Universitat Autònoma de Barcelona

2021/2022

Mineral Deposits

Code: 101051
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

Teachers

Didac Navarro Ciurana

Isaac Corral Calleja

Prerequisites

It is essential to have successfully completed the course on Mineralogy.

It is important to have taken or simultaneously taking the courses of Petrology (igneous, sedimentary and metamorphic) and Structural Geology.

Objectives and Contextualisation

To know the main types of ore deposits

To understand the formation processes of ore deposits.

To comprehend and relate petrographic, geochemical, structural or hydrological data in order to deduce forming processes and exploration guides for ore deposits.

To learn how to use the reflected light microscope and mineral properties that lead to mineral recognition.

To identify the principal ore minerals and the textures of the different ore deposit types.

Competences

Geology

- Display knowledge of the applications and limitations of geophysical methods for learning about the Earth.

- Display understanding of the size of the space and time dimensions of Earth processes, on different scales.
- Draw up and interpret geological maps and other means of depicting geological information (columns, correlation frames, geological cross-sections, etc.)
- Evaluate and carry out the selection and collection of suitable geological samples.
- Identify and characterise minerals and rocks through instrumental techniques, determine their formation environments and know their industrial applications.
- Identify and tackle environmental problems, plan land-use and know the principles of prevention and mitigation of geological risks.
- 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 theories, paradigms, concepts and principles in the field of geology and use them in different areas of application, whether scientific or technical.
- 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.

Learning Outcomes

1. Apply instrumental techniques to characterise materials rock mechanics and geotechnics.
2. Construct subsoil models with applications for geological engineering.
3. Correctly interpret geological information with applications in the exploration of hydrocarbons and mineral deposits, and in geological engineering.
4. Correctly sample industrial mineral and rock deposits.
5. Draw up geological cross-sections or other types of presentation for geological data in order to characterise hydrocarbon reserves and mineral deposits.
6. Evaluate the environmental problems related to mining, industrial rock and hydrocarbon exploitations.
7. Learn and apply the knowledge acquired, and use it to solve problems.
8. Make geophysical prospections for geotechnical purposes, keeping in mind the limitations of the results and the margins of error.
9. Obtain information from texts written in other languages.
10. Provide solutions to geological problems in applied geology and engineering.
11. Reconstruct hydrocarbon reserves based on the appropriate data.
12. Relate tectonic structures to hydrocarbon reserves.
13. Relate the theories and principles of geology to the exploration of reserves and mineral deposits, and to problem solving in geological engineering.
14. Solve problems in reserves, mineral deposits and geological engineering based on field and laboratory observations and the concepts studied.
15. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
16. Synthesise and analyse information critically.
17. Use geochemical methods to detect and study mineral deposits.

Content

1. Introduction to the Ore Deposits. Mineralizing processes, metal transport and deposition. Classification of ore deposits.

2. Study techniques I. Trace elements partition. Stable isotopes. Radiogenic isotopes.

3. Mineralizing processes of igneous origin.

Ore deposits associated with mafic and ultramafic rocks. Cromitites. Niquel sulfides and sulfides with PGE.

Ore deposits associated with alkaline rocks. Carbonatites. Kimberlites.

4. Mineralizing processes of metamorphic origin.

5. Mineralizing processes of hydrothermal origin. Metal transport and deposition mechanisms in aqueous media.

6. Study techniques II. Fluid inclusions. Host rocks alteration. Mineral stability.

7. Deposits associated with felsic igneous rocks. Pegmatites. Skarns. Porphyry copper deposits. Sn-W veins.

8. Deposits associated with volcanic rocks. Au-Ag epithermal deposits. VHMS.

9. Deposits associated with sedimentary rocks. SHMS. Pb-Zn carbonate hosted (MVTs). Red beds. U in sandstones. U in uncomformitites. Fe-Mn accumulations.

10. Surficial mineralizing processes. Mechanical concentration deposits: placers. Supergenic enrichment deposits. Residual deposits: bauxites and other laterites.

11. The optical microscope of reflected light: functioning and observable properties. Principal ore minerals under the reflected light microscope. Recognizing and interpreting ore minerals textures. Ore minerals parageneses of the main deposit types.

Methodology

The course is organized with two theoretical sessions per week, of 50 minutes each and with all the group, and one practical session of 110 minutes per week, in small groups.

The theoretical sessions consist mainly in classes where concepts are clarified, textures and ore deposits types are described, study techniques are summarized and ore forming processes are presented. These lectures are combined with simple calculations development in order to solve problems related to ore deposits, and cooperative groups tasks. Some of the tasks are developed during the class hour, but others are started towards the end of the class and the students have to finalize on their own.

The tasks consist on reading short texts or scientific articles; the students have to understand them, contrast with previous information or with new material they have to find. They have to be able to summarize what they learn and extract some conclusions about the ore deposit formation or prospection. Most of the texts are written in English.

A part from the specific references of the course, the student will get complementary material (graphics, photographs, maps, schemes, etc) that will be uploaded into the Campus Virtual.

The practical sessions will be held in the Microscopy Laboratory, where the students will learn how to work with the reflected light microscope, how to recognize the principal ore minerals and how to interpret their textures. Hand samples will be studied also, from host rocks and ore and gangue minerals, of several deposits representative of the most significant types. The students will be able to use lab on their own during the study and exams weeks if the course teacher considers it necessary.

The field work related to the Ore Deposits course is, in part, integrated within the field trips of 3r and 4^{th} year of regional geology. Nevertheless, a one day field trip is also organized to specifically visit a nearby ore deposits of interest.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field work	7	0.28	3, 13, 12, 11, 9, 2, 6
Laboratory practical classes	22	0.88	16, 10, 2
Theoretical classes	22	0.88	16, 1, 13, 12, 4, 9, 17, 14, 2, 5, 8, 6
Type: Autonomous			
Exam preparation and tasks	82	3.28	16, 3, 1, 13, 12, 4, 9, 17, 14, 2, 5, 6

Assessment

Two or three exams about the competences acquired in the theoretical sessions will be programmed during the semester. Besides, some tasks, collective or individually, and some tests will be demanded. The failed exams will be retaken together with the final exam on the day marked in the Facultat schedule. This day a final/global exam will have to be taken by all students. Every exam, partial or global, will consist of short answer questions that could be anwered with the help of books and notes; the exams may also include a problem of simple calculation.

The laboratory practical part will be evaluated in the lab with a final exam after finalizing all sessions. It will consist of mineral identification and textures description of polished sections and hand samples recognition of ore minerals. This exam will be repeated/recovered on another day that the teacher decides.

An exam of the field trip will be held at the end of the day.

The students that do not obtain a minimum grade of 3,5 (out of 10) in each exam, will fail the course.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Individual and group tasks, field work exam	15%	8	0.32	16, 3, 1, 9, 14, 2, 8, 6
global exam	10%	3	0.12	16, 7, 3, 1, 13, 12, 17, 14, 2, 5, 15, 8, 6
partial exams of theoretical concepts and problems	35%	4	0.16	13, 12, 4, 17, 5, 8, 6
practical exam	40%	2	0.08	10, 12, 11, 2

Bibliography

BARNES, H.L. (1997). Geochemistry of hydrothermal ore deposits (3ª edició). *John Wiley & sons, Inc*.

CRAIG, J.R., VAUGHAN, D.J, and SKINNER, B.J. (2001). Resources of the Earth. Origin, use and environmental impact. *Prentice Hall*.

EDWARDS, R. and ATKINSON, K (1986). Ore deposits geology. *Chapman and Hall.*

EVANS, A.M. (1997). An introduction to Economic Geology and its environmental impact. *Blackwell Scientific Publications.*

KESLER, S.E. (1994). Mineral resources, economics and the environment. *Maxwell MacMillan International*.

KRAUSKOPF, K.B. and BIRD, D.K. (1995). Introduction to geochemistry (3ª edició). McGraw-Hill.

RIDLEY, J. (2013) Ore deposit geology. Cambridge University Press (llibre electrònic).

ROBB, L. (2005). Introduction to ore-forming processes. Blackwell Publishing.

Software

There is no need for specific software.