Igneous Petrology

Code: 101055
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500254 Geology	OB	3

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

It is advised to have passed the following subjects of the
1st year: Fundamentals of Geology, Earth Planet and Chemistry of the Earth, and Mineralogy of the 2nd year.

Objectives and Contextualisation

Igneous Petrology is a fundamental subject of Geology, key to understand how the Earth Planet works inside and generates magmas and igneous rocks. Knowlege of Mineralogy is essential to describe these rocks, which are also very related to metamorphic and sedimentary ones, all of them Earth materials studied in the 3rd year. Also, high temperature geochemistry (3rd year subject) is particularly useful to understand igneous processes.

The subject is divided into lectures and practices

the aims to be achieved by students from lectures are:

- Skills in using with criteria the different classifications of igneous rocks and in correlating the different types of classifications.
- To use adequate geochemical diagrams to classify igneous series
- To relate the different types of basalts to their mineral and chemical compositions; to identify their typical outcrop structures and volcano types; to assess the basaltic magma genesis and crystallization based on geochemical compositions and the geodynamic setting of their outcrops.

- To discuss magmatic differentiation processes from a parental basaltic melt using simple phase diagrams.
- To relate the different types of gabbros and dolerites to their mineral and geochemical compositions; to identify internal structures and types of outcrops; to discuss their genesis and magmatic crystallization based on geochemical data and the geological setting of these rocks.
- To relate the ultramafic and ultrabasic rocks to their mineral compositions and to identify their internal structures, type of outcrops and other related rocks.
- To relate andesites, dacites and rhyolites to their mineral and geochemical compositions, types of outcrops and volcanoes; to discuss their genesis and magmatic crystallization based on geochemical data and their geodynamic settings.
- To relate the different types of granitoids with their mineral, geochemical compositions and outcrops at different scales. To discuss the different mechanism of intrusion of granitic magmas, their genesis and crystallization based on geochemical data and their geodynamic settings.

Detail aims to achieve from practices are:
- Field work to watch and describe the contacts between the different types of igneous rocks (plutonic, volcanic and subvolcanic) and their country rocks (either sedimentary, metamorphic or igneous), along with the relationships between their structures in order to infer the relative chronology of intrusion.
- To describe and identify igneous rocks at the outcrop scale and in hand specimen.
- To get skills in identifying minerals and textures of igneous rocks under the petrographic microscope.
- To describe and classify different types of igneous rocks under the microscope, based on their mineral mode and textures using the IUGS normative classification

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.
- Process, interpret and present laboratory data using qualitative and quantitative techniques, and suitable computer programmes.
- 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. Present arguments based on phase diagrams.
3. Recognise the principal types of rocks in hand specimen and using a petrographic microscope.
4. Relate each type of rock to its genesis and the temporal dimension.
5. Relate field observations of minerals and rocks to laboratory observations and to genetic theory, based on the textures.
6. Show an interest in quality and incorporate it into practice.
7. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
8. Synthesise and analyse information critically.
9. Work independently.

Content

Lectures

Chapter 1- Magmas and igneous rocks.

Chapter 2- Basalts and related rocks.

Chapter 3- Magmatic differentiation.

Chapter 4- Gabbroid rocks.

Chapter 5- Ultramafic and ultrabasic rocks.

Chapter 6- Andesites, dacites and rhyolites.

Chapter 7- Granitic rocks.

Field works

One day excursion to watch igneous rocks of the Catalan Coastal Range.

Laboratory practices (Petrography)

1. Minerals, textures and description of igneous rocks.

2. Associations of basic and ultrabasic rocks.

2a) Volcanic rocks (basalts and related rocks).

2b) Plutonic and subvolcanic rocks (gabbros, dolerites and ultrabasic rocks).

3. Associations of intermediate and acid rocks.

3a) Volcanic rocks (andesites, dacites and rhyolites).

3b) Subvolcanic rocks (microgranitoids).

3c) Plutonic rocks (granitoids).

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field work	7.5	0.3	1, 3, 5, 6, 9
Lectures	24	0.96	2, 4, 5, 6, 8
Practices in the microscope laboratory	20	0.8	1, 3, 5, 6
Type: Supervised			
Personal tutorials	14	0.56	1, 2, 4
Type: Autonomous			

To do complementary tasks and exercises of the lectures, to describe hand specimens and thin sections of igneous rocks	40	1.6	1, 2, 4, 7
To study the subject	35	1.4	1, 2, 3, 4, 5, 6, 8, 9

To achieve the competences in this subject, the student must attend the lectures, the field excursion and the practices.

Notes taken or provided during the lectures must be extended with further reading of the recommended references and doing related tasks. These tasks will be supervised by the teacher and discussed during the classes, along with students' doubts about theoretical and/or practical issues.

Field work data must be further completed by the student, after the field excursion, using adequate references .

Didactic material will be used during the lectures, with illustrations that will be provided to the students via Virtual Campus. For the practices of microscopy specific documents will be used and provided to the students in the same way. Documents for the field excursion, including maps and instructions for doing the job, will be also available from the Virtual Campus.

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
Control of regular task during the course (evidence).	10%	1.5	0.06	1, 2, 3, 4, 5, 6, 7, 8, 9
Exam on the field work	10% of the global qualification	1	0.04	4, 5, 6, 7, 9
To control the attendance to practical works in the laboratory (75% minimum)	>75% attendance to practical works	0	0	6
Two partial exams on lecture chapters, or a sole global exam, and/or one second-chance global exam	50% of the global qualification	4	0.16	1, 2, 4, 5, 6, 7, 8, 9
Two partial exams or one sole global exam on practices in the laboratory and/or a second-chance global exam	30%	3	0.12	1, 3, 6, 7, 8, 9

For assessing the students about the competences of this subject, the following items will be taken into account:

1- Skipping practical works more than 25%, without a reason, will be punished with 5% discount on the final qualification. Attendance to lectures is not compulsory, but it will be taken into account as attitude.

2- Attendance to the field excursion and passing an exam on it will count 10% of the final qualification. If an student does not go to the field excursion, he/she will lose 60% of this item qualification. The field work exam will not have a second-chance opportunity.

3- During the course, regular working on doing description of samples, either in hand specimen or under the microcrospe, and doing tasks on theoretical chapters will count 10% of the final qualification. This item will not be re-assessed.

4- Passing either two partial exams on both lecture chapters and practices on petrography,or a global exam on both lectures and practices, or a second-chance final exam of the whole subject will count 80%, distributed into 50% for the exam on lectures and 30% for the practice exam. For passing each partial exam a minimum of 4 points is required between the lecture part and the practices. However, qualifications on the lectures and on practices will not compensate each other, if the former is <2 of a total 5 and the latter is <1 of a total 3. The same rules apply for the globlal unic exam. Students getting <3 points of total 8 in one or both partial exams, or in the global exam, must take the second-chance global exam. To take this second-chance exam, the student must have previously taken the two partial exams or a first global exam.

To be successful, the student must get a minimum of 5 points considering items from 1 to 4.

Students who pass the two partial exams, or the first global exam, but want to improve their qualification can also take the second-chance exam.

If the continuous assessing of the student is>35%, he/she cannot apply for the "Not have been taken" qualification

If the student decides to enrol a single global exam, this will take place the same day of the second parcial exam for the other students. If it is the case, the second-chance exam must be done the same date as the other students.

Bibliography

Lectures

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BEST M. G., CHRISTIANSEN E.H. (2001). Igneous Petrology.Blackwell Science. 458 p.

BLATT H., TRACY R.J. (1996).- Petrology, Igneous, Sedimentary, and Metamorphic. Freeman and Company. 529 p.

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GILL,R., FITTON, G. (2022, 2na edició). Igneous Rocks and Processes: A practical guide. Wiley-Blackwell. 414p.

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RAYMOND L.A. (1995).- Petrology. The study of Igneous, sedimentary and metamorphic rocks. Wm.C. Publishers. 742p.

SEN G. (2001). Earth's Materials. Minerals and Rocks. Prentice Hall. 542 p.

WINTER J. D. (2001, 2010). An Introduction to Igneous and Metamorphic Petrology. Prentice Hall. 697 p

Practical works in the microscope laboratory

LE MAITRE R.W (Ed) (2002). Igneous Rocks. A classification and Glossary of Terms. Cambrige University Press. 236 p. (Available on line)

MCKENZIE M., DONALDSON C.H. & GUILFORD C.(1996).Atlas de Rocas Ignias y sus Texturas. Masson.149 p.

NOCKOLDS S.R., KNOX R.W.O'B & CHINNER G.A.(1979).-Petrology for students. Cambridge University press.435p

PICHLER H., SCHMITT-RIEGRAF C. (1997).- Rock-forming Minerals in Thin Section. Chapman & Hall. 220 p.

SHELLEY D.(1992).- Igneous and Metamorphic Rocksunder the microscope.Chapman &Hall. 445.p.

Software

No specific software will be used

Language list

Name	Group	Language	Semester	Turn
(PCAM) Field practices	1	Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	1	Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	2	Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	3	Spanish	first semester	morning-mixed
(TE) Theory	1	Spanish	first semester	morning-mixed