Taras Shevchenko National University of Kyiv

Institute of Geology

Department: **Geology of mineral deposits**

«APPROVED»
Deputy director on academic work
_____
«_____»_____2019

WORK PROGRAMME OF DISCIPLINE
Earth's evolution

First-year master students

Branch of knowledge: **10 – Natural sciences**
Training direction: **103 – Earth sciences**
Educational level: **Master**
Educational program: **Geology, Geochemistry and mineralogy, Geophysics**
Type of discipline: **Obligatory**

Teaching mode	**full-time studies**
Academic year	2019/2020
Semester	**1**
Number of credits ECTS	**4**
Language of teaching, learning and evaluation	**English**
Form of final control	**modular test**

Lecturer(s): Hrinchenko Oleksandr Victorovych, PhD in geology and mineralogy, Associate professor, Department of geology of mMineral Deposits

20__/20__ a.y. _____(_____) «__»___ 20__
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KYIV – 2019

Author(s): Hrinchenko Oleksandr Victorovych, PhD in geology and mineralogy, Associate professor, Department of geology of mineral deposits

«Approved»

Head of Department of Geology of mineral deposits

_____ (*Zahnitko V.M.*)

Record of the Department meeting

N 8, «13» March, 2019

Approved by Scientific-Methodical Commission of the Institute of Geology

Record of the meeting N 1, «03» September, 2019

Head of the scientific methodical commission _____ (*Demydov V.K.*)

Aim of the discipline – to introduce students with general principles and concepts about the Earth as integrated planetary system that consists of different components – lithosphere, core, mantle, hydrosphere and atmosphere. These interconnected components act as a whole system from the point of view of planetary evolution of the Earth in time and space.

Preliminary requirements:

1. knowledge of the theoretical foundations of regional and global geology
2. be able to analyze current ideas about earth evolution in time and space

Annotation of discipline:

Academic discipline «Earth's evolution» is part of education and professional training program for the education level «master» branch of knowledge 10 - Natural Science of speciality 103 - Earth Sciences, educational program – geology, geochemistry, geophysics.

The discipline is taught in the 1st semester of 1 year Master's degree program in volume - 120 hours (4 credits ECTS) including lectures - 28 hours, seminars – 10 hours, consultations - 2 hours, self-study work - 80 hours. The course content provides two modules and modular test. The discipline finished by modular test.

The tasks of the discipline – to highlight the following issues:

- ideas about the Earth as an unique planet of the Solar system;
- current ideas about evolution of the early Earth;
- peculiar features of Hadean period of Earth evolution;
- typical characteristics of Archean cratons with Ukrainian Shield as one of the examples;
- formation of supercontinents during Proterozoic period of Earth evolution and associated events;
- modern style plate tectonics as tectonic regime typical of Phanerozoic time of Earth evolution

The results of study:

Results (1. to know; 2. to be able)		*Methods of teaching and learning*	*Assessment methods*	*Percentage in the final assessment of the discipline*
1.1	*Current ideas about Earth evolution in time and space*	*Lecture*	*Seminar*	*up to 10 %*
1.2	*Current ideas about Earths in the Solar system and the Universe*	*Lecture*	*Seminar*	*up to 10 %*
1.3	*Current ideas about meteorite classification and primitive Earth composition, .giant impact model and Moon formation.*	*Lecture*	*Seminar*	*up to 10 %*
1.4	*Current ideas about Hadean Earth – Earth's core formation, terrestrial magma oceans, early Earth crust*	*Lecture*	*Seminar*	*up to 10 %*
1.5	*Current ideas about Archean Earth – cratons, greenstone belts, komatiites, reduced atmosphere, flat subduction and sugduction mode;*	*Lecture*	*Seminar*	*up to 10 %*
1.6	*Current ideas about Earth in Proterozoic – supercontinental cycles, atmosphere oxygenation (GOE – great oxidation event), global glaciations (snowbal Earth)*	*Lecture*	*Seminar*	*up to 10 %*
1.7	*Current ideas about Earth in Phanerozoic – modern style plate tectonics, large igneous provinces, mass extinction events*	*Lecture*	*Seminar*	*up to 10 %*
2.1	*Analyze general trends, features and peculiarities of Earth's evolution in time and space*	*Seminar*	*Seminar*	*up to 10 %*
2.2	*Analyze geological paper published in current*	*Seminar*	*Seminar*	*up to 10 %*

	periodicals in English with following preparation of brief summary;			
2.3	*Prepare a presentation in English about fundamental principles of geology with using computer technology and acquire the ability to present a presentation to the audience.*	*Seminar*	*Seminar*	*up to 10 %*

Structure of discipline*: lectures, seminars, self-studying work of student.*

Learning Outcomes and scheduled results of tuition:

According to program Geology

Learning Outcomes / ***Program results of the tuition***	***1.1***	***1.2***	***1.3***	***1.4***	***1.5***	***1.6***	***1.7***	***2.1***	***2.2***	***2.3***
To show ability to adapt and operate in the new situation associated with work in the specialty, ability to generate new ideas in the area of stratigraphy, paleontology, geotectonics, modeling of geological systems, prospectings and mineral deposit exploration, economic geology.	+	+	+	+	+	+	+	+	+	+

According to program Geochemistry and mineralogy

Learning Outcomes / ***Program results of the tuition***	***1.1***	***1.2***	***1.3***	***1.4***	***1.5***	***1.6***	***1.7***	***2.1***	***2.2***	***2.3***
To analyze features of natural and anthropogenic systems and objects of Earth's geospheres.	+		+	+	+					
To know genetal processes of evolution of Earth as space object.		+				+	+	+	+	+

According to program Geophysics

Learning Outcomes / ***Program results of the tuition***	***1.1***	***1.2***	***1.3***	***1.4***	***1.5***	***1.6***	***1.7***	***2.1***	***2.2***	***2.3***
To analyze features of natural and anthropogenic systems and objects of upper part of the Earth's crust and its sedimentary layer, in particular	+				+		+	+		
To be able to communicate with experts and searching authorities of different level in other areas of knowledge, including international context and global information environment.		+	+	+		+			+	+

Scheme of grading forms:

Form of student evaluation:

- semester grading:

1. **Control test – (min - 6, max - 10 grades)**

2 **Control test – (min - 6, max - 10 grades)**

3. **Presentations – (min - 38, max - 60 grades)**

- final assessment (modular test) in form of the written test **(min - 12 , max - 20 grades)**

Final evaluation is in the form of modular test (total score of discipline (maximum 100 grades) is defined as the sum for the systematic work during the semester).

Final evaluation is based on the results of the student's work throughout the semester.

Procedure and evaluation system

	Semesters grades	**Modular test**	**Final grade**
Min	*48*	*12*	*60*
Max	**80**	**20**	**100**

For students who have obtained total grades less than critically-calculated minimum of 40 grades repeated seminar is obligatory for taking the test.

Grading: For admission to the final grading it is obligatory: 1) to pass two control tests; 2) to prepare three oral reports, which can be presented in the form of presentations and abstracts. The final grading is carried out in the form of written modular test.

Assessment:

Conformity scale

Passed	60-100
Fail	0-59

STRUCTURE OF THE DISCIPLINE
PLAN OF LECTURES AND SEMINARS

N	Theme	Hours		
		Lectures	Seminars	Self-studying work
	Module 1. *Formation of the Earth as planetary system*			
1	**Theme 1.** Earth as evolving planetary system.	2	2	10
2	**Theme 2.** Earth in the Universe	2		10
3	**Theme 3.** Solar system and origin of the Earth	4	2	10
4	**Theme 4.** Early Earth and the Moon	4		10
	Test 1			
	Module 2. *Earth's evolution in geologic time*			
5	**Theme 5.** Hadean Earth. Magma ocean and early crust	4	2	10
6	**Theme 6.** Archean Earth. Greenstone belts and cratons	4		10
7	**Theme 7.** Proterozoic Earth. Supercontinents in the Earth's history	4	2	10
8	**Theme 8.** Phanerozoic Earth. Modern style plate tectonics	4		10
	Test 2			
	Modular test		2	
	Total	**28**	**10**	**80**

Total hours of the discipline – *120, that include:*
Lectures – 28
Seminars – 10
Consultations – 2
Self-studying work – 80

RECOMMENDED LITERATURE

Basic:

1) Archean crustal evolution. // Edited by Condie K.C. et al. in: Developments in Precambrian geology, V. 11 – Amsterdam: Elsevier Academic Press – 1994. – 528 p.
2) Best M.G. Igneous and metamorphic petrology. – Malden, USA: Blackwell Science Ltd. – 2003, 2nd ed. – 729 p.
3) Boggs S.Jr. Petrology of sedimentary rocks. – Cambridge, UK: Cambridge University Press. – 2009, 2nd ed. – 600 p.
4) Condie K.C. Plate tectonics and crustal evolution. – Oxford: Butterworth -Heinemann. – 2003, 4th ed. – 282 p.
5) Condie K.C. Earth as an evolving planetary system. – Amsterdam: Elsevier Academic Press – 2005. – 447 p.
6) Earth's oldest rocks. // Van Kranendonk M.J.R. et al. in: Developments in Precambrian geology, V. 15 – Amsterdam: Elsevier Academic Press – 2007. – 1307 p.
7) Proterozoic crustal evolution. // Edited by Windley B.F. et al. in: Developments in Precambrian geology, V. 10 – Amsterdam: Elsevier Academic Press – 1992. – 537 p.
8) Rogers J. J.W., Santosh M. Continents and supercontinents. – New York, USA: Oxford University Press. – 2004 – 289 p.
9) Rollinson H. Early Earth systems: a geochemical approach. – Malden, USA: Blackwell Publishing Ltd. – 2003. – 285 p.
10) Taylor S.R., McLennan S.M. Planetary crusts: their composition, origin and evolution. – Cambridge, UK: Cambridge University Press. – 2009. – 378 p.
11) The Precambrian Earth: tempos and events. // Edited by Naqvi S.M. et al. in: Developments in Precambrian geology, V. 12 – Amsterdam: Elsevier Academic Press – 2004. – 941 p.
12) Wilson M. Igneous petrogenesis. – Dordrecht, The Netherlands: Springer – 2007, 8 ed. – 466 p.

Additional:

13) Allegre C.J. Isotope geology. – Cambridge: Cambridge University Press – 2008. – 512 p.
14) Biogeochemistry // Edited by Schlesinger W.H. et al. in: Treatise on Geochemistry. V. 8 – Amsterdam: Elsevier Academic Press – 2003. – 682 p.
15) Bucher K., Grapes R. Petrogenesis of metamorphic rocks. – Berlin: Springer-Verlag – 2011. – p. 428.
16) Evolution of the Earth. // Edited by Stefenson D. et al. in: Treatise on Geophysics. V. 9 – Amsterdam: Elsevier Academic Press – 2003. – 320 p.
17) Faure G. Principles and applications of geochemistry: A comprehensive textbook for geology students (2^{nd} edition) – Prentice Hall. Publ. – 1998. – 600 p.
18) Fountain D.M., Arculus R., Kay R.W. Continental lower crust. – Amsterdam: Elsevier – 1992. – 486 p.
19) Ganguly J. Thermodynamics in earth and planetary sciences. – Berlin: Springer-Verlag – 2008. – p. 501.
20) Gill R. Igneous rocks and processes. A Practical Guide. – Oxford: Blackwell Publishing. – 2010. – 428 p.
21) Hoef J. Stable isotope geochemistry. – Berlin: Springer-Verlag. – 2009. – 285 p.
22) The oceans and marine geochemistry// Edited by Elderfield H. et al. in: Treatise on Geochemistry. V. 6. – Amsterdam: Elsevier Academic Press – 2003. – 625 p.
23) The Crust // Edited by Rudnick R.L. et al. in: Treatise on Geochemistry. V. 3 – Amsterdam: Elsevier Academic Press – 2003. – 659 p.
24) The Mantle and Core. // Edited by Carlson W.R. et al. in: Treatise on Geochemistry. V. 2 – Amsterdam: Elsevier Academic Press – 2007. – 568 p.

Internet resources: *www.sciencedirect.com; www.blackwell-synergy.com; www.springerlink.com*