Universidad Zaragoza

Academic Year/course: 2022/23

60380 - Facies analysis and sedimentary models: principles and applications

Syllabus Information

Academic Year: 2022/23
Subject: 60380 - Facies analysis and sedimentary models: principles and applications
Faculty / School: 100 - Facultad de Ciencias
Degree: 624 - Master's in Geology: Techniques and Applications
ECTS: 6.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

- Interpretation of sediments and sedimentary rocks.
- Understanding and establishment of lateral and vertical facies trends of sedimentary successions.
- Knowledge of different sedimentary environments as well as their most characteristics sedimentary processes.
- Study of sedimentary sequences in order to establish sedimentary models.
- Reconstruction of sedimentary environments and their evolution in time.
- Interpretation of the geological factors that control the evolution of the sedimentary basin successions and comparison of main inferred changes with those recognised at regional or global scale.

These objectives are in the line of the following Sustainable Development Goals of the UN 2030 Agenda (https://www.un.org/sustainabledevelopment/), in such a way that the acquisition of the knowledge given in this course provides the ability and competence to contribute to their achievement:

SDG 4: Quality Education

SDG 8: Decent work & economic growth

SDG 9: Industry, innovation & infrastructure

SDG 11: Sustainable cities & communities

SDG 12: Responsable consuption & production

SDG 13: Climate action

SDG 9: Industry, Innovation and Infrastructure

1.2. Context and importance of this course in the degree

- Consolidate knowledge about sedimentology and sequential stratigraphy.
- Apply sequential and facies analysis to the interpretation of models that help in the exploration of natural resources.

1.3. 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.

2. Learning goals

2.1. Competences

- Interpretation of the evolution of sedimentary series and the geological factors that control their evolution.
- Comparison of their evolution with changes at regional or global scale.

- Proposal of paleogeographic models.

2.2. Learning goals

- Understanding of sedimentary processes and environments and recognition of their deposits in the geological record as the basis for the interpretation of their evolution over time and their predictive models. These aspects are essential in the search of natural resources of sedimentary origin and in the prevention of natural risks.

- Interpretation of factors controlling the evolution of sedimentary successions.

2.3. Importance of learning goals

Advance in the knowledge of sedimentary systems as a previous 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)

Continuous assessment:

1. Individual work on a topic that addresses the study and interpretation of sediments and / or sedimentary rocks, linked to Module II (see section 4.3). The obtained grade will suppose 50% of the grade of the subject.
2. Elaboration of an individual written work on the study and interpretation of sediments and / or sedimentary rocks from the field data, linked to Module III. The obtained grade will suppose 50% of the grade of the subject.

Global test (for those students who have not passed the subject by continuous assessment):

Theoretical-practical exam. The obtained grade will suppose 100% of the grade of the subject.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

- Lectures: 10 h.
- Laboratory practices: 34 h.
- Field practices: 16 h, divided into two field trips.
- Student personal work: 84 h.
- Evaluation: 6 h.

4.2. Learning tasks

Lectures:

- Factors that control sedimentation. Sediment production and accumulation.

- Bi- and three-dimensional sedimentary models: homogeneous and heterogeneous sedimentary bodies.

- Sedimentary dynamics.

- Facies analysis in the exploration and exploitation of natural resources.

- The sedimentary record and its application to the knowledge of geological history.

Laboratory practices:

- Description an interpretation of facies from thin section to outcrop scale, and interpretation of sedimentary processes.

- Description, sampling and interpretation of stratigraphic profiles or core samples.

- Physicochemical data analysis: usefulness in stratigraphic / sedimentological studies.

- Interpretation of facies and sedimentary sequences; establishment of facies models and approximation to allocyclic factors controlling sedimentation.

- Integration of results in bi- and three-dimensional models.

Field practices:

- Filed study and data collection in continental sedimentary units in the Pyrenees / Ebro Basin.

- Field study and data collection in marine sedimentary units in the Iberian Ranges.

Teaching and assessment activities will be carried out as indicated in this guide unless, due to the health situation, the provisions issued by the competent authorities and by the University of Zaragoza provide for them

to be carried in other way.

4.3. Syllabus

LECTURES

Module I: Introduction

- Facies and facies analysis.
- Internal factor controling sediment production and accumulation.
- External factors controlling sedimentation.

Module II: Bi- and three-dimensional sedimentary models in continental environments

- Facies architecture, genetic factors and interest of sediments linked to different sedimentary models.
- Alluvial and fluvial environments.
- Lacustrine environment.
- Aeolian environment.

Module III: Bi- and three-dimensional sedimentary models in marine environments

- Facies architecture, genetic factors and interest of sediments linked to different sedimentary models.
- Coastal environment.
- Platform environment.
- Slope-oceanic environment.

LABORATORY PRACTICES (P)

(practices listed below can encompass several practice sessions)

- P1: Facies architecture in response of base-level changes; examples of carbonate platforms using *Carbonate* computer program.
- P2-3: Alluvial-fluvial environment. Sedimentary models and analysis of heterogeneities at different scales: lithofacies, architectural elements and megasequences. Allocyclic factors controlling sedimentation.
- P3-4: Lacustrine environment: facies analysis of shallow lacustrine environments and their contribution to the interpretation of paleoenvironmental changes.
- P5: Linking sedimentary successions and preservation potential.
- P6: Facies analysis form thin section to outcrop scales of sandy (clastic, carbonate) sedimentary bodies in shallow marine environments.
- P7: Architecture elements and facies heterogeneities of buildup facies in shallow to deep marine environments: fossil reefs, sponge mounds and microbialites.
- P8: Characterization and origin of eventites in offshore environments.
- P9: Characterization of organic-rich muddy sediments of offshore environments: relationship with accumulation rates, anoxia, climate and relative sea-level changes.

FIELD PRACTICES (C)

C1 (8 h): Architecture and facies heterogeneities of continental sedimentary systems. Influence of allocyclic factors in sedimentation. Study case: Cenozoic deposits of the Ebro Basin (field practice linked to P2-P4).

C2 (8 h): Architecture and facies heterogeneities of muddy, sandy and buildup facies in marine environments. Study case: Mesozoic deposits in the Iberian Ranges (field practice linked to P6 and P7).

4.4. Course planning and calendar

The specific schedule of activities is published in the Faculty of Sciences´ website.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=60380