60436 - Facies analysis and sedimentary models: principles and applications

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	541 - Master's in Geology: Techniques and Applications
ECTS	5.0
Year	1
Semester	Second semester
Subject Type	Optional
Module	---

1.General information

1.1.Introduction

Introduction

1.2.Recommendations to take this course

It is recommended to have previous knowledge on Natural Sciences. Students have to hold a Bachelor's degree in Chemistry, Physics, Biology, Geology, Geography, Environmental Sciences, Marine Sciences, or Engineering.

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

The classes will start at the beginning of the second semester, and the exams/assessments will be held at the end of the class period (see calendar on the website of the Faculty of Sciences).

2.Learning goals

2.1.Learning goals

The aim of this course is to analyse sedimentary facies, facies architecture at different scales, sedimentary models, as well as factors controlling basin sedimentation. This general view on the interpretation of sediments and sedimentary rocks will be useful in the analysis of sedimentary basins, geological history, exploration of natural resources as well as the assessment of natural risks related to sedimentary processes.

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

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3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

- To interpret sediments and sedimentary rocks;

- To understand and establish the lateral and vertical facies trends of sedimentary successions;

- To know different sedimentary environments as well as their most characteristics sedimentary processes;

- To study sedimentary sequences in order to establish sedimentary models;

- To reconstruct sedimentary environments and their evolution in time;

- To interpret the geological factors that control the evolution of the sedimentary basin successions and to compare the main inferred changes with those recognised at regional or global scale.

5.2.Learning tasks

Assessment details

Two modalities:

1) Continuous assessment. Including:

- Individual oral presentation of a subject related to the analysis and interpretation of sediments/sedimentary rocks linked to Topic II (50% of the final mark);

- Individual written report of a subject related to the analysis and interpretation of sediments/sedimentary rocks linked to Topic III (50% of the final mark).

2) Final assessment (for students who do not pass the course by means of the continuous assessment): Theoretical-practical exam (100% of the final mark).

5.3.Syllabus

The course will address the following topics:

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Lectures

Topic I. Introduction (2 h): Facies and facies analysis; Internal factors (physical, biological and chemical processes) and external factors (climate and tectonics) controlling basin sedimentation;

Topic II. 2-D and 3-D sedimentary models in continental environments (4 h): Facies architecture, genetic factors and interest of sediments in alluvial, lacustrine and aeolian environments;

Topic III. 2-D and 3-D sedimentary models in marine environments (4 h): Facies architecture, genetic factors and interest of sediments in coastal, continental platform, and submarine slope-ocean environments.

Practice sessions

Laboratory sessions (P) (2.4 ECTS, 24 h)

- P1 (2.5 h): Coring of a borehole in present lacustrine sediments; lithological description, photographing, sampling, graphical representation and computer processing of data;

- P2 (2.5 h): Physico-chemical analyses on the sedimentary samples taken in P1; macro- and microscopic textural characterization of components in the sediments;

- P3 (2 h): Establishment and interpretation of sedimentary units with palaeoenvironmental significance; interpretation of physico-chemical and biological processes;

- P4 (5 h): Facies, architectural elements and megasequences in alluvial environments; analysis of facies heterogeneities at different scales;

- P5 (2.5 h): Facies analysis from thin-section to outcrop scale of sandy sedimentary bodies in shallow-marine environments;

- P6 (2.5 h): Architectural elements and facies heterogeneities of reefal facies in shallow to deep marine environments (fossil coral reefs, sponge mounds and microbialites);

- P7 (2.5 h): Sedimentological characterization of offshore sandy deposits (turbiditic flows, storms or internal waves?);

- P8 (2.5 h): Sedimentological characterization of offshore muddy deposits rich in organic matter; relationship with accumulation rates, anoxia, climate and relative sea-level changes;

- P9 (2 h): Facies architecture in response of relative sea-level changes; examples of carbonate platforms using *Carbonate* computer program.

Field work sessions (C) (1.6 ECTS, 3 field trips- 2 mid-day field trips and 1 full day field trip)

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C1 (4 h): Present lacustrine environments (core sampling in borehole: linked to P1 and P3);

C2 (4 h): Architectural elements and facies heterogeneities of terrigenous continental environments (Pleistocene, Ebro Basin) and their usefulness for the analysis of allogenic and autogenic changes in sedimentation (linked to P4);

C3 (8 h): Architectural elements and facies heterogeneities of sandy and muddy, carbonate and siliciclastic sedimentary bodies in coastal environments (Jurassic, Teruel, Iberian Basin) (linked to P5 and P6).

5.4.Course planning and calendar

The course includes the following learning tasks:

- 1) Lectures (1.0 ECTS): 10 sessions of 1 hour
- 2) Laboratory sessions (2.4 ECTS): 8 sessions of 2.5 hours and 2 sessions of 2 hours
- 3) Field work sessions (1.6 ECTS): 2 mid-day field trips and 1 full day field trip
- 4) 75 hours of autonomous work

The specific schedule of activities is published on the Faculty of Science website.

5.5.Bibliography and recommended resources

- Carbonates in continental settings : facies, environments, and processes / editors, A.M. Alonso-Zarza and L.H. Tanner . - [1st ed.] Amsterdam [etc.] : Elsevier, 2010
- Carbonates in continental settings : geochemistry, diagenesis and applications / editors, A.M. Alonso-Zarza and L.H. Tanner . - [1st ed.] Amsterdam [etc.] : Elsevier, 2010
- Boggs, Sam. Principles of sedimentology and stratigraphy / Sam Boggs, Jr. . - 3rd ed. Upper Saddle River (New Jersey) : Prentice Hall, 2001
- Bridge, John S.. Rivers and floodplains : forms, processes, and sedimentary record / John S. Bridge Oxford : Blackwell Publishing , cop. 2003
- Global geological record of lake basins. Vol.1 / edited by E. Gierlowski-Kordesch and K. Kelts . - 1st publ. Cambridge : Cambridge University Press, 1994
- Lake basins through space and time / edited by E. H. Gierlowski-Kordesch and K. R. Kelts Tulsa (Oklahoma) : American Association of Petroleum Geologists, 2000
- Livingstone, I. . Aeolian Environments, Sediments and Landforms. Wiley-Blackwell. 2000
- Hambrey, Michael. Glacial environments / Michael J. Hambrey London : UCL Press, cop. 1994
- Hambrey, M.J.. Glacial Sedimentary Processes and Products. Wiley-Blackwell. 2007
- Facies models. 4 / edited by Noel P. James and Robert W. Dalrymple Newfoundland : Geological Association of Canada, 2010
- Kenneth, P.. Aeolian Sand and Sand Dunes. 1st, 1st reimp. Springer. 2009
- Modern and past glacial environments/ editor, John Menzies . - Rev. student ed Oxford : Butterworth-Heinemann, 2002
- Miall, A.D. . The geology of fluvial deposits. Sedimentary Facies, Basin Analysis, and Petroleum Geology. 1st. corr. Springer. 2010
- Pedley, P.M.. Tufas and Speleothems: Unravelling the Microbial and Physical Controls. Geological Society. 2010
- Sedimentary environments : Processes, Facies and Stratigraphy / edited by H. G. Reading . - 3rd. ed. New York : Elsevier, 1996
- Techniques in sedimentology / edited by Maurice Tucker . - 1st published Oxford : Blackwell Scientific Publications, 1988
- 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