

《沉积岩与沉积相》教学大纲

一、基本信息

课程名称：沉积岩与沉积相

课程代码：160101T007

总学时：32

实验学时：0

开课学院：石油学院

课程性质：选修

英文课程名称：Sedimentary rocks and facies

总学分：2

课内学时：32

上机学时：0

适用专业：石油工程

先修课程：普通地质学、岩石学

二、课程简介

《沉积岩与沉积相》是勘查技术与工程专业重要的专业选修课之一。在前期岩石学学习的基础上，本课程将重点讲授沉积相方面的相关知识，通过本课程学习，掌握沉积相概念、不同沉积相类型沉积特征和沉积相模式以及不同沉积相类型的识别方法，了解不同沉积相类型与油气富集之间的关系。

根据沉积岩的原生沉积特点和时空分布规律，阐明沉积岩的物源、沉积岩的成分、沉积岩的结构和构造、沉积相的概念和分类、不同碎屑岩和碳酸盐岩沉积相的基本特征、沉积相模式、主要识别标志和与油气分布之间的关系、沉积岩形成的沉积环境、沉积砂体的时空分布，恢复沉积古地理面貌，预测沉积矿产的有利分布地区。同时，介绍沉积岩和沉积相的综合研究方法。

本课程要求学生在学习该课程后具备以下知识与能力：（1）掌握油气田勘探开发研究中涉及的沉积学基本概念、基本理论和基本方法；（2）具备运用所学知识进行沉积地质研究的基本能力以及较强的创新思维；（3）具有较强的团队合作能力与表达能力；（4）具有自主学习的能力。

三、教学目标

通过课程学习，使学生掌握沉积地质研究的基本概念、基本理论、基本方法及技能，提高学生分析问题和解决问题的能力，为今后从事油田勘探与开发地质工作奠定必要的基础。要求学习本课程后，应达到以下基本要求：

（1）正确理解沉积相涉及的基本概念；

（2）掌握碎屑岩和碳酸盐岩沉积学研究的基本原理与基本方法；掌握碎屑岩和碳酸盐岩沉积相识别的基本方法和技能；掌握建立碎屑岩和碳酸盐岩沉积相模式的基本方法。

（3）能够运用所学知识和技能确定沉积相类型，建立沉积相模式，指导油气勘探开发。

（4）具备分析问题和解决问题的能力以及较强的创新思维，具有较强的团队合作能力与表达能力，具有自主学习的能力。

四、教学内容与学习要求

章节/教学单元		教学内容、重点、难点	学时	学习要求
沉积岩部分				
第一章 绪论	1、沉积岩与沉积岩石学	沉积岩的概念（重点）； 沉积岩的基本特征（难点）；	2	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	2、沉积岩的分类	沉积岩的分类（重点）。		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆

章节/教学单元		教学内容、重点、难点	学时	学习要求
第二章 沉积岩的形成与演化	1、沉积岩原始物质的形成	母岩风化作用的阶段性（难点）； 风化产物类型（重点）；	4	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	2、沉积岩的搬运和沉积作用	碎屑物质的沉积分异作用（重点）； 碎屑物质搬运过程中的变化（难点）。		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	3、沉积后作用的主要类型及其成岩阶段划分	沉积后作用的概念及主要类型（重点）； 压实作用、胶结作用、交代作用、溶解作用的概念及效应（重点）		<input type="checkbox"/> 理解 <input type="checkbox"/> 综合分析
第三章 碎屑岩的成分	1、碎屑岩的成分	碎屑岩的基本组成（重点）；	2	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
第四章 碎屑岩的结构	2、碎屑岩的结构	碎屑岩的结构特征（难点）： (1) 碎屑颗粒结构 (2) 填隙物结构 (3) 孔隙结构	2	<input type="checkbox"/> 理解 <input type="checkbox"/> 综合分析
第五章 碎屑岩的构造和颜色	1、碎屑岩的构造	碎屑岩主要层理类型、特征及其环境意义（重点）； 波痕、槽模等层面构造的特征及环境意义（难点）； 重荷构造、包卷层理等同生变形构造的特征和环境意义（难点）；	4	<input type="checkbox"/> 理解 <input type="checkbox"/> 应用
	2、碎屑岩的颜色	碎屑岩颜色的类型及环境意义（重点）		<input type="checkbox"/> 理解 <input type="checkbox"/> 应用 <input type="checkbox"/> 记忆
第六章 陆源碎屑岩各论	1、砾岩	砾岩的主要成因类型（重点）；	4	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	2、砂岩、粉砂岩	砂岩的分类原则及分类方案（难点）		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	3、粘土岩 4、火山碎屑岩	粘土岩的成分、结构、构造和颜色及分类； 火山碎屑岩的成分、结构、构造和颜色（重点）； 火山碎屑岩的分类和命名原则； 火山碎屑岩的主要岩类和成因类型		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆

章节/教学单元		教学内容、重点、难点	学时	学习要求
沉积相部分				
第七章 绪论	1、沉积相的概念	沉积相的概念（重点）；	1	<input type="checkbox"/> 理解
	2、岩相，沃尔索相律	沃尔索相律（重点）； 相模式及其作用（难点）		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
第八章 山麓-洪积相	1、概念、形态、形成条件、 类型及亚相划分	冲积扇相沉积类型及特征（重点）； 冲积扇的形成条件（重点）； 冲积扇的相模式及鉴定标志（难点）；	1	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	2、与油气关系	冲积扇相与油气的关系（重点）		<input type="checkbox"/> 理解
第九章 河流相	1、河流的分类	河流的分类（重点）；	3	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	2、曲流河亚相划分及沉积 特征	河流相的亚相、微相划分及特征（重 点）；		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	3、其它主要河流类型的沉 积特征	辫状河与曲流河的区别（难点）； 河流相的鉴定标志（难点） 河流相与油气的关系（重点）		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
第十章 湖泊相	1、湖泊沉积环境和分类		1	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	2、陆源碎屑湖泊沉积模式 及亚相类型	湖泊相的亚相、微相划分及特征（重 点）； 湖泊相的沉积模式和鉴定特征（重点）；		<input type="checkbox"/> 理解 <input type="checkbox"/> 应用
	3、主要储集砂体和沉积相 组合 4、湖泊相与油气的关系	湖泊相中的主要储集砂体及其与油气关 系（难点）		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
第十一章 三角洲相	1、概念和主要类型、亚相 类型	三角洲的主要类型及其一般特征（重 点）； 三角洲相的亚相、微相划分及特征（重 点）；	3	<input type="checkbox"/> 理解 <input type="checkbox"/> 应用 <input type="checkbox"/> 记忆
	2、沉积相组合及与油气的 关系	三角洲相的相模式及鉴定标志（难点）； 三角洲相与油气的关系（重点）		<input type="checkbox"/> 理解 <input type="checkbox"/> 应用 <input type="checkbox"/> 记忆 <input type="checkbox"/> 综合分析
第十二章 重力流沉积	1、重力流的概念及形成条 件	重力流的概念、形成条件及主要类型（重 点）；	1	<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆
	2、浊积岩的基本特征	鲍马序列（重点）； 浊积岩的扇相沉积模式（难点） 重力流沉积相模式		<input type="checkbox"/> 理解 <input type="checkbox"/> 记忆

章节/教学单元		教学内容、重点、难点	学时	学习要求
野外实践	红山湖野外实践及探讨		4	<input type="checkbox"/> 理解 <input type="checkbox"/> 应用 <input type="checkbox"/> 综合分析

五、教学方法

基础地质理论以课堂教学为主,矿物和岩石部分内容采用课堂教学和实验室观察相结合方式,构造变形部分采用实物标本和模型相结合方式,培养学生三维空间构型能力。本课程提倡学生广泛阅读参考书和参考文献,实行课堂讲授、自学、实训练习与课堂讨论相结合的教学方法,达到教师精讲、学生宽学多练的学习目的。□

六、考核方式

期末考试: 60%

课后作业: 30%

考勤: 10%

七、教材与参考书

(一) 教材

《沉积岩石学》,第五版,朱筱敏编著,石油工业出版社,2020,ISBN: 978-7-5183-4387-4。

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审核人: 陈刚强

制(修)订时间: 2023年9月

《Sedimentary rocks and facies》 Syllabus

I. Basic Information

Course Name: Sedimentary rocks and facies	Name in Chinese: Sedimentary rocks and facies
Course No.: 160101T007	Total Credits:2
Total Hours: 32	Lecture Hours: 32
Lab Hours: 0	Computer Lab Hours:
Offering College: Petroleum institute	Corresponding Majors: resource exploration engineering
Course Type: Elective	Prerequisite: Physical geology

II. Course Introduction

Sedimentary Rock and Sedimentary Facies is one of the important elective courses for the major of exploration technology and engineering. Based on the previous petrology study, this course will focus on the relevant knowledge of sedimentary facies. Through this course, we will master the concept of sedimentary facies, the sedimentary characteristics and modes of different sedimentary facies types and the identification methods of different sedimentary facies types, and understand the relationship between different sedimentary facies types and oil and gas enrichment.

According to the laws of the primary sedimentary characteristics and time-space distribution of sedimentary rocks, expounds the source of sedimentary rocks, sedimentary rocks of the composition, structure and texture of sedimentary rock, the concept and classification of sedimentary facies, clastic rock and carbonate rock the basic features of sedimentary facies, sedimentary facies model, main identification marks and with the relationship between the oil and gas distribution, sedimentary formation, sedimentary environment, sedimentary sand body of time and space distribution, Restore sedimentary palaeogeographic features and predict favorable distribution areas of sedimentary minerals. At the same time, the comprehensive research methods of sedimentary rocks and sedimentary facies are introduced.

This course requires students to acquire the following knowledge and abilities : (1) master the basic concepts, theories and methods of sedimentology involved in oil and gas field exploration and development research; (2) Have the basic ability to use the knowledge learned to conduct sedimentary geology research and strong innovative thinking; (3) Strong team work and presentation skills; (4) Have the ability of independent learning.

III. Course Objective

Through the course learning, students can master the basic concepts, basic theories, basic methods and skills of sedimentary geology research, improve their ability to analyze and solve problems, and lay a necessary foundation for future oilfield exploration and development geology work. Upon completion of this course, the following basic requirements should be met:

- (1) Correctly understand the basic concepts involved in sedimentary facies;
- (2) Master the basic principles and methods of clastic and carbonate sedimentology; Master the basic methods and skills of clastic and carbonate sedimentary differentiation; To master basic methods for establishing sedimentary facies models of clastic and carbonate rocks.
- (3) To use the knowledge and skills learned to determine sedimentary facies types, establish sedimentary facies models, and guide oil and gas exploration and development.
- (4) Have the ability to analyze and solve problems, strong innovative thinking, strong

teamwork and expression skills, and independent learning ability.

IV. Contents and Requirements

Chapter/teaching unit		Teaching content, key points and difficult points	Hours	Study requirement
Sedimentary Rocks Part				
Chapter 1 Introduction	1. Sedimentary rocks and sedimentary petrology	Concept of sedimentary rocks ; Basic characteristics of sedimentary rocks ;	2	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	2. Classification of sedimentary rocks	Classification of sedimentary rocks		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
Chapter 2 Formation and evolution of sedimentary rocks	1, the formation of the original material of sedimentary rock	Stages of parent rock weathering ; Types of weathering products ;	4	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	2. Transportation and sedimentation of sedimentary rocks	Depositional differentiation of clastic materials ; Changes in detrital material transport.		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	1. Main types of post-deposition and Diagenetic stage	The concept and main types of post-sedimentary processes; Concepts and effects of Compaction, cementation, metasomatism and dissolution		<input type="checkbox"/> Understand <input type="checkbox"/> Comprehensive analysis
Chapter 3 Composition of clastic rocks	1. Composition of clastic rocks	Basic composition of clastic rocks ;	2	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
Chapter 4 Structure of clastic rocks	1. Structure of clastic rocks	Structural characteristics of clastic rocks (difficult points) : (1) Clastic grain structure (2) interstitial structure (3) Pore structure	2	<input type="checkbox"/> Understand <input type="checkbox"/> Comprehensive analysis
Chapter 5 The structure and color of clastic rocks	1. Structure of clastic rocks	The main bedding types, characteristics and environmental significance of clastic rocks ; Characteristics and environmental significance of plane structure such as ripple mark and groove mode; The characteristics and environmental	4	<input type="checkbox"/> Understand <input type="checkbox"/> Application

Chapter/teaching unit		Teaching content, key points and difficult points	H o u r s	Study requirement
		significance of heavy load structure, enrolling bedding and generative deformation structure;		
	2. Color of clastic rock	Color types of Clastic rocks and their Environmental Significance		<input type="checkbox"/> Understand <input type="checkbox"/> Application <input type="checkbox"/> Memorize
Chapter 6 A monograph on terrigenous clastic rocks	1. The conglomerate	Main genetic types of conglomerate	4	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	2. Sandstone, siltstone	Classification principle and Scheme of Sandstone		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	3. Clay rock	The composition, structure, structure, color, and classification of clay rock		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	4. Pyroclastic rock	Composition, structure, structure, and color of volcanic clastic rocks Classification and naming principles of volcanic clastic rocks; Main rock types and genetic types of volcanic clastic rocks		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
Sedimentary Facis Parts				
Chapter 7 introduction	1. Concept of sedimentary facies	Concept of sedimentary facies; Wolthau phase law ;	1	<input type="checkbox"/> Understand
	2, lithofacies, Wolsault phase law	Law of the Correlation (or Succession) of Facies Faces modes and their Functions.		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
Chapter 8 Alluvial (diluvial) fan facies	1.Concept, morphology, formation condition, type and subfacies division	Sedimentary types and characteristics of alluvial fan facies; Formation conditions of alluvial fans; Phase model and identification mark of alluvial fan;	1	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	2、Relationship with oil and gas	Relationship between alluvial fan facies and oil and gas		<input type="checkbox"/> Understand
Chapter 9 Fluvial	1. Classification of rivers	Classification of Rivers	3	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize

Chapter/teaching unit		Teaching content, key points and difficult points	H o u r s	Study requirement
facies	2. Subfacies division and sedimentary characteristics of meandering river	Subfacies, microfacies division and characteristics of fluvial facies ;		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	3. Sedimentary characteristics of other major river types	The difference between braided river and meandering river ; Identification marks of fluvial facies; Relationship between Fluvial facies and oil and Gas		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
Chapter 10 Lacustrine Facies	1 、 Lake sedimentary environment and classification	Lake sedimentary environment and classification	1	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
	2. Sedimentary models and subfacies types of terrigenous clastic lake	Subfacies, microfacies division and characteristics of lacustrine facies; Sedimentary model and identification characteristics of lacustrine facies ;		<input type="checkbox"/> Understand <input type="checkbox"/> Application
	3. Main reservoir sand bodies and sedimentary facies assemblages 4. Relationship between lacustrine facies and oil and gas	Main reservoir sand bodies in lacustrine facies and their relationship with oil and gas		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
Chapter 11 Delta facies	1. Concept and main types and subfacies types	Main types of deltas and their general characteristics; Subfacies, microfacies division and characteristics of delta facies ;	3	<input type="checkbox"/> Understand <input type="checkbox"/> Application <input type="checkbox"/> Memorize
	2. Sedimentary facies association and its relationship with oil and gas	The facies model and identification mark of delta facies ; Relationship between Delta facies and oil and gas		<input type="checkbox"/> Understand <input type="checkbox"/> Application <input type="checkbox"/> Memorize <input type="checkbox"/> Comprehensive analysis
Chapter 12. Gravity flow	1. Concept and formation conditions of gravity flow	The concept, formation conditions and main types of gravity flow;	1	<input type="checkbox"/> Understand <input type="checkbox"/> Memorize

Chapter/teaching unit		Teaching content, key points and difficult points	H o u r s	Study requirement
sedimentary facies model	2. Basic characteristics of turbidite	Bauma sequence ; Fan facies sedimentary model of turbidite Gravity flow sedimentary facies model		<input type="checkbox"/> Understand <input type="checkbox"/> Memorize
Field practice	Field Practice and Exploration of Hongshan Lake		4	<input type="checkbox"/> Understand <input type="checkbox"/> Application <input type="checkbox"/> Comprehensive analysis

V. Teaching Method

The basic geological theory is based on classroom teaching, the mineral and rock part adopts the combination of classroom teaching and laboratory observation, and the structural deformation part adopts the combination of physical specimens and models, so as to cultivate students' ability of THREE-DIMENSIONAL space configuration. This course encourages students to read reference books and literature extensively, and implements the teaching method of combining classroom teaching, self-study, practical training and classroom discussion, so as to achieve the learning purpose of teachers' intensive teaching and students' wide learning and more practice.

VI. Evaluation

Final exam: 60%

Homework: 30%

Attendance: 10%

VII. Textbook and Reference

Sedimentology (5th edition)

Edited by Zhu Xiaomin et al. Petroleum Industry Press, 2020