Also, the network ensures the flow of tourists to these places by engaging in extensive promotion of those cities. On the other hand, initiatives aimed at the development of various creative fields accelerate the development of the creative economy as a whole, and contribute to the improvement of the well-being of the city population by attracting additional income.

Development of knowledge society and tourism in Azerbaijan as one of the priority issues. A number of legal documents regulate the field of tourism in our country. For example, the Law of the Republic of Azerbaijan "On Tourism" (December 27, 2021), "Strategic Roadmap for the Development of the Specialized Tourism Industry in the Republic of Azerbaijan" (December 6, 2016), "Azerbaijan 2030: National Priorities for Socio-Economic Development" (February 2, 2021) and based on this document "Socio-economic development strategy of the Republic of Azerbaijan for 2022-2026" (July 22, 2022), etc.

In the "Strategic Roadmap for the Development of the Specialized Tourism Industry in the Republic of Azerbaijan", it is noted that the development of tourism mainly affects three areas – the Gross Domestic Product, increasing employment and the socio-economic development of the regions, and the development of the infrastructure of the regions. In addition, the tourism sector supports efforts in the direction of environmental sustainability, cultural heritage, protection and development of local values. A successful tourism strategy helps to improve the country's image internationally, so tourism also acts as a marketing tool for countries [1, p. 8].

If we look at the "Socio-economic development strategy for 2022-2026", one of the main directions of activity of the national economy of Azerbaijan is the strengthening of strategic, institutional and financial mechanisms to ensure sustainable development of the tourism sector. This direction includes the preparation and implementation of state programs for the development of tourism, the implementation of a marketing and communication plan for expanding the country's tour-

ism potential, the creation of a mechanism for coordinating the activities of participants in the tourism industry in the form of regular dialogue, as well as the implementation of other projects and measures [2].

Taking into account the above legal documents, we can come to the conclusion that our republic attaches great importance to the development of sustainable and socially responsible tourism. The goal of sustainable tourism is to organize more efficient and humane activities based on the interests of local communities and environmental opportunities. During sustainable tourism services are based on the socio-economic and ecological opportunities of the area, these opportunities determine the characteristics of tourism activities, travelers behave in accordance with the culture of the places they come to, respect natural objects, customs and traditions, establish a relationship with the local population on the basis of friendship and mutual respect [10].

Socially responsible tourism also gives a person the opportunity to make a real contribution to the sustainable development of the place he travels to. Socially responsible tourism ensures the protection of nature, promotes the social and economic development of the region, instills a sense of respect for the historical-cultural heritage, the environment and traditions [11, p. 13].

Summarizing what has been mentioned, let us note that the creation of tourism products in accordance with the requirements of the modern era will give a great boost to the development of the creative economy in our country.

Prospects of Azerbaijan's representation in UNESCO's Creative Cities network. To date, 3 cities of Azerbaijan have been included in the network. In 2017, the city of Shaki was included in the network's list of creative cities on the theme of "crafts and folk art", in 2019, the city of Baku was included in the list of "design", and in 2021, the city of Lankaran was included in the list of creative cities on the theme of "gastronomy". On the official website of UCCN, information reflecting the specifics and future priorities of each city in the creative field is posted.

In Shaki, which is known as the place of many types of crafts and folk arts, especially netting, pottery and sericulture, the following initiatives are planned for future activities: a) development and implementation of a comprehensive marketing program for the development of local creativity, the production and distribution of handicrafts and folk art products; b) establishment of the Shaki Institute of Arts and Crafts, turning this place into a center of professional education in the field of craft technologies, entrepreneurship, management and marketing skills in the field of creativity and innovation; c) developing a multifaceted cultural tourism strategy aimed at making art workshops accessible to everyone, especially people with limited opportunities; d) organization of International Shaki craft and folk art fair twice a year in order to strengthen partnership with other creative cities; e) management of a regional network of cities in Turkic-speaking countries to stimulate the integration of craft and folk art sectors into local development plans; f) feasibility studies of projects

aimed at exploring new potential cultural tourism routes connecting Sheki with other UCCN cities in the field of crafts and folk art, gastronomy and music [17].

Known as the center of innovative projects and start-ups in the field of design, **Baku** offers wide opportunities in the field of fashion, graphic and web design, eco-design, architecture, interior design and urban landscape. The following initiatives are planned to be implemented in Baku in the future: a) creation of opportunities for authors working in various design fields; b) improving opportunities for authors at various levels and opening jobs for them; c) providing support for the production, distribution and dissemination of products and services in the field of design; d) strengthening relations with other creative fields such as crafts and folk art, gastronomy and music covered by the network; e) expansion of cooperation with creative cities that consider design and other creative fields as an important factor of sustainable urban development [14].

With its rich agricultural potential, historical and cultural heritage, **Lankaran** makes important contributions to the non-oil economy. The following steps are envisaged for Lankaran: a) expansion of opportunities for creation, production, distribution and distribution of products and services in the field of gastronomy; b) strengthening synergies with other creative field covered by the UNESCO Creative Cities Network, such as crafts and folk art and design; c) expansion of cooperation between cities that see gastronomy and other related creative fields as a strategic driving force of urban development; d) creating wider opportunities for students, authors, experts and civil society to exchange knowledge and experience [16].

Of course, in the future, the inclusion of other cities of our country in such lists according to various topics will promote both the comprehensive recognition of the republic in the international world, the establishment of extensive relations in relevant fields, and the development of various types of tourism, creative economy and knowledge society in the country. For example, taking into account the colorful and rich culinary culture of Azerbaijan, various cities of the republic can be included in the list of creative cities on the theme of “gastronomy”, Shemakha – on the theme of “literature”, Shusha – on the theme of “music”, etc. In addition, taking into account films shot in Baku, the city can be included on the theme of “cinema”, in accordance with projects on media art – on the theme “media art”, taking into account the major music festivals held in Gabala and the role of these festivals in music tourism, the city of Gabala can be included in the network on the theme “music”, etc.

Now extensive repair and reconstruction works are being carried out in Karabakh. As experts have noted, “the creative economy to be formed in the Karabakh economic region is important in providing employment, increasing the volume of creative goods and services in exports, and achieving sustainable economic growth... The transition from culture to economy, the creation of cultural and creative sectors will also stimulate the development of tourism” [7, p. 172].

Much can be said about Shusha's role in the development of the musical culture of Azerbaijan. Academician Zemfira Safarova, who covered this issue extensively, writes that “there are several cities in the world where music is absorbed into every stone, every castle, and its entire aura. This is Vienna in Austria, Naples in Italy, and Shusha in Karabakh” [12, p. 3].

Indeed, it is enough to list only some of the outstanding musical figures who came out of Shusha, for example, wonderful musicians and singers Bulbul, Sadigjan, Jabbar Garyagdyoglu, Mir Mohsun Navvab, Khan Shushinsky, Zulfi Adigozalov, Gurban Pirimov, our famous composers Uzeyir Hajibeyli, Fikret Amirov, Niyazi, Zulfugar Hajibeyov, Afrasiyab Badalbeyli, Suleiman Aleskerov, Vasif Adigozalov and others to prove that Shusha is the musical cradle of Azerbaijan. Therefore, the inclusion of Shusha in the UCCN on the theme “music” is one of the priority issues facing us, and the necessary measures are being taken in this direction.

Speaking about Shamakhi, we should list some figures of Azerbaijani literature, for example, Imadeddin Nasimi, Khagani Shirvani, Mirza Alekper Sabir, Seyid Azim Shirvani, Sultan Ganizadeh, Muhammad Hadi, Abbas Sahhat and many others, in order to recognize the validity of our proposal to include Shamakhi in the UNESCO Creative Cities Network on the theme “literature”. The same applies to our other offers.

UCCN and museums. It is known that tourists who come to different cities go to the museums operating here, along with other places. In general, the expansion of museum functions, the active participation of these institutions in the life of modern societies, the direct participation of museums in both the collection and creation of knowledge create ample opportunities for close contact of these institutions with creative industries.

In our opinion, full information about cities can be conveyed to visitors through museums of history of cities, which are still quite rare in Azerbaijan. When talking about museums of history of cities, it should be noted that everything surrounding these institutions is the subject of their research. Museums of cities convey the culture of city residents to the audience, promote the uniqueness of communities, and engage in activities aimed at the cultural development of communities. All the areas we have listed coincide with the goals of the UNESCO Creative Cities Network, such museums occupy an important place both in the development of the creative economy, in the education of people, and in the wider recognition of cities in the world.

We got information about only two museums of history of cities currently operating in Azerbaijan. These are the museums of the cities of Sumgait and Mingachevir, which were created in the 60-s of the 20th century. At that time, such a museum was also established in Shusha, but it operated for a short time.

We have prepared and presented to the public the initial concepts of the museums of Baku [3], Shusha [15] and Nakhchivan [9].

Taking into account one of the priority issues for inclusion in the UCCN, let us state that in addition to

two music profile museums in Shusha – Bulbul and Uzeyir Hajibeyli's house museums, the houses of a number of our musical figures are recognized as cultural monuments. We have presented the initial concept of the house-museum of Jabbar Garyagdioglu, which is aimed at the development of music tourism in Shusha [4].

In our opinion, the implementation of such projects and the creation of relevant museums will give a great impetus to the development of creative industries in the republic.

Conclusion and offers. Thus, the goals of the UCCN are realized through the exchange of knowledge and experience both at the level of the network's member cities and at the international level, through pilot projects bringing together public, private sectors and civil societies, partnerships and initiatives, programs of professional and creative exchange, events, aimed at sustainable urban development, coordination, propaganda, etc. Our cities have rich potential to tap into this network in various creative fields, and we must use this potential to promote relevant projects. We also consider the creation of various types of museums, especially museums of history of cities, to be a pressing issue within the UCCN.

References

1. Azərbaycan Respublikasında ixtisaslaşmış turizm sənayesinin inkişafına dair Strateji Yol Xəritəsi. – Bakı, – 2016. – 98 s.
2. Azərbaycan Respublikasının 2022–2026-cı illərdə sosial-iqtisadi inkişaf Strategiyası. [Elektron resurs]. URL: <https://e-qanun.az/framework/50013>
3. Cəfərova, N. Bakı şəhərinin tarixi muzeyinin konsepsiyası // Filologiya və sənətsünaslıq. – 2021, № 1. – s. 265-270.
4. Cəfərova, N. Şuşada Cabbar Qaryağdıoğlunun Ev Muzeyinin yaradılması perspektivləri // Turizm və qonaqpərvərlik tədqiqatları. – 2021, № 2. – s. 106-116.
5. Hüseynov, A., Tağıyev, C. Azərbaycanın ixrac məhsul çeşitləndirilməsində qeyri-neft ixracı // Elm və İnnovativ Texnologiyalar Jurnalı. – 2023, № 26. – s. 48-56.
6. Məhişov, S.E. Mədəni turizmin maarifçilik mahiyyəti və onun inkişaf amilləri: / sənətsünaslıq üzrə fəlsəfə doktoru dis. avtoreferatı. / – Bakı, 2014. – 28 s.
7. Tağıyev, C.Ə. Qarabağda kreativ iqtisadiyyat və ixrac potensialı // “Mədəniyyətin iqtisadiyyatı: Şuşadan inkişaf impulsları” Beynəlxalq elmi-praktiki konfransın Materialları. – Bakı, 2022. – s. 167-173.
8. Всемирный день городов. [Электронный ресурс] URL: <https://www.calend.ru/holidays/0/0/3327/>
9. Джафарова, Н. Перспективы создания Музея истории города Нахчыван // Filologiya və sənətsünaslıq. – № 2, 2022. – s. 304-311.
10. Новиков, В.С. Инновации в туризме / В.С.Новиков. М.: ИЦ «Академия», 2007. – 208 с. [Электронный ресурс] URL: https://tourlib.net/books_tourism/novikov95.htm
11. Потапова, Е.В., Суходулов Я.А. Гармонизация рекреационных возможностей и растущего туристического потока на байкальской природной территории // Известия Байкальского государственного университета. – 2019, № 1. – с. 7–17.
12. Сафарова, З. Шуша – цитадель азербайджанской музыки. – Баку: Элм. – 2020. – 236с.
13. 2023 Call for Applications. [Electronic resource] URL <https://en.unesco.org/creative-cities/content/2023-call-applications>
14. Baku. [Electronic resource] URL: <https://en.unesco.org/creative-cities/baku>
15. Jafarova, N. The concept of the Museum of the History of Shusha // İncəsənət və Mədəniyyət problemləri. – 2021, № 1 (75). – p. 33-41.
16. Lankaran. [Electronic resource] URL: <https://en.unesco.org/creative-cities/lankaran>
17. Sheki. [Electronic resource] URL: <https://en.unesco.org/creative-cities/sheki>
18. Take Action for the Sustainable Development Goals. [Electronic resource] URL: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

ECONOMIC SCIENCES

A PEACEFUL GLOBAL EMPIRE OF DIGITAL PLATFORMS

Jolia G.

*Georgian Technical University,
Professor at Department of Engineering Economics,
Doctor of Economic Science
DOI: [10.5281/zenodo.10467992](https://doi.org/10.5281/zenodo.10467992)*

Abstract

The article discusses the positive and negative outcomes of world empires. It determines the prerequisites and characteristics of the genesis of the peaceful global empire of digital platforms that emerged in the 21st century.

Keywords: platform, digital technologies, global empire, netocracy, algorithm.

The 21st century began with global changes in the development of humanity. Digital platforms that shape the future digital world are actively involved in almost all spheres of activity.

The transition of people's activities and daily lives to a digital format is a consistent process in society's development, as well as an objective and reversible challenge to society's progress that cannot be halted.

As time progressed, world empires were established, each experiencing its own ebbs and flows, which are natural according to R. Vernon's universal "Life Cycle Theory": everything that has a beginning has an end.

Previously, the emergence of each new empire was immediately followed by the collapse or disappearance of the old one, or another empire existed in a different territorial space at the same time.

In general, there are conflicting opinions about world empires. On the one hand, the great empires contributed to the civilization of local populations: they advanced science and economics, introduced technological innovations, and disseminated innovative ideas, religion, culture, law, new labor measures, and tools. They also organized residential and communication infrastructure, among other developments.

On the other hand, they perpetrated unprecedented violence, robbery, and genocide against forcibly conquered people.

Since ancient times, the primary objective of all empires has been singular – to employ "brute force", conquering others and seizing their material possessions. This belief persisted throughout the long pre-industrial period, where the prevailing opinion held that wealth could only be attained by appropriating others' property and at the expense of impoverishment.

Over the centuries, scientific progress was slow, and economic growth was minimal. Less attention was given to the development of science, as there was a prevailing belief that production was relatively stable, and efforts to increase it were not a priority.

In 1776, the seminal work of classical economics by the Scottish economist and philosopher Adam Smith, "An Inquiry into the Nature and Causes of the Wealth of Nations", was published. This work served as an economic manifesto and laid the foundation for the development of economic science. Among many innovations, a revolutionary idea was articulated for the first time – both the individual and society as a whole

could be enriched by creating and exploiting new opportunities.

The concept of "capital", associated with the concept of "wealth", emerged as a source of additional income. While all capital is considered wealth, not all wealth, such as gold buried in the ground, qualifies as capital because it lacks utility [3].

It was widely recognized that the profitability of capital is determined by progressive ideas that mature in the human mind. This is why the empires of the industrial age prioritized enlightenment, elevating the level of human intelligence, and engaging in research and conquest expeditions that significantly augmented their incomes, production volume, and established the global capital market.

The world empires of the industrial era, influenced by protests from conquered peoples, peacefully ceased to exist in the 20th century.

In the second half of the 20th century, an information crisis emerged: on one hand, the content and volume of accumulated information, and on the other hand, the methods of its effective processing and transmission, came into conflict with each other. It was believed that overcoming the crisis would be possible only through the adoption of new information processing technologies.

This is how the demand for the Internet and related information and communication technologies, digital platforms, and social networks (Google, Yahoo, Apple, Microsoft, and Facebook) arose. Information, as an intangible asset, has become the fundamental resource for the development of society.

The question naturally arises: who creates and owns the information?

Information is intensively created, collected, and distributed by people on global search systems and social network platforms.

The Internet gave birth to giant transnational companies in the IT field and a new ruling class of their owners – netocrats.

They were the first to understand the difference between information and knowledge, especially the value of exclusive knowledge, making them the dominant class in the new society [1].

Netocrats were the first to appear "at the right time, in the right place". They "have been able to adapt to changes better than others" (Ch. Darwin) and have found great benefits in the global "data value chain".

They mostly own not real estate but intangible capital (e.g., software, operating systems...) and equipment (e.g., servers). For netocrats, buildings and streamline are "excessive burdens". Their task is simple: to obtain from all possible sources the valuable resource of modern times – the personal information of consumers, to process it, to transform it into a knowledge-containing product, and to sell it. Therefore, to gain power, all efforts were shifted to the creation and effective use of digital technologies, thus providing easy access to information and levers to influence others.

Today, they fully control over the "global information mine", tapping into its inexhaustible resource of "raw" information. Although this information is freely available to everyone, the netocrats own the filtering technologies (algorithms) and exclusive knowledge, treating them as valuable commodities and specific forms of intelligence – assets only they possess.

Simultaneously, the volume of the "global information deposit" is not decreasing; on the contrary, it is growing intensively. Essentially, the netocrats are continually enriched by new "raw" informational mass without any additional effort on their part.

As a result, an unprecedented model of world hegemony is emerging – a new form of governance in the shape of a peaceful global empire of digital platforms. This empire, facilitated by digital technologies, is gradually taking form alongside enhancements in people's well-being, orchestrated by its owners, leading to an unprecedented increase in financial capital.

In contrast to traditional empires throughout human development, the peaceful global empire of digital platforms:

1. Develops and expands not through the coarse method of influencing others, not by "muscle power", but by "soft power" – attractiveness. This method achieves compliance within its information base, involving the intensive and continuous (24/7/365) engagement of the "conquered" people.

2. Is grounded not in combat strategies and tactics but in the perfection and development of digital technologies.

3. It is not ruled by one single country or one ethno-cultural group, but in intense competition, on different continents (mainly, North America and Eurasia) founded by a small group of private IT company owners – netocrats.

4. "Voluntarily conquered" people do not show hidden aggression or obvious aggression towards him, but eagerness and interest.

5. It represents the first peaceful empire in the history of mankind that does not physically exploit its "conquered" people. Regardless of their economic status, social standing, nationality, gender, or any other characteristic, it encourages the emergence and utilization of new opportunities for development and enrichment. From this perspective, its operation aligns perfectly with the wisdom of A. In accordance with the concept articulated by Smith three and a half centuries ago – both as an individual economic actor and within the potential for the development and enrichment of society as a whole.

6. It exists simultaneously and ubiquitously, functioning virtually, somewhere in the "clouds", devoid of weapons and heavy combat equipment. Established geographical boundaries and adjacent territories systematically expand its sphere of activity, positioning it as a prospective world empire with significant development prospects in the future.

7. At its initial stage of development, it generates substantial income by utilizing rapidly growing and systematically updated data that reflects the economic behavior of others. This data serves as a specific "raw" material, transformed into a new intangible asset – valuable information that, for the purpose of advertising innovative products/services, is sold at a relatively high price [4].

8. It consumes non-limited natural resources but continually accumulates growing intangible resources [2].

The characteristic features of the global empire of digital platforms are evident from the above; however, it is equally important to note that it cannot be conquered, destroyed, or dismantled by the forceful methods known to mankind. In the history of societal development, such as through the exertion of fighting force by conquered peoples, their physical destruction by others, and/or the seizure of wealth, the empire remains resilient.

The global empire of digital platforms cannot be acquired through force; its strength lies in systematic development and expansion. It is not land or material possessions that make it formidable, but an ever-increasing and renewable intangible asset – innovative technologies that transform user data into knowledge-rich information. In the form of skills, these technologies are embedded in the minds and information base of the empire's owners. For example, the wealth and reputation of the state of California are determined not by its historical gold deposits but by Silicon Valley – a globally significant high-tech industrial zone encompassing computer and electronic industries, serving as a robust hub for the production of cutting-edge products.

Now, consider the hypothetical scenario: What if the state of California were attacked using the "law of the jungle" or "brute force"? What wealth would it gain in return?

The answer lies beyond the realm of rich deposits of silicon in Silicon Valley. Instead, it resides in the collective expertise of the world's elite digital platforms (Google, Yahoo, Apple, Microsoft, Facebook, Amazon, Intel, etc.), whose wealth is vested in the minds of software development engineers. Rather than extracting resources, they amass billions of dollars through trade and economic collaboration with these technological giants, primarily by selling their computer programs.

Based on the aforementioned, the peaceful global empire of digital platforms will continue to function, as its weakening and destruction will only become possible with the emergence of new innovative solutions that are more attractive.

Conclusions:

1. A completely new process of innovative development for humanity is underway – the digital revolution. This revolution serves as a universal challenge – an objective, extremely complex, and irreversible event with both positive and negative outcomes, fundamentally altering all spheres of public activity and people's lives.

2. The new corporate ruling class, known as netocrats, is gaining strength. These netocrats exercise complete control over the valuable information world "minefield", reflecting the economic behavior of consumers and experiencing systematic growth. They obtain colossal profits by selling updated data and participating in the "global data value chain" that proves beneficial for them. Consequently, a peaceful global empire of extraordinary and previously unheard-of digital platforms, an economic system led by netocrats, has been established – a modern "corporation" or what can be termed as a "Corporate Digital Dictatorship". This system is managed by a global giant consisting of pri-

vate transnational IT companies in conditions of intense competition, all led by a small group of individuals.

References

1. Bard, Alexander, Soderqvist, Jan. NETOCRACY: the new power elite and life after capitalism Paperback. Publisher: Pearson FT Press. 2002. 288 p.
2. Jolia G. Education and Labor Market in the Digital Environment. Monography. Tbilisi, Georgia. "Technical University". ISBN 978-9941-28-668-1. 2021. 370 p. (in Georgian). <http://opac.gtu.ge/cgi-bin/koha/opac-detail.pl?biblionumber=50235>.
3. Malashkhia G. THE IDLE ECONOMY. The Iniquity of Mankind Criticism of the Economic Theory. Tbilisi. Georgia. "Universal". 2014. 179 p. (in Georgian).
4. Srnicek Nick. Platform Capitalism. Polity Press, Cambridge, UK and Malden, MA, 2016. 120 p.

MEDICAL SCIENCES

ACUTE RESPIRATORY FAILURE DURING LABOUR IN A PATIENT WITH CONGENITAL MITRAL VALVE REGURGITATION

Koritarova V.,
Phd

*Anesthesiology and Intensive Care Clinic at Specialized Hospital for Obstetrics and Gynecology
„Maichin dom” Sofia, Bulgaria*

Cherneva V.

*Anesthesiology and Intensive Care Clinic at Specialized Hospital for Obstetrics and Gynecology
„Maichin dom” Sofia, Bulgaria*

DOI: [10.5281/zenodo.10467998](https://doi.org/10.5281/zenodo.10467998)

Abstract

Pregnancy, delivery and postpartum hide risks of cardio-pulmonary complications in women with cardiac diseases. Anesthesia, analgesia and correct treatment can reduce significantly maternal and fetal mortality. Epidural analgesia during labour decreases pain-induced production of catecholamines, risk of thromboembolism, and provides stable hemodynamic. Each uterine contraction increases cardiac output with 30 %.

Raised preload could worsen pulmonary hypertension, which already existed in pregnant women with congestive heart failure and pulmonary edema may occur. That may causes acute fetal respiratory failure and emergency caesarean section must be done. In these cases general anesthesia with rapid sequence induction is preferred. However there are not enough studies for strategies of mechanical ventilation during surgery and postpartum.

Keywords: NYHA, BIPAP, PaO₂, PEEP,

Introduction: Incidence of cardiac diseases in pregnant women varies from 0,3 to 3,5% . Valvular heart diseases could be categorized as congenital, aquired, corrected and uncorrected, cyanotic and non-cyanotic. Asymptomatic patients during second and third trimester of pregnancy may develop symptoms like progressive dyspnea, ortopnea, paroxysmal nocturnal dyspnea, oedema, swollen neck veins, hepatjugular reflux, diastolic murmur, arrhythmia. According to the criteria for heart failure during pregnancy, systolic blood pressure must be higher than 160 mmHg or lower than 90 mmHg diastolic blood pressure must be higher than 100 mmHg or lower than 50 mm Hg, heart rate faster than 120 / min, respiratory rate over 30 / min or under 10 / min. Saturation lower then 95 % on room air, diuresis under 35 ml / h (1,3,17). During pregnancy typical physiological changes occur: cardiac output increases mainly because of enlarged with 50 % volume of plasma. Volume of erythrocytes increases with 20-30%, that causes dilutional anemia. Heart rate is accelerated (5,19) .Minute ventilation is also increased as consequence of higher tidal volume and respiratory rate. (physiological hyperventilation).

Because of the higher position of diaphragm functional residual capacity is decreased, and hypoxia may appear rapidly after induction of general anesthesia.

Pulmonary compliance is also reduced. Respiratory alkalosis is common, oxygen consumption is increased. (7,16,20). In pregnant women is recommended partial arterial pressure of oxygen to be higher than 75 mmHg. (PaO₂), that protects from fetal hypoxia. Incidence of cardiac and respiratory complications is higher during pregnancy, delivery and postpartum in patients categorized as NYHA III-IV, in those with pulmonary hypertension, uncorrected cyanotic heart diseases, severe aortic and mitral

stenosis (18). During delivery intense pain causes production of large amount of catecholamine, which increases heart rate and myocardial contractility. During each uterine contraction cardiac output increases with 20-30% and preload, end-diastolic left ventricular volume are also extended. (4,13). That could lead to pulmonary hypertension and edema in pregnant women with valvular heart diseases. During labour and in early postpartum pulmonary capillary pressure rises with 10 mm Hg. That may cause pulmonary edema in patients with severe heart failure. After delivery of fetus, the aortocaval compression is released and that increases cardiac output. Epidural analgesia is recommended in those patients during labour, because it reduces level of catecholamines also preload, heart rate, afterload and risk of thromboembolism (2). In cases of Cesarean section epidural anesthesia is considered safe for pregnant women with valvular heart diseases. It doesn't cause hemodynamic instability. Effect of epidural anesthesia is slow and prolonged, so in cases of emergency general anesthesia is preferred. That may provide secure airway, hemodynamic stability, analgesia, monitoring of respiratory and hemodynamic parameters (8) .

Case report: It concerns pregnant woman at term, who was admitted in University Hospital „Manchin Dom ” in Sofia, Bulgaria. She was multipara almost in the second stage of labour and epidural analgesia was not applied. The patient had twelve pregnancies and congenital mitral regurgitation. During her admission in the hospital she complained from dyspnea, cough with white sputum, fatigue from one week. These symptoms have worsened on the day of her admission. The pregnant woman was defined as NYHA III . When the woman was admitted to the hospital she was not febrile, her skin and visible mucous membranes were pales, she was conscious, with bilateral vesicular breathing, wheezing saturation 93 % on air, respiratory

rate 25-30 / min, arterial blood pressure 140/90 mm Hg, heart rate 70-80/ min.

Her laboratory results were normal, except CRP, which was 147. During period of expulsion of the fetus the patient developed acute respiratory failure- she turned cyanotic with tachypnea dyspnea, and bradypnea occurred later. The patient was with stable arterial blood pressure and sinus tachycardia- heart rate 140/ min, saturation 70 % on air. She was treated with oxygen mask with reservoir bag. Arterial blood gases (ABG) analysis was taken and it showed respiratory and metabolic acidosis - pH -7,1, PaO_2 -96 mm Hg, PaCO_2 -48 mm Hg, HCO_3 -11, $\text{PaO}_2/\text{FiO}_2$ -195 mm Hg. Acute fetal asphyxia happened and it was decided that she had to undergo emergent Cesarean section. General anesthesia with rapid sequence induction was performed. As intravenous anesthetic was used thiopental-5 mg / kg, and as neuromuscular relaxant was used succinylcholine- 1mg / kg. The patient was with stable hemodynamic during induction in general anesthesia. For maintenance of it inhalation anesthetic sevoflurane was applied in minimal concentration and non- depolarizing neuromuscular relaxant atracurium was used. Analgesia was performed with fentanyl after delivery of baby, tramadol, ketoprofen, paracetamol. As uterotonic was used oxytocin. Bolus doses of oxytocin are not recommended in patients with heart diseases, because they could reduce rapidly arterial blood pressure. In cases of mitral regurgitation bradycardia could increase pulmonary arterial pressure. Therefore in cases of hypotension ephedrine was preferred vasopressor. Magnesium treatment could cause hypotension and bradycardia.

General anesthesia provides secure airways, and decreases minute ventilation, work of breathing, oxygen consumption, preload. Patient was ventilated with volume controlled mechanical ventilation -tidal volume 6ml / kg, FiO_2 – 80 %, respiratory rate 12 /мин, PEEP- 8 mBr, Saturation was 89-90 %. Monitoring of hemodynamic consisted invasive measurement of arterial blood pressure, central venous line, which was used for estimation of central venous pressure. ABG analysis showed hypoxia, respiratory alkalosis- pH -7,46, PaCO_2 - 29,5 mm Hg, PaO_2 -62 mm Hg, HCO_3 -23.

Cesarean section proceeded without complications. As the patient was with severe mitral regurgitation we had to avoid hypertension, bradycardia, arrhythmia and raise of cardiac output. Hypoxia, acidosis, hypercapnea, hyperventilation could increase pulmonary arterial pressure. After operation patient was admitted to intensive care unit, where she was ventilated by Bilevel positive airway pressure (BIPAP) with following parameters - FiO_2 -50 %, Pinsp .-20 mBr, PEEP- 10 mBr, respiratory rate-12/ min, Saturation 93-94 %. ABG analysis that was taken one hour after BIPAP ventilation was started showed improvement- pH -7,42, PaO_2 -126 mm Hg, PaCO_2 -32 mmHg, HCO_3 - 23, $\text{PaO}_2/\text{FiO}_2$ - 252. Hemodynamic was stable, continuous infusions of fentanyl and midazolam was started. Chest X-Ray was performed and it showed bilateral pleural effusions and perichilar haze, enlargement of cardiac silhouette, Kerley B lines (horizontal lines in the periphery of the lower posterior lungs field), upper

lobe pulmonary venous congestion and interstitial edema.

Echocardiography was made and revealed depressed systolic function, ejection fraction was estimated-38%, severe mitral and tricuspid regurgitation. As diagnosis was considered acute pulmonary edema caused by physiological changes during labour in patient with severe mitral regurgitation. The patient was treated with diuretic therapy (furosemide), as vasodilator nitroglycerin was used on continuous intravenous infusion. We added also antibiotic and anticoagulant therapy.

On the next her condition was improved, her hemodynamic was stable without sinus tachycardia, arterial blood gases analysis was also improved. The process of weaning was started. The patient was ventilated by mode of pressure support mechanical ventilation – (PSV), Pinsp . -10 mBr, PEEP- 6 mBr, FiO_2 -40 %. ABG analysis- pH -7,44, PaO_2 -177 mm Hg, PaCO_2 -30 mm Hg, HCO_3 - 23, $\text{PaO}_2/\text{FiO}_2$ - 440. On the same day she was extubated successfully. Her length of hospital stay was 5 days. She was discharged and later consulted in cardiac surgery department.

Discussion: Physiological changes during pregnancy and labour could cause cardio- pulmonary complications especially at pregnant women defined as NYHA III-IV. Pain during uterine contraction in first stage of labour and perineal pain in second stage when expulsion of fetus happens leads to release of large amount of catecholamines. That causes tachycardia, hypertension, increased myocardial contractility and oxygen consumption. Each uterine contraction adds blood volume to systemic blood circulation. That leads to raised preload and cardiac output. In patients with heart valvular diseases these changes might cause pulmonary hypertension. In parturients with congestive heart failure acute pulmonary edema, acute respiratory failure and acute intrapartum fetal asphyxia could occur. Epidural analgesia reduces amount of released catecholamines, provides stable hemodynamic in process of delivery. It also decreases preload and prevents from thromboembolism. Epidural catheter could also be used when cesarean section is needed. Spinal anesthesia decreases rapidly arterial blood pressure and preload. So treatment with crystalloid and colloid infusion as well as vasopressors might be applied.(15) Epidural anesthesia has similar, but slower effect on patient's hemodynamic. So anesthesiologist has enough time to correct it with vasopressors and colloid and crystalloid infusions. General anesthesia might be applied in cases of acute respiratory failure, heart failure, treatment with anticoagulants, thrombocytopenia, eclampsia, e.t Endotracheal intubation is the most safe method for airway's protection. During induction in general anesthesia hypertension and tachycardia could occur. That could be avoided with administration of beta blockers with short duration of action, or with opiates like remifentanyl. The most suitable for induction in general anesthesia is etomidate, because it provides stable hemodynamic. Pregnant women with congestive heart failure are exposed to risk of paroxysmal supraventricular tachycardia, ventricular tachycardia and ventricular fi-

brillation. (14). Previous studies proved higher maternal mortality in pregnant patients with severe mitral stenosis who underwent general anesthesia in compared to those who were operated with epidural anesthesia (2). Inhalation anesthetics suppress myocardial contractility, volume controlled mechanical ventilation increases pulmonary vascular resistance, that could lead to pulmonary edema in patients with pre-existing pulmonary arterial hypertension. While titrated epidural anesthesia decreases systemic vascular resistance, preload and cardiac output.(18). In parturients defined as NYHA III-IV is recommended monitoring of invasive arterial blood pressure, central venous pressure, echocardiography, and in cases with pulmonary hypertension is useful pulmonary catheter for measuring pulmonary capillary pressure. After delivery of fetus cardiac output increases, because of decompression of abdominal aorta and vena cava inferior, that could also worsen pulmonary hypertension. In this case of periparturient acute respiratory failure diagnosis as amniotic embolism, pulmonary thromboembolism, periparturient cardiomyopathy, pneumonia, sepsis, preeclampsia could also be considered (4). Fetal hypoxia could happen when maternal saturation is under 95 % and partial arterial oxygen pressure (PaO₂) is under 70 mm Hg (10). According to previous researches non-invasive mechanical ventilation could be used successfully in pregnant women with pulmonary edema, pneumonia, severe anemia, bronchial asthma, e.t. The most common used mode is BIPAP with parameters- P_{insp} 12-25 mBr, PEEP- 5-10 mBr. (22) Some of advantages of non-invasive mechanical ventilation are no need of neuromuscular relaxation, lower doses of sedative drugs, lower risk of nosocomial pneumonia, e.t. Pregnant women are considered to have full stomach, and there is huge risk of pulmonary aspiration syndrome during induction in general anesthesia. In all cases of respiratory acidosis, signs of respiratory muscles fatigue, lost of consciousness, endotracheal intubation and mechanical ventilation are inevitables. Because thoracic compliance is reduced in pregnant patients, they could tolerate higher values of plateau pressure (P_{plat})- until 30 mBr (17). In pregnant women intraabdominal pressure is increased and application of prone position is difficult. (6). Many drugs that are used for sedation could pass through uteroplacental barrier and cumulates in fetus. Propofol causes muscular hypotension and depresses neuromuscular activity of fetus. There are not enough studies about respiratory parameters in pregnant women, but low tidal volume 4-6 ml/kg and P_{plat} under 30 mBr are recommended. The value of applied PEEP might prevent from hypoxia.

Conclusion: Cardiac diseases are one of the main causes of maternal and fetal mortality. Management of the patients is multidisciplinary. Anesthesiologist has to provide suitable anesthesia, analgesia monitoring of respiratory and hemodynamic parameters and treatment in intensive care unit.

References

1. Arendt KW, Lindley KJ: Obstetric anesthesia management of the patient with cardiac disease. *Int J Obstet Anesth*. 2019; 37:73–85

2. Bedard E, Dimopoulos K, Gatzoulis MA. Has there been any progress made on pregnancy outcomes among women with pulmonary arterial hypertension? *Eur Heart J*. 2009;30:256–65.

3. Carabello BA, Crawford FA, Jr Valvular heart disease. *N Engl J Med*. 1997;337:32–41.

4. Catanzarite V, Willms D, Wong D, Landers C, Cousins L, Schrimmer D. Acute respiratory distress syndrome in pregnancy and the puerperium: Causes, courses, and outcomes. *Obstet Gynecol*. 2001;97(5 Pt 1):760–

5. Clark SL, Cotton DB, Lee W, Bishop C, Hill T, Southwick J, et al. Central hemodynamic assessment of normal term pregnancy. *Am J Obstet Gynecol*. 1989;161(6 Pt 1):1439–42.

6. Contreras G, Gutiérrez M, Beroiza T, et al. Ventilatory drive and respiratory muscle function in pregnancy. *Am Rev Respir Dis* 1991; 144: 837–841

7. Draisci G, Volpe C, Pitoni S, Zanfini BA, Gonnella GL, Catarci S, et al. Non-invasive ventilation for acute respiratory failure in preterm pregnancy. *Int J Obstet Anesth*. 2013;22:169–7

8. Dresner M, Pinder A. Anaesthesia for caesarean section in women with complex cardiac disease: 34 cases using the Braun Spinocath spinal catheter. *Int J Obstet Anesth* 2009;

9. 131–6. Filippatos et al. Cardiac output monitoring during vaginal delivery. *J Obstet Gynaecol* (1997)

10. Gei AF, Hankins GD. Cardiac disease and pregnancy. *Obstet Gynecol Clin North Am*. 2001;28:465–512.

11. Guidelines for indication and management of pregnancy and delivery in women with heart disease (JCS 2010): digest versio *Circ J*, 76 (2012), pp. 240–260

12. Jenkins TM, Troiano NH, Graves CR, Baird SM, Boehm FH. Mechanical ventilation in an obstetric population: Characteristics and delivery rates. *Am J Obstet*

13. Jensen D, Duffin J, Lam YM, et al. Physiological mechanisms of hyperventilation during human pregnancy. *Respir Physiol Neurobiol* 2008; 161: 76–86.

14. Katsugari S, Yamanaka K, Neki R, Kamiya C, Sasaki Y Maternal outcome in pregnancy complicated with pulmonary arterial hypertension *Circ J*, 76 (2012), pp. 2249–2254

15. Langesæter, Eldrid; Dyer, Robert A .Maternal haemodynamic changes during spinal anaesthesia for caesarean section .*Current Opinion in Anaesthesiology* 24(3);p 242–248, June 2011.

16. Perloff JK. Pregnancy and congenital heart disease. *J Am Coll Cardiol*. 1991;18:340–2.

17. Pradeep Kumar Bhatia, Ghansham Biyani, Sadik Mohammed, Priyanka Sethi, and Pooja Bihani Acute respiratory failure and mechanical ventilation in pregnant patient: A narrative review of literature *J Anaesthesiol Clin Pharmacol*. 2016 Oct-Dec; 32(4): 431–439

18. Pritchard JA. Changes in the blood volume during pregnancy and delivery. *Anesthesiology*. 1965;26:393–9.

19. Robson, W. Dunlop, R.J. Boys, S. Hunter Cardiac output during labour. *Br Med J*, 295 (1987), pp. 1169-1172
20. Samanta S, Samanta S, Wig J, Baronia AK. How safe is the prone position in acute respiratory distress syndrome at late pregnancy? *Am J Emerg Med*. 2014;32:687.e1–3. *Gynecol*. 2003;188:549
21. S.M. Shnider, T.K. Abboud, R. Artal, E.H. Henriksen, S.J. Stefani, G. Levinson Maternal catecholamines decrease d G.S. during labor after lumbar epidural anesthesia. *Am J Obstet Gynecol*, 147 (1983), pp. 13-15 JCS Joint Working Group
22. Weinberger SE, Weiss ST, Cohen WR, et al. Pregnancy and the lung. *Am Rev Respir Dis* 1980; 121: 559–581.

PHYSICS AND MATHEMATICS

SURFACE LAYER THICKNESS, DEFECTS AND STRENGTH OF GRAPHITE

Yurov V.,

*Candidate of Physics and Mathematics Sciences, Associate Professor
KarTU, Karaganda, Kazakhstan*

Zhangozin K.

*Candidate of Physics and Mathematics Sciences, Associate Professor,
TSK Vostok LLP, Ust-Kamenogorsk, Republic of Kazakhstan*

DOI: [10.5281/zenodo.10468004](https://doi.org/10.5281/zenodo.10468004)

Abstract

The article proposes an empirical formula that determines the thickness of the surface layer R(I) and the length of nanocracks L_{nm} of a solid body. It is applied to graphite, which has an anisotropic structure. It is shown that the thickness of the R(I)_a layer (and the length of nanocracks L_{nma}) varies from 0.9 to 1.24 nm in the upper plane, and the thickness of the R(I)_c layer (and the length of nanocracks L_{nmc}) varies from 2.46 to 3.39 nm perpendicular to this plane. The number of layers of graphite is 3-5. This is due to changes in the density of graphite and its layered structure. The mechanical properties differ both in the longitudinal (for example, Young's modulus $E_a \approx 6$ GPa) and in the transverse directions ($E_c \approx 2.5$ GPa). The Young's modulus of graphite is $10 \div 100$ times less than that of most metals. Cracks L_{nm} , L_{um} , L_c for graphite are caused by their dislocation interaction. The dislocation density is maximum in the R(I) layer $\rho_{nma} = 10^{18} \text{ m}^{-2}$ (in the longitudinal direction), $\rho_{nmc} = 10^{19} \text{ m}^{-2}$ (in the transverse direction) and then it falls deep into the graphite crystal. When the R(I) layer is formed, internal stress-strain states arise in it. It has been shown that it is much easier to destroy graphite in the transverse direction ($\sigma_{Bc} \approx 40$ MPa), but in the longitudinal direction ($\sigma_{Ba} \approx 200$ MPa). The formulas proposed in the article make it possible to theoretically determine the critical length of cracks and the strength of not only graphite, but also carbon-carbon composite materials.

Keywords: graphite, surface layer thickness, crack length, strength, crystal, metal, density, carbon, composite.

Introduction

An alternative definition of strength is formulated in [1] and looks like this: strength is the property of a material to resist the occurrence of cracks in it during deformation. From here it becomes clear that the deformation of a material without the occurrence of cracks is one of the types of flow (viscous, plastic, etc.). The strength of graphite varies significantly depending on the method of its manufacture, therefore graphites with the same density, but of different grades, differing in structure, can have different strengths [2]. The general rule is that a finer structured graphite composite tends to have greater strength. Graphite is a thermodynamically

stable allotropic modification of carbon - an element of the 4th group of the main subgroup of the 2nd period of the periodic system, serial number 6, atomic mass of a natural mixture of isotopes 12.0107 g/mol [3]. The theoretical density of 2.26 g/cm³ is achieved only in natural graphite. The density of artificial graphite is in the range of 1.65-1.75 g/cm³ [4]. Such a low density of artificial graphite is explained by its porosity. Graphite does not melt, but sublimates at a temperature of about 3650 °C [5]. The crystal structure of graphite has hexagonal symmetry and consists of flat layers of carbon atoms located parallel to each other (Fig. 1a). The phase diagram of carbon according to Bundy [6] is shown in Fig. 1b.

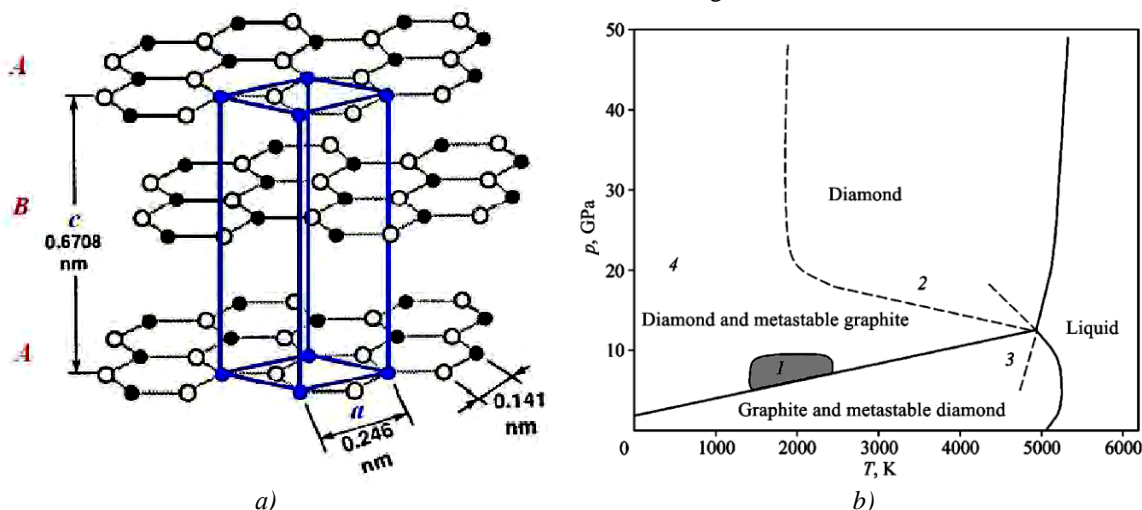


Figure 1. Structure of α -graphite (a) and phase diagram of carbon (b).

In α -graphite, half of the atoms of each layer are located above and below the centers of the hexagon (laying...AVAVAVA...) (see Fig. 1a). Each carbon atom is covalently bonded to three other carbon atoms surrounding it. Since the bonds acting in the basal planes (bond energy is 420...460 kJ/mol) and the bonds between these basal planes (bond energy is 42 kJ/mol) are very different, there is a strong anisotropy of properties in single-crystalline graphite, and this determines the features properties and structure of polycrystalline graphites.

Very important factors to consider when modeling a graphite block in a nuclear reactor are the initiation and growth of cracks. It is these processes that lead to the accumulation of stresses and strains in graphite [7, 8].

In this work, we will demonstrate our work [9] on

determining the length of nanocracks and apply it to graphite.

Surface layer thickness and length of nanocracks in graphite

The thickness of the surface layer $R(I)$ and the length of nanocracks L_{nm} are given by the empirical formula [10, 11]:

$$R(I) = L_{nm} = 0,17 \cdot 10^{-9} \cdot \alpha \cdot v \text{ [m]}. \quad (1)$$

In equation (1), you need to know one parameter - the molar volume of the element, which is equal to $v = M/\rho$ (M is the molar mass, ρ is its density), $\alpha = 1 \text{ m}^{-2}$ - a constant, so that the dimension $(R(I) = [m])$. Using formula (1), we calculate $R(I) = L_{nm}$ (Table 1) for graphite parallel to the plane $x = a = b$ and perpendicular to this plane $x = c$.

Table 1.

Parameters $R(I) = L_{nm}$ of graphite.

Graphite	Structure	M, g/mol	ρ , g/sm ³	$R(I)_a = L_{nma}$, nm	$R(I)_c = L_{nmc}$, nm
C	C6/mmc-D _{6h} ⁴	12,0107	2,26	0.90 (3)	2.46 (3)
			1,75	1.17 (4)	3.19 (4)
			1,65	1.24 (5)	3.39 (5)

From the table Figure 1 shows that the thickness of the layer $R(I)_a$ (and the length of nanocracks L_{nma}) varies from 0.9 to 1.24 nm in the upper plane (Fig. 1a), and the thickness of the layer $R(I)_c$ (and the length of nanocracks L_{nmc}) varies from 2.46 to 3.39 nm perpendicular to this plane (Fig. 1a). This is due to changes in the density of graphite and its layered structure. Table

2 shows the thickness of the surface layer of some cubic metals, which is also a nanostructure with a size of about 2 nm. In table 1 and 2, the number in brackets represents the number of layers - $n = R(I)/a$ (a is the crystal lattice constant of the metal). It can be seen that the number of metal layers in graphite is 3-5.

Table 2.

Elastic parameters of some hard metals

Metal	$R(I)$, nm	W_a , J/m ²	ϵ_{is} , GPa	E , GPa
Au	1.73 (4)	1.337	7.813	79
Ag	1.75 (4)	1.235	7.665	83
Cu	1.21 (3)	1.357	12.000	110
Mn	1.30 (2)	1.517	15.199	198
Ni	1.12 (3)	1.726	17.776	207
Fe	1.21 (4)	1.812	17.550	211
Cr	1.23 (4)	2.130	21.977	279
Mo	1.60 (5)	2.896	24.413	293
W	1.62 (5)	3.695	30.611	371

Other parameters are in the table. 2 will be discussed later. Now we will say the most important thing. We will call the layer $R(I)$ the surface layer and denote the surface energy of this layer by γ_1 . In general, there are two approaches: the Gibbs approach [13], in which the surface layer is conventionally considered as a geometric surface without thickness; the approach of Van der Wals, Guggenheim, Rusanov, in which the surface layer is considered as a layer of finite thickness [14]. According to modern concepts [15, 16], the surface phase γ_1 is understood as an ultrathin film (surface

layer) that is in equilibrium with a crystalline base (substrate), the properties and structure of which are different from the bulk properties of γ_2 . However, the question of the theoretical "thickness" of this surface layer for various substances remained open until 2018. Only after our works [10, 11] it became clear how the thickness of the surface layer, which plays a big role in nanotechnology and mesomechanics, can be theoretically determined [17].

In the surface layer $R(I)$, relaxation or reconstruction [15] of atomic monolayers occurs (Fig. 2).

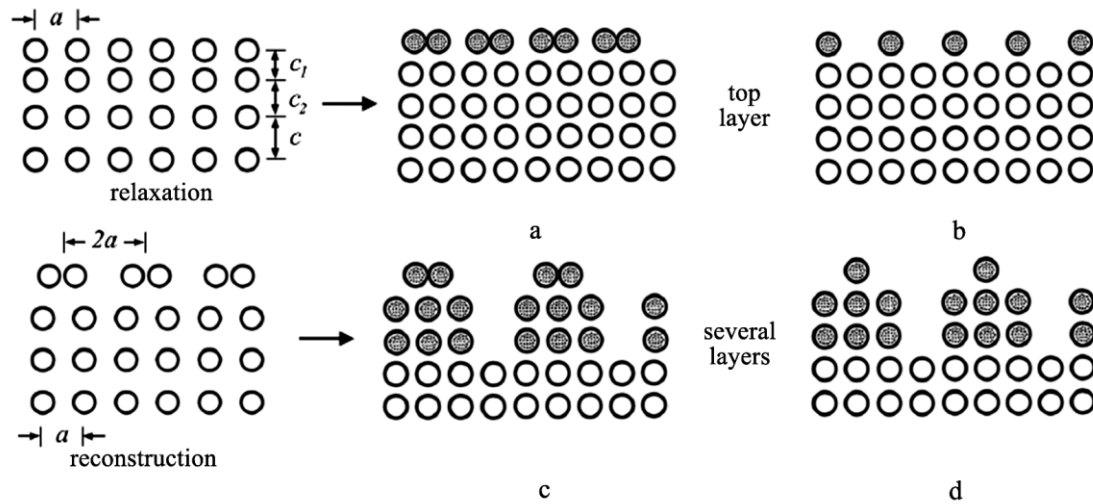


Figure 2. – Transformation of the metal surface

Size effects in the R(I) layer are determined by the entire collective of atoms in the system (collective processes). Such “quasi-classical” size effects are observed only in nanoparticles and nanostructures [18]. Experimentally, R(I) can be observed on very pure single crystals in high vacuum with grazing incidence of X-ray radiation, when the angle of incidence is equal to or less than the critical angle of total internal reflection [15]. When the angle of incidence becomes less than the critical one, the refracted wave decays exponentially in the volume at a characteristic depth of the order of several nanometers (for example, for silicon this depth is $R(I) = 3.2$ nm, and for gold $R(I) = 1.2$ nm) [15].

In [12] it is shown that the surface energy of a bulk metal γ_2 , with an accuracy of 3%, is equal to:

$$\gamma_2 = 0,7 \cdot 10^{-3} \cdot T_m \text{ [J/m}^2\text{]}, \quad (2)$$

where T_m is the melting temperature of the metal (K).

In the R(I) layer, it is necessary to take into account the size effect and the surface energy of the R(I) layer becomes equal to γ_1 [9]:

$$\gamma_1 = \gamma_2(1 - R(I)/R(I) + h) \approx 0,3\gamma_2, \quad (3)$$

Equation (3) shows that the surface energy of the R(I) layer is three times less than the surface energy of the main crystal. To separate the R(I) layer from the rest of the crystal, it is necessary to expend energy, which is called adhesion energy [19]:

$$W_a = \gamma_1 + \gamma_2 - \gamma_{12} \approx \gamma_1 + \gamma_2 = 1,3\gamma_2, \quad (4)$$

where γ_{12} is the surface energy at the phase interface, which is negligible due to a second-order phase transition.

Internal voltages σ_{is} between phases γ_1 and γ_2 can be calculated using the formula [19]:

$$\sigma_{is} = \sqrt{W_a \cdot \bar{A}/R(I)}, \quad (5)$$

where E is Young's modulus of elasticity.

Using equations (1) – (5), we calculate the elastic parameters for graphite.

Table 3.

Elastic parameters of graphite						
Graphite	W_{aa} , J/m ²	W_{ac} , J/m ²	σ_{isa} , MPa	σ_{isc} , MPa	E_a , GPa	E_c , GPa
C ($\rho = 2,26$)	3,613	1,323	5740	1370	7,59	3,48
C ($\rho = 1,75$)	2,801	1,026	3750	930	5,88	2,70
C ($\rho = 1,65$)	2,637	0,966	3440	870	5,55	2,55

For graphite, the average value is $T_m = 3970$ K and $\gamma_2 = 2.779$ J/m² (see formula (2)). According to work [2], graphite with a density $\rho = 1.75$ g/cm³ refers to pressed samples, and with a density $\rho = 1.65$ g/cm³ refers to pressed samples. Because of this, their mechanical properties differ both in the longitudinal (for example, Young's modulus $E = E_a$) and in the transverse directions ($E = E_c$) (Table 3). The Young's modulus of graphite is $10 \div 100$ times less than that of most metals (Table 2). However, the magnitude of internal stresses is 2 times less than that of gold and silver.

Defects and cracks in graphite.

Defects in graphite, according to [2, 20, 21], can be divided into two types: defects related to disturbances between layers and bond defects in networks. The first include layer packing defects, characterized by a

violation of the packing order of parallel layers of hexagonal networks. Thus, carbon consisting of fairly perfect hexagonal networks, but with a disturbed order in the sequence of layer packing, is usually called turbostratic. In such a structure, graphite-like networks are randomly displaced relative to each other (with a random vector of displacement of one layer relative to another).

The second type of structural damage in graphite is defects in the bonds of the carbon lattice. These include vacancies and their groups, impurity atoms embedded in the hexagonal layer, defects in isomeric bonds when some of the atoms have sp^3 hybridization, edge defects, screw dislocations, etc.

Cracks in solids (and graphite) occur mainly for three reasons. Firstly, the root cause of crack formation

is stresses associated with the formation of a surface nanostructured layer due to relaxation processes or surface reconstruction [9]. They are called natural (or primary) cracks or nanocracks (see Table 1 - Lnm), which were experimentally discovered quite recently in minerals by fractoluminescence [22]. Secondly, cracks arise due to the process of crystal growth from a melt, from a solution or from a gas phase with changes in temperature, pressure, impurities, etc. They are called technological cracks. Thirdly, cracks can occur when a solid body (especially metals) interacts with the external environment. They are called corrosion cracks.

The numerical value of these nanocracks is determined by equation (1) and is presented in table. 2. The

maximum speed of crack propagation according to Griffiths theory is equal to [23]:

$$V_c = \beta \cdot V_0 \cdot (1 - \gamma_1 / W_a)^{1/2} \quad (6)$$

and is about 1/3 of the speed of sound V_0 in the material.

After Griffiths, a significant number of works were published in which various models of crack development were analyzed, but we make a choice in work [24], where it became possible to calculate the maximum crack propagation speed V_{\max} in solid materials for which the main mechanical characteristics are known (E – Young's modulus, ν – Poisson's ratio, ρ – material density):

$$V_{\max} = \frac{dL}{dt} = \sqrt{\frac{1 - \nu}{4(1 + \nu)[\nu^2 - 3\nu\nu/ + 7/8)\ln 5,2 - 3\nu\nu/ + 3/32]}} \cdot \sqrt{\frac{E}{\rho}},$$

$$\text{at } \nu = 0,25 \quad V_{\max} = 0,38 \cdot \sqrt{\frac{E}{\rho}}. \quad (7)$$

In equation (7), the speed $V_0 \approx \sqrt{E/\rho}$ is equal to the speed of sound in the volume, which means that the Griffiths formula for the limiting speed of crack propagation is also valid. However, calculating this speed using formula (6) is much more difficult (β , γ_1 , W_a) than

using formula (7) - (E , ρ , ν).

If we substitute the formula for $R(I)$ into the last formula (7), then we have:

$$V_{\max} = \frac{dL}{dt} = \sqrt{\frac{1 - \nu}{4(1 + \nu)[\nu^2 - 3\nu\nu/ + 7/8)\ln 5,2 - 3\nu\nu/ + 3/32]}} \cdot \sqrt{\frac{E}{\rho}},$$

$$\text{at } \nu = 0,25 \quad V_{\max} = 0,38 \cdot \sqrt{\frac{E}{\rho}}. \quad (8)$$

Integrating both sides of formula (8) and squaring them, we have:

$$L_{\max} = 0.07 \cdot \frac{E \cdot R_0 \cdot T}{\gamma M} \cdot t^2. \quad (9)$$

According to formula (9), the length of a nanocrack depends quadratically on the time of applied voltage E and depends linearly on temperature T .

In [25], some metals were subjected to stresses from 5 to 70 GPa, which led to a change in $\Delta\rho/\rho$ and the movement of nanocracks according to equations (6) and (7). As a result, the resulting microcracks were ex-

amined by L_R X-ray and L_V electron microscopy methods. Their results are shown in table. 4.

From the table 4 it follows that within the experimental errors: $L_{\mu m} = 10^2 L_{nm}$.

$$L_{\mu m} = 10^2 \cdot L_{nm} \quad (10)$$

According to work [26], the critical length of cracks L_C of most metals and alloys lies in the range of 30-50 μm , which is much greater than $L_{\mu m} \approx 0.2 \mu m$.

This leads to the conclusion that the critical length of cracks in metals must be determined taking into account formulas (6) and (8), and a similar formula (10) (Table 4):

$$L_C = 10^4 \cdot L_{nm} = 0.17 \cdot 10^{-5} \cdot \nu = 0.17 \cdot 10^{-5} \cdot M / \rho \quad (11)$$

Table 4.

Length of cracks in metals

Metal	L_{nm} , nm	$L_{\mu m}$, nm	L_R , nm [25]	L_V , nm [25]	L_C , nm
Fe	1.21	121	90	100	12100
Al	1.70	170	140	200	17000
Ni	1.12	112	80	100	11200
Cu	1.21	121	-	250	12100
Ag	1.75	175	-	200	17500
Au	1.73	173	-	200	17300
Mo	1.60	160	-	80	16000

If for iron as L_C we take the values of L_{nm} from the table. 2, i.e. $L_C = 1.21 \cdot 10^{-5} \text{ m} = 12.1 \text{ }\mu\text{m}$, then for the strength of iron [26]: $(K_{Ic})^2 = 2\gamma E/(1-\mu^2) = 65.5 \cdot 10^{10}$; $(\sigma_B)^2 = (K_{Ic})^2/L_C = 541.3 \cdot 10^{14}$; $\sigma_B = 233 \text{ MPa}$. In the reference book – $\sigma_B = 250 \text{ MPa}$, which is consistent with

the nanocrack growth model: $L_{nm} \rightarrow 10^2 L_{\mu m} \rightarrow 10^4 L_C$.

Let's calculate the crack length L_{nm} , $L_{\mu m}$, L_C for graphite.

Table 5.

Length of graphite cracks.

Graphite	$L_{nma}, \text{ nm}$	$L_{nmc}, \text{ nm}$	$L_{\mu ma}, \text{ nm}$	$L_{\mu mc}, \text{ nm}$	$L_{Ca}, \text{ nm}$	$L_{Cc}, \text{ nm}$
C	0.90	2.46	90	246	9000	24600
	1.17	3.19	117	319	11700	31900
	1.24	3.39	124	339	12400	33900

Cracks L_{nm} , $L_{\mu m}$, L_C for graphite are caused by their dislocation interaction [27]. The work [28] provides a review of modern methods for studying and calculating the dislocation density in single crystals. A brief analysis of the main advantages and disadvantages of each method is given, as well as experimental results. In Fig. 3 shows some results.

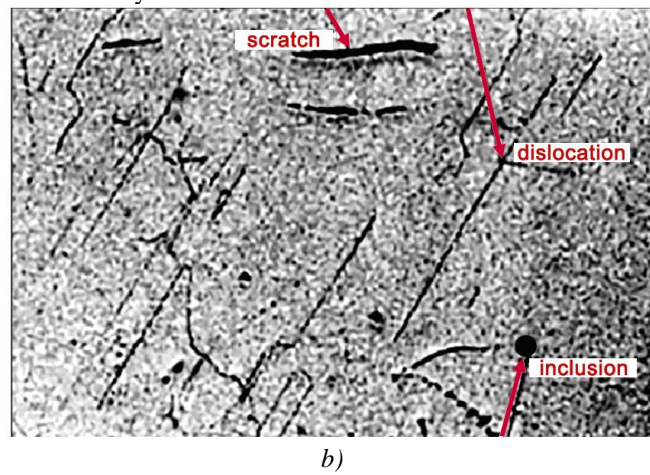
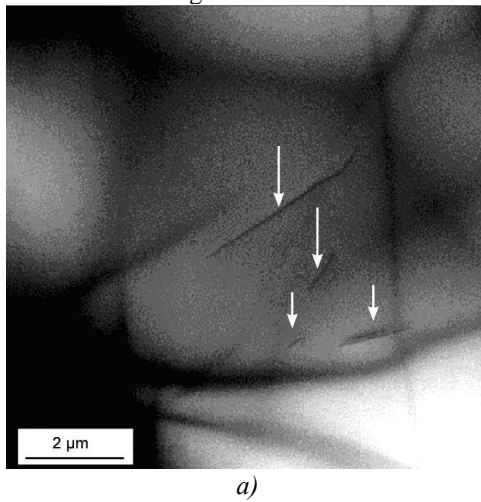


Figure 3. TEM micrographs of GaAs dislocations (a); synchrotron double-crystal transmission topogram of germanium reflection (111): visible scratch, dislocation, inclusion (b) [28].

In the case of relaxation of the R(I) layer, stress gradients arise, then in addition to the dislocation density ρ_s , the accumulation of geometrically necessary dislocations (GNDs) with a density ρ_G occurs [29].

In this case:

$$\rho = \rho_s + \rho_G \quad (12)$$

Taking into account equation (11), for the dislocation density we have:

$$\begin{aligned} \rho_{nm} &= (L_{nm} \cdot b)^{-1}, \\ \rho_{\mu m} &= (L_{\mu m} \cdot b)^{-1}, \\ \rho_{\tilde{N}} &= (L_{\tilde{N}} \cdot b)^{-1}. \end{aligned} \quad (13)$$

where b is the Burgers vector.

The dislocation density in graphite is shown in table 6. From the table 6 it can be seen that the dislocation density is maximum in the layer R(I) $\rho_{nma} = 10^{18} \text{ m}^{-2}$ (in the longitudinal direction), $\rho_{nmc} = 10^{19} \text{ m}^{-2}$ (in the transverse direction) and then it falls deep into the graphite crystal.

Table 6.

Graphite dislocation density

Graphite	$\rho_{nma}, 10^{18} \text{ m}^{-2}$	$\rho_{nmc}, 10^{19} \text{ m}^{-2}$	$\rho_{\mu ma}, 10^8 \text{ m}^{-2}$	$\rho_{\mu mc}, 10^9 \text{ m}^{-2}$	$\rho_{Ca}, 10^4 \text{ m}^{-2}$	$\rho_{Cc}, 10^5 \text{ m}^{-2}$
C	4,5	6,1	4,5	6,1	4,5	6,1
	3,5	4,7	3,5	4,7	3,5	4,7
	3,3	4,4	3,3	4,4	3,3	4,4

According to work [30], in an annealed single crystal the number of dislocations can be 10^8 - 10^{10} m^{-2} . At the same time, in an annealed polycrystal, ρ already reaches 10^{10} - 10^{12} m^{-2} , and in a highly deformed state up to 10^{16} m^{-2} (so that the average distance between adjacent dislocations becomes approximately 10 nm). Table 3 shows that highly deformed states σ_{is} arise in the

R(I) layer, so that the dislocation density is quite significant. Strongly deformed states σ_{is} lead to features in the structure of dislocations noted in [31]. As the authors of [31] believe, it's all about dislocations that arise where the graphene layers in graphite are rotated at a small angle relative to each other (Fig. 4).

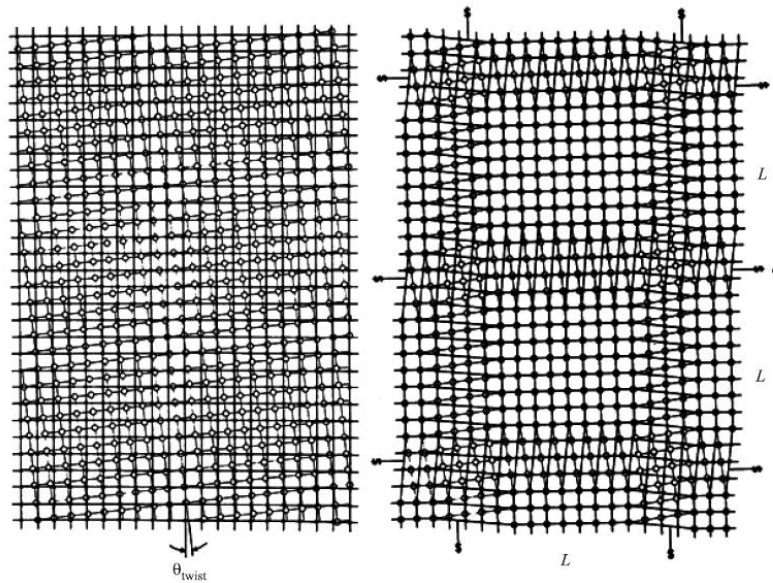


Figure 4.

Schematic representation of the occurrence of dislocations at the boundaries of graphite granules [31].

In Fig. Figure 4 (left) shows the initial stacking of graphene layers forming a small angle θ_{twist} with each other (for simplicity, a square rather than a hexagonal lattice is shown in the graphene layers). In Fig. Figure 4 (right) shows a relaxed state with large areas of lattices coinciding with each other, separated by thin boundaries - screw dislocations, in which mechanical stress is concentrated and anomalies in the conductive properties of graphite are observed.

Instead of the usual superposition of two lattices (Fig. 4a), regions with atoms in layers that are ideally fitted to each other appear, separated by transition regions - dislocations, forming a large-scale network with a period from 3 to 25 nm (Fig. 4b). In places of dislocations, mechanical stresses lead to the formation of a flat energy zone and, as a consequence, a singularity in the density of energy states of electrons, which, in turn, gives rise to high-temperature superconductivity.

However, in [31], the described mechanism does not allow us to explain the features of the phenomenon:

due to its poor reproducibility, instability and weakness of the signal - after all, superconducting “corridors” occupy a small volume compared to the total thickness of graphite and their very existence is highly dependent on the preparation conditions : Even the smallest adsorption of foreign atoms (eg hydrogen) can destroy the fragile superconducting state.

Graphite Strength

When the R(I) layer is formed, internal stress-strain states σ_{is} (SSS) arise in it (Table 3). The R(I) layer is similar to a thin coating on a substrate (Fig. 5) [32]. In a coating, SDS creates an energetic state that prevents adhesion and promotes peeling of the coating. SSS energy can be estimated using the formula [33]:

$$W_{in} = (\sigma_{is}^2 / 2\text{\AA}) \cdot S \cdot R(I), \quad (14)$$

where $S = 1 \text{ m}^2$ – coverage area, E – Young’s modulus.

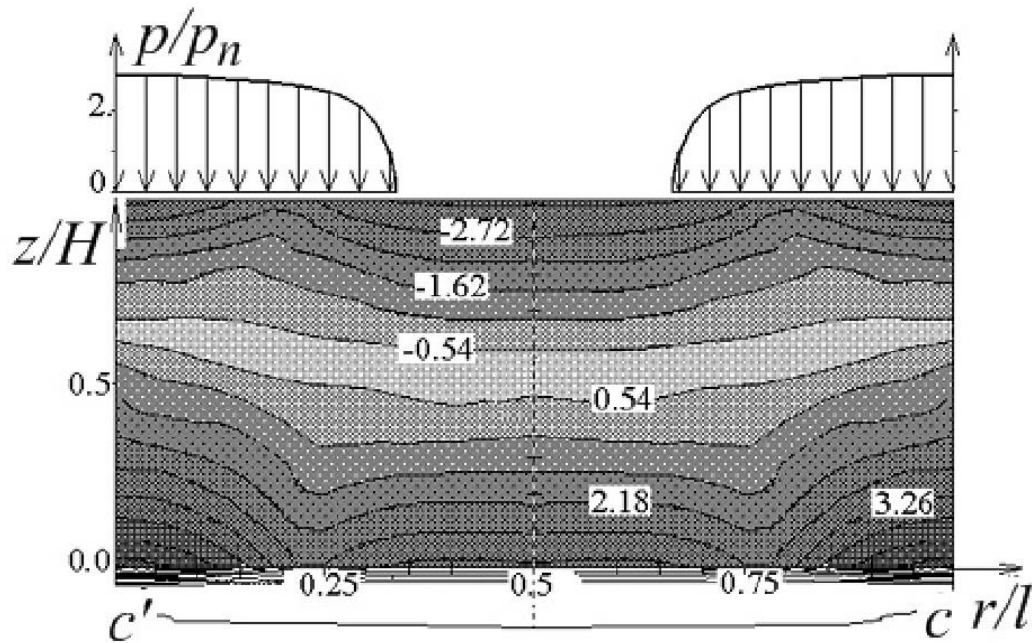


Figure 5. Distribution of contact pressures and isolines of tensile-compressive stresses $\sigma_r(r,z)/p_n$ in the coating and in the substrate [32].

For example, let's calculate W_{in} ($\rho = 1.75$) using table 3: $W_{in} \approx 1.4 \text{ J/m}^2$; $W_{in} \approx 0.5 \text{ J/m}^2$. If we compare W_{in} with the adhesion energy W_a from the table. 3, it turns out that $W_{aa} > W_{in} \sim 2$ times; $W_{ac} > W_{bc} \sim 2$ times. In other words, the energy of internal stresses W_{in} is 2 times less than the adhesion energy W_a of graphite in both the longitudinal and transverse directions.

This means that internal stresses cannot tear off

$$\frac{K_{IN}^2(1-\mu^2)}{E} = 2\delta_{IN}\sigma_B = G_{IN} = J_{IN} = 2\gamma = W_a, \quad (15)$$

where K_{Ic} is the critical stress intensity factor, the force criterion for destruction; E - elastic modulus; μ - Poisson's ratio; δ_{Ic} - critical opening at the crack tip, deformation criterion of destruction; σ_B - tensile strength; G_{Ic} - critical intensity of released energy, energy criterion of destruction; J_{Ic} - critical j-integral, energy criterion of destruction; γ - surface energy, W_a - adhesion energy.

Wherein:

the R(I) layer and it is a stable structure that is in equilibrium with the crystalline base (substrate), the properties and structure of which are different from the bulk properties.

For the destruction of a solid body, force, deformation and energy failure criteria have been developed. There is the following connection between them [26]:

$$K_{IN} = \sqrt{EJ_{IN}}. \quad (16)$$

In the case of a plate with a crack L_C :

$$\hat{E}_{IN} = \sigma_{is} \sqrt{L_N}, \quad \delta_{IN} = K_{IN}^2 / \sigma_{is} \cdot E. \quad (17)$$

Let us evaluate equations (15), (16) and (17) for graphite (Table 7).

Table 7.

Graphite failure criteria

Graphite	K_{ICa} , GPa m ^{1/2}	K_{ICc} , GPa m ^{1/2}	δ_{ICa} , nm	δ_{ICc} , nm	σ_{Ba} , MPa	σ_{Bc} , MPa
C	545300	215090	6,1	9,7	296	68
	397500	166470	7,2	11,0	194	47
	381840	160080	7,6	11,6	173	42

From the table 7 it is clear that it is much easier to destroy graphite in the transverse direction, while in the longitudinal direction. This is illustrated in Table. 8,

which shows various carbon-carbon composite materials.

Table 8.

Strength of carbon-carbon composite materials

Composite	SG-P	SG-M	MPG-7	MIG-2	NIIgrafit
Density g/cm ³	2.2	2.1	1.8	1.8	1.45
Tensile strength longitudinal, MPa	420	125	103	80	130
Tensile strength transverse, MPa	100	65	49	30	60

Listed in table 8 carbon-carbon composite materials are used as components of friction units (o-rings, heels, plain bearings, etc.) in pumps, reactors, separators and other equipment; for protective fittings of immersion thermocouples, for stop-pouring supplies of metallurgical furnaces and ladles, etc. Artificial graphites of the MPG-7 and MIG-2 grades are high-strength thermally resistant materials based on a special coke-pitch composition.

Conclusion

The formula $L_C = 0.17 \cdot 10^{-3} M/\rho$ proposed in equation (11) allows one to theoretically determine the critical crack length and strength not only of graphite, but also of carbon-carbon composite materials, the synthesis of which is important for use in nuclear engineering, aviation, metallurgy, space technology and other industries.

References

1. Litvinsky G.G. Analytical theory of strength of rocks and massifs. - Donetsk: Nord-Press, 2008. - 207 p.
2. Zhmurikov E.I., Bubnenkov I.A., Dremov V.V., Samarin S.I., Pokrovsky A.S., Kharkov D.V. Graphite in science and nuclear technology. - Novosibirsk, 2013. - 193 p.
3. Knunyants I.L. (chief ed.). Chemical encyclopedia: 5 volumes - M.: Sov. enz. 1988. V.1. - 623 p.
4. Asinovsky E.I., Kirillin A.V., Kostanovsky A.V. Experimental study of the properties of carbon at high temperatures and moderate pressures // UFN, 2002, V 172, No. 8. - P. 932-944.
5. Savvatimsky A.I. Melting of graphite and liquid carbon // UFN, 2003, V. 173, No. 12. - P. 1371-1379.
6. Bundy F.P., Bassett W.A., Weathers M.S., et al. The Pressure-Temperature Phase and Transformation Diagram for Carbon; Updated Through 1994 // Carbon, 1996, V. 34, N 2. - P. 141-153.
7. Panyukov S.V., Subbotin A.V., Arzhakov M.V. Irradiation induced dimensional changes in bulk graphite: The theory. // Journal of Nuclear Materials, 2013, V. 439. - P. 72-83.
8. Alekseev A.T. Modeling of thermomechanical behavior of the graphite block of the RBMK-1000 reactor using advanced calculation algorithms. - Dissertation of Technical Sciences, Moscow, 2017. - 133 p.
9. Yurov V.M., Goncharenko V.I., Oleshko V.S. Study of primary nanocracks in atomically smooth metals // Letters to ZhTP, 2023, V. 49, No. 8. - P. 35-38.
10. Yurov V.M. Thickness of the surface layer of atomically smooth crystals // Physical and chemical aspects of studying clusters, nanostructures and nanomaterials, 2019, No. 11. - P. 389-397.
11. Yurov V.M., Goncharenko V.I., Oleshko V.S., Sha Mingun. Anisotropy of the surface of carbon materials // Eurasian Physical Technical Journal, 2021, Vol. 18, No. 3(37). - P. 15-24.
12. Rekhviashvili S.Sh., Kishtikova E.V., Karmokova R.Yu. On the calculation of the Tolman constant // Letters to ZhTP, 2007, V. 33, Issue. 2. - P. 1-7.
13. Gibbs J.W. Thermodynamic works. - M.: GITTL, 1950. - 303 p.
14. Rusanov A.I. Phase equilibria and surface phenomena. - L.: Chemistry, 1967. - 346 p.
15. Oura K., Lifshits V.G., Saranin A.A. etc. Introduction to surface physics. - M.: Nauka, 2006. - 490p.
16. Roldugin V.I. Physical chemistry of the surface. Dolgoprudny: Publishing House "Intelligence", 2008. - 568 p.
17. Panin V.E., Sergeev V.P., Panin A.V. Nanostructuring of surface layers of structural materials and application of nanostructured coatings // Tomsk: TPU Publishing House, 2010. - 254 p.
18. Uvarov N.F., Boldyrev V.V. Size effects in the chemistry of heterogeneous systems // Uspekhi khimii, 2001, V. 70 (4). - P. 307-329.
19. Zimon A.D. Adhesion of films and coatings. - M.: Chemistry, 1977. - 352 p.
20. Ubellode A.R., Lewis F.A. Graphite and its crystalline compounds. - M.: Mir, 1965. - 256 p.
21. Kostikov V.I., Shipkov N.N., Kalashnikov Ya.A. and others. Graphitization and diamond formation. - M.: Metallurgy, 1991. - 223 p.
22. Vettegren V.I., Ponomarev A.V., Mamalimov R.I., Shcherbakov I.P. Nanocracks during the destruction of oligoclase // Physics of the Earth, 2021, No. 6. - P.87-92.
23. Griffith A.A. The phenomena of rupture and flow in solids // Philos. Trans. Roy. Soc. London. Ser. A., 1920, V. 221. - P. 163-198.
24. Chekunaev N.I., Kaplan A.M. Limiting speed of crack propagation in elastic materials // Applied mechanics and technical physics, 2009, V. 50, No. 4. - P. 158-166.
25. Betekhtin V.I., Kadomtsev A.G. Evolution of microscopic cracks and pores in loaded solids // FTT, 2005, vol. 47, issue. 5. - P. 801-807.
26. Erasov V.S., Oreshko E.I. Reasons for the dependence of the mechanical characteristics of the crack resistance of a material on the size of the sample // Aviation materials and technologies, 2018, No. 3(52). - P. 56-64.
27. Karkina L.E., Yakovenkova L.I. Initiation of microcracks during dislocation interactions in single-crystal Ti_3Al // FTT, 2008, vol. 50, No. 6. - P. 1018-1027.
28. Knyazev S.N., Kudrya A.V., Komarovskiy N.Yu., Parkhomenko Yu.N., Molodtsova E.V., Yushchuk V.V. Methods for studying the dislocation structure of semiconductor single crystals of group AIIIBV // Izvestia VUZov. Materials of electronic technology, 2022, V. 25, No. 4. - P. 323-336.
29. Kozlov E.V., Popova N.A., Koneva N.A. Size effect in dislocation substructures of metallic materials // Fundamental problems of modern materials science, 2009, Vol. 6, No. 2. - P. 14-24.
30. Baraz V.R., Levchenko V.P., Povzner A.A. Structure and physical properties of crystals. - Ekaterinburg: USTU-UIP, 2009. - 164 p.
31. Esquinazi P., Heikkilä T.T., Lysogorskiy Y.V., Tayurskii D.A., Volovik G.E. On the superconductivity of graphite interfaces // Pis'ma v ZhETF, vol. 100, iss. 5. - P. 374-378.
32. Torskaya E.V. Modeling of frictional interaction of bodies with coatings. - Dissertation of Doctor of Physics and Mathematics. Sciences, Moscow, 2014. - 251p.
33. Ainbinder S.B., Panch A.S. The influence of the relative mechanical properties of metals on the formation and destruction of adhesion at low sliding speeds. - In the book: Dry friction. Riga, 1961. - P. 64-79.

TECHNICAL SCIENCES

МЕТОДИ МАТЕМАТИЧНОГО МОДЕЛЮВАННЯ ДЛЯ ОЦІНКИ РІВНЯ ВИКОРИСТАННЯ ЗЕМЕЛЬ ОБ'ЄКТІВ ПРИРОДНО-ЗАПОВІДНОГО ФОНДУ РЕГІОНІВ

Мамонов К.А.

*Харківський національний університет міського господарства
імені О.М. Бекетова, Україна*

*д.е.н., професор, завідувач кафедри земельного адміністрування та геоінформаційних систем
ID ORCID: <http://orcid.org/0000-0002-0797-2609>*

Вяткін Р.С.

*Харківський національний університет міського господарства
імені О.М. Бекетова, Україна*

к.техн.наук, асистент кафедри земельного адміністрування та геоінформаційних систем

Штерндок Е.С.

*Харківський національний університет міського господарства
імені О.М. Бекетова, Україна*

*к.техн.наук, ст.викладач кафедри земельного адміністрування та геоінформаційних систем
ID ORCID: <https://orcid.org/0000-0003-1107-7401>*

Штерндок А.В.

*Національний науковий центр «Інститут судових експертиз
ім. Засл. проф. М.С. Бокаріуса», м. Харків, Україна*

*Старший судовий експерт лабораторії будівельно-технічних досліджень
ID ORCID: <https://orcid.org/0009-0006-9367-6932>*

METHODS OF MATHEMATICAL MODELING FOR ASSESSMENT OF THE LEVEL OF LAND USE OF OBJECTS OF THE NATURE AND PRESERVE FUND OF THE REGIONS

Matonov K.,

Doctor of Economic Sciences, Professor, Department of Land Administration and Geographic Information Systems

O.M. Beketov National University of Urban Economy in Kharkiv

Vyatkin R.,

Candidate of technical sciences, assistant of the Department of Land Administration and Geographic Information Systems

O.M. Beketov National University of Urban Economy in Kharkiv

Shterndok E.,

Candidate of Technical Sciences, Senior Lecturer, Department of Land Administration and Geographic Information Systems

O.M. Beketov National University of Urban Economy in Kharkiv

Shterndok A.

Senior forensic expert of the Laboratory of Construction and Technical Research, National Research Center "Institute of Forensic Expertise named after Post Prof. M.S. Bokarius"

DOI: [10.5281/zenodo.10468008](https://doi.org/10.5281/zenodo.10468008)

Анотація

Доведено, що у сучасних надзвичайних умовах, які характеризуються зниженням ефективності використання земель, уповільненням або необґрунтованим формуванням об'єднаних територіальних громад, регіональними диспропорціями, скороченням основних показників функціонування суб'єктів на регіональному рівні, потребує переосмислення підходів до формування та використання земель.

Abstract

It has been proven that in modern emergency conditions, which are characterized by a decrease in the efficiency of land use, a slowdown or unjustified formation of united territorial communities, regional disparities, a reduction in the main indicators of the functioning of subjects at the regional level, there is a need to rethink approaches to the formation and use of land.

Ключові слова: використання земель, об'єкти природно-заповідного фонду регіонів, методи, математичне моделювання, моніторинг.

Keywords: land use, objects of the nature reserve fund of regions, methods, mathematical modeling, monitoring.

У сучасних надзвичайних умовах, які характеризуються зниженням ефективності використання земель, уповільненням або необґрунтованим формуванням об'єднаних територіальних громад, регіональними диспропорціями, скороченням основних показників функціонування суб'єктів на регіональному рівні, потребує переосмислення підходів до формування та використання земель. При цьому особливого значення має вирішення питань та підвищення ефективності використання земель об'єктів природно-заповідного фонду регіонів як важливого чинника регіонального розвитку. Для вирішення представлених складних питань застосовується сучасний моніторинговий інструментарій.

Аналізуючи нормативну базу та проблемні питання стану і перспектив створення та розвитку земель природно-заповідного фонду України [1], відзначають основні сповільнюючі фактори розвитку використання земель.

Характеризуючи теоретичні положення щодо визначення моніторингу використання земель об'єктів природно-заповідного фонду слід відзначити відсутність єдиних підходів до його обґрунтування. Особливої уваги заслуговує правовий підхід до визначення моніторингу земель об'єктів природно-заповідного фонду. У своїх наукових розробках автори Василюк О., Костюшин В., Коломицев Г. Дейнега М. Кагало О. досліджували вплив правового режиму на використання та моніторинг охоронних земель України.

Кожен вид моніторингу екомережі має свої особливості, наприклад:

- моніторинг земель екомережі - система спостереження за станом земельного фонду екомережі для своєчасного виявлення змін, їх оцінки, попередження та усунення наслідків негативних процесів
- моніторинг лісових об'єктів природно-заповідного фонду - система спостережень, оцінки та прогнозу стану і динаміки лісового фонду об'єкту або декількох об'єктів природно-заповідного фонду.
- моніторинг водних об'єктів природно-заповідного фонду - система регулярних спостережень за гідрологічними, гідрогеологічними і гідрогеохімічними показниками стану об'єктів природно-заповідного фонду, що забезпечує збір, передачу і обробку отриманої інформації з метою своєчасного виявлення негативних процесів, прогнозування їх розвитку, запобігання шкідливих наслідків і визначення ступеня ефективності здійснюваних водоохоронних заходів.
- моніторинг об'єктів тваринного світу екомережі - система регулярних спостережень за поширенням, чисельністю, фізичним станом об'єктів тваринного світу, структурою, якістю і площею середовища їх проживання та ін.
- моніторинг окремих об'єктів природно-заповідного фонду є складовими частинами системи державного, регіонального чи місцевого моніторингу об'єкта екомережі.

У цьому аспекті заслуговує уваги конструктивний підхід до визначення моніторингу земель

об'єктів природно-заповідного фонду, в рамках якого автори [2] визначають структурні елементи екомережі України, порівнюючи її з міжнародними аналогами. З точки зору Чорного М. Г., екомережа України потребує створення категорій (рангів) та поліфункціональності її складових елементів. Такий підхід дозволить привести структуру національної екомережі до міжнародних стандартів.

В рамках комплексного підходу автори [3] стверджують, що найбільш інформативним і достовірним є комплексний екологічний моніторинг об'єктів природно-заповідного фонду. Комплексний екологічний моніторинг об'єктів природно-заповідного фонду - це організація системи спостережень за станом об'єктів екомережі для оцінки їх фактичного рівня забруднення і попередження про можливість утворення критичних ситуацій, шкідливих для її існування чи порушення режиму використання об'єкту.

У результаті систематизації теоретичних підходів до обґрунтування моніторингу використання земель об'єктів природно-заповідного фонду регіонів запропоновано його визначення, який характеризується сукупністю правових, конструктивних, комплексних, організаційних, функціональних та інструментальних напрямів, спрямованих на формування інформаційно-аналітичного й просторового забезпечення щодо стану та рівня використання земель об'єктів природно-заповідного фонду на регіональному рівні із застосуванням методів математичного моделювання, що створює кількісну основу для перманентного відстеження та контролю за використанням об'єктів природно-заповідного фонду.

Математичне моделювання, яке застосовується для формування кількісної основи моніторингу використання земель об'єктів природно-заповідного фонду регіонів включає наступні етапи:

- визначення показників, що впливають на формування моніторингу земель об'єктів природно-заповідного фонду регіонів;
 - встановлення рівня впливу показників на узагальнюючий чинник рівня використання земель об'єктів природно-заповідного фонду регіонів на основі коефіцієнтів кореляції (r) та детермінації (D). Значення коефіцієнтів кореляції варіюються у проміжку від -1 до 1 (якщо однофакторна модель) та від 0 до 1 (якщо багатфакторна модель). Знак мінус визначає напрямок зв'язку – обернений. Отже значення коефіцієнтів кореляції відповідно до рівня зв'язків між чинниками наступні:
- 0 – відсутній зв'язок між чинниками;
 - 0,01 – 0,3 – низький рівень зв'язку між чинниками;
 - 0,301 – 0,6 – посередній рівень зв'язку;
 - 0,601 – 0,99 – високий рівень зв'язку;
 - 1 – абсолютний рівень зв'язку між чинниками.
- Коефіцієнт детермінації визначається за моделлю:

$$D = r^2.$$

- побудова математичної моделі впливу показників на узагальнюючий чинник рівня використання земель об'єктів природно-заповідного фонду

регіонів;

- визначення критеріїв адекватності математичної моделі;
- інтерпретація отриманих результатів.

Визначені критерії адекватності:

t – критерій Ст'юдента - застосовується модель:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{m_1^2 + m_2^2}}$$

де \bar{X}_1, \bar{X}_2 – середні значення середніх арифметичних показників, відн. од.;

m_1^2, m_2^2 – значення статистичних помилок середніх арифметичних, відн. од.

t – критерій Ст'юдента визначає достовірність й повноту встановлених зв'язків між незалежним чинником (X_i) та залежною змінною (y). Визначається розрахункове значення t – критерію Ст'юдента, яке порівнюється із табличним (нормативним) значенням. Якщо фактичне значення перевищує нормативне, то робиться висновок про достовірність і повноту встановлених зв'язків. У протилежному випадку – незалежна змінна або незалежні змінні не включаються у математичну модель.

F – критерій Фішера – використовується модель:

$$F = \frac{r_{xy}^2}{1 - r_{xy}^2} \times (n - 2),$$

де r_{xy}^2 – коефіцієнт парної кореляції між залежною і незалежною змінними, відн. од.;

n – кількість спостережень, відн. од.

F – критерій Фішера обґрунтовує доцільність встановлених зв'язків між залежною і незалежною змінними. Визначається розрахункове значення критерію, яке порівнюється із (табличним) нормативним значенням. У випадку перевищення розрахункового значення над нормативним, то підтверджується доцільність встановлених зв'язків. У протилежному випадку приймається рішення щодо неадекватності розробленої математичної моделі.

Критерії перевірки на гомо або гетероскедастичність - визначаються за наступними етапами:

1. Формування груп спостережень (X).
2. Визначення суми квадратів відхилень за кожною групою спостережень:

$$S_{xi} = \sum_{i=1}^k (X_i - \bar{X}_i)^2,$$

де S_{xi} – суми квадратів відхилень за кожною групою спостережень.

3. Визначення суми квадратів відхилень в цілому за всіма вибірками:

$$\sum_{t=1}^k S_t = \sum_{i=1}^{n_t} \sum_{i=1}^k (S_{xi}),$$

де S_t – суми квадратів відхилень в цілому за всіма вибірками.

4. Визначення критерію:

$$\delta = \frac{\prod_{i=1}^k \left(\frac{S_t}{n_t} \right)^{n_t/2}}{\left(\sum_{t=1}^k S_t / n \right)^{n/2}},$$

де n – загальна кількість спостережень;

n_t – кількість спостережень t -ої групи.

5. Оцінка критерію:

$$\lambda = -2 \ln \delta.$$

Здійснюється перевірка на залишків для кожного із спостережень математичної моделі на наявність постійної дисперсії. Визначається критерій λ . Якщо його значення перевищує табличне (нормативне) значення t – критерій Ст'юдента, то спостерігається гетероскедастичність і непостійна дисперсія. У математичній моделі існують неоднорідність розподілу залишків і існують погрешності щодо визначення критеріїв, тобто гетероскедастичність. У протилежному випадку ($\lambda < t$) – гомоскедастичність, модель вважається адекватною.

Критерій Дарбіна-Уотсона (DW) - визначення критерію Дарбіна-Уотсона здійснюється за наступними етапами:

1. Визначається специфікація математичної моделі та формується відповідна система спостережень.
2. Формується система рівнянь для оцінки параметрів моделі.
3. Побудова математичної моделі залежності між незалежними і залежними змінними.
4. Визначення фактичного значення моделі (Y_X).
5. Порівняння фактичного значення моделі (Y_X) із вхідними значеннями (Y).
6. Оцінка коефіцієнту h_i :

$$h_i = Y_i - Y_{xi}.$$
7. Визначення різниці між $h_i - h_{i-1}$.
8. Множення показників $h_i \times h_{i-1}$.
9. Визначення квадрату відхилень показників h :

$$(h_i - h_{i-1})^2.$$

10. Оцінка квадрату h^2 .
11. Узагальнення отриманих результатів в відповідній таблиці.
12. Оцінка критерію Дарбіна – Уотсона:

$$DW = \frac{\sum_{i=1}^n (h_i - h_{i-1})^2}{\sum_{i=1}^n (h_i)^2}.$$

Отримане фактичне значення DW порівнюється із визначеними зонами, визначаються два нормативних значень DW_1, DW_2 (залежно від рівня значущості, кількості спостережень та кількості факторів):

- якщо виконується співвідношення ($0 < DW < DW_1$), то наявна автокореляція;
- якщо виконується співвідношення ($DW_1 < DW < DW_2$ або $4 - DW_2 < DW < 4 - DW_1$) визначається зона невизначеності, не можна зробити висновку або про наявність, або про відсутність автокореляції;
- якщо $4 - DW_1 < DW < 4 - DW_2$ – від'ємна автокореляція;
- якщо $DW_1 < DW < 4 - DW_2$ – відсутня автокореляція [4].

Критерій Дарбіна-Уотсона застосовується для перевірки залишків на автокореляцію. Модель вважається адекватною, коли розрахункове значення

критерію Дарбіна-Уотсона знаходиться у проміжку, де відсутня автокореляція.

Перевірка на мультиколінеарність - будується матриця коефіцієнтів кореляції, здійснюється аналіз їх значень та рівень взаємного впливу між незалежними змінними. Відповідно до значень коефіцієнтів парної кореляції незалежних факторів встановлюється рівень їх взаємного впливу. Визначені діапазони значень, які відповідають рівню мультиколінеарності:

0 – відсутня мультиколінеарність;
 0,01 – 0,3 – низький рівень мультиколінеарності;
 0,301 – 0,6 – помірний рівень мультиколінеарності;
 0,601 – 0,99 – високий рівень мультиколінеарності;

1 – абсолютний рівень.

Якщо значення коефіцієнтів парної кореляції знаходяться у діапазоні від 0,601 до 1, то один із незалежних факторів виключається із математичної моделі.

У інших випадках, коли значення коефіцієнтів парної кореляції незалежних факторів знаходяться у діапазоні від 0 до 0,6 робиться висновок про відсутність мультиколінеарності та про адекватність математичної моделі.

Запропонована схема застосування методів щодо формування інформаційно-аналітичного забезпечення моніторингу використання земель об'єктів природно-заповідного фонду регіонів на основі математичного моделювання (рис. 1).

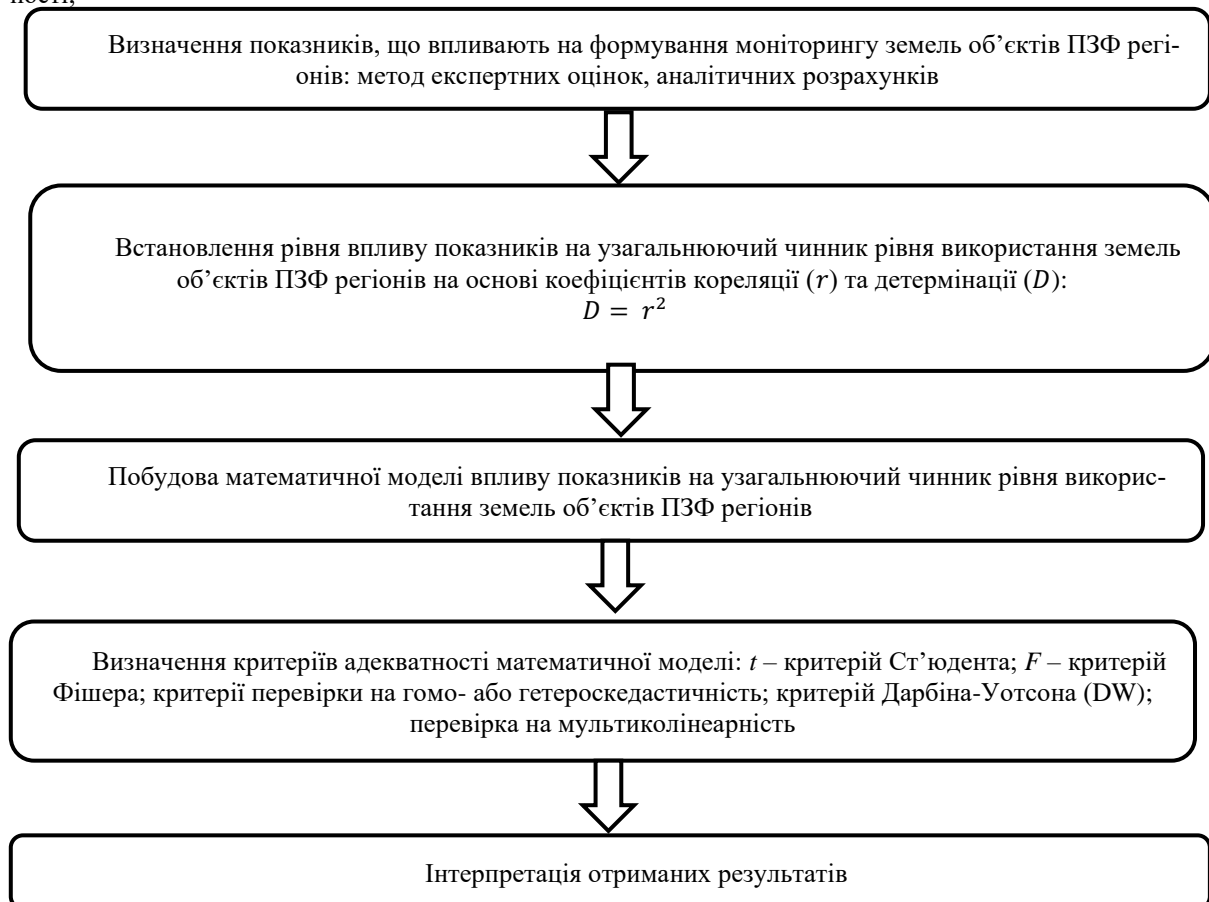


Рис. 1 – Схема застосування методів щодо формування інформаційно-аналітичного забезпечення моніторингу використання земель об'єктів природно-заповідного фонду регіонів на основі математичного моделювання

Таким чином, запропоновано для оцінки рівня використання земель об'єктів природно-заповідного фонду регіонів застосовувати методи математичного моделювання, які включають сукупність взаємопов'язаних етапів, спрямованих на встановлення зв'язків між чинниками, що дозволяє сформувати кількісну основу для їх прогнозування і розробки науково обґрунтованих рекомендацій щодо формування інформаційно-аналітичного забезпечення моніторингу використання земель об'єктів природно-заповідного фонду регіонів.

Базуючись на теоретичних положеннях, визначені напрями розробки системи моніторингу використання земель об'єктів природно-заповідного фонду України, які враховують комплекс інформаційно-аналітичних та просторових даних про стан об'єктів природно-заповідного фонду з використанням сучасних методів аналізу та обробки даних, інструментів візуалізації та автоматизованих систем вивчення стану та динаміки змін екомережі.

Список літератури

1. Мірошніченко О.В., Артамонов В.А. Інституційні проблеми створення та розвитку об'єктів природно-заповідного фонду України. Всеукр. екол. ліга. К.: Аспект-Поліграф. 2013. № 6 С. 5–8.
2. Ващишин М.Я., Шарван О.О. Вплив законодавства ЄС на розвиток законодавства України про національну екологічну мережу. Сучасні тенденції розвитку національного законодавства України: Збірник тез міжнародної науково-практичної конференції, присвяченої 10-річчю створення юридичного факультету НУБіП (19–20 травня 2011 р.). 2011. 268 с.
3. Андрієнко Т.Л., Онищенко В.А., Клестов М.Л. Система категорій природно-заповідного фонду України та питання її оптимізації. К.: Фітосоціоцентр, 2001. 60 с.
4. Петрук Т.М. Методичні рекомендації до написання модуля 2 з курсу «Економетрика» для студентів спеціальностей БФ, БОФ, МЕ. Львівський інститут економіки і туризму. Львів, 2013, 53 с. URL: <https://www.google.com.ua/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&cad=rja&uact=8&ved=2ahUKewj>.

VETERINARY SCIENCES

CLINICAL AND THERAPEUTIC OBSERVATIONS IN PARASITIC DERMATITIS IN DOGS AND CATS

**Băcescu B.,
Slătineanu C.**

*Lect. Dr, Parasitology Dpt, Faculty of Veterinary Medicine,
Spiru Haret University, Bucharest.
DOI: [10.5281/zenodo.10468014](https://doi.org/10.5281/zenodo.10468014)*

Abstract

The investigations were conducted on 115 dogs with skin wounds and 46 cats with external otitis and was conducted through clinical examination, microscopic examination of the curetted material obtained from the skin and of the cerumen collected from the outer auditory duct. The diagnosed acarioses were treated with miticide solutions, emulsions and ointments applied daily or at 2-3 days intervals, until healing. In the generalised clinical forms, a general therapy was started with antibiotics, according to the antibiogram, immunostimulants, liver protectors, vitamin- mineral therapy and a proper feeding. The microscopic examination conducted on 115 dogs with skin wounds showed dermatitis with parasitic etiology in 58 dogs (50.4%), of which 29.3% with sarcoptic mange and 70.6% with demodicosis. Otodectic mange was noticed in 17.3% of the examined cats, of which 37.5% in Persian cats.

Keywords: sarcoptic mange, otodectes, dogs, cats, demodicosis.

INTRODUCTION

The increased incidence of parasitic dermatitis in dogs and cats produced by acari was noticed by many authors (Meleney, Nayak, Castro). In some geographical areas the sarcoptic mange is the most frequent clinical form of manifestation of dermatitis in dogs (Nayak, 1997). The zoonotic character of the sarcoptic mange was noticed in 30-50% of the children coming into contact with infested dogs and it manifested as pruritus papules on the forearms, ankle, thighs or abdomen. The otodectic mange was noticed more frequently in the cats than in dogs, the prevalence being 25% (Castro, 2005).

Demodex canis is considered to be a skin symbiont in the healthy dogs, because this species has been identified in 60% of the microscopic preparations from curetted material obtained from the skin of lesion-free dogs. The symbiotic balance is broken when factors occur which decrease the resistance of the organism, frequently the state of immunodepression (Hamman, 2004).

Demodex canis has an immunosuppressive effect, and by its irritative mechanical action it causes a hypersecretion of sebum which is favourable to the multiplication of the acari; it also has a pyogenic effect which contributes to the purulent aspect of the secretions from the wet form of the demodicosis (Hamman, 2004). The onset of demodicosis is favoured by the congenital or acquired hypoactivity of the T lymphocytes as proven by the experiments conducted on dogs used to reproduce tumours, which receive antilymphocyte serums which produce the onset of acariasis. Nayak et al. (9) reported a 60% incidence of demodicosis in puppies below the age of one year, 23% in the dogs aged 1-2 years and 17% in the dogs over 2 years.

MATERIAL AND METHODS

The investigations conducted during February 2017 – April 2018 at the clinic of the Faculty of Veterinary Medicine of the Spiru Haret University, Bucharest, on a total of 115 dogs of different breeds and ages

with skin lesions and on 46 cats with external otitis. The animals have been examined clinically to determine the body regions that are affected and the aspect of the lesions.

The acari species has been identified by the microscopic examination of the preparations made from curetted material obtained from the skin and of the cerumen collected from the outer auditory duct. The microscopic preparations were cleared with sodium hydroxide 10%.

The incidence of acariasis in dogs and cats was classified according to the evolutive clinical forms by age categories and breeds. The following therapeutic designs were used to control the acariasis diagnosed in the dogs and cats:

- the dogs with sarcoptic mange were treated with doramectin, 4-5 SC administrations at 10 days, associated with a local therapy with amitraz 1%, 4-5 applications at 2-3 days;

- the local demodicosis was treated with doramectin, 3 SC administrations at 10 days, and 4-5 local applications with amitraz 1%;

- the generalised demodicosis was treated for 60-90 days by parenteral administration of doramectin, immunostimulants (Levamisol), liver protecting agents, vitamin-mineral therapy (vitamin A, biotin, Se, Zn) and antibiotics associated with local applications with amitraz 1%;

- the auricular mange in cats was treated by cleaning the outer auditory duct of the cerumen, followed by daily local instillations with one of the specific products, Oticure, Mitex or Otoguard

Results and discussion

- The incidence of the parasitic dermatitis in the group of 115 dogs: 58 dogs (50.4%) have been diagnosed with the parasitic aetiology.

- The incidence of acariasis observed in 58 dogs: 29.4% were diagnosed with sarcoptic mange and 70.6% with demodicosis

- The highest prevalence was noticed in puppies aged 1-6 months (41.1%), 11.7% in 7-11 months old puppies and in dogs aged 8-10 years, and 17.6% in 1-6 years old dogs.

The localized demodicosis was observed in 43.9% of the infested dogs, the generalized form in 24.3% of the dogs; the localised suprainfected demodicosis was

observed in 4.8% of the infested dogs, while the generalised suprainfected form in 26.8% of the dogs.

The incidence of demodicosis by age category was as follows: the highest prevalence was noticed in the puppies aged 3 – 11 months (41.4%), followed by 36.5% in the dogs 1-2 years old, 17.3% in the dogs aged 3-5 years and 4.8% in the dogs aged 6-8 years



Fig 1. Demodicosis – localized simply form



Fig 2. Demodicosis- generalized suprainfected

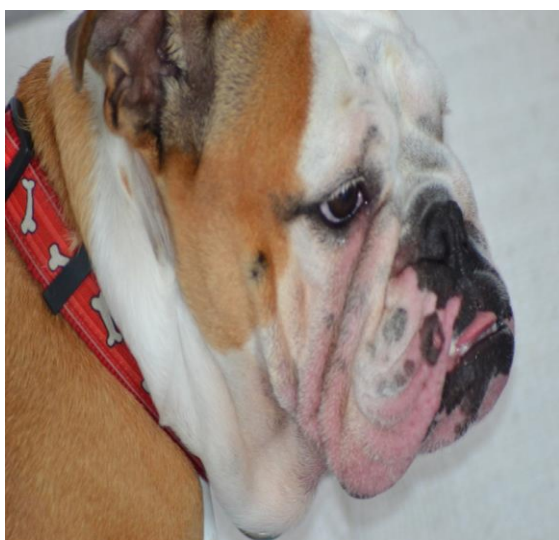


Fig.3. Demodicosis – localized simply form alopecia complicated



Fig 4. Demodicosis- generalized suprainfected form

CONCLUSIONS

1. Dermatitis with parasitic aetiology were reported in 50.4% of the dogs with skin lesions that were examined.
2. Sarcoptic mange was diagnosed in 29.4% and demodicosis was diagnosed in 70.6% of the dogs with ectoparasitoses;
3. 78.04% of the demodicosis cases were reported in dogs aged 3 months – 2 years;
4. 17.3% of the cats with external otitis were diagnosed with otodectic mange
5. The general and local treatment applied to the generalised wet demodicosis was 98% efficient;

References

1. Castro R. et all.(2005) – Retrospective study of canine and feline scabies presented in Sao – Paulo in the period 1984 – 2002. Brazilian Jour. Vet. Res. and Animal Science 42, (2),135 – 142.
2. Franco M.B., Hamann W.(2004) – Doramectin in the treatment of dogs with sarcoptic mange and gastrointestinal nematodes , Archives of Vet. Science 9, (1), 23 – 29.
3. Meleney W.P. (1985) – Mange mite and other Parasitic Mite, In Gaafar Parasites, Pests and Predators Elsevier, Amsterdam.
4. Nayak D.C.et all.(1997) – Prevalence of canine demodicosis in Orissa (India) Vet. Parasitol. 73, (3/4), 347 – 352.
5. Rataj A.V., (2004) – Ectoparasites: Otodectes cynotis, in the ear of cats, Slovenian, Vet., Rec. 41, (2), 89 – 92.

No 128 (128) (2023)

The scientific heritage

(Budapest, Hungary)

The journal is registered and published in Hungary.

The journal publishes scientific studies, reports and reports about achievements in different scientific fields.

Journal is published in English, Hungarian, Polish, Russian, Ukrainian, German and French.

Articles are accepted each month.

Frequency: 24 issues per year.

Format - A4

ISSN 9215 — 0365

All articles are reviewed

Free access to the electronic version of journal

Edition of journal does not carry responsibility for the materials published in a journal.

Sending the article to the editorial the author confirms it's uniqueness and takes full responsibility for possible consequences for breaking copyright laws

Chief editor: Biro Krisztian

Managing editor: Khavash Bernat

- Gridchina Olga - Ph.D., Head of the Department of Industrial Management and Logistics (Moscow, Russian Federation)
- Singula Aleksandra - Professor, Department of Organization and Management at the University of Zagreb (Zagreb, Croatia)
- Bogdanov Dmitrij - Ph.D., candidate of pedagogical sciences, managing the laboratory (Kiev, Ukraine)
- Chukurov Valeriy - Doctor of Biological Sciences, Head of the Department of Biochemistry of the Faculty of Physics, Mathematics and Natural Sciences (Minsk, Republic of Belarus)
- Torok Dezso - Doctor of Chemistry, professor, Head of the Department of Organic Chemistry (Budapest, Hungary)
- Filipiak Pawel - doctor of political sciences, pro-rector on a management by a property complex and to the public relations (Gdansk, Poland)
- Flater Karl - Doctor of legal sciences, managing the department of theory and history of the state and legal (Koln, Germany)
- Yakushev Vasilii - Candidate of engineering sciences, associate professor of department of higher mathematics (Moscow, Russian Federation)
- Bence Orban - Doctor of sociological sciences, professor of department of philosophy of religion and religious studies (Miskolc, Hungary)
- Feld Ella - Doctor of historical sciences, managing the department of historical informatics, scientific leader of Center of economic history historical faculty (Dresden, Germany)
- Owczarek Zbigniew - Doctor of philological sciences (Warsaw, Poland)
- Shashkov Oleg - Candidate of economic sciences, associate professor of department (St. Petersburg, Russian Federation)
- Gál Jenő - MD, assistant professor of history of medicine and the social sciences and humanities (Budapest, Hungary)
- Borbély Kinga - Ph.D, Professor, Department of Philosophy and History (Kosice, Slovakia)
- Eberhardt Mona - Doctor of Psychology, Professor, Chair of General Psychology and Pedagogy (Munich, Germany)
- Kramarchuk Vyacheslav - Doctor of Pharmacy, Department of Clinical Pharmacy and Clinical Pharmacology (Vinnytsia, Ukraine)

«The scientific heritage»

Editorial board address: Budapest, Kossuth Lajos utca 84,1204

E-mail: public@tsh-journal.com

Web: www.tsh-journal.com