

26411 - Mineralogy

Syllabus Information

Academic Year: 2022/23

Subject: 26411 - Mineralogy

Faculty / School: 100 - Facultad de Ciencias

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

ECTS: 8.5

Year: 2

Semester: Annual

Subject Type: Compulsory

Module:

1. General information

1.1. Aims of the course

SDG 4: Quality Education

2. Learning goals

3. Assessment (1st and 2nd call)

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. A wide range of teaching and learning tasks are implemented, such as lectures, laboratory sessions, fieldwork, tutorials and autonomous work and study and assessment tasks.

The course has a basic character, thus the proposed activities focus on the comprehension of the basic principles of Mineralogy to use them as a tool to characterize and identify the most important rock-forming minerals. Also, the student will manage to deduce the structural and textural features of different mineral associations together with the context and genetic conditions under they formed.

For this reason, the knowledge acquired through participatory master classes will be enhanced by practice sessions, where the students should demonstrate their knowledge about different methods and analysis and their application in order to identify and characterize the rock-forming minerals.

4.2. Learning tasks

This course is organized as follows:

- **Lectures** (40 hours). Resource material will be uploaded on the Internet (<https://moodle2.unizar.es>).
- **Laboratory sessions** (32 hours). Two-hours sessions.
- **Fieldwork** (10 hours). Two field trips are scheduled. In the first term field trip is related to genesis environments of silicate minerals and in the second term field trip to non-silicate minerals.
- **Autonomous work and study** (60 hours).
- **Assessment tasks** (13 hours). This includes 3 hours for the elaboration of a bibliographic assignment. Students can choose a topic related to the course contents for the development and exposition of that assignment, following

the indications of the teaching staff. They have to prove their team work abilities as well as their capacity to expose and to defend a report about different mineralogical aspects related to the course contents.

- **Tutorials.** The monitoring of the learning process will be favoured through conventional tutoring and more specific tutoring related to the report that the students have to expose.

Teaching and assessment activities will be carried out on site for as long and as much as possible. This scenario could change if safety regulations related to the covid19 crisis recommended online activities.

4.3. Syllabus

This course will address the following topics:

Lectures

Introduction

- **Topic 1. Mineralogy:** definition and relationships with other sciences. Importance among the Geologic Sciences. Concept of mineral. Industrial mineral, ore, gangue and gem.

Section I. Mineral Genesis Environments

- **Topic 2. Structure and chemical composition of the Earth.** Distinctive features of the Crust, the Mantle and the Core. The Earth Crust, the Lithosphere and the Asthenosphere. Chemical composition of the Earth Crust. Geochemical classification of the elements.
- **Topic 3. Mineral genesis and geologic processes.** Mineral formation and the phases rule: statement and terms explanation. Phase equilibrium diagrams. One-, two- and three-phases systems.
- **Topic 4. Magmatic environment.** Equilibrium and fractionated crystallization. The Bowen Series. Mineralogy of the igneous rocks. The pegmatitic and pneumatolytic stages. The hydrothermal satage. Metasomatic processes.
- **Topic 5. Sedimentary environment.** Weathering and types. Edaphic profiles and types. Physic-chemical factors controlling the sedimentary processes. Mineralogy of the sedimentary rocks.
- **Topic 6. Metamorphic environment.** Physic-chemical factors controlling the metamorphic processes. Types of metamorphism and features. Metamorphic facies. Mineralogy of the metamorphic rocks.

Section II. Systematics of Silicate Minerals

- **Topic 7. Mineral classification:** used criteria. Strunz classification. Silicates: generalities, crystal chemistry, classification, physical properties and types of rocks where they are present.
- **Topic 8. Nesosilicates.** Main features. Olivine group. Aluminum silicates group. Garnet group.
- **Topic 9. Sorosilicates.** Main features. Epidote group.
- **Topic 10. Ciclosilicates.** Main features. Tourmaline group. Cordierite.
- **Topic 11. Inosilicates.** Main features. Classification: pyroxenes, pyroxenoids y amphiboles.
- **Topic 12. Pyroxenes.** Chemical composition and classification. Physical properties. Types of rocks where they are present.
- **Topic 13. Pyroxenoids.** Main features. Wollastonite.
- **Topic 14. Amphiboles.** Chemical composition and classification. Physical properties. Types of rocks where they are present.
- **Topic 15. Phyllosilicates.** Main features crystal chemistry and classification. 1:1 phyllosilicates. 2:1 phyllosilicates.
- **Topic 16. Clay phyllosilicates.** Chlorite group. Fibrous clay minerals.
- **Topic 17. Tectosilicates.** Main features. SiO₂ group. Alkali feldspar group. Physical properties. Types of rocks where they are present.
- **Topic 18. Plagioclases.** Chemical composition and structure. Physical properties. Types of rocks where they are present.
- **Topic 19. Feldspathoids.** Scapolite group. Zeolite group.

Section III. Systematics of Non-Silicate Minerals

- **Topic 20. Introduction to non-silicate minerals:** scientific, technical and economic interest of non-silicate minerals, main applications, exploration and exploitation of mineral deposits, mineral and energy resources, Plate tectonics and metallogeny.
- **Topic 21. Native elements.** General characteristics. Crystal chemistry and physical properties. Classification. Description of the main groups: metals, semimetals and nonmetals.
- **Topic 22. Halides.** Introduction. General characteristics. Classification. Description of the main groups. Types of rocks where they are found.
- **Topic 23. Sulfides, related minerals and sulfosalts.** Introduction. Crystal chemistry and physical properties.

Classifications, structures and characteristics of the main groups and associations.

- **Topic 24. Oxides and hydroxides.** Introduction. Crystal chemistry and physical properties. Classification. Origin and types of deposits.
- **Topic 25. Carbonates, nitrates and borates.** Introduction. Crystal chemistry and physical properties of carbonate minerals. Carbonates classification. Calcite, dolomite and aragonite series. Properties and forming environments.
- **Topic 26. Sulfates, chromates, molybdates and wolframates.** Introduction. Gypsum and anhydrite. Types of rocks where they are found.
- **Topic 27. Phosphates, arsenates and vanadates.** Introduction. General characteristics.

Laboratory sessions

Contents are divided in two hour sessions scheduled as follows:

- Session 1. Macroscopic observation and identification of silicate minerals
- Session 2. Optical microscopy: tectosilicates
- Session 3. Optical microscopy: phyllosilicates
- Session 4. Optical microscopy: inosilicates
- Session 5. Optical microscopy: nesosilicates
- Session 6. Optical microscopy: soro and ciclosilicates
- Session 7. Silicates review
- Session 8. Macroscopic observation and identification of non-silicate minerals: non-metallic minerals
- Session 9. Macroscopic observation and identification of non-silicate minerals: metallic minerals
- Session 10. Optical microscopy: carbonates, sulphates and halides
- Session 11. Optical microscopy: reference ore minerals (I)
- Session 12. Optical microscopy: reference ore minerals (II)
- Session 13. Optical microscopy: sulphides and related minerals
- Session 14. Optical microscopy: oxides
- Session 15. Optical microscopy: copper minerals
- Session 16. Non-silicates minerals review

Field trips

Two field trips are scheduled. The first term field trip is related to genesis environments of silicate minerals and the second term field trip to non-silicate minerals.

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=26411>