

Academic Year/course: 2021/22

26414 - Sedimentary Processes and Environments

Syllabus Information

Academic Year: 2021/22

Subject: 26414 - Sedimentary Processes and Environments

Faculty / School: 100 - Facultad de Ciencias

Degree: 296 - Degree in Geology
588 - Degree in Geology

ECTS: 9.0

Year: 2

Semester: Annual

Subject Type: Compulsory

Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, laboratory sessions and fieldwork.

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 interpretive concepts concerning facies and sedimentary processes and environments. By means of individual and team works, the students will improve their knowledge and ability to work on fields such as Stratigraphy, Sedimentology and Basin analysis.

4.2. Learning tasks

This 9 ECTS (225 hours) course is organized as follows:

- **Lectures** (45 hours)
- **Laboratory sessions** (25 hours). Twelve sessions 2 hours each.
- **Fieldwork** (20 hours). It includes 6 daylong field trips
- **Autonomous work and study** (132 hours). This section includes the oral presentations in seminars (see Syllabus, laboratory sessions, section 9). Working teams (up to 4 members) and choice of topic will be established at the beginning of each term. Each team will explain the obtained results in a report (up to 5 pages) and in a 15-minute-long oral presentation in the first half of may.
- **Exams** (3 hours).

Teaching and assessment activities will be carried out on site for as long and as much as possible. This scenario could change if safety regulations related to the covid19 crisis recommended online activities.

4.3. Syllabus

This course will address the following topics:

Lectures

Section 1. Sedimentary processes

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

Section 2. Continental sedimentary environments

- **Topic 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/Mudflow. Channel deposits. Sedimentary sequences. Alluvial sedimentary model.
- **Topic 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.
- **Topic 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.
- **Topic 7.** Aeolian environments. Sedimentary processes. Types of aeolian ripples. Aeolian dunes: geometry and internal structure. Aqueous processes. Aeolian facies models.
- **Topic 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.

Section 3. Marine sedimentary environments

- **Topic 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.
- **Topic 10.** Tide-dominated coastal environments. Characteristics of tidal flats. Carbonate tidal flats. Terrigenous-clastic tidal flats. Estuaries.
- **Topic 11.** Wave-dominated coastal environments. Introduction. Barrier islands. Tidal deltas. Beaches. Aeolian coastal dunes. Washover fans. Rocky coasts.
- **Topic 12.** Continental platforms. Definition and classification. Barrier platforms. Isolated platform. Carbonate ramps and siliciclastic platforms.
- **Topic 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.
- **Topic 14.** Submarine slopes. Sedimentary processes and deposits. Siliciclastic submarine slopes. Carbonate submarine slopes.
- **Topic 15.** Pelagic sedimentation. Sedimentary processes and main controlling factors. Present pelagic sediments and fossil pelagic sediments.

Laboratory sessions

- **Section 1.** Granulometric analysis. Laboratory techniques for particle-size analysis, logarithmic-probabilistic diagrams and analysis of transport processes. (1 session).
- **Section 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).
- **Section 4.** Sequential analysis. Analysis of different-order sedimentary sequences as a tool for facies analysis. (1 session).
- **Section 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).

- **Section 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).
- **Section 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).
- **Section 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 session).
- **Section 9.** Oral presentation of the seminars. (1 session).

Fieldwork

- **Section 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.
- **Section 2.** Jurassic carbonate platforms in the Iberian Chain. Sedimentological profiles in carbonate tidal flats and carbonate ramps: analysis of facies, processes and related subenvironments.
- **Section 3.** Transitional and submarine slope deposits in the Cenozoic Jaca Basin. Sedimentological profiles in detrital deposits of the Sabiñánigo sandstones and the submarine slope sediments of the Hecho group.

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences and Earth Sciences Department websites (<https://ciencias.unizar.es>, <https://cienciatierra.unizar.es>) and Moodle.

4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=26414>