

26414 - Sedimentary Processes and Environments

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	296 - Degree in Geology
ECTS	9.0
Course	2
Period	Annual
Subject Type	Compulsory
Module	---

1. Basic info

1.1. Recommendations to take this course

1.2. Activities and key dates for the course

2. Initiation

2.1. Learning outcomes that define the subject

2.2. Introduction

3. Context and competences

3.1. Goals

3.2. Context and meaning of the subject in the degree

3.3. Competences

3.4. Importance of learning outcomes

4. Evaluation

5. Activities and resources

5.1. General methodological presentation

The main objective of the course is the description and the interpretation of present and ancient sedimentary environments. The course is developed using some descriptive concepts seen in the previous course "Stratigraphic analysis", but including detailed descriptive and interpretative subjects concerning facies and sedimentary processes and environments. These concepts are useful for the development of other stratigraphic and geological sciences (i.e., Stratigraphy, Basin analysis...). By means of individual and team works, the students will improve their knowledge and ability to work on theoretic and practical subjects related to the Stratigraphy, Sedimentology and Basin analysis.

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5.2. Learning activities

The learning activities encompass lectures, laboratory practices and field practices. These activities are detailed in section 5.3:

1) Lectures (45 h), including 3 modules:

Module I. Sedimentary processes

Module II. Continental sedimentary environments

Module III. Marine sedimentary environments

2) Laboratory practices (25 h), developed in 9 modules:

1. Granulometric analysis

2. Paleocurrent analysis

3. Genetic analysis of sedimentary structures

4. Sequential analysis

5. Interpretation of sedimentary logs in continental and transitional sedimentary environments

6. Genetic analysis of present carbonate sediments

7. Genetic analysis of carbonate rocks in polished- and thin-sections

8. Interpretation of sedimentary logs in marine sedimentary environments

9. Oral presentation of the seminars

3) Field practices (48 h), including 3 main modules:

1. Cenozoic continental deposits in the Iberian Chain and the Ebro Basin

2. Jurassic carbonate platforms in the Iberian Chain

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3. Transitional and submarine slope deposits in the Cenozoic Jaca Basin

5.3. Program

1) Lectures (45 h)

Module 1. Sedimentary processes, encompassing 3 themes:

1. Sedimentary environments and Sedimentology. Definition and classification of environments. Sedimentology: processes and deposits. Basic principles. Walther's law. Historical development. Applicability.

2. Facies analysis. Facies definition. Concept of facies association. Statistical methods used in sequence analysis: the idealized type sequence. Concept of lateral and vertical accretion. Facies model.

3. Sedimentary processes: transport-sedimentation interaction. Physics of the grain-fluid interaction. Basic concepts: Reynolds' number. Laminar and turbulent flows. Froude's number. Flow regime. Boundary shear stress. Stream power. Bedforms: stability fields, classification and their relationship with sedimentary structures.

Module 2. Continental sedimentary environments, including 5 themes:

4. Alluvial fans. Definition and concept. Lateral relationship with other sedimentary environments. Geometry and main zones. Sedimentary processes: mass flows, non-channelized aqueous flows. Deposits: Debris flow/Mud flow. Channel deposits. Sedimentary sequences. Alluvial sedimentary model.

5. Fluvial environments. Sedimentary processes. Bedforms developed in channels. Current ripples. Fluvial facies models. Braided fluvial systems. Bars types, genesis. High-sinuosity fluvial systems: meanders and related sediments. Flood plains and abandoned channels. Sedimentary sequences. Fluvial sedimentary architecture.

6. Lake environments. Definition. Chemical characteristics. Temperature and water circulation. Biological productivity. Shallow-water carbonate facies: marginal lacustrine-palustrine coal-bearing facies. Deep-water lake facies: bituminous shales. Saline lakes.

7. Aeolian environments. Sedimentary processes. Types of aeolian ripples. Aeolian dunes: geometry and internal structure. Aqueous processes. Aeolian facies models.

8. Deltaic environments. Morphology and generation of deltas. Delta zones. Classification and facies associations. Fluvial-dominated deltas: processes, facies and sequences in shallow and deep deltas. Facies in abandoned deltas. Wave-dominated deltas. Tide-dominated deltas. Delta response to climatic and/or tectonic changes.

Module 3. Marine sedimentary environments, encompassing 7 themes:

9. Marine sedimentation: introduction. Main sedimentary environments and sediment types. Carbonate vs. terrigenous-clastic sediments. Application of present marine environments to the interpretation of sedimentary record.

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10. Tide-dominated coastal environments. Characteristics of tidal flats. Carbonate tidal flats. Terrigenous-clastic tidal flats. Estuaries.

11. Wave-dominated coastal environments. Introduction. Barrier islands. Tidal deltas. Beaches. Aeolian coastal dunes. Washover fans. Rocky coasts.

12. Continental platforms. Definition and classification. Barrier platforms. Isolated platform. Carbonate ramps and siliciclastic platforms.

13. Bioconstructed sedimentary systems. Concept of reef and bioconstruction. Sedimentary processes in reefs and related reefal facies. Presents reefs. Bioconstructions in the sedimentary record: types and zonation.

14. Submarine slopes. Sedimentary processes and deposits. Siliciclastic submarine slopes. Carbonate submarine slopes.

15. Pelagic sedimentation. Sedimentary processes and main controlling factors. Present pelagic sediments and fossil pelagic sediments.

2) Laboratory practices (25 h, 12 sessions/2h), developed in 9 modules :

Module 1. Granulometric analysis. Laboratory techniques for particle-size analysis, logarithmic-probabilistic diagrams and analysis of transport processes. (1 session).

Module 2. Palaeocurrent analysis. Paleocurrent diagrams and maps and analysis of source areas based on cross-bedding and imbricated clasts. (1 session).

Module 3. Genetic analysis of sedimentary structures. Study of unidirectional and bidirectional sedimentary structures and interpretation of possible sedimentary environments. (1 session).

Module 4. Sequential analysis. Analysis of different-order sedimentary sequences as a tool for facies analysis. (1 session).

Module 5. Interpretation of sedimentary logs in continental and transitional sedimentary environments. Analysis of sedimentological profiles and deposits and of sedimentary sequences in terrigenous-clastic continental and transitional sedimentary environments. (3 sessions).

Module 6. Genetic analysis of present carbonate sediments. Analysis of components and related sedimentary processes and environments of present carbonate sediments of Florida and Bahamas carbonate platforms. (1 session).

Module 7. Genetic analysis of carbonate rocks in polished- and thin-sections. Description of textures and sedimentary structures of marine carbonate rocks and interpretation of processes and environments of deposition. (2 sessions).

Module 8. Interpretation of sedimentary logs in marine sedimentary environments. Sedimentological profiles in terrigenous-clastic platforms: facies, sequences, and interpretation of processes and subenvironments of deposition. (1 sesión).

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Module 9. Oral presentation of the seminars. (1 session).

3) Field practices (48 h), including 6 full-day field trips, developed in 3 main modules:

Module 1. Cenozoic continental deposits in the Iberian Chain and the Ebro Basin. Analysis of facies, deposits, sequences and processes in an alluvial fans, including debris flow, stream channel, sheet floods and point-bars, and of lacustrine and palustrine environments.

Module 2. Jurassic carbonate platforms in the Iberian Chain. Sedimentological profiles in carbonate tidal flats and carbonate ramps: analysis of facies, processes and related subenvironments.

Module 3. Transitional and submarine slope deposits in the Cenozoic Jaca Basin. Sedimentological profiles in detrital deposits of the Sabiñanigo sandstones and the submarine slope sediments of the Hecho group.

5.4.Planning and scheduling

The course has 9 ECTS credits (225 h) and includes:

- **45 h of lectures** (see sections 5.2 and 5.3). For detailed information of the schedule and classroom see the webpage of the Sciences Faculty.

- **25 h of laboratory practices** (see sections 5.2 and 5.3), including 12 sessions/2 h. For detailed information of the schedule and classroom see the webpage of the Sciences Faculty.

- **48 h of field practices** (see sections 5.2 and 5.3), including 6 full-day field trips. For detailed information of the dates, see field calendar in the webpage of the Earth Sciences department.

- **100 h of individual and team works** , including the seminars (Module 9; see sections 5.2 and 5.3). The subjects of the seminar and the student teams (formed by up to 4 students) will be established at the beginning of each quarter. Each team will explain the obtained results in a (up to 5 pages) report and in a 15 minutes long oral presentation in the first half of may.

- **7 h of exams** (see section 4). For detailed information of the schedule and classroom see the bulleting board of the Area of Stratigraphy.

5.5.Bibliography and recommended resources

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- BB** Boggs, Sam. Principles of sedimentology and stratigraphy / Sam Boggs, Jr. . - 3rd ed. Upper Saddle River (New Jersey) : Prentice Hall, 2001
- BB** Facies models : response to sea level change / edited by Roger G. Walker and Noel P. James . - 6th repr. St. John's : Geological Association of Canada, 2002
- BB** Sedimentary environments : Processes, Facies and Stratigraphy / edited by H. G. Reading . - 3rd. ed. New York : Elsevier, 1996
- BB** Tucker, M. Techniques in Sedimentology. 1995 Blackwell Science