

26413 - Sedimentary Petrology

Syllabus Information

Academic Year: 2021/22

Subject: 26413 - Sedimentary Petrology

Faculty / School: 100 - Facultad de Ciencias

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

ECTS: 6.0

Year: 2

Semester: Second semester

Subject Type: Compulsory

Module:

1. General information

1.1. Aims of the course

This course is designed to cover the principles of Sedimentary Petrology and to provide a broad understanding on the characters and origin of the sedimentary rocks. The compositional, textural, structural and petrophysical characteristics of the sedimentary rocks, as well as their classification, will be studied. Effects of the diagenetical processes conducting to lithification will be analysed as a key point in the final properties of sedimentary rocks.

These objectives are in the line of the following Sustainable Development Goals of the UN 2030 Agenda (<https://www.un.org/sustainabledevelopment/>):

- SDG 4: Quality Education

in such a way that the acquisition of the knowledge given in this course provides the ability and competence to contribute to their achievement.

1.2. Context and importance of this course in the degree

Sedimentary Petrology is one of the compulsory courses in the second year of the Geology Degree and it is included in the module called Fundamentals of Geology. It provides the foundation necessary for other geological disciplines dealing with sedimentary rocks.

1.3. Recommendations to take this course

It is recommended to have a continuous working plan with constant review of the theoretical and practical concepts and to use the resources indicated by the teachers in terms of web pages and academic tuition.

2. Learning goals

2.1. Competences

Upon successful completion of this course, students will be able to:

- Understand and apply the concepts and methods of Sedimentary Petrology.
- Demonstrate an adequate understanding of the most important processes involved in the origin of sedimentary rocks.
- Effectively express themselves in written and oral form on topics dealing with Sedimentary Petrology.

2.2. Learning goals

Successful students will learn to:

- Apply fundamentals of Sedimentary Petrology for the interpretation of processes affecting sedimentary rocks formation.

- Recognize, describe and classify sedimentary rocks, identifying their main compositional, textural and structural characters in outcrops, hand samples and thin sections.
- Apply various laboratory techniques and optical microscopy for analyzing sedimentary rock compositions, textures, fabrics and the effects of diagenetic processes.

2.3. Importance of learning goals

Sedimentary Petrology is one of the core disciplines in the Earth Sciences, being also multidisciplinary and transversal. Thus, concepts and methodologies are frequently used in most of the other geological disciplines (as Mineralogy, Stratigraphy, Sedimentology, Geomorphology, etc.).

3. Assessment (1st and 2nd call)

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

There are two forms of evaluation: continuous assessment and end-of-term examination.

Continuous assessment

Student performance will be evaluated on the basis of theory quizzes, lab reports/exercises and short reports about the field trips. Final grades for this assessment will be based on the following: theory quizzes (42.5% of the final grade); lab reports/exercises (42.5% of the final grade); and field trip reports (15% of the final grade).

End-of-term examination

Students who do not opt for the continuous assessment, or who do not pass them, shall attend the End-of-term Examination which consists of three parts:

- A theory test on the topics addressed during the course (this test will include multiple-choice questions, true/false questions and short answer questions).
- A lab/optical microscopy test with hand specimens and thin sections.
- A field test with short questions on the field trips performed during the course.

The exam scores will be weighed as in the continuous assessment option.

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. It is prepared in such a way that it will provide the students with the necessary link between the theoretical knowledge and its practical use in the Sedimentary Petrology field. A wide range of teaching and learning tasks are implemented, such as lectures, laboratory sessions, problem-solving sessions and fieldwork. The student will be able to recognise, describe and classify sedimentary rocks, identifying their main compositional, textural and structural characters in outcrop, hand samples and thin sections.

4.2. Learning tasks

This course is organized as follows:

- **Lectures** (2.2 ECTS: 22 hours). Two 55-minute sessions per week in which theoretical foundations of the course will be explained.
- **Practice sessions** (3.8 ECTS: 30 hours). One 2.5-hour weekly session of laboratory or problem-solving (optical microscopy). In these sessions various laboratory and fieldwork techniques and optical microscopy will be applied in order to analyse sedimentary rock compositions, textures, fabrics and the effects of diagenetic processes.
- **Fieldwork**. Two daylong field trips are scheduled in this course.
- **Autonomous work and study** (74 hours).
- **Assessment tasks** (8 hours)

Note: the teaching and evaluation activities will be carried out on-site unless, due to the Covid-19 health situation, the provisions issued by the competent authorities and by the University of Zaragoza require them to be carried out online or mixed on-site-online with reduced-capacity rotating groups. Online teaching will not be applied to field practices.

4.3. Syllabus

This course will address the following topics:

Lectures

Section I. Fundamentals

- **Topic 1.** Introduction. The Petrogenetic cycle. Classification of sedimentary rocks.
- **Topic 2.** Chemical and mineralogical composition of the sedimentary rocks.
- **Topic 3.** Textural components of siliciclastic and carbonate rocks. Classification.
- **Topic 4.** Textural components of chemical rocks.
- **Topic 5.** Structures in sedimentary rocks.

Section II. Diagenesis

- **Topic 6.** Diagenesis. Major diagenetic processes. Diagenetic stages and realms. Diagenetic grade indicators. Diagenetic textures and structures.
- **Topic 7.** Diagenesis of siliciclastic rocks. Sandstones: shallow and burial diagenetic environments and processes. Mudrocks: diagenesis of clay minerals. Conglomerates and breccias: effects of compaction. Porosity and permeability.
- **Topic 8.** Diagenesis of carbonate rocks. Cementation processes: mineralogy, texture and diagenetic environment. Dissolution processes and secondary porosity. Biogenic degradation processes. Neomorphism. Physical and chemical compaction. Dolomitisation: dolomitisation mechanisms and models. Dolomitisation and porosity. Dedolomitisation processes.
- **Topic 9.** Diagenesis of evaporite rocks. Gypsum and anhydrite rocks. Halite rocks.
- **Topic 10.** Siliceous (chert) and iron-rich sedimentary rocks. Origin. Mineralogical and textural characters. Diagenesis.

Practice sessions

Section I. Laboratory

- Session 1. Sample preparation (weighing out, cutting, polishing, coding, etc.). Colour determination. Hardness and composition.
- Session 2. Structures and discontinuities. Textural analysis with acetate peels.
- Session 3. Mineral identification in hand specimens. Hardness, etching with acids, and staining. Observation with binocular lens.
- Session 4. Porosity determination by hydrostatic weighing.
- Session 5. Size measurements and granulometry. Phase separation.
- Session 6. Petrophysical characters. Measurement of sound propagation.
- Session 7. Photographic techniques. Drafting a report.

Section II. Optical microscopy.

- Session 1. Basic mineralogy in sedimentary rocks. Review of optical properties.
- Session 2. Siliciclastic rocks: clasts, matrix and cements.
- Sessions 3 and 4. Siliciclastic rocks: percentage estimation of textural components. Classification.
- Session 5. Carbonate rocks. Allochems: skeletal and non-skeletal grains.
- Session 6. Carbonate rocks. Orthochems: matrix and cements. Porosity types.
- Session 7. Carbonate rocks. Diagenetic processes.
- Session 8. Carbonate rocks. Classification.

Section III. Fieldwork

- Field trip 1. Precambrian-Cambrian rocks outcropping near Calatayud village (Zaragoza).
- Field trip 2. Carbonate-evaporitic rocks of the Tertiary Calatayud Basin (Zaragoza).

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=26413>