Universitat Autònoma de Barcelona

2020/2021

Basin Analysis

Code: 101065
ECTS Credits: 6

Degree	Type	Year	Semester
2500254 Geology	OT	3	0
2500254 Geology	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

This subject has a marked character of integration and synthesis of all disciplines involved in sedimentary geology, emphasizing on the subsoil stratigraphic interpretation. It is oriented to the characterization of the sedimentary deposition in sedimentary basins and the application to projects with economic objectives, and mainly of hydrocarbon exploration.

It is assumed that students have the basic knowledge of different branches of fundamental sedimentary geology from previous courses, mainly on stratigraphy and sedimentology but also on tectonics.

Objectives and Contextualisation

This course aims the student to reaches a knowledge of the dynamics of formation of sedimentary basins and their infill, to know how it can be arranged into a genetic point of view of sequence stratigraphy, and learn the study methods not only in outcrops, but also, and more important in this case, of subsoil geology. It is a subject where the student faces techniques to obtain data from the subsoil and its geological interpretation. These data and interpretations are oriented to economic objectives. Consequently, the conceptual application is emphasized combining the geological information from field outcrops and subsoil data, and a specific treatment is given to the study methods of subsoil, mainly of seismic reflection surveys and some types of well logs.

Competences

Geology

- Describe stratigraphic successions and their temporal dimension and use correlation and interpretation techniques.
- Draw up and interpret geological maps and other means of depicting geological information (columns, correlation frames, geological cross-sections, etc.)
- Learn and apply the knowledge acquired, and use it to solve problems.
- Obtain information from texts written in other languages.
- Plan the exploration and sustainable development of geological resources.

- Process, interpret and present field data using qualitative and quantitative techniques, and suitable computer programmes.
- Recognise, depict and reconstruct tectonic structures and the processes that generate them and relate types of rocks and structures to geodynamic environments.
- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Synthesise and analyse information critically.
- Work in teams, developing the social skills needed for this.
- Work independently.

Learning Outcomes

1. Draw up partial evolution models of the sedimentary infilling of basins and its three-dimensional stratigraphic architecture.
2. Draw up stratigraphic columns and correlation frames.
3. Extrapolate the depth range of the stratigraphic units from data on surface sediments.
4. Learn and apply the knowledge acquired, and use it to solve problems.
5. Make stratigraphic columns and correlation frames and geological maps based on lithostratigraphic and chronostratigraphic units.
6. Obtain information from texts written in other languages.
7. Process stratigraphic and sedimentological data from the field in order to produce new synthesis data and documents.
8. Recognise, locate stratigraphically and evaluate units of economic value in the sedimentary succession of the basin.
9. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
10. Synthesise and analyse information critically.
11. Work in teams, developing the social skills needed for this.
12. Work independently.

Content

Contents

Theory program
1.- Introduction. Basin concept. Objectives of the basin analysis.
2.- Surface data of interest for the basin analysis.
3.- Well logs. The most used logs in basin analysis. Correlation of logs.
4.- Seismic reflection. Obtaining data and processing. Seismic sections and their interpretation.
5.- Controlling factors in the basin analysis. Subsidence. Supply rates. Sea level fluctuations. Concepts of available space and accommodation
6.- Sequence stratigraphy. The EXXON model. "TR" cycles. Other models.
7.- High resolution sequence stratigraphy. Conceptual basis, hierarchy orders and high-frequency cycles. Concept of regime and depositional style. Trajectory analysis
8.- Types of basins and classification. Basins in stable settings. Distenssive basins. Types of basins associated to strike slip. Compressive basins.

Program of practical exercises
1.-Seismic reflection.
1.a.- Introductory exercises on seismic interpretation.
1.b.- Drawing of reflections and description of seismic facies.
1.c.- Identification of the different types of termination of reflections of seismic reflections and their implications: identification of seismic sequences. Wheeler diagrams.
1.d.- Identification of clinoforms, their different types and trajectory analysis. Basic interpretation of depositional systems, systems tracts and depositional sequences.
1.e.- Interpretation of real study cases of rift basins, Atlantic margins type basins, and other types of basins in compressive settings.

2- Well-log interpretation
- Interpretation of simple and spectral SP and GR logs.
- Correlation of logs and log correlation panels.
- Crossing log data and seismic sections with the whole set interpretation.

Methodology

1.- Managed activities

Theoretical classes
This course consists of a theoretical part, in which the professor will explain, in the form of master classes, the different lessons, and will pass the instruction guidelines for the student to complete the learning independently. Apart from the recommended bibliography, students will have available additional material (graphics and scientific articles), selected by the teacher and uploaded for a limited time in the coresponding Moodle of the subject.

Laboratory exercises and seminars.

They will basically consist on the completion of a set of exercises related to practical work on seismic reflection stratigraphic interpretation, and less on interpretation and correlation of logs. Both types of exercises will be assisted by the teacher, who will solve general problems that will be discussed, as well as the particular problems of individual students. The basic material for exercises is from real cases and will be progressively disclosed remaining available for download for a specific time, not less than 30 days, in the Moodle of the subject, as the course progresses.

2.- Supervised activities

Original synthesis work on a type of basin

2a) Preparation in groups of two students of an original work of synthesis on a type of basin. The theme of each group will be chosen according to a previous proposal that the professor will present the first day of class.

The work must be delivered in a pdf file, in the space that has been enabled in the Moodle, and will be presented for the students orally in class whithin a limited time. Each work will have to include a comprehensive summary, with the key figures and will be uploaded in a specific space of the Moodle. Abstracts must be studied by students as they may result in exam questions.

2b) Groupal and individual mentoring

These activities are oriented to support previous training activities and will be carried out in theoretical or exercise times, prior to the teacher's announcement and acceptance of the date by the students. The topics to be dealt with are mainly those related to sequence stratigraphy and internal stratigraphic divisions, and high-frequency cycles. Additionally, individualized mentoring is planned in the office of the teacher according to the schedule and order that will be indicated on the first day of class.

3.- Autonomous activities
This section includes the study of the theory, elaboration of the works and study of the bibliography of the recommended articles, with both the latter if they have not finished in the time of the corresponding exercise session.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theoretical classes and practical exercises	56	2.24	10, 7, 4, 5, 2, 1, 3, 6, 8, 12

Type: Supervised			
Original synthesis work on a type of basin and mentoring	16	0.64	10, 7, 4, 2, 1, 6, 9, 12, 11
Type: Autonomous			
Study of the theory, completion of practical exercises and work on a basin	74	2.96	10, 7, 4, 5, 2, 1, 3, 6, 8, 12, 11

Assessment

The assessment will be carried out on a continuous basis, and will be based on a minimum of 2 written partial tests, which constitute 70% of the final grade.

The original synthesis work on a concrete basin type will be also evaluated (accounting 15% of the final mark); the dossier with the practical exercises will also be evaluated and should contain the overall exercises (accounting 15% of the final mark). All deliveries must be made in the corresponding available space in the Moodle and strictly following instructions (index where appropriate, maximum number of Mb of the document, appointment of the documents, etc.).

In the partial written tests, the data will be determined by the teacher in agreement with the students. The questions may include practical aspects although what is mainly evaluated is the achievement of the theoretical aspects, and in the cases of include practical questions, the degree for solution of problems.

In the work on a specific type of basin, the scientific content, the ordered workflow, the writing and presentation will be evalued, as well as the correct treatment of stratigraphic and sedimentological data from bibliographic sources to produce new synthesis data and documents. A summary of the work, of a maximum of 5 pages including figures, will be deposited in the corresponding Moodle's space for delivery, as well as the ppt of the oral presentation that each student will have to do according to a maximum time no higher than 10 '. This activity assigns a value of 15% of the final mark.

The dossier of practical exercises will also be evaluated with all the finished practices, ordered chronologically, and this dossier must clearly reflect personal work. The verification of a copy of an exercise implies to fail the subject. This activity assigns you a value of 15% of the final mark.

Its is necessary to remark that the subject contemplates a degree of obligatory attendance to both theory and practical exercises classes.

The directed activities mean a substantial part of the learning activities of the subject. In order for a student to be evaluated by continuous assessment, he must attend [1] at least 70% of the theoretical sessions, and each day of presentations of works (both of the same student and of the different groups of students) and [2] 80% of the practical sessions with delivery of the dossier within the fixed time period and before deadline (day and hour determined by agreement between the teacher and the students).

Recovery tests
Students not passing the subject through continuous assessment may have a final oportunity. The subject of examination in the final exam is the full content of the course. In case of not having submitted the final dossier of the practical exercises and/or the work on a type of basin, the student who wants a recovery exam will have to deliver these works at the time of the final test for recovery. For the final note, the same percentages are maintained than in the case of continuous evaluation (70% for the written test, 15% for work on a determined basin and 15% corresponding to the practice dossier). The note of this last test fully replaces the note previously obtained by continuous evaluation.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Individual written tests	70	4	0.16	10, 9
Original synthesis work on a type of basin and mentoring	15	0	0	10, 7, 4, 5, 2, 1, 3, 6, 8, 9, 12, 11
Practical exercises dossier	15	0	0	10, 4, 5, 2, 1, 3, 8, 9

Bibliography

- Allen, P.A. i Allen J.R. 2005. *Basin analysis*. Blackwell Scientific Publications, Oxford, (2nd ed.)

- Miall, A. D. 2000. *Principles of Sedimentary Basin Analysis*, (3rd ed.). Springer-Verlag.

- Rider M. H. 1999. *The Geological Interpretation of Well Logs* (2nd ed.). Whittles Publishing Services.

- Herron D. A. 2012. *First Steps in Seismic Interpretation*, Society of Exploration Geophysicists, Tulsa.