MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
ODESSA NATIONAL UNIVERSITY NAMED I. I. MECHNYKOV
Department of Marine Geology, Hydrogeology, Engineering Geology and Paleontology

"ЗАТВЕРДЖУЮ"
Проректор з науково-педагогічної роботи
_____ Олександр ЗАПОРОЖЧЕНКО
"___" _____ 2022 р.

WORKING PROGRAM OF EDUCATIONAL DISCIPLINE
Advanced Topics in Paleontology, Micropaleontology and Paleoecology».
(name of academic discipline)

Level of higher education: __ Third (educational and scientific)_____
Field of knowledge: ___Natural sciences_____
Specialty: __103 "Earth Sciences"_____
(code and name of specialty(s)
Educational & professional/scientific program: __Earth Sciences_

ONU
2022

Work program of the educational discipline " Advanced Topics in Paleontology, Micropaleontology and Paleoecology»". – Odesa: ONU, 2022. – 13 p.

Developer: Kadurin S.V., PhD in Geology, Associate Professor of the Department Of Marine Geology, Hydrogeology, Engineering Geology and Paleontology.

The Work Program was approved at the meeting of the department

Protocol No. 1 from 1 September 2022

Head of Department _____ (Євген ЧЕРКЕЗ)
(signat (First Name, Surname)

Agreed with the OPP/ONP guarantor _____ (Valentina YANKO)
(First Name, Surname)

Approved by the educational and methodological commission (EMC) of the __Geology-Geography__ Faculty

Protocol No. 1 from 2 September 2022.

Head of EMC _____ __ (Vitaly SYCH)
(signature) (First Name, Surname)

Revised and approved at the meeting of the Department _____Protocol No. __ dated "__" _____ 20__ year

Head of Department _____ (_____)
(signature) (First Name, Surname)

Revised and approved at the meeting of the Department _____Protocol No. __ dated "__" _____ 20__ year

Head of Department _____ (_____)
(signature) (First Name, Surname)

1. Description of academic discipline

<table>
<tr><td rowspan="2">Name of indicators</td><td rowspan="2">Field of knowledge, specialty, specialization, level of higher education</td><td colspan="2">Characteristics of academic discipline</td></tr>
<tr><td>Daytime form of education</td><td>Evening form of education</td></tr>
<tr><td rowspan="15">Total number: credits – 3

Hours - 90

Content modules - 2</td><td rowspan="15">Field of knowledge
10 Natural sciences

Specialty
103 Earth Sciences

Level of higher education:

Third (educational and scientific)</td><td colspan="2">Selective</td></tr>
<tr><td colspan="2">Year of study:</td></tr>
<tr><td>1st</td><td></td></tr>
<tr><td colspan="2">Semester</td></tr>
<tr><td>2d</td><td></td></tr>
<tr><td colspan="2">Lectures</td></tr>
<tr><td>12 hours</td><td></td></tr>
<tr><td colspan="2">Practical work</td></tr>
<tr><td>10 hours</td><td></td></tr>
<tr><td colspan="2">Lab work</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><td colspan="2">Individual work</td></tr>
<tr><td>68 hours</td><td></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Final control
credit</td></tr>
</table>

* the number of hours is identical in daytime and evening forms of education

2. Main goal and tasks of academic discipline

Goal: To form graduate students in-depth knowledge of modern achievements of paleontology, micropaleontology and paleoecology for their further implementation in the practice of Earth Sciences.

Tasks: To teach graduate students about the modern achievements of paleontology, micropaleontology and paleoecology, to form a common point of view on their place in the series of Earth Sciences and to demonstrate their implementation in the practice of scientific research.

The process of studying the discipline is aimed at forming the elements of the following competencies**:**

а) general (GC):

GC 02. Ability to work in an international environment.

GC 04. Ability to generate new ideas (creativity).

GC 05. Ability to apply acquired knowledge in practical situations.

GC 07. Ability to communicate on professional topics with experts from other fields.

б) special (SC):

SC 05. Ability to use the latest information and communication technologies, specialized software in scientific and educational activities.

SC 07. The ability to search, process, analyze and systematize scientific information on the topic of the dissertation, to choose methods and means of solving scientific problems.

SC 09. The ability to independently carry out research activities in the field of geology and related sciences, to interpret the data of one's own scientific research, to relate them to the appropriate theory using modern research methods, information technologies.

SC 10. The ability to demonstrate knowledge of the current state, main trends and perspectives of the development of geological science, to navigate modern problems of scientific research in the field of geology and related sciences, to produce new ideas when solving research and practical problems.

Program learning outcomes (PLO):

PLO 01. Conceptual scientific and practical knowledge of the latest directions of geological research and their critical understanding for the expansion of the information space and the formation of professional consciousness.

PLO 04. The ability to apply conceptual and methodological tools of the subject branches of geology (marine geology, paleontology, engineering geology, hydrogeology, etc.) in one's own research, professional activity and in teaching practice.

PLO 05. The ability to formulate a scientific problem in view of the value orientations of modern society and the state of its scientific development

PLO 07. The ability to plan and carry out competitive experimental and theoretical research and obtain domestic and international grants for them.

As a result of studying the academic discipline, the student must

know:

- the latest views on modern achievements of paleontology, micropaleontology and paleoecology;
- the latest views on modern methods of developing the phylogeny of fossil organisms;
- the latest views on the molecular taxonomy of fossil organisms;
- the difference between classical and environmental micropaleontology;
- the basics of quantitative paleoecological analysis of marine invertebrate complexes.

be able:

- to implement the acquired knowledge in the practice of geological research and teaching activities;
- to build phylogenetic schemes of intelligence of individual groups of organisms;
- use traces of life activity of organisms to reconstruct marine paleoenvironments.

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3. Content of the academic discipline

Content module 1. Modern achievements of paleontology.

Topic 1.1 Little-studied and problematic groups of fossil organisms.

Topic 1.2 Molecular taxonomy of fossil organisms. Genome and its sequencing. The genome of fossil vertebrates. Examples of contradictions between the molecular taxonomy of modern groups of organisms (elephants, mammoths, bulls, etc.) and paleontological data on their kinship.

Topic 1.3 New approach.

Content module 2. Modern achievements of micropaleontology.

Topic 2.1 Environmental micropaleontology.

Topic 2.2 The use of micropaleontological objects to track the pollution of the marine environment by various substances.

Topic 2.3 Use of micropaleontological objects to detect hydrocarbon accumulations under the seabed.

Content module 3. Modern achievements of paleoecology.

Topic 3.1. The latest methods of quantitative paleoecological analysis of marine invertebrate complexes for the purpose of reconstructing paleodepths, paleotemperatures, and other features of ancient basins.

Topic 3.2. The latest methods of paleoichnology. Types of traces. Ichnofacies. The use of traces of life activity of organisms for the reconstruction of marine paleoenvironments.

Topic 3.3. Recent data on biotic crises and mass extinctions. Concept of biotic crisis, its model. Phanerozoic mass extinctions: large (end of the Ordovician, end of the Permian, end of the Triassic, border of the Cretaceous and Paleogene) and small (Frankish / Famennian, Mississippian / Pennsylvanian, etc.), features and possible causes.

4. Structure of academic discipline

Names of topics	Number of hours				
	Daytime form of education				
	Together	Including			
		l	p	lab	i.w.
Content module 1. Understudied and problematic groups of fossil organisms.					
Topic 1.1 Little-studied and problematic groups of fossil organisms.	1	-	2	-	6
Topic 1.2 Molecular taxonomy of fossil organisms. Genome and its sequencing. The genome of fossil vertebrates. Examples of contradictions between the molecular taxonomy of modern groups of organisms (elephants, mammoths, bulls, etc.) and paleontological data on their kinship.	1	-	-	-	6
Topic 1.3 New approaches to the phylogeny of invertebrate and vertebrate animals.	1	-	2	-	8
Content module 2. Modern achievements of micropaleontology.					
Topic 2.1 Environmental micropaleontology.	1	-	-	-	6
Topic 2.2 Use of micropaleontological objects to monitor pollution of marine environment by various substances.	1	-	2	-	8
Topic 2.3 Use of micropaleontological objects to detect hydrocarbon accumulations under the seabed.	1	-	2	-	8
Content module 3. Modern achievements of paleoecology.					
Topic 3.1. The latest methods of quantitative paleoecological analysis of marine invertebrate complexes for the purpose of reconstruction of paleodepths, salinity, paleotemperatures and other features of sea basins.	2	-	2	-	10
Topic 3.2. The latest methods of paleoichnology. Types of traces. Ichnofacies. The use of traces of life activity of organisms for the	2				8

reconstruction of marine paleoenvironments.					
Topic 3.3. Recent data on biotic crises and mass extinctions. Concept of biotic crisis, its model. Phanerozoic mass extinctions, features and possible causes.	2				8
Total hours	**12**	-	10		68

5. Topics of seminar classes

Seminar classes are not provided.

6. Теми практичних занять

No	Topic name	Number of hours
1	Work with little-studied and problematic groups of fossil organisms.	1
2	Construction of phylogenetic schemes of invertebrates and vertebrates on the example of foraminifera and humans.	1
3	Monitoring of pollution of the marine environment by heavy metals, oil, pesticides by foraminifera.	2
4	Contouring of hydrocarbon accumulations under the seabed by meiobenthos.	2
5.	Reconstruction of the paleodepth and salinity of the Black Sea in Quaternary time based on the quantitative paleoecological analysis of foraminiferal complexes.	2
6	The use of traces of life activity of organisms for the reconstruction of marine paleoenvironments.	2
Together		**10**

7. Topics of laboratory classes

Laboratory classes are not provided.

8. Individual work

No	Title of the topic / types of tasks	Number of hours
1	Little-studied and problematic groups of fossil organisms - list and general characteristics / *preparation for the lecture*.	8
2	The concept of the genome and its sequencing. Principles of molecular taxonomy of modern groups of organisms / *preparation for the lecture.*	8
3	Principles of construction of phylogenetic schemes / *preparation for practical training*.	8
4	The difference between classical and ecological micropaleontology / *preparation for the lecture*.	8
5	General data on foraminifera, ostracods and nematodes / *preparation for practical classes*.	8
6	Methods of quantitative paleoecological analysis of marine invertebrate complexes for the purpose of reconstruction of paleodepths, salinity, paleotemperatures and other features of sea basins / *preparation for a lecture*.	8

7	The concept of paleoichnology" purpose, task, practical use / *preparation for practical classes*.	8
8	Prospects of oil and gas capacity of the Black Sea shelf / *preparation for the lecture*.	8
9.	Biotic crises and mass extinctions / *preparation for the lecture*.	4
	Together	**68**

9. Teaching methods

1. Verbal (lectures; explanations, conversations).
2. Visual (illustrating; PowerPoint demonstration; independent observation).
3. Educational collections of fossils stored in Paleontological Museum of Odessa I.I. Mechnikov National University
4. Practical and theoretical knowledge (practical classes).
5. Methods of executive, reproductive and search training at performing individual work.
6. Individual and group consultations..

10. Forms of control and assessment methods (including criteria for evaluating learning outcomes)

Carrying out ongoing and periodic control of students' knowledge. During the ongoing control, the student can receive the maximum mark (5 points) for each topic of the content module and the maximum mark (20 points) for the control paper. For an independent individual task, the maximum score is 20 points. The credit is assessed on a 100-point scale. The final grade in the academic discipline is the total number of points.

Methods of ongoing/periodic control: oral survey, control written works, evaluation of individual task performance, evaluation of calculation problem solving, defense of the results of practical and laboratory works, evaluation of reports, testing (form or computer), evaluation of essays, evaluation of performance of practical skills, etc.

11. Questions for ongoing control

1. Purpose and objectives of academic discipline.
2. Examples of poorly studied and problematic groups of fossil organisms.
3. What is a genome and its sequencing?
4. Principles of molecular taxonomy of fossil organisms.
5. Examples of contradictions between molecular taxonomy of modern foraminifera and paleontological data on their relationship.
6. List of the latest approaches to the phylogeny of invertebrates and vertebrates.
7. Principles of ecological micropaleontology.
8. Micropaleontological objects as indicators of pollution of the marine environment by heavy metals, oil, pesticides.
9. Meiobenthos as an indicator of the presence of hydrocarbon accumulations under the seabed.
10. List of the latest methods of quantitative paleoecological analysis of marine invertebrate complexes and their characteristics.
11. Characteristics of the latest methods of paleoichnology.
12. The use of traces of life activity of organisms for the reconstruction of marine paleoenvironments.
13. Latest data on biotic crises and mass extinctions.

12. Distribution of points received by students

Ongoing and periodical control										
Content module 1			Content module 2			Content module 3			Individual independent task	Total points
T1	T2	T3	T4	T5	T6	T7	T8	T9	26	100
6	6	6	6	6	6	6	6	6		
Test work on the content module 1			Test work on the content module 2			Test work on the content module 3			20	

GENERAL CRITERIA FOR EVALUATING EDUCATIONAL ACHIEVEMENTS OF HIGHER EDUCATION SUCCESS

Excellent	Fully controls the educational material; freely, independently, and reasonably presents it during oral presentations and writing; deeply and comprehensively reveals the content of theoretical issues, while using normative, mandatory, and additional literature; draws independent conclusions, reveals cause-and-effect relationships; independently finds additional information and uses it to implement the tasks set before him; is able to distinguish the essential features of the studied subject by means of operations of synthesis and analysis, identifies cause-and-effect relationships, forms conclusions and generalizations, freely operates with facts and information.	Deeply and comprehensively reveals the essence of practical/calculation tasks, while using normative, mandatory, and additional literature; can reasonably choose a rational way of performing the task and evaluating the results of his own practical activity; performs creative tasks and initiates new ways of implementing them; freely uses acquired theoretical knowledge when analyzing practical material; shows a creative approach to the performance of individual and collective tasks while working independently.

Good	Has a sufficiently complete command of the educational material, presents it reasonably during oral presentations and written answers, while using normative and mandatory literature; when presenting some questions, there is insufficient depth and argumentation, applies knowledge to solve standard situations; independently analyzes, summarizes and systematizes educational information, but certain insignificant inaccuracies and minor errors are allowed.	Correctly solves most of the calculation/test tasks according to the sample; has stable task performance skills.
Satisfactory	Possesses educational material at the reproductive level or reproduces a certain part of the educational material with elements of logical connections, knows the basic concepts of the educational material; has complications during the selection of essential features of the subject when identifying cause.	Can use knowledge in standard situations, has elementary, unstable, task performance skills. Solved half of the calculation/test tasks correctly. The acquirer has complications under the time of selection of essential features of the subject.
Unsatisfactory with the possibility of reassembly	Possesses educational material superficially and fragmentarily (without argumentation and justification); unsystematically singles out random features of the subject; does not know how to perform the simplest operations of analysis and synthesis, make generalizations or conclusions; significant mistakes are made during the answer.	Does not sufficiently disclose the essence of practical tasks, while allowing significant inaccuracies, correctly solves individual calculation/test tasks only with the help of a teacher, lacks formed skills and abilities.
Unsatisfactory with mandatory repeated study of the discipline	Does not know the educational material.	Performs only the elements of the task, needs constant help from the teacher.

Evaluation scale: national and ECTS

Sum of points for all types of training activity	Rating ECTS	Evaluation according to the national scale	
		Exam, course project (work), practice	Test

90 – 100	**A**	Excellent	Credited
85-89	**B**	Good	
75-84	**C**		
70-74	**D**	Satisfactory	
60-69	**E**		
35-59	**FX**	Unsatisfactory with possibility to retake the exam	Unsatisfactory with possibility to retake the test
0-34	**F**	Unsatisfactory with mandatory requirement to retake the course.	Unsatisfactory with mandatory requirement to retake the course.

13. Educational and methodological support

Working program of the academic discipline; syllabus; educational and methodical materials for lectures, lecture notes; multimedia presentations.

14. Recommended literature

Basic

1. Bottjer D. J. Paleoecology: Past, Present and Future. John Wiley & Sons, 2016. 232 p. https://www.academia.edu/36747676/Palaeoecology_Past_Present_and_Future_Bottjer_2016_ (application date 31.08.2022)
2. Bresler V., Yanko V. Chemical Ecology: A new approach to study living benthic epiphytic foraminifera. J. Foram. Res. 1995. Vol. 25. Issue 3. P. 267-279.
3. Environmental Micropalaeontology / ed. R. Martin. New York, Boston, Dordrecht, London, Moscow: Kluwer Academic Plenum Publishers, 2000. 481 p. (Library of Paleontological Museum, Odessa I.I. Mechnikov National University)
4. Modern Foraminifera / ed. B.K. Sen Gupta. Dordrecht: Kluwer Academic Publishers, 1999.. 371 p. (Library of Paleontological Museum, Odessa I.I. Mechnikov National University)
5. Pawlowski J. Introduction to the Molecular Systematics of Foraminifera. Micropaleontology. 2000. Vol. 46, Supplement 1: Advances in the Biology of Foraminifera. P. 1-12.
6. Topics in Paleobiology / ed. P. J. Harries. Dordrecht: Kluwer Academic Publishers, 2003. 474 p.
7. Yanko V. Quaternary Foraminifera of the Caspian-Black Sea-Mediterranean Corridors: Volume 1 Ponto-Caspian Foraminifera : Monography. Switzerland: Springer, 2022. 409 p. (Library of Paleontological Museum, Odessa I.I. Mechnikov National University)

Additional

8. Foster, W. J., Danise, S., Price, G. D., Twitchett, R. J. Subsequent biotic crises delayed marine recovery following the late Permian mass extinction event in northern Italy. National Academy of Sciences colloquium, “The Future of Evolution,” March 16–20, 2000. https://doi.org/10.1371/journal.pone.0172321 (application date 31.08.2022)
9. Myers N., Knoll H.A. The biotic crisis and the future of evolution. 2001. https://doi.org/10.1073/pnas.09109249 (application date 31.08.2022)

15. Electronic information resources

https://en.wikipedia.org/wiki/Genome
https://en.wikipedia.org/wiki/Extinction_event
https://en.wikipedia.org/wiki/Trace_fossil
https://en.wikipedia.org/wiki/Paleoecology
https://en.wikipedia.org/wiki/Molecular_biology
https://en.wikipedia.org/wiki/Phylogenetic_tree