THE FIRST HIGHER TECHNICAL UNIVERSITY IN RUSSIA

MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION
Federal State Budgetary Educational Institution of Higher Education
"Saint-Petersburg Mining University"

IOM3 PD APPROVED

IOM3 The Institute of Materials, Minerals and Mining

Approved by
Vice-Rector for Educational Activity
Prof. V.A. SHPENST

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Professional training program

«LITHOLOGICAL AND GENETIC METHODS OF FORECAST OF MORPHOLOGY AND RESERVOIR PROPERTIES OF COLLECTORS DURING PROSPECTING, EXPLORATION AND EXPLOITATION OF HYDROCARBONS»

Specialty: 130303 - *«Oil and gas geology »*

Attendance: Full-time

Course leader:

Head of the Department of Historical and Dynamic Geology I.V. Talovina

Saint-Petersburg
2016

1. GENERAL PROVISIONS

1.1. The purpose and objectives of the training program

Lithological and genetic research methods play an important role in the forecasting, prospecting and exploitation of non-structural (lithologic) traps of hydrocarbons. They allow to determine the morphology of reservoirs and impermeable beds on the basis of a comprehensive study of drill cores and geophysical data.

In this regard, the main purpose of the discipline "Lithological and genetic methods of forecast of morphology and reservoir properties of collectors during prospecting, exploration and exploitation of hydrocarbons" is the development of a theoretical framework and methods of description and analysis of well sections aimed at identifying of geological structure. The objectives of this discipline are:

- theoretical foundations of lithological-genetic analysis for the allocation and description of geological bodies;
- summary of current knowledge about the structure and genesis of geological bodies;
- study of the principles of lithological and genetic analysis aimed to forecast lithologic traps of hydrocarbons;
- using the results of lithological and genetic analysis in prospecting, exploration and exploitation of hydrocarbons.

Duration of training -18 hours (3 days).

Category of trainees - the course is designed for employees of public and private companies, specializing in the field of forecasting, prospecting and exploitation of hydrocarbons.

1.2. Requirements to the course achievement level

As a result of the course "Lithological and genetic methods of forecast of morphology and reservoir properties of collectors during prospecting, exploration and exploitation of hydrocarbons" the trainees should:

- **know** the scientific and methodological basis and the algorithm of the lithological and genetic analysis of oil and gas basins;
- **be able** to document core wells, to implement cameral processing of the collected materials, and on this basis to allocate geological bodies, to reconstruct the conditions of their formation and to forecast lateral changes in their structure;
- **have** an understanding of the possibilities of using the results of lithological and genetic analysis in prospecting, exploration and exploitation of hydrocarbons.

Type of work	Total hours
Total hours of the discipline	**18**
Auditorium training	18
Lectures	10
Laboratory works (LW)	8

1.3. Final assessment

Final assessment of the course - credit.

1.4. Certificates

Trainees are given certificates after completing the short-term professional training program successfully.

2. CONTENTS

2.1. Course structure

№	Discipline units	Lectures, hours	LW, hours
1	Scientific and methodological basis and algorithm of Lithological and genetic analysis of oil and gas basins.	2	-
2	Typization of rocks on primary features as a basis for study of the reservoirs.	2	2
3	The hierarchical system and structure of geological bodies (layer parageneration-geoformation).	2	2
4	Using the results of lithological and genetic analysis for paleogeographic modelling.	2	2
5	Regional and local forecasts of hydrocarbon lithologic traps on the results of lithological and genetic analysis.	2	2

2.2. Learning content

Unit 1. Scientific and methodological basis and algorithm of Lithological and genetic analysis of oil and gas basins. Natural geological bodies. The concept of "sedimentary formation." The concept of levels of organization of geological objects. Systems approach. Theoretical principles of lithologic and genetic analysis, definitions of key terms and concepts, algorithm.

Unit 2. Typization of rocks on primary features as a basis for study of the reservoirs. Initial signs of sedimentary rocks and their possible genetic interpretation. Profile of balance and sedimentary space. The Irwin idealized profile of epicontinental basin and its modifications in the arid and humid types of

lithogenesis. Models of the evolution of sedimentary systems. The principles of lithological-genetic typization of rocks. Review of existing lithological-genetic typizations.

Unit 3. The hierarchical system and structure of geological bodies (layer parageneration-geoformation). Layers as systems of lithotypes (typization and regularity of lateral changes). Paragenerations – systems of layers (description and typization of lateral changes). Geoformations – systems of paragenerations (procedure of allocation, peculiarities of structure). The correlation potential and the genesis of regional cycles of sedimentation forming geoformations.

Unit 4. Using the results of lithological and genetic analysis for paleogeographic modelling. Method of paleogeographic schemes for short time intervals - transgressive and regressive periods in regional or local cycles of sedimentation.

Unit 5. Regional and local forecasts of hydrocarbon lithologic traps on the results of lithological and genetic analysis. Summary of results of lithological and genetic analysis. Charting of correlation schemes of sections, lithological profiles and morphogenetic patterns reflecting border layered structure and morphology changes in the bodies of collectors and impermeable beds.

2.3. Laboratory works

№	Unit number	Laboratory works
1	2	Description of thin sections and samples of sedimentary rocks.
2	2,3,4	Drawing of lithological column with particle size curve for terrigenous rocks, revealing cyclothems (transgressive- regressive sequence of layers).
3	2,3,4	Drawing a lithological column with particle size curve for carbonate rocks, identification of cyclothems (transgressive - regressive sequences of layers).
4	3,4,5	Charting of correlation schemes of sections, lithological and genetic profiles and paleogeographic schemes. Identification of features of lithologic traps.

3. ACADEMIC STAFF INVOLVED IN EDUCATIONAL PROCESS

№	Full Name	Education (high school, year of graduation, specialty)	Position, academic degree, title. Experience in this or a similar field, years	List of major scientific and teaching publications
Course leader				
1	Shchekoldin Roman Anatolievich	Leningrad Mining Institute named after G.V. Plekhanov, 1970, "Geology and Mineral Exploration"	Ass. Prof. of the Department of Historical and dynamic geology, PhD, 30 years	Author of more than 20 scientific papers
Staff of the program				
2	Talovina Irina Vladimirovna	Leningrad Mining Institute named after G.V. Plekhanov, 1994, "Geology and Mineral Exploration"	Prof. of the Department of Historical and dynamic geology, PhD, 15 years	Author of more than 90 scientific papers
3	Tarasenko Anna Borisovna	St. Petersburg State Mining Institute named after G.V. Plekhanov (Technical University), 2009, "Mineralogy, geochemistry, petrography"	Assistant of the Department of Historical and dynamic geology, PhD, 8 years.	Author of more than 20 scientific papers

4. EDUCATIONAL AND METHODOLOGICAL SUPPORT

4.1. Recommended reading

Fundamental:

1. Alekseev V.P. Lithofacies analysis: Study guide to practical exercises and independent work on discipline "Lithology". Ekaterinburg: Izd UGTTA, 2002. 147 pp.

2. Additions to the stratigraphic code SPb.: Publishing House of the total, in 2000.

3. Maslov A.B., Alekseev V.P. Sedimentary formations and sedimentary basins: the manual. Ekaterinburg: Izd UGTTA, 2003. 203 pp.

4. Systematics and classification of sedimentary rocks and their analogues. SPb.: Nedra, 1998. 351c.

5. Stratigraphic Code. Third Edition. SPb .: Publishing House of the total, 2006.

6. Tseysler V.M. Basics facies analysis. M.: SAM, 2009. 150 pp.

7. Schlesinger A.E. Regional seismic stratigraphy. M. Scientific world. 1998.

8. Yapaskurt O.V. The study of sedimentary rocks in the preparation of medium- and small-scale geological maps of a new generation guidelines. Part 1: Theoretical Foundations. M.: MGU, 1998. 167 p.

9. Yapaskurt O.V. Rostovtseva Y.V., Soloviev H.A., Sorokin V.M., Shardanova T.A. The study of sedimentary rocks in the preparation of medium- and small-scale geological maps of a new generation guidelines. Part 2. Genetic analysis of marine shallow and deep cones. M.: Izd MGU, 1998. 162 pp.

Additional:

1. Bush D.A. Stratigraphic traps in sandstones. M.: Mir, 1977. 216 pp.

2. Dragunov V.K., Aynimer A.F., Vasiliev V.I. Fundamentals of sedimentary formations. L.: Nedra, 1974.

3. Delta - a model for the study. / Ed. M. Broussard. Trans. from English. M.: Nedra, 1979. 323 p.

4. Leonov G.L. Bases stratigraphy (2 m). M. Izd. MGU, ie. 1.1973. t.2. 1974

5. Depositional environment and facies: In 2 t. / Ed. X. Reading. Trans. from English. M.: Mir, 1990. T-1. 352; 2 T-384.

6. Romanovsky S. Dynamic modes of sedimentation. Cyclogenesis. L.: Nedra, 1985. 263 pp.

7. SelliR.Ch. The ancient depositional environment. Trans. from English. M.: Nedra, 1989.

8. Modern ideas of theoretical geology, L.: Nedra, 1984.

9. Frolov V.T. Genetic typing of marine sediments. M.: Nedra, 1984.

10. Frolov V.T. Lithology. Bk. 3. M.: MGU, 1995.

11. Hallam E. Interpretation of facies and sequence stratigraphy. Trans. from English. M.: Mir, 1983.
12. Shvanov V.N. Structural analysis of the real-sedimentary formations (Beginning of litomografy). SPb.: Nedra, 1992.

4.2. Course support materials

The basis of the study of the discipline make electronic presentations on each section of the lecture course, specially selected sample collection for laboratory and individual study.

5. COURSE FACILITIES

Specialized auditoriums of the department of historical and dynamic geology and the Center of Continuing Professional Education will be used for the implementation of the program. The lecture halls are equipped with multimedia projectors. The classes for laboratory works are equipped with collections of paleontological and lithological samples. For laboratory works it will be used the Roentgen-Tomographic Laboratory of the department of historical and dynamic geology equipped with two Bruker-Tomographic devices 1272 and 1173 and also computer lab equipped with advanced special software (ArcGIS, CorelDRAW, Petrel, STAP).