UAB
Universitat Autònoma de Barcelona

Mineral Deposits

Code: 101051
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500254 Geology	OT	3
2500254 Geology	OT	4

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Teaching groups languages

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Prerequisites

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

2- 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 ore deposits formational processes.
- 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, to know the mineral optical properties as well as the method used to their identification.
- To know how to identify the main ore minerals and textures of the different studied ore deposit types.
- To deduce the mineral crystallization sequence and to know how to represent it in a paragenetic table.

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

Lectures:

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

2. Study techniques I: Trace elements partition, Stable and Radiogenic isotopes.

3. Mineralizing processes of igneous origin.

- Ore deposits associated with mafic and ultramafic rocks: Cromitites and Copper-Niquel massive sulfides, and sulfides with PGE.

- Ore deposits associated with alkaline rocks: Carbonatites and 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 rock hydrothermal alteration, mineral stability.

7. Ore deposits associated with felsic igneous rocks: Pegmatites, Skarns, Porphyry copper deposits and Sn-W veins.

8. Ore deposits associated with volcanic rocks: High- and Low-sulfidation epithermal deposits and Volcanogenic Massive Sulfide deposits (VMS/VHMS).

9. Ore deposits associated with sedimentary rocks: Sedimentary-Hosted Massive Sulfide deposits (SHMS), carbonate hosted Pb-Zn deposits (Mississippi Valley Type; MVTs), Red beds, U in sandstones and in uncomformitites, and Fe-Mn accumulations.

10. Surficial mineralizing processes: Mechanical concentration deposits (e.g., placers), supergene enrichment deposits, and residual deposits (e.g., bauxites and 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.

Practicals:

Block 1 (2-3 sessions). Reflected light optical microscopy: microscope operation and mineral optical properties, mineral textures, crosscutting relationships and mineral paragenesis.

Block2 (7-8 sessions). Hydrothermal alteration, main ore minerals characteristics under reflected light microscopy, recognition and interpretation of mineral textures and crosscutting relationships, observation of hand samples, and mineral paragenesis of the main ore deposit types.

Activities and Methodology

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

Exam preparation and tasks	82	3.28	1, 2, 3, 4, 5, 6, 9, 12, 13, 14, 16, 17

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

The lecture sessions consist mainly in lessons where concepts are clarified, textures and ore deposit types are described, study techniques are summarized and ore forming processes are presented. These lectures are combined with simple calculations development to solve problems related to ore deposits, and cooperative groups assignments. 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 finish them on their own.

The assignments consist of reading short texts or scientific articles that students need to understand, compare with previous information or material they have to search for. They should be able to summarize what they have learned and draw conclusions about the formation or exploration of the mineral deposit. Most texts are written in English. In addition to specific references, supplementary material (such as graphics, photographs, and diagrams) will be available to students on the virtual campus.

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.

Practical sessions take place in the Microscopy Laboratory, where students learn to work with reflected light microscopy, recognize major ore minerals, and interpret textures. Hand samples of host rocks, ore and gangue minerals from various ore deposits representing significant typologies will also be examined. The students willbe able to use the Microscopy Laboratory on their own during the study and exams week, if deemed necessary by the subject coordinator.

Ore deposits fieldwork will be conducted during a one-day field trip. This will be planned to visit nearby mineral deposits of interest.

Note: 15 minutes of a lecture session, within the schedule established by the institution/program, will be reserved for students to complete the evaluation of the teaching activity of the lecturers as well as of the subject/module assessment.

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

During the course, there will be two or three exams on the knowledge acquired in the theoretical lessons. Additionally, some assignments, either in groups or individually, and some tests will be required, along with a field exam. At the end of the course, it will be possible to retake any failed exams on the date set by the Faculty (Virtual activities are not retakeable). On this date, a final/global exam will be conducted for all students. All partial and final exams will consist of short-answer questions that can be answered with the help of books and notes; they may also include some simple calculation problems.

The laboratory practical part will be assessed 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.

The assessment of the practical laboratory component will take place in the same laboratory with an exam at the end of the practical sessions. It will involve the identification of minerals and description of textures in polished blocks, as well as the recognition of metallic ores in hand specimen. This exam can be retaken/repeated on the day set by the faculty.

There will also be a fieldwork exam at the end of the field trip.

The practical exam will count for 40% of the final grade, the theory and problem partial exams for 35%, the progress in assignments and the field exam for 15%, and a final comprehensive exam for the remaining 10%. If a student does not achieve a minimum grade (3.5 out of 10) in each of the previous exams, the percentages will not be considered, and the student will fail the subject.

If a student requests a single evaluation (in the form and date determined by the Faculty), they will take an exam consisting of a theory test (50%), a practical exam on mineral recognition in hand specimens and under the microscope, with oral correction (40%), and a field exam (10%). The date of this exam will be the same as the last theory partial exam of the subject. Attendance at the field trip and at 70% of the practical sessions will be mandatory.

Bibliography

References for Lecture Sessions (highlighted the most recommended)

- BARNES, H.L. (1997). Geochemistry of hydrothermal ore deposits (3ª edition). *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. and SIMON, A.C. (2015). Mineral resources, economics and the environment. *Cambridge University Press*.

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

- MOON, C.J., WHATELEY, M.K.G., and EVANS, A.M. (2006). Introduction to Mineral Exploration. Blackwell Publishing.

- PARK, C.F. and MACDIARMID, R.A. (1975). Ore Deposits. W.H. Freeman and Company.

- PIRANJO, F. (2009). Hydrothermal Processes and Mineral Systems. Springer.

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

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

References for Practical Sessions (highlighted the most recommended)

- AUGUSITHIS, S.S.P. (1995). Atlas of the textural paterns of oreminerals and metallogenic processes. Walter de Gruyter & Co.

- BASTIN, E.S. (1953). Interpretation of ore textures. The Geological Society of America.

- INESON, P.R. (1989). Introduction to practical ore microscopy. Routledge (Taylor & Francis Group).

- LOPEZ-GARCÍA, J.A. (2019). Microscopía práctica de minerales opacos. Ediciones GEMM Universidad Complutense de Madrid.

- LUFKIN, J.L. (2012). Ore mineralogy and microscopy. Golden Publishers.

- MARSHALL, D., ANGLIN, C.D., and MUMIN, H. (2004). Ore Mineral Atlas. Geological Association of Canada.

- NEUMANN, U. (2019). Guide for the microscopical identification of ore and gangue minerals. Tübingen University Press.

- PRACEJUS, B. (2015). The ore minerals under the microscope. Elsevier.

- TAYLOR, R. (2009). Ore Textures. Springer.

- THOMPSON, A.J.B. and THOMPSON, J.F.H. (1996). Atlas of alteration. Geological Association of Canada.

Recommended webpages

BARTHELMY, D. Mineralogy database. [Accessed: June 10th 2024]. Available at: https://webmineral.com/

DA MOMMIO, A. Alex Strekeisen. [Accessed: June 11th 2024]. Available at: https://www.alexstrekeisen.it/english/index.php

GRUP MINERALÓGIC CATALÀ. MinerAtlas. [Accessed: June 10th 2024]. Available at: https://mineratlas.com/

IXER R.A. and DULLER, P.R. Virtual atlas of opaque and ore minerals and their associations. [Accessed: July 8th 2024]. Available at: http://www.atlas-of-ore-minerals.com/

ORE DEPOSITS HUB. Open Geoscience Talks on Ore Deposits. [Accessed: July 8th 2024]. Available at: https://oredepositshub.com/

RALPH, J., CHAU, I. Mineralogy database. [Accessed: June 10th 2024]. Available at: http://www.mindat.org/

UNIVERSITY OF GENEVE. Mineral Resources and Geofluids. Lluís Fontboté. [Accessed: July 8th 2024]. Available at: https://www.unige.ch/sciences/terre/research/Groups/mineral_resources/opaques/opaques_menu.php

UNIVERSIDAD DE VIGO. Menas metálicas al microscopio. Ricardo Castroviejo. [Accessed: July 8th 2024]. Available at: https://coleccion.menas.webs.uvigo.es/

Social Networks

ALEXSTRECKEISEN. Instagram minerals under optical microscope. [Accessed: June 11th 2024]. Available at: https://www.instagram.com/alexstrekeisen/

BCNSGASEGSC. Instagram of the ore deposit students fom UB. [Accessed: July 8th 2024]. Available at: https://www.instagram.com/bcnsgasegsc/

EXMODE_CSIC. Instagram of the ore depòsits model research group (CSIC Madrid). [Accessed: July 8th 2024]. Available at: https://www.instagram.com/exmode_csic/

ISAAC_CORRAL_GEO_CONSULTING. Instagram opaques minerals under the microscopi and ore depòsits fieldtrips. [Accessed: July 8th 2024]. Available at: https://www.instagram.com/isaac_corral_geo_consulting/

MICROPTICA. Instagram minerals under Optical microscope. [Accessed: July 8th 2024]. Available at: https://www.instagram.com/microptica/

OREDEPOSITSHUB. Instagram ore deposit open talks. [Accessed: July 8th 2024]. Available at: https://www.instagram.com/oredepositshub/

SEM_MINERALOGIA. Instagram of the Sociedad Española de Mineralogía. [Accessed: July 8th 2024]. Available at: https://www.instagram.com/sem_mineralogia/

SOCIETYOFECONOMICGEOLOGISTS. Instagram of the SEG.[Accessed: July 8th 2024]. Available at: https://www.instagram.com/societyofeconomicgeologists/

Software

There is no need for specific software.

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
(TE) Theory	1	Catalan	first semester	morning-mixed