

60436 - Facies analysis and sedimentary models: principles and applications

Syllabus Information

Academic Year: 2019/20

Subject: 60436 - Facies analysis and sedimentary models: principles and applications

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.Aims of the course

The aim of this course is to analyse sedimentary facies and facies architecture at different scales, sedimentary models, as well as factors controlling continental and marine 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.

1.2.Context and importance of this course in the degree

Consolidate knowledge of Sedimentology and the application of facies analysis in the exploration of natural resources.

1.3.Recommendations to take this course

It is recommended 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.

2.Learning goals

2.1.Competences

To interpret the geological factors that control the evolution of the sedimentary systems and compare their changes with those observed on a regional or global scale.

2.2.Learning goals

Understand sedimentary environments (present and ancient), recognise their deposits in the sedimentary record, and interpret sediments and evolution of different-scale successions, all of this helping in the proposal of predictive sedimentary models useful for searching natural resources of sedimentary origin, as well as for the prevention of natural risks.

2.3.Importance of learning goals

Advance in the knowledge of sedimentary systems as a preliminary step to the analysis of sedimentary basins.

3.Assessment (1st and 2nd call)

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

Two modalities:

1) Continuous assessment.

- Two individual reports of a subject related to the analysis and interpretation of sediments/sedimentary rocks linked

to Topic II (50% of the final mark) and Topic III (50% of the final mark).

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

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

- 1) Lectures (1.0 ECTS)
- 2) Practice sessions (2.4 ECTS)
- 3) Field work sessions (1.6 ECTS): 2 full day field trips
- 4) 75 hours of autonomous work

4.2. Learning tasks

Lectures

- Factors controlling sedimentation. Production and deposition of sediments.
- 2D and 3D sedimentary models: homogeneous and heterogeneous sedimentary bodies.
- Sedimentary dynamics.
- Facies analysis and exploration of natural resources.
- Sedimentary record and its usefulness on historical Geology.

Practical and Laboratory sessions:

- Description of hand samples and microscopy study. Classification of rocks and interpretation of sedimentary processes.
- Description, sampling and interpretation of stratigraphic profiles or core samples.
- Physicochemical analyses on sedimentary samples. Usefulness on stratigraphical/sedimentological studies.
- Interpretation of sedimentary sequences and establishment of facies models.
- Integration of results in 2D and 3D models.

Field trips:

- 1.- Study on the terrain of continental sedimentary units. Pyrenees/Ebro Basin.
- 2.- Study on the terrain of marine sedimentary units. Iberian Range.

4.3. Syllabus

The course will address the following topics:

Lectures (1 ECTS, 10 h)

Topic I. Introduction: 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: Facies architecture, genetic factors and interest of sediments in alluvial, fluvial, lacustrine and aeolian environments.

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

Practice sessions

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

- P1-2: Alluvial-Fluvial sedimentary systems. Models, lithofacies, architectural elements and megasequences. Control of allogenic factors on sedimentation.
- P3-4: Lacustrine sedimentary systems: Facies analysis in shallow lakes and usefulness on the study of palaeoenvironmental changes.
- P5: Interrelation between continental sedimentary systems: analysing preservation potential.
- P6: Facies analysis from thin-section to outcrop scale of sandy sedimentary bodies in shallow-marine environments.
- P7: Architectural elements and facies heterogeneities of reefal facies in shallow to deep marine environments (fossil coral reefs, sponge mounds and microbialites).

- P8: Sedimentological characterization of offshore sandy deposits (turbiditic flows, storms or internal waves?).
- P9: Sedimentological characterization of offshore muddy deposits rich in organic matter; relationship with accumulation rates, anoxia, climate and relative sea-level changes.
- P10: Facies architecture in response of relative sea-level changes; examples of carbonate platforms using *Carbonate* computer program.

Field work sessions (C) (1.6 ECTS, 2 full day field trips).

C1 (8 h): Architectural elements and facies heterogeneities of continental environments (Cenozoic Pyrenees/Ebro Basin) and their usefulness for the analysis of allogenic changes in sedimentation (linked to P1-P3).

C2 (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).

4.4.Course planning and calendar

The classes 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).

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

Field trips activities are published on the Earth Science Department and Sciences Faculty websites.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=60436&year=2019