Sedimentary Petrology

Code: 101056
ECTS Credits: 4

2024/2025

Degree	Type	Year
2500254 Geology	OB	3

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

There are no prerequisites. However, it is recommended for students to have previously taken the courses "Geology, Earth Chemistry, Mineralogy, Sedimentology and Stratigraphy.

Objectives and Contextualisation

The specific objectives of the Sedimentary Petrology course are as follows:

Objectives of the cognitive field

- Recognize the characteristics of the different types of sedimentary rocks, both in the field and from hand samples and thin sections.

- Identify the most common minerals and most common components of sedimentary rocks, both with the microscope and naked eye.

- Integrate terminology and classifications of sedimentary rocks.

- Become familiar with the common workflow in the analysis of sedimentary rocks and with the analysis and interpretation of the obtained data.

- Understand the mechanisms and processes that generate sediments and sedimentary rocks based on the physical and chemical parameters involved in their formation.

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- Highlight the usefulness of sedimentary rocks in the various fields of their potential application.

Objectives of the emotional field

- Communicate a holistic approach of the Sedimentary Petrology and their related disciplines, in order to promote a unitary view of Earth Sciences.

- Promote the motivation of the students by developing in him an attitude of intellectual curiosity towards the natural phenomena.

Objectives of the psychomotor field

- Achieve the necessary skills to make observations, obtain data and represent them in a way that the information will be durable and transmissible.

-Get used to the scientific terminology related to Sedimentary Petrology.

- Learn how to use the petrographic microscope as the basis for sedimentary rocks identification, coupled with observations with a magnifying glass. Learn to use other usual tools in the field and laboratory work.

Competences

- Draw up and interpret geological maps and other means of depicting geological information (columns, correlation frames, geological cross-sections, etc.)
- Identify and characterise minerals and rocks through instrumental techniques, determine their formation environments and know their industrial applications.
- Learn and apply the knowledge acquired, and use it to solve problems.
- Show an interest in quality and incorporate it into practice.
- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Synthesise and analyse information critically.
- Work independently.

Learning Outcomes

1. Learn and apply the knowledge acquired, and use it to solve problems.
2. Recognise the principal types of rocks in hand specimen and using a petrographic microscope.
3. Relate each type of rock to its genesis and the temporal dimension.
4. Relate field observations of minerals and rocks to laboratory observations and to genetic theory, based on the textures.
5. Show an interest in quality and incorporate it into practice.
6. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
7. Synthesise and analyse information critically.
8. Work independently.

Content

Theorics and practical Class Program

Unit 1. Presentation of the subject and introduction to Sedimentary Petrology. Nature and origin of sedimentary rocks. The external geological cycle.

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Unit 2. Characterization and classification of sediments and rocks and geological significance.

Unit 3. Hypergenesis (I). Chemical and physical meteoritization.

Unit 4. Hypergenesis (II). Alteration products: Debris and soils.

Unit 5. Diagenetic stages and processes.

Unit 6. Provenance analysis of detrital systems.

Topic 1 aims to create student motivation by suggesting the scientific and economic importance of the subject matter of the program. A succinct description of the most commonly used methods and techniques of study in the analysis of sediments and sedimentary rocks allows the student to become familiar with what will be his working topics throughout the course. The presentation of the organization, objectives and way of development of the course is complemented with the information to the student of the bibliographical sources of the subject, providing a bibliography of the texts of general character and of easy access for him. It is essential to mark the basic differences between sediments and sedimentary rocks, introducing the textural concept of factory (clastic, chemical and organogenic) and compositional and genetic concepts of the integrating elements of sedimentary deposits (for example, terrigenous, chemical, allochthonous, autochthonous). These concepts allow us to easily elaborate a classification of sedimentary rocks and to explain the relative abundance of species and the total volume of sedimentary rocks and sediments with respect to other rock types.

In Topic 2, a review of the textural and compositional criteria traditionally used in the classification of sediments and detrital rocks is carried out to, finally, provide the students with the classification scheme adopted from which they will proceed to a systematic description and interpretation of the different types of detrital materials.

Topic 3 deals with how the modification of materials (igneous, metamorphic rocks or primary sediments) is the source of the elements and detritus that give rise to sediments and sedimentary rocks. The mechanisms that produce physical and chemical weathering are discussed.

Once the mechanisms that produce the physical and chemical weathering of rocks in the source area (Theme 3) have been dealt with, Theme 4 deals with the products of alteration (detritus and soils), which are important for the characterization of some deposits that appear frequently in the sedimentary record as well as for the interpretative and in some cases economic interest they present. The control exerted by environmental factors in the source area (climate, vegetation, relief) on the intensity of the alteration processes and the composition of the detritus that will initiate the transport cycle is also important.

Theme 5 develops the diagenetic steps and processes that can affect the materials during burial. This topic, besides outlining in a greater extension the concept of diagenesis and its importance in the studies of Sedimentary Petrology, contributes to fix in the students the three characteristics of the processes of sedimentation, dissolution, compaction, mineral transformations and other reactions that have their basis in the first topics included in the Program of Theoretical Classes of this subject.

Finally, Topic 6 deals with one of the most relevant applications of Sedimentary Petrology, which is the study of the origin of sediments and rocks. This discipline involves the integration of other concepts studied in the field of Geology, such as tectonics, sedimentology, stratigraphy and mineralogy.
Practical Class Program

Introduction to the study of sedimentary rocks. Differentiation of the main groups of sedimentary rocks. Structure of a classic rock: skeleton,paste (matter and cement), porosity. Nomenclature of the components of a rock: grain, clast, crystal, allochthonous, autochthonous, autigenetic.

Exercises: Microscopy and vision.

1) Recognition of the main elements of a clastic rock: skeleton, paste, pore (choose 2 samples and 3 thin slices).

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2) Estimation of the relative percentages on these plates and samples.

3) Reconstruction of the main textures of a clastic rock: size (modal class and centile), arrodonation, sphericity and selection.

Differentiation between matrix and cement. The concept in the different textural groups: rudites, arenites and lutites. Type of matrix and mineralogical composition. Cement: textural types and mineralogical composition. Difference between porosity and intergranular volume. Type of porosity. Loss of intergranular volume with burial. Mechanical and chemical compaction. Effects of compaction on sediment components.

Practice 2. The skeleton: type of decomponents I.

Practice 2. The skeleton: type of components I. Skeleton components: classification criteria. Non-carbonate extraquencal components (NCE): monominerals (quartz, feldspar, mica and other minerals) and polyminerals (rock fragments).carbonate extraquencal components (CE): monominerals and polyminerals.

Exercises: Microscopy and vision

1) Recognition of the extra-alkaline components of the skeleton of clastic rocks (choose 2 samples and 2 lamellae).

2) Estimation in these laminae and relative percentages of these elements.

3) Study the fragments derived from these mines and minerals. Make a scheme and describe them.

4) Make a list, in order of importance, of the main components of the skeleton.

Practice 3. The skeleton: type of components II. Non-carbonate intraquencal components (NCI): evaporite, glauconitic, phosphate, ferric grains. Carbonaceous intraquencal components (CI): skeletal grains (bioclasts) and non-skeletal grains (oolites, pisolites, oncolites-stromatolites, peloids, intraclasts).

Exercises: Microscopy and vision

1) Identification of the intra-sequence components of the skeleton of clastic rocks (choose 2 samples and 2 plates from the collection).

2) Estimation on these plates and samples of the relative percentages of these elements.

3) Study the rock fragments of these mines and mines. Make a scheme and describe them.

4) Make a list, in order of importance, of the main intrachondral components of the skeleton.

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Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field practices	7	0.28	1, 2, 3, 4, 5, 8

Laboratory Practices	16	0.64	1, 2, 3, 4, 8
Theory	11	0.44	1, 3, 5, 6, 7, 8
Type: Supervised			
Classroom Tutorials	6	0.24	3, 5, 6, 7
Tutorials and supervision of the Field Work and the Laboratory Practice Report	9	0.36	5, 7
Type: Autonomous			
Study, preparation of field work and preparation of laboratory practice repor	47	1.88	1, 3, 5, 6, 7, 8

Theoretical classes

The theoretical knowledge is transmitted through master classes and notes of the topics that cannot be developed in the virtual classroom (webinar). Apart from the selected bibliography, students will be provided with several presentations, figures, diagrams or notes of the topics and aspects that are developed throughout the course. All of this information is available on the Virtual Campus as well as exercises to test rock classification, links to educational webpages and figures or interesting pictures related to the topics of study.

Laboratory Sessions

The practical contents will be developed in the microscopy laboratory, in groups of up to 25 students and in accordance with the requirements established by the sanitary and academic authorities. Each class is 2 hours long; therefore a maximum of six sessions is set.

The aims of the Lab Sessions are the familiarization of the student with the most common study techniques of sedimentary materials. Learning the methods of obtaining textural data of sediments and rocks. The recognition through the petrographic microscope and naked eye the components of the sedimentary rocks, as well as developing its potential to describe, classify and interpret them. It is based on the knowledge of optical mineralogy acquired by the student in previous courses. The development of the Lab Session is done based on a self-published Guidebook that helps to follow the classes easily and eliminates excessive time to present the contents of the practice.

In addition, the student is advised to use individual learning methods (especially web pages) that have been recently published in the field of Sedimentary Petrology. Use of this material allows illustrating and complementing the developed concepts and learning skills of the student.

Fieldtrips

Practical contents are also developed in the field, in groups of 25 students maximum and in accordance with the requirements established by the sanitary and academic authorities. The time available for the student for field sessions is 7.5 hours; therefore, a one-day fieldtrip is set.

The aim of the Fieldtrip is to gain experience in the recognition of sedimentary rocks in the outcrop, using the necessary techniques for their correct description and representation.

Throughout the fieldtrip, students must get familiar with the workflow in the field regarding sedimentary rocks: observations, data collection, sampling, etc. Therefore, they must learn and acquire skills in using the necessary materials (field book, magnifying glass, hammer, compass, granulimeter, HCl....).

The main goal is that the students observe, describe and classify as many sedimentary rocks as possible and to analyse those structures that help them to interpret the depositional environment. At the same time, they must recognize and interpret those diagenetic processes that are observable.

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The fieldtrip concludes with a discussion of the results obtained by the students based on their own observations and with a synthesis and final explanation by the teacher in order to facilitate the understanding of the geological history of the visited area. The end of the fieldtrip is used to make a questionnaire, which is answered individually by the students with the help of all the annotations collected in their field notebooks.

The fieldtrip ends with the exposition of a problem related to the knowledge acquired in the zone. In this way, the student must present a final report with the development and resolution of the problem posed with the one that is finished by the practice of field.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Correction Notebook Work Field Practices	15	0	0	1, 3, 4, 5, 6, 7, 8
Global exam	50	2	0.08	3, 6, 7
Laboratory exam	35	2	0.08	1, 2, 3, 4, 6

The evaluation of the work of the student of the subject Sedimentary Petrology is as follows:

- Global exam combining multiple-choice test with written exposition questions where the capacity for synthesis and relation of concepts and ideas of the student in the whole of the subject prevails. It is done in December and all students must do it. Its value over the final grade is 50%.

- Second-chance examination with written exposition questions and short questions. Only students that have failed to pass the global exam should apply and will only be used to overcome the note.

- Laboratory Practical exam, through an exercise of identification, description, and interpretation of sedimentary rocks, both in thin section and in hand sample. It is held in December and its value over the final grade is 35%. There will be a laboratory second-chance examination, where only students that have failed to pass the Laboratory Practical exam.

- The evaluation of field practices is carried out based on the correction of individual field books or fieldwork. Its value over the final grade is 15% and will not have a second-chance examination.

- The minimum grade for averaging the Global exam as well as the Laboratory Practical exam is 5 and if the student does not reach this minimum mark, the final qualification will be at most 4.

- It is mandatory to attend to the practical sessions. Non-attendance to 3 or more sessions implies failing the subject. The attendance to the field trip is mandatory.

The final grade is also obtained based on the attitude and interest shown by the students during the various teaching activities carried out throughout the course. Although it can introduce a certain degree of subjective elements in the assessment, it records, in some way, the differential participation of some students.

Scheduling of the assessment activities

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The dates of the assessment tests and the submission of exercises are published in the VirtualCampus (VC) and may be subject to changes in programming due to unforeseen eventualities. Any modification will be reported through this platform.

It is important to bear in mind that no assessment activities will be permitted for any student at a different date or time to that established, unless for justified causes duly advised before the activity and with the lecturer's previous consent. In all other cases, if an activity has not been carried out, this cannot be re-assessed.

Grades review

The marks obtained by students in each of the tests are published in the VC. Along with the grades, the place, date and time of review will be indicated, allowing students to review the activity with the lecturer. In this context, students may discuss the activity grade awarded by the lecturers responsible for the subject.

If the student does not take part in this review, no further opportunity will be made available.

Irregularities committed by the student, copy and plagiarism

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the academic regulations in force, assessment activities will receive a zero whenever a student commits academic irregularities that may alter such assessment. Assessment activities graded in this way and by this procedure will not be re-assessable. If passing the assessment activity or activities in question is required to pass the subject, the awarding of a zero for disciplinary measures will also entail a direct fail for the subject, with no opportunity to re-assess this in the same academic year.

Irregularities contemplated in this procedure include, among others:

- the total or partial copying of a test, practical exercise, report, or any other evaluation activity;
- allowing others to copy;
- presenting group work that has not been done entirely by the members of the group;
- presenting any materials prepared by a third part as one's own work, even if these materials are translations or adaptations, including work that isnot original or exclusively that of the student;
- having communication devices (such as mobile phones, smart watches, etc.) accessible during theoretical-practical assessment tests (individual exams).

Assessment of students who followed the subject last year but do not successfully passed it

Students who completed and passed the laboratory practices and field trip in the previous course but did not pass the subject may choose not to make them again in the current course. In that case, the laboratory practices mark (*LT*) will be 5, regardless of the grade reached the previous year.

The list of students who can choose this option will be published at the beginning of the course in the VC. If, anyway, the student wants to make the laboratory practices again, he/she must communicate it by mail to the professor responsible for the practices.

Special grades

- A "non-assessable" grade cannot be assigned to students who have participated in any of the individual partial tests or the final test.
- In order to pass the course with honours, the final grade must be ≥ 9.0. Because the number of students with this distinction cannot exceed 5% of the number of students enrolled in the course, this distinction will be awarded to whoever has the highest final grade.

To consult the academic regulations approved by the Governing Council of the UAB, please follow this link: https://www.uab.cat/doc/TR_Normativa_Academica_Plans_Nous

Bibliography

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Theoretical Sessions

ARCHE, A. (2010). Sedimentología: Del proceso físico a la cuenca sedimentaria. Textos Universitarios, 46, CSIC. Madrid, 1287 pp. Topogràfic biblio: 551.3. 051 Sed

BATHURST, R.G.C. (1975). Carbonate sediments and their diagenesis. Developments in Sedimentology, 12, Elsevier. Amsterdam, 658 pp.

BLATT, H. (1992): Sedimentary Petrology. Segunda edición. W.M. Freeman and Co., 514 p.

BLATT, H., MIDDLETON,G. Y MURRAY, R. (1980). Origin of Sedimentary Rocks. Prentice-Hall, Inc., New Jersey, 782 pp.

BOGGS, S. (2009). Petrology of Sedimentary Rocks. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK, 600 pp.

CASTRO, A. (1989): Petrografía bàsica: Texturas, clasificación y nomenclatura de rocas. Editorial paraninfo, Madrid, 143 p. (Capítol 3. Pàgines 77-92) Topogràfic biblio: 552 Cas

GREENSMITH, J.T. (1988). Petrology of sedimentary rocks. George Allen & Unwin, Oxford, 241 pp.

HIBBARD, M.J. (1995). Petrography to petrogenesis. Prentice-Hall, Inc., 587 pp.

MELGAREJO, J. C. (1997): Atlas de asociaciones minerales en lámina delgada. Edicions Universitat de Barcelona., 1076 p.

MINGARRO, F. y ORDOÑEZ, S. (1982). *Petrología Exógena I. Hipergénesis y sedimentogenesis alóctona.* Ed. Rueda, Madrid, 387 pp.

NICHOLS, G. (1999). Sedimentology and Stratigraphy. Blackwell Science Ltd, Oxford, 355 pp.

PROTHERO, D.R. i SCHWAB, F. (1996). Sedimentary Geology. An introduction to Sedimentary Rocks and Stratigraphy. W.H. Freeman & Company, 575 pp. Topogràfic biblio: 552.5Pro

RAYMOND, L.A. (1995). Petrology. WCB publishers. Capítol 3. Sedimentary. Pàgines 264-466. Topogràfic biblio: 552 Ray

SCHOLLE, P.A. (1978). A color illustrated guide to carbonate rock constituents, textures, cements and porosities. A.A.P.G. Mem., 27, 241 pp.

SCHOLLE, P.A. (1979). A color illustrated guide to constituents, cements and porosities of sandstones and associated rocks. A.A.P.G. Memoir 28, 201 pp. Topogràfic biblio: 552.5 Sch

TARBUCK, E.J. i LUTGENS, F.K. (1999). Ciencias de la Tierra. Una introducción a la Geología Física. Prentice Hall, Madrid, 616 pp.

TUCKER, M.E. (1991). Sedimentary Petrology. 2a Ed. Blackwell Sci. Pub. Oxford, 260 pp.

WARREN, J. (1999). Evaporites. Blackwell Science Ltd, Oxford, 327 pp.

Practical sessions

ADAMS, A.E., MACKENZIE, W.S. Y GUILDFORD, C. (1984). Atlas of sedimentary rocks under the microscope. Logman Scientific and Technical. 103 pp.

DEMANGE, M. (2004). Les minéraux constitutifs des roches. 4 presentacions power point, profusament il·lustrades amb fotografies de microscopi, sobre característiques òptiques, estructura cristal·lina, forma dels minerals i petrografia. CD-ROM. École Nationale Supérieure des Mines de Paris.

GÓMEZ-GRAS, D. (1999). Petrologia Sedimentària de roques detrítiques. Manual de pràctiques de laboratori. Col·lecció Materials nº 70. Servei de Publicacions de la Universitat Autònoma de Barcelona. Bellaterra, 74 pp.

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INGERSOLL, R.V., BULLARD, T.F., FORD, R.L., GRIMM, J.P., PICKLE, J.D. i SARES, S.W. (1984). The effect of grain size in detrital modes: a test of the Gazzi-Dickinson point-counting method. Jour. Sediment. Petrol., 54, 103-116.

Milliken, K. Choh, S-J. i McBride, E.F. (2003). Sandstone Petrology. A Tutorial Petrographic ImageAtlas.AAPG/Datapages Discovery Series 6, Tulsa, CD-ROM.

ROBINSON, D. (2004). Digital Microscope CD-ROM. En: Discovering Geology CD-ROM set que inclou 6 CD-ROMs dels temes: Maps and Landscapes, Earth Materials, Internal Processes, Surface Processes I el video Maps and Landscape/Earth Materials. Open University Geology Course, UK.

SCHOLLE, P.A. (2002). A colour illustrate guide to Carbonate Rock Constituents, Textures, Cements and Porosities. AAPG/Datapages, Mem. 27, Tulsa, CD-ROM.

TARBUCK, E.J. i LUTGENS, F.K. (1999). Ciencias de la Tierra. Una introducción a la Geología Física. Prentice Hall, Madrid, 616 pp.

TARBUCK, E.J. i LUTGENS, F.K. (1999). Earth: An Introduction to Physical Geology. Prentice Hall, Madrid, CD-ROM interactiu d'autoaprenentatge i qüestionaris d'autoavaluació.

TARBUCK, E.J. i LUTGENS, F.K. Earth: An Introduction to Physical Geology. Pàgina web: http://www.prenhall.com/tarbuck amb últimes edicions del llibre, exercisis d'autoavaluació.

Montijo, A. Curso de Petrografía de Rocas Sedimentarias. Pàgina web: http://www.geologia.uson.mx/academicos/amontijo/principal.htm .

Universidad Complutense de Madrid. Atlas de Petrografía de Rocas Sedimentarias. Pàgina web: http://www.ucm.es/info/petrosed/index.html

Software

To follow the course it is not necessary to use a specific computer program.

Language list

Name	Group	Language	Semester	Turn
(PCAM) Field practices	1	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed

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